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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UP-DATED TRAINING MANUAL OF WASTE MANAGEMENT IN HIGH DENSITY AREAS OF THE AFRICA REGION

GENERAL INTRODUCTION

Contents

1. GENERAL INTRODUCTION

Waste problems exist wherever there is a human population of a certain density.
The waste problem is increasing as the population density and standards of living rise.
In developing countries, waste management often emerges as a problem that endangers human health and the environment. To make it worse, waste management usually has a low priority on the political agenda of such countries, as they are struggling with other important issues such as hunger, health problems, water shortage, unemployment and even civil war.
In those situations, it can be understood why waste problems have a tendency to grow steadily.

The costs of urban solid waste disposal (collection, transportation, recycling and costs of treating the mixed waste) are about US$1-2 per person per week, this is cheaper than buying a packet of cigarettes every week.
From this, it can be concluded that everybody may afford waste disposal. But the initial investments of well equipped landfill sites is expensive. However, costs must be considered over a long period of time.

From past experience, it can be observed that cleaning up old, polluting waste deposits may cost more than adequate treatment of the waste would have required. Therefore, it is not a question of affordability as of choosing to pay sufficiently for waste disposal, rather than going for the cheaper option and experiencing uncontrolled, inflated costs later.

There is no any other area of environmental protection, where every person can contribute as much to the success of the waste management.

This manual of Waste Management in High Density Areas of the Africa Region is an up-dated version of the Training Manual on Municipal Solid Waste Management for Africa, what was compiled at 1998.
During the last five years, the Manual was tested in a series of regional workshops in Africa.

The solid waste management, through the philosophy of sustainability, and simultaneously at the pressing problem of densely populated cities waste management, befalling most African cities.
Africa is undergoing fast changes in many aspects of life. New patterns of consumption and production are emerging, and waste handling and management practices are also changing.

The closely related issue of industrial and hazardous wastes has been dealt partly only, as necessary in case of municipal solid waste management.

It has been agreed in the First Nairobi Expert Group Meeting, in December of 1997 that the Manual will be partly a source book as well as a training manual. This would ensure depth of knowledge as well as looking into relevant practical problems associated with policy and technical management of municipal solid waste.

In the course of the regional workshops, specific problems pertinent to the African context was addressed and handled in depth and the results are presented in the Up-dated Manual being topical and of practical value to the target groups.

Certain aspects of waste management are addressed in the up-dated version with some more detail. These comprise areas like waste recycling, environmental health, informal sector participation, etc. The treatment here is tilted towards concrete economic and technical concepts. This trend is expected to continue with more emphasis on legal aspects, institutional strengthening and legislative processes of policy implementation as well as on technical and industrial aspects.

The Up-dated Training Manual is presented on a CD ROM. This gives the opportunity to include some other materials on it, like previous reports, selected literature on waste management and some pictures taken during workshop periods.
The pictures presented here were taken in Tanzania and Mozambique. The pictures, shown here, would have been taken at almost any part of Africa. In Tanzania and Mozambique there are nicely kept, nicely cleaned areas not those waste burdened places only. These pictures show the examples what are to be improved.

1.1. DEFINITION OF THE PROBLEM

The problem of solid waste in Africa is a direct result of a growing (urban) population, the changing patterns of production and consumption, the inherently more urbanised life-style and the consequent industrialisation. The increasing amounts of waste emanating from residential, commercial and industrial areas and the changing nature of waste over time (type, composition, etc.) have triggered the alarm on the short and long term consequences on the environment and human life.
The health hazard, depletion of natural resources or pollution have to be checked and controlled.

In low-income developing countries, recyclable materials comprise about 15% of the solid waste stream. As an economy improves, residents are likely to consume more packaged goods and to generate more waste. In mid-income developing countries, recyclable materials comprise about 30% of the solid waste stream. In industrialised countries, recyclables comprise about 60% of the waste stream. Again the highest recovery of recyclables (paper, glass, metal, and plastic) is possible only if source separation is practised. Because of the above, we will concentrate on waste collection and disposal cost analysis - without having to forget the limited practice of recycling.

The emphasis above would direct us to concentrate on solid waste collection, cleansing, disposal, and transfer. This will be undertaken with a view on formulating the framework for analysing the costs and advantages of private sector participation arrangements in comparison to existing services. The examples below are from experience or desk research as mentioned in the UNDP/UNCHS/World Bank Urban Management Programme. It is to be borne in mind that in most cities the costs of MSW is between 20-50% of total municipal expenditure. Despite the high level of expenditure collection service levels are low. Only 50-70% of urban residents receive service and most disposal is done by unsafe open dumping.

1.2. GENERAL OBJECTIVES

With time we have come to appreciate the pressure that wastes put on our natural resources and our health. The traditionally applied methods of dealing with wastes have not been successful, and the resulting contamination of water and land has led to pressure on governments, municipalities and industry to improve the situation as well as to provide waste management services. Hence the objectives of this Manual are:

- ***To increase the awareness of the importance of proper, sanitary and environmentally sustainable treatment of Municipal Solid Waste (MSW) in the densely populated African cities, particularly for government officers and community members.***
- ***To provide the necessary information on the treatment of MSW for policy and decision-makers.***

Action would entail the awakening of awareness on the part of all: policy makers, consumers, business community, private individuals, etc. Environmentally conscious behaviour as well as direct action by all has to be brought to bearing.

This Manual attempts to select pertinent topics, which would raise awareness and qualify corrective action while addressing the waste problem.

The target people here are not local government officials only, NGOs and national institutions, but the whole range of stakeholders who either manage, generate or handle waste. Corrected and positive attitudes are the main target in such a course of action. Social, behavioural and policy aspects being the main focus of this Training Manual, technical capability and commitment are also addressed here to facilitate effective action.

You are kindly requested to read the Modules and solve the tasks. For further details please refer to the literature, articles and reports.

1.3 TARGET GROUPS

The target group contains all formal and informal organisations and groups connected to the waste management problems of a city through sustained waste recycling and reuse programs. A well-based partnership approach among all formal and informal organisations and groups is needed. This approach needs an appropriate institutional framework, which clearly lays out the roles and responsibilities of each party for effective and efficient use of the scarce resources of a city.
The stakeholders/target groups in the waste management programs are thought to be the following:

- ***Policy and Decision Makers;***
- ***Municipalities and Local Authorities***
- ***The Private Sector, Commerce, and Industry***
- ***The Community***
- ***Non-governmental organisations (NGOs); and community based organisations (CBOs):***
  - ***Civic Groups (Civil Society Organisations, CSOs)***
  - ***Street Committees***
  - ***Disease Victims,***
  - ***Pollution Affected Groups, and***
  - ***UNIDO Approach NGOs***
- ***Research Institutions***

A model of an institutional arrangement is given in Figure 1.1, which shows how the community, city managers, industry and non-governmental organisations and other groups can work in partnership to promote waste management programs. However, the model might not be universally applicable because the local conditions in each case will have to be taken into account. The roles and responsibilities of each of the stakeholders are summarised in Table 1.1.

1.3.1 POLICY AND DECISION MAKERS

The Government bears the overall responsibility for setting the stage e.g. by way of establishing framework laws, institutions, and national legislation on waste policy and strategy. It also allocates funds for capital and operation of the administrative structure and other infrastructural facilities. A third and important role of the central or upper level is to monitor and control the work of local governments on solid waste as well as co-ordinating LGA activities in that sphere. Policy and decision-makers are the people who conceptualise and help put these policies into practice.

1.3.2 MUNICIPALITIES & LOCAL AUTHORITIES

Local authorities are traditionally organised to collect, transport and dispose of the solid wastes generated in the cities. Normally, they are in control of the city resources and are authorised to formulate policies, promulgate laws and levy taxes. They have operational relations with other government agencies, which are or can be instrumental in effectively addressing the waste management problems in the city. These prerogatives put the local government in a strategic leadership position to promote waste management in order to improve the urban environment. The leadership position of the local government makes it responsible for initiating such a partnership arrangement with other participants.

The operational departments relevant to the task of SWM in a local authority would normally include the following:

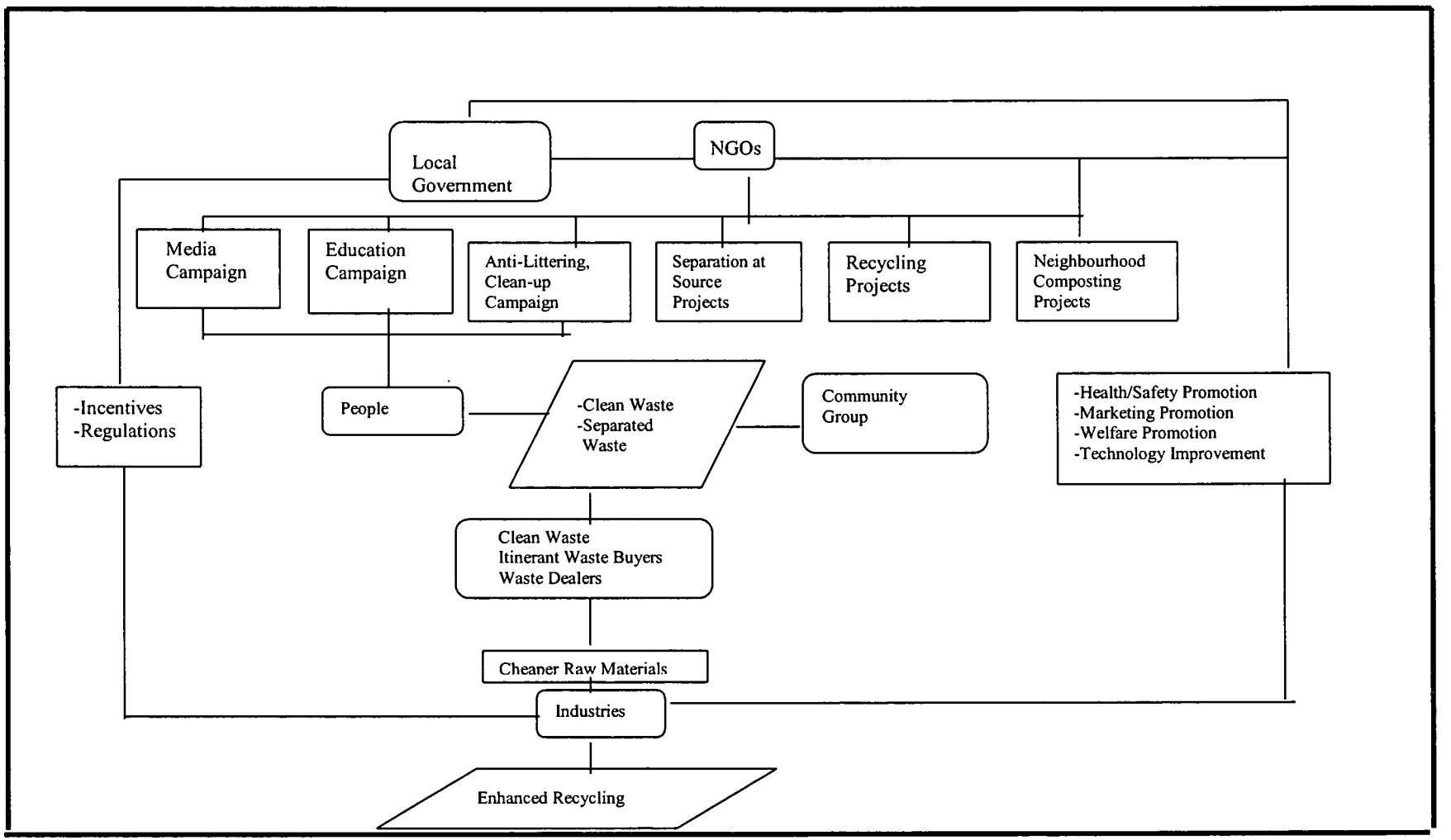
- Public Health and Sanitation Department.
- Public Works Department.
- Natural Resources Management Department
- Waste Management Department
- Education Department
- Licensing Department
- Finance Department
- Community Services and Awareness Department
- Survey, Housing and Planning Department

Table 1.1: Roles and Responsibilities of Stakeholders

Policy and Decision Makers
• Monitoring and follow-up of regional plans and programmes on MWM. • Provision of finance and technology development • Framework policy and legislation • Support L.A.s and directly assist with educational and awareness campaigns. • Facilitate participation of the private sector, community and other organisations.
Municipalities & Local Authorities
• Provide NG0s and the community access to available infrastructure • Facilitate participation of the private sector, community and other organisations. • Issue regulations and by-laws • Are owners of waste and therefore bear primary responsibility for MWM. • Prepare WM plans and sets guidelines as to the organisation of the

MWM activity, awareness and education, etc
The Community
• Design, implement and manage project • Ensure co-operation with local government and bear charges
Private Sector, Industry & Commerce
• Ensure market for source separated recyclables. • Improve technology and strengthen health and safety standards in industry. • Directly provide services in profitable areas of operation • Are special contributors (of fees, charges, etc.) to cost recovery schemes • Intensify reduction efforts in-plant or through producer responsibility and other schemes • Ensure co-operation with L.As.
Research Institutions
• Enhance public participation and education • Contribute to technology development • Other research projects which assist in guiding stakeholder efforts • Establish a link between industry, government and the community.
NG0s & CBOs
• Organise and motivate the community and industry. • Provide technical and managerial assistance to the community and industry. • Liase with local government, community and industries
Disease Victims
• Focused study of problems, agitation and action. • Create effective pressure groups • Exchange of ideas and entrenchment of lessons from personal experience
Street Committees
• Localised and community oriented participation • A forum for exchange of experiences and concerted interaction to effect change and see to it that action is actually taken. • A relevant organisation to care for out-of-residence cleansing and waste management, i.e. parks, streets, drainage, etc. • An occasion not only to manage programmes, but to *design and manage* them.
Pollution Affected Groups
• Focused study of problems, agitation and action. • Create effective pressure groups • Exchange of ideas and entrenchment of lessons from personal experience
Civic Groups (CSOs)
• Influence political decisions and the electoral process and results by raising critical issues favourable to sound SWM.

- Address technical and sophisticated waste management issues and requirements, and, thus, contribute to enlightenment and awareness.
- Initiate positive attitudinal change



[1]Figure 1.1. An Organisational Model for a Partnership Approach in the Promotion of Solid Waste Management [1]

These structures used to provide services without significant direct pecuniary rewards. ***raditionally, societies in developing countries, particularly at the low income level, look to their governments as providers of sanitation services -- and therefore are unwilling to pay for the services -- despite the limited resources*** the governments have at their disposal. In view of the many demands on local governments, the governments are finding it increasingly difficult to cope with the growing problem of wastes in the cities. ***The only option the local governments are left with is to change their present image from a provider to a facilitator.*** To change this image, local governments will have to find ways to use all available resources in the community, and share their own infrastructural facilities with them.

The local governments may be able to share their own resources with the community and other partners in the following ways:

- provision of adequate waste containers and communal bins to improve neighbourhood cleanliness,
- subsidies in standardisation of domestic waste containers and disposal bags for separated waste collection,
- sharing the resources for collection and transport activity with private sector operators,
- assisting and encouraging informal sector formation of establishments providing the above services,
- directly assisting in the formation of opinion and awareness on how to optimally react to the cycle of waste generation, recycling all the way up to disposal,
- providing land for waste recycling centres and community composting yards,
- delivering wastes to recycling centres and compost yards
- sharing information,
- sharing technical expertise and skills, and
- providing staff time for planning and development of programs and for training program participants.

1.3.3 THE PRIVATE SECTOR

The private sector, commerce and industry are involved in waste generation mainly by products that are negatively affecting the environment. They should do their best to decrease packaging material by bulk supply wherever possible, produce products that are durable and firm where applicable with a view on elongating the life cycle of such products. But most importantly, they should pre-treat their effluent before discharging it in the surrounding environment as many rivers and soils around industrial areas are becoming increasingly polluted. Commerce and market areas are also highly responsible for huge amounts of waste generated in the cities. They should desist from this and try their best to generate as little waste as possible and at the same time co-operate with those

responsible for collection and transport of waste. Of course, for both industry and commerce this is not the optimal solution but a second best one (widely known as an end of pipe solution). Prevention and avoidance is the best choice for industries.

Another dimension to the participation of the private sector is in their role in collection, street sweeping, recovery of materials or as concessionaires and contractors for the local authority. They should be encouraged in this role without forgetting to consider their profit motive in providing such services, and at the same time proper accountability and monitoring techniques and standards have to be established to ensure efficiency. More prospects in Africa have to be sought in recycling activity including construction and operation of sanitary landfills, incinerators –especially those for hazardous waste like those from hospital and industry.

The existing waste recycling sector consists of scavengers, itinerant waste buyers, waste dealers and processing industries in both the formal and informal sectors. They have, over the years, developed firm operating styles and business interests and loyalty among themselves. A waste recycling and reuse promotional program tends to interfere with their working relations and working methods, or, at least, that is the way they look at it.

A waste recycling program, therefore, will have to overcome their apprehension and at the same time mobilise them to collaborate with the program to achieve everyone's wish to keep the urban environment clean. The program should be developed on the strength of their ties and their experiences in the sector.

The program should aim to achieve the following:

- Co-operation of waste processors, waste dealers and wholesalers in purchasing source-separated wastes at fair prices to ensure a reliable market for the wastes.
- Co-operation of processing industries in implementing programs to improve technologies, working conditions, and to strengthen the health and safety standards in the industry in order to improve industrial productivity and hence profitability.
- Co-operation of scavengers in improving their existing unhygienic methods and habits of waste separation at communal bins and dumping sites in the short term and a willingness to move to the socially more respectable work of an itinerant waste buyer, dealer and waste buyer in the long-term.

The micro-industry sector (a subset of the informal sector) is one of the most important sectors in African cities. They satisfy about 40% of the local demand for implements, technical services, handicrafts, etc. These groups are mainly made up of uneducated people, (wood workers, metal fabricators, food sellers, etc.) but tend to respond favourably to efforts to make them take care of the environment and maintain cleanliness in their workplaces and neighbourhood. Their limited resources, however, play a big role

in their behaviour. Their simple and rudimentary methods and techniques of production, their location and mixing with city dwellers in market places coupled with their limited knowledge of environmental awareness and orderly handling of waste makes them an important source of municipal waste. Mechanics tend to litter spare part packages around their workshops, pour oil in nearby ditches and drainage, etc. Awareness campaigns among their unions would possibly make them more conscious of their negligence because they tend to heed and adhere to advice from their leaders. They are an important target group because of their capacity to act as proactive stakeholders in their environment who would positively influence education and awareness campaigns.

1.3.4 COMMUNITIES

A program intended to benefit the community should involve active community participation. Experience has shown that even participation is not enough; community management of the program is essential. The communities should be made responsible for the design and implementation of the program, with external assistance in certain necessary areas only.

Communities in general are keen to keep their own neighbourhood environment clean. Low-income communities, specifically, are keen on the income generating prospects of waste recycling, and – at a minor cost, see the Pay-as-you-dump case from Ghana - in keeping the environment clean. The inherent desire of the community will have to be suitably exploited to develop and implement self-help programs directed towards waste minimisation through recycling and reuse. The usual constraint the communities face in solving their problems are:

- a lack of motivating and organising forces behind them,
- a lack of resources,
- a lack of know-how.

Local government and non-governmental organisations will have to appropriately intervene with support in these areas which the communities need most.
The intervening agencies should be careful not to impose their ideas on the community. The individuals in the community have their own ideas on how to solve their own problems. The role of the outside agency should be to facilitate the expression of ideas and pool the various ideas together.

A waste recycling and reuse promotional program is preferably initiated at a pilot scale. The selected neighbourhood should have a high chance of success. The pilot program can serve as a learning ground for all participants for replication in other neighbourhoods in the city, with necessary modifications.

Though it is the local situation that should ultimately determine the steps to be taken in implementing the program, the following general steps are suggested:

- approach the community through a person of social and political standing;
- motivate the community in program participation;
- form a representative neighbourhood association;
- identify the problems and the appropriate solutions;
- organise community education and training; and
- implementation, monitoring and evaluation of the project.

1.3.5 NON-GOVERNMENTAL ORGANISATIONS (NGOs) AND COMMUNITY BASED ORGANISATIONS (CBOs)

Experiences in many countries have shown that a non-governmental organisation can play an important role in alleviating urban environmental sanitation problems. Many NGOs/CBOs are already tackling waste reduction in a number of cities and have produced results with variable success rates. Their efforts are mostly oriented towards organising campaigns for raising environmental awareness and assisting in the social help of scavengers. Their roles can be extended to assist the community and industry in technical and managerial aspects of waste recycling and reuse.
The common problems faced by the NGOs are:

- a lack of resources for continued operation until the program becomes self-sustaining,
- a lack of commitment and support from the local authorities, and
- weaknesses in the program design.

The example of "Para sa Basura Project" implemented in Metro Manila in 1978, given below, highlights these problems.

The 'Para sa Basura Project', meaning 'cash for trash' was a follow-up of several earlier programs with variable success rates. The new program aimed at separation and purchase of recyclable domestic wastes at source to give collectors and pickers the opportunity for better earnings by bypassing their customary informal waste traders. Dump pickers and itinerant collectors were recruited and registered by the project.
The program soon ran into numerous difficulties with managerial and financial problems, and some were related to the marketing of waste materials. One of the major problems was its competition with the established informal systems of waste recovery and trading in the city. This resulted in resistance from the junk merchants.

The scheme operated for two years and had to be terminated because of lack of support from both the formal and informal sectors.

Local governments can benefit by involving NGOs for the following reasons:

- NGOs are usually better organised to interact with and motivate the target groups than the government.
- Because of the government's image as a provider of infrastructure and services free of cost, the local government's direct efforts to motivate communities to provide the community resources to the government in solving waste management problems have often produced frustrating results.
- Local governments are organised along bureaucratic lines restricting them to cumbersome regulations and varied procedures, which often are contrary to community spirit and expectations. NGOs can be more flexible and responsive in their approaches to solving specific problems.

1.3.5.1. Civic Groups (Civil Society Organisations or CSOs)

Civil Society Organisations (CSOs) encompass a broad range of independent and heterogeneous groups and organisations. They are established on the direct initiative of individual members or groups of society and do not belong to the official governmental, political or administrative systems at any level.

CSOs include farmers' organisations, rural workers' organisations, community based organisations (CBOs), NGOs, relief and humanitarian organisations, research institutes, trade unions and cooperatives, professional associations, consumers' organisations, universities, private sector organisations, NGO networks, etc. With their independent, but proactive structures, MWM can best be served by the initiatives of such organisations. The education, prominence or celebrity status and personal initiative of members would be most effective in addressing WM problems in the society.

Also, CSOs can be national or international, local or regional. Their roles may be focused around one particular technical or issue area (e.g. sustainable agriculture, environment, gender, population, utilities, municipal waste collection and disposal, etc). or around multiple ones. Those of them that are involved in MWM may be organised nationally or regionally to initiate change, awareness, and action.

1.3.5.2. Street Committees

These were initially started in South Africa, where people in a given area would establish committees and address environmental problems in their locality. This is an excellent initiatives that brings together people with different educational backgrounds, affiliations and experiences to debate and take action by cleansing or identifying local waste problems.

1.3.5.3. Disease Victims

These are special sections of the society which are affected by outbreaks of diseases or industrial accidents. Examples of them are those suffering from epidemics resulting from contamination of food or some other disease vector attributable to environmental negligence. The organisation and exchange of experiences among these groups, educated rather than uneducated, would make them look more closely at the basic reasons for their ailment. They could either take action by reducing the factors leading to their predicament or may even take political action and carry out agitation for better services or living conditions.

1.3.5.4. Pollution Affected Groups

Pollution affected groups usually reside or work in the same place or locality. Their common aim and predicament makes them concerned about the creation of better conditions that would forestall the cause of the pollution or its risks. They form a special kind of pressure group because they can not only seek ways to prevent the incidence but can give each other advice, exchange experiences, and provide a homogeneous test group for investigating the effects of the pollution accident and its other effects.

1.3.5.5. The UNIDO Approach to NGOs

The UNIDO Branch for NGOs considers NGO projects and deals with industry NGOs, policy NGOs, and other functional NGOs such as those working on MWM. UNIDO provides a forum for trans-national and national co-operation.

1.3.6. UNIVERSITIES, TRAINING AND RESEARCH INSTITUTES

Research institutions and universities have been detached from the happenings in the urban scene. Apart from some scattered efforts in some countries, they are not involved much in MWM in Africa. Their role as mentioned above is to track, monitor and provide scientific insight into MWM problems.

1.4. HOW TO USE THIS MANUAL

This is a trainer's support material, not a reference book. It does not give a systematic, comprehensive overview. It focuses on some selected aspects that are important to the subject. The structure of the document allows further sections to be easily developed and added as additional modules.
The package is written mainly for trainers to provide them with support material and ideas, rather than as a study book for students. One of the purposes of this package is to provide some case studies and situation scenarios that can be used as a basis for interactive training and simulated decision-making. However, the exercises only explore a small part of the potential of the case studies, and trainers are strongly encouraged to develop further case studies, exercises or tasks.
The package is oriented at developing insights and decision-making skills. For teaching the factual knowledge base of the subject, trainers are referred to background information and the reading lists in the bibliography.
Work exercises are predominantly based on interactive group-work and a team approach to problem solving. Such work needs to be guided by a tutor who is a recognised expert in the field. This method allows the full complexity of real decision-making to be explored. Trainers are strongly urged not to see this package merely as a set of arithmetic exercises. The case studies, and the whole package itself, are based on real life situations and decision-making, making it most suitable for senior students and trainees, and especially for professional training (or retraining) courses.
Finally, we must stress again that this package does not cover all aspects of municipal waste management. Its primary purpose is to lead trainers into this field, and to help and encourage them to develop their own material, appropriately tailored to their specific learning situation. UNIDO is prepared to work further with trainers who wish to extend this package into new directions, or go into greater depths on some subjects.

1.5. ORGANISING EFFECTIVE TRAINING

Workshops provide a stimulating learning environment where people with a wide range of experiences and skills can join together to address practical problems beyond the ability of an individual to resolve.

Interactive workshops use a combination of several techniques to bring about a deeper and more pragmatic learning experience than is possible with a lecture-style format.

Workshops also provide excellent opportunities for exchanging personal experiences, problem solving through panel sessions and direct consultations with experts, and discussing some of the complex situations, which surround most waste management problems.

The UNIDO workshop format incorporates the following elements:

- Sending out pre-workshop reading material, with some simple exercises;
- Short introductory or overview lectures on key issues;
- Practical problem-solving work with exercises on case studies;
- Feedback by experts and discussions of workshop exercises;
- Panel sessions (that is, question-answer dialogues) with experts;
- Individual study sessions,
- Structured oral presentations with a regional overview;
- Audiovisuals such as videos, films, and slides;
- Field visits where appropriate;
- Personal action planning by participants for follow-up activity.

1.5.1 INTERACTIVE WORKSHOP ORGANISATION

Sessions need to be carefully prepared, with participants knowing in advance what they will do or see. A report form on the current situation of municipal waste management gives a good base for discussion.

It cannot be overstressed how important it is that participants be thoroughly prepared for the workshops.

Groups should first meet informally, elect their own chairman, and then act as a permanent team in various workshop sessions. They are guided, but not instructed, by technical experts.

It is useful to finish the workshop by preparing session reports and personal action plans. Participants should develop and present their proposals for what they can initiate immediately on their return home. Such action includes:

- what they can achieve unassisted, and
- what they could achieve if some assistance were available.

The role of resource experts as advisors is crucial. They should have sufficient experience to assist in all sessions and provide general advice on all subjects in workshops, discussions or panel sessions. They should not, however, dominate the workshops.

The five-day format is ideal for covering all these requirements.. If more time is available, consider including site visits, social events and private study sessions, along with more extensive project work for the students.

1.5.2 IDEAS FOR MORE EFFECTIVE COMMUNICATION

If the training is to be successful, effective communication is essential - from the beginning of the training to the final evaluation of the event.

Without good communication, all kinds of things can go wrong:

- the training is too early - or too late - to make any impact on performance
- trainees do not know what the training is about or what to expect
- the course is planned for a short period, not more than three weeks
- trainees who are traditionally used to lectures are suddenly required to take part in discussion groups, which might feel alien to them.

Most of these issues can be anticipated and overcome by good communication between the course designers, writers, and event organisers and presenters on the one side, and the students and their organisations on the other.

Some simple communication considerations will help to improve results in training and avoid disasters.

Before the learning event:

Find out:

- The educational background of the trainees;
- The real needs and situation of the learners;
- Whether the facilities are adequate for the envisaged training;
- Whether the training you are about to undertake has the support of your office;
- How success will be measured.

Make a project plan for the organisers, giving details of how the event will be organised. Send the plan to them with details of the key dates and needs.

During the learning:

- Find out how relevant the topics are to the work situation of the participants;
- Start with the familiar oil can - not a video of an oil spill disaster;
- Communicate using topics, themes and issues in the local press;
- Make a note of unanswered questions, and remember to answer them before the end of the session;
- Use a bullet-point format for notes to participants- few read essays, or even articles;
- Ensure that the participants keep these notes for future reference;
- If you are working in a foreign language, at least translate the slides.

After the learning event:

- Always communicate your thanks and best wishes;
- Inform participants on follow-up study procedures, and how the instructor can help to

analyse the evaluations and inform the organisers of the results;
- Communicate to colleagues the results of the training and what can be learned from these results.

1.5.3 SUGGESTIONS FOR EFFECTIVE TRAINING

- Provide an enjoyable learning situation.
- Model courses and teaching styles on examples that you think are outstanding.
- Allow the subject matter to be discussed and discovered by students.
- Make courses relevant and interesting by understanding your audience.
- Ask them what they already know, and then plan for their needs.
- Incorporate ideas from the group in the course.
- Remember that no amount of style will substitute for a lack of substance.
- Think about helping people to learn, rather than teaching them.
- Seek trainee feedback, and measure results achieved with objective tests.
- Set learning time limits.
- Seek learning, based on understanding and skills.

1.5.4 TRAINERS' GUIDE

Be sure that you have ***read and understood thoroughly*** participant's notes before you meet your group. There's nothing like being prepared and more familiar with the case study scenario than the participants are!
Before every group work session, take time to visit your assigned meeting room and check the:
Seating arrangements - there should be a large enough table surrounded by enough chairs for the participants and yourself;
Equipment and supplies - such as flipcharts, flipchart papers, marker pens, white/black board, board eraser, masking tape, transparency sheets, writing pads, ball-pen/pencils, calculator, etc.;
Physical conditions of the room - there should be sufficient lighting, the room temperature should be comfortable, noise should be as low as possible, etc.

During the initial group meeting, it is important to ***set an informal and friendly atmosphere.*** It is suggested that you ***introduce yourself,*** preferably asking everyone to call you by your first name, and then let everybody introduce himself/herself in a similar manner. *Do not waste time stating positions and respective organisations, etc.,* which should have been done on the first day. Then ask if the ***objectives and purpose*** of the exercise, which have been previously discussed in the plenary session, are clear to them.

Sample objectives are:

- -identify and understand the options that SMEs can employ in their pollution prevention program;
- -evaluate the feasibility and suitability of these options in view of technical, environmental, financial, organisational, and social criteria and constraints.

It will be useful to know whether the majority of the group members have actually read the text provided, which states the background and the problem. If they have not, then you will need to direct them to focus their attention first on what needs to be accomplished by the end of each part.

If your group gets involved in diverse issues, try to steer them back on the right track by ***asking relevant questions***, rather than telling them what to do. Give ***technical* assistance *and supplementary information*** as needed, without 'spoon-feeding' the participants. However, do not lecture or dominate the group discussion process.

Although you need not stay with your group for 100% of the time, it is expected that you *spend at least 80% of the time* with them during regular sessions. If they decide to work beyond the prescribed regular time, just make sure that they are on the right track; your presence during overtime is not mandatory, but voluntary.

The crucial times are at the ***beginning, middle,*** and near the ***end*** of each group work session. There will be ***critical parts*** during the identification of options, followed by technical, environmental, and economic evaluation, where your technical advice will be most needed by your group. The best way to assist the participants is by giving only the advantages and disadvantages of the options in question. Let them weigh these pros and cons and decide for themselves whether to take or drop the option.

If you encounter any question about the technical content of the material that you have not been briefed on, discuss it with the Team Leader and ***agree on how to tackle the situation***. It may well be that the other resource persons need to be duly advised on the particular question. See to it that you ***compare* notes, *exchange hints,*** and ***share strategies*** with other resource persons so that you can assist one another, as well as gauge your group's progress in comparison with the others.

If tension or heated argument arises among your group members, try your best (with a sense of humour) to ***defuse*** it. In the case *of* ***absenteeism,*** approach the person/persons in question and encourage them to participate. If one or two group members are dominating the discussions or doing all the work, intervene and ***encourage everyone to get involved.*** In order to do this effectively, you need to be attuned to your group's 'culture' and trend of discussion.

Although ***division of labour is*** a time saving group work strategy, it is counter-productive for group members to work individually on these exercises. The most productive,

meaningful and fulfilling group work is when they get to accomplish what they have to do ***as a team*** - and have fun in the process!

1.5.5 SUGGESTIONS FOR SELF-STUDY

Although this package was designed to provide resources for trainers, the potential for self-study should not be ignored.

The package does not constitute a complete course on MWM, but can be seen as an introduction to be supplemented by further reading and additional training materials listed in the references list, and perhaps by site visits and discussions with professionals.

The following approach is suggested for individual study:

- Read the ***introduction***, but avoid any sections on organising training events.
- Seek out the section containing ***background papers*** *or* ***subject content.*** Read through the whole section as a narrative.
- Work through the pages offered to the trainer for ***overhead projection***, and ensure you can relate the key points of each overhead to the text you have read.
- Look at the section on ***exercises***. Identify those which lend themselves to individual work, and tackle them. Those exercises clearly constructed for teamwork, or requiring research, may not be appropriate.
- Refer back to the ***narrative*** text as and when you need to, to complete the exercises.
- Check your ***answers*** against those given in this resource pack. Where there are discrepancies, check through your own work to understand why the discrepancies appeared.

1.6 CASEWORK TASKS

Exercise 1. WHAT KIND OF CO-OPERATION EXISTS BETWEEN THE DIFFERENT DEPARTMENTS IN A MUNICIPAL AUTHORITY IN RESPECT TO WASTE MANAGEMENT AND HEALTH AND SAFETY?

? Identify the departments, their roles and structures, and their interactions with other departments. Identify areas that need more co-ordination.

Make preliminary comments in this space! Refer to 1.3.2

Report on this exercise on a worksheet.

EXERCISE 2 CHOOSE EFFECTIVE METHODS FOR CO-OPERATION!

? What kinds of CBOs, NGOs, etc exist in your locality that are active in MSWM? How does the municipality co-operate with them?

Make preliminary comments in this space! Refer to 1.3.5

Report on this exercise on a worksheet.

A worksheet such as the one shown below can be conveniently used to summarise the results of each exercise.

Make copies of this sheet for as many exercises as are attempted.

? WORKSHEET ?
Session ..... Date .....
Exercise .....
Work Group Members

GLOSSARY

TERMS	EXPLANATION
Anaerobic decomposition	The breakdown of organic material in the absence of oxygen.
Anaerobic digestion	The controlled process of anaerobic decomposition.
Blue Box	A system of kerbside collection of dry recyclables, typically using one or two 50 litre collection containers.
Bring scheme	A system in which householders bring source separated recyclable materials to designated collection points, also called a drop-off scheme.
Calorific value	The energy content of a material or mixture of materials, measured in megajoules per kilogramme (MJ/kg).
Commercial waste	Waste arising from premises which are not private households or industrial premises, for example shops and restaurants.
Composting	The natural decomposition of organic material in the presence of oxygen.
Diversion rate	The amount of material diverted from disposal by recycling or recovery, measured as a percentage of total waste arisings.
Drop-off scheme	A system in which householders bring source separated recyclable materials to designated collection points, also called a bring scheme.
Dry recyclables	Recyclable materials comprising paper and board, plastics, metals, glass and textiles.
Fraction	A designated proportion of the waste stream.
High density bring scheme	A drop-off scheme with a high density of collection points, density being measured in terms of the number of sites or containers per head of population.
Integrated collection	The separate collection of both recyclable materials and refuse in a single RCV.
Kerbside scheme	The collection of a range of recyclable materials from individual house-holds following source separation of these materials.
Landfill cover	A layer of inert material deposited each day to cover waste which has been landfilled.

Landfill gas	A mixture of methane and carbon dioxide generated within landfill sites as a result of anaerobic decomposition (also called biogas).
Landfill levy	A surcharge on the cost of landfill measured in £/tonne.
Landfill site	A site at which waste is deposited for permanent disposal.
Leachate	Liquid generated within a landfill and which requires containment or treatment.
Material reprocessing	The industrial treatment of recyclable materials in which the form of the material is changed in order to produce recycled materials.
Mixed refuse	Refuse which has not been separated at source and which typically arises in the traditional dustbin.
Municipal solid waste	A term referring to waste consisting mainly of household, public parks and streets, commercial and partly industrial waste which is disposed of by or on behalf of a local authority.
Negative sorting	Removing minority unwanted materials from commingled recyclable materials during processing, leaving the majority of the material to pass through the processing operation.
Organic material	Kitchen or garden waste of an organic nature which is suitable for composting or anaerobic digestion.
Picking station	A work place in a processing plant at which material is manually sorted.
Post-consumer waste	Waste which is generated because the product has reached the end of its useful life, that is, products which have been used and discarded.
Processing	The treatment of collected recyclable materials prior to reprocessing.
Putrescibles	Organic material.
Reuse	Using a product more than once without changing its physical form.
Recyclable materials	Materials which have the potential to be recycled.
Recycled materials	Materials which have been recycled either by incorporation into a product or in the form of a secondary raw material.
Recycling centre	A designated collection point in a drop-off scheme.
Recycling credits	A financial credit payable by a WDA to a WCA or by a WCA to a WDA or by either to a third party.
Recycling rate	The tonnage of waste recycled expressed as a percentage of total waste arisings.

Secondary raw material	Recycled material in the form of a raw material which is suitable for use in new product manufacture.
Source separation	The separation of recyclable materials into different fractions by the householder prior to collection.
Sustainability	The use and consumption of the Earth's resources in a way which does not disadvantage future generations.
Transfer station	A facility to which loose refuse is delivered by RCVs and at which the refuse is transferred to larger bulk vehicles or containers for onward transport, normally for disposal.
Virgin material	Raw material produced from previously unused sources, that is, not recycled.
Waste analysis	The analysis of a sample of waste to determine its composition and the weight of the component fractions.
Waste arisings	The quantity of waste generated, usually measured in tonnes per annum.
Waste minimisation	Techniques to prevent waste being generated, also termed waste prevention (see also waste reduction).
Waste recycling plan	A plan produced by a WCA, detailing how recycling is to be undertaken.
Waste reduction	Any technique which reduces the amount of waste (once generated) which has to be disposed of. Thus re-use and recycling are waste reduction techniques. Not to be confused with waste minimisation.
Wheeled bin	A lidded refuse container fitted with wheels. If supplied to households by a WCA the householder is usually required to wheel the bin to the kerbside for collection.
Windrow	An elongated pile of organic material undergoing composting.

ACRONYMS AND ABBREVIATIONS

AD	anaerobic digestion
CAC	command and control approach
CBOs	community based organisations
CHP	combined heat and power
DoE	Department of the Environment
DSD	Duales System Deutschland
EPA	Environmental Protection Act
HDPE	high density polyethylene
IWMS	integrated waste management system
KIRDI	Kenya Industrial Research and Development Institute
LA	Local Authority
LCA	life cycle analysis
LCI	Life cycle inventory
LDC	Leather Development Centre
LSWDB	Lagos State Waste Disposal Board
MRF	materials recovery facility
MSW	municipal solid waste
MSWM	municipal solid waste management
MWM	municipal waste management
NGOs	non-governmental organisations
PE	polyethylene
PET	polyethylene-tere-phthalate
PS	polystyrene
PVC	polyvinyl chloride
RCV	refuse collection vehicle
RDF	refuse-derived fuel
REL	rear-end loader
SME	small and medium enterprise
SWM	solid waste management
TDP	Transferable discharge permit
UNDP	United Nations Development Programmes
UNEP	United Nations Environmental Programmes
UNIDO	Industrial Development Organisation
WCA	waste collection authority
WDA	waste disposal authority
WRA	waste regulation authority
WTE	waste to energy

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UP-DATED TRAINING MANUAL OF WASTE MANAGEMENT IN HIGH DENSITY AREAS OF THE AFRICA REGION

MODULE 1.
THE POLICY FRAMEWORK

Contents

1. INTRODUCTION

The changing patterns of production and consumption in Africa and the population explosion in urban life accompanying it have lead to greater generation of waste in the cities. It has also become clear that massive environmental degradation is in fact threatening African cities: the composition of waste is tilting very fast towards non-biodegradable, rather than degradable materials. Rural areas have seen large-scale soil erosion and water quality deterioration, deforestation, and declining soil productivity. Urban areas have experienced seriously diminished air and water quality, but before all a visibly increasing congestion of solid waste and littered urban environment. Furthermore, this environmental deterioration in developing countries' urban and semi-urban locations was not just a matter of aesthetics or quality of life, but rather a more serious issue involving the diminishment of economic productivity, health problems, water quality deterioration and the acceleration of social dislocation. The UN Centre for Human Settlement (Habitat), Africa Branch estimated that over 80% of the African cities do not possess adequate and meaningful waste management services. To face the problem in a systematic manner governments have to establish policies for waste management at all levels. This would provide conceptual framework for action and control of negligent behaviour and at the same time establish the basis for political commitment necessary for the facilitation of the service (budgeting, prioritisation, institution strengthening and building, etc).

The legislative framework for waste management can be traced to legislation at the national level. This consists of the legislation, standards, regulations, institutions and administrations adopted to control activities causing damage to the environment by way of waste generation or pollution within a state. Framework legislation is usually a single law which contains a comprehensive system of waste management. This would include the institutional issues such as which government authority(ies) will manage waste by way of collection, treatment and disposal as well as the organisational and behavioural aspects. For waste management the local authorities are usually the focal institutions responsible for the implementation of the law. In the course of their action they may enact by-laws suitable for the specific locality or sectoral laws relating to specific sources of waste, households, factories, health, farming, hunting, etc.

Essential Policy Attributes

Irrespective of policy categorisation, all policies, whether national, sectoral, or sub-sectoral, require the following attributes as a minimum to be implementable and to achieve the intended impact:

(a) be guided by very explicit goals, e.g. providing affordable WMS to urban poor, targeting waste prevention, minimisation and recovery.
(b) be targeted and relevant, e.g. levies on specific commercial institutions, households, handling of specific types of waste (priority waste streams).
(c) be supported by clear implementation guidelines, which should include identification of implementing agencies, roles of individuals

within each agency, etc. as stated in a waste handling/management plan, or in guiding instruments apart from and beyond the given legislations.

(d) have a minimal or no conflict with other policies,

(e) for each policy a monitoring and evaluation system has to be put in place. If the poor in a city, for instance, are not to pay fees for collection they have to provide an alternative service like collecting garbage in secondary bins, separating waste, etc. This has to be closely monitored at specific intervals and while operations individuals failing to comply have to pay a fine, after operation such data and records should be used for an overall evaluation of the impact of the measure/specific policy.

(f) executing agencies, e.g. ministries, authorities, etc. have to report to a supervising and responsible agency who is to record, guide, monitor and co-ordinate activities.

Criteria for Evaluating Environmental Policies

There are different types of policies relating to MWM. Each type is expected to cover various stakeholders, for example administrators, polluters, NGOs, private sectors, etc. Each of these will respond in particular ways. Each chosen set of policies has specific characteristics to make it successful in certain circumstances and not in others. In evaluating the effectiveness and the appropriateness of a policy in addressing a given problem in waste management, a set of evaluation criteria has to be set. These criteria usually relate to the following:

- Ability to achieve efficient and effective reductions in waste generation and litter within a given time frame. Increases in level of service (can be taken as an indicator.
  - i. Effectiveness may relate to quality of waste storage, promptness of service, proper collection, ease of service, environmentally friendly facilities.
  - ii. Efficiency would mean highest economic benefits associated with lowest costs for the same output (or input) over a given time period.
  - iii. Level of service (coverage, frequency and schedule in an area) is associated with cost and has to be affordable. L of S has to be tuned with affordability, users willingness to pay for the service and the cost recovery objectives.
- The incentives offered to people to search for better solutions
- Enforceability
- The extent to which they agree with certain moral precepts.

Policy Evaluation Techniques

A specific policy is identifiable when a specific problem arises or when a specific effect, behaviour or emphasis on a particular activity is desirable. Policy choice however, is not always easy and direct. It may be based on direct financial benefits. When this is done it means that the choice is relatively simple and direct. In other situations, where this may not be the case, other techniques for policy evaluation and selection are applied. These are known as cost effectiveness or cost benefit analysis. These can also be based on direct quantitative (and thereby financial) basis or on socio-economic estimations (corrections) of the variables building the components of the system. This latter is a treatment of issue from the standpoint of the nation (meaning the economy or the society). In the course of this certain elements of the components will have to be internalised in the analysis – rather than being seen as externalities to the components of the system of analysis. Cost benefit or cost effectiveness can be applied to policy options as well as specific lines of action (e.g. projects). They have wide applications in environmental economics as well as in municipal waste management. This will briefly be discussed below.

Impact Assessment

Impact is a very general word, meaning the effect of any actual or proposed policy. Impact has been generally used to encompass indirect effects – but in environmental economics it has come to mean direct effects, as well. By direct effects we mean actions which directly affect the build-up of the cash-flow of a new project/policy for whatever purpose it is used: financial, economic or social. There are many types of effects, hence also, effect analysis. There are specific areas relating to MWM. These will be very briefly defined below.

A. **Environmental Impact Assessment.** An Environmental Impact Assessment is essentially an identification and study (description, analysis and assessment) of all significant environmental repercussions stemming from a course of action. Mostly these focus on impacts that are expected to result from a proposed action e.g. a sanitary landfill.

Retrospective EIAs (i.e. those made for existing projects) are also known as Environmental Impact Statements. Both EIAs and EISs can be carried out for any social action, whether public or private, industrial or domestic, local or international. They are largely the work of natural scientists who focus on tracing out and describing the physical impacts of projects and programmes. Impact assessments, depending on their scope, can also be classified as strategic or tactical or simply prospective assessments. In practice their preparation precedes the project design stage and they act as inputs to project designers, policy makers, funders, etc.

For SWM, EIAs are conducted at the collection, transport, treatment and disposal levels or for a whole system in an integrated manner. They are usually conducted at the final disposal level because the size at other levels may not justify the costs. Depending on the size and importance of each of the WM operations the

following parameters would be closely looked at in more detail in an EIA exercise:

I. *Visual Impact* of large and prominent industrial plants (incinerator) or of the waste itself on the surroundings and the landscape
II. *Air Emissions* of the incinerator, landfill site or the offensive odour of accumulated waste
III. *Water Discharges* from incinerators, landfills, treatment or transfer stations and their effects on downstream treatment works, soil, and water resources.
IV. *Ash Discharge* assessment of incinerators or open dump areas' bottom and fly ash
V. *Human Health*: impacts of exposure to pollutants, ingestion via the food chain, water or inhalation. An estimate of the hazards and risks must be made
VI. *Effect on Fauna and Flora*, loss of habitat, etc.
VII. *Site Operations. Management Controls* must be assessed and risks analysed including operational failure and noise impact.
VIII. *Traffic*: rate of increased vehicle movement (and noise) must be assessed for impact on existing road network and traffic flows.
IX. *Socio-economic Impacts*: effect of project on neighbouring residents and existing industries must be assessed. Impact on residents around the facility (their income and employment patterns, social values, customs and traditions, etc) or those directly affected by it has to be assessed, as well.
X. *Land Use and Cultural Heritage*: compatibility of the project with existing and proposed adjacent land use and conformity with local development plans.

All assessments would involve an appraisal of alternative sites, processes, baseline surveys of site and surroundings etc. in order to give enough elbow room for making a best choice from a wide range of alternatives.

B. **Socio-economic Impact Assessment.** When interest centres on how some action – a new law, technological breakthrough, a new source of imports, etc. – will affect an economic system, in whole or in terms of its various parts, we can speak of economic impact analysis. Especially in developing countries, there is wide interest in the impact of environmental regulations on economic growth rates. Sometimes the interest will be on tracing out the effects of a public programme on certain economic variables that are considered particularly important. Examples are the impact of environmental regulation on employment, the impact of import restrictions on the rate of technological change in an industry, the effects of an environmental law on the growth of the pollution-control industry, the response of the food industry to new packaging regulations, the effect of environmental regulation on trade, etc.

Particularly the economics of waste management system structures and their relation to other economic sectors and their interrelationships are of utmost importance. Accumulated waste and its

treatment, costs (pecuniary and other), charges are of great relevance, too. (See discussions on cost effectiveness analysis & cost/benefit analysis below)

C. **Regulatory Impact Assessment.** This is used mostly in the USA where the government introduced a procedure called Regulatory Impact Analysis (RIA). The procedure calls for federal agencies to conduct RIAs for all major federal regulations. A basic component of an RIA is simply a benefit-cost analysis of an existing or proposed regulation, e.g. the EPA's proposal to phase out asbestos in manufacturing production processes. The inevitable costs of this proposal are the increased production costs of a large array of asbestos-using products stemming from a switch to alternative materials. The benefits are the values associated with reduced negative health effects, particularly the reduction of the incidence of cancer.

2. DEFINITION OF POLICY & WASTE MANAGEMENT POLICY

Policies are courses of action adopted to correct behaviour or bring about a desired change. Sometimes policies need to be strengthened by detailed statements that outline areas of desired action or prohibit certain kinds of action. Laws are used to achieve this objective for government policy. Laws themselves are made to reflect or shape a society's norms. They can further be employed to change attitudes and/or change behaviour in a direction consistent with society's norms or values. They can be defined as codes of conduct appropriate to the values of the community that is drafting and enforcing them. Types and sources of laws (written and not written) are many, such as customary or traditional, canon, common and civil law. Laws establish institutions (physical or other) used to implement objectives of the laws.

Broadly defined, policy should be regarded as the overall framework, philosophy or broad structure by which a government (or an establishment) intends to or does influence socio-economic activities or human behaviour. A study by the ILO (1992) entitled "Government Policies and Urban and Informal Sectors in Africa" defined policy as a set of rules influencing how resources are allocated and who benefits from resource allocation. The Collins English Dictionary (Updated Edition) defines policy as a plan of action adopted or pursued by an individual, government party or business, etc. An economic policy may be defined as a government plan of action targeting socio-economic goals of economic development. An environmental policy can be understood as the set of governmental action and statements expressing their vision, outlining the path to realize this vision and specifying individuals and institutions charged with carrying out the tasks and objectives of these visions. This is also made by the use of instruments like action plans, management systems (institutions) and legislation (laws, by-laws, regulations) and the guiding tools with the aim of improving the environment by meeting sustainability objectives. Within the context of policy management, policies have to be co-ordinated, reviewed, corrected and harmonised from time to time with other relevant policies like economic, industrial, agricultural, population, and other policies.

Solid waste management as defined by Tchobanoglaous is "the discipline associated with the control of generation, storage, collection, transfer and transport, processing, and

disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations, and that is also responsive to public attitudes".

Waste management, seen as a set of interrelated activities where all activities are planned and carried out in relation to each other: waste avoidance or minimization, collection, transport, processing and disposal. Others relate to financial planning and management (funding, cost effectiveness, costing and cost recovery mechanisms), strategies for moving towards operational efficiency and sound practices, participation (public and private involvement in all stages: policy formulation and implementation), and training and public education (creation of awareness and communication modalities). All of these aspects have to be captured in a practicable manner in a policy framework which would facilitate their combination and implementation and management.

3. WASTE MANAGEMENT POLICY: THE BASIC PHILOSOPHY

A waste management policy (typically called strategy, too) is mostly a subset of environmental and health policies. The purpose of a waste management policy is twofold:

- ***Prioritise the waste management service***
- ***Create a conceptual framework for policy formulation and implementation.***

Prioritisation of the service would mean ensuring political commitment, hence, inclusion in the budget and creation of institutional structures and capacities needed to deliver the service.

Creation of the conceptual framework is attained by creating a waste management policy framework needed to shape and direct the policy impetus at all levels.

Waste management policy framework is based on two basic concepts which are the waste management hierarchy and the integrated waste management.
The conceptual framework for waste management can first be approached by addressing the waste management hierarchy. Second it can be further developed by adopting an integrated framework which would internally optimise the chosen combinations of waste management options over time, on the one hand and by extending the integration to include policy formulation and implementation.

This is not a simple task as the conceptual framework has to take into consideration a host of issues:

1) Overall goals:
    (a) Public health.
    (b) Environmental Protection
    (c) Economic and social development
    (d) Employment in the WM sector itself, and
    (e) Poverty alleviation/ Poverty eradication: programmes for lower income groups like Food for Work.

2) Basic Structures:
   (a) Who are the main actors: public, private, community; service users and providers; regulators; facilitators; their respective interests, roles and capacities?
   (b) What is the scope of MSWM and what are the identified tasks, functions and activities involved?
   (c) How should strategies be sought and thought out; what specific issues, objectives, aims and targets are to be addressed with respect to strategic issues?

These questions will not be directly addressed here but in the course of this Manual as a whole answers can be found.

4. WASTE MANAGEMENT HIERARCHY

Options for waste management are often arranged in a hierarchical manner to reflect their desirability. The first priority is waste avoidance, that is not producing waste in the first place. If the waste must be produced, then the quantities should be minimised. Once that has been achieved, the next priority is to maximise recovery, reuse and recycling of suitable waste materials. Taken together, these three options are often called waste prevention, although strictly speaking only the first two are prevention whereas the third is already an end of pipe solution.

Once the possibilities for waste prevention have been exhausted, the next priority is to reduce the volume of residual wastes being passed on for final disposal, extracting resources in the form of products and/or energy in the process.

Figure 1.1.A represents this hierarchy as an upright cone, with the most desirable option, waste avoidance, at the apex. By coincidence, the volume of each of the layers in the cone is also roughly proportional to the relative quantities of waste currently being managed by each of the options in most countries around the world. In other words, while there is general agreement on the order of desirability of the various options, in practice the current situation in terms of relative quantities is generally inversely proportional to desirability.

An alternative representation of the hierarchy, in which the volume of the layers is proportional to their desirability, is as an inverted cone (**Figure 1.1.B**) rather than an upright cone. This reflects the relative quantities of waste, which the introduction of a sustainable waste management strategy seeks to achieve.

A comparison of **Figures 1.1.A** and **1.1.B** allows one to draw another analogy with waste management in practice. An upright cone is a stable structure, while the inverted cone is inherently unstable. To move from the current situation in which the majority of wastes are dealt with by final disposal or other end of pipe solutions to one where waste prevention becomes dominant, it is necessary for governments to provide some support through policy measures. **Figure 1.1.C** illustrates that policies which encourage waste

avoidance and waste minimisation are to be preferred over those which focus purely on further encouraging present efforts in recycling, recovery and reuse.

Figure 1.1.: Solid Waste Management Hierarchy

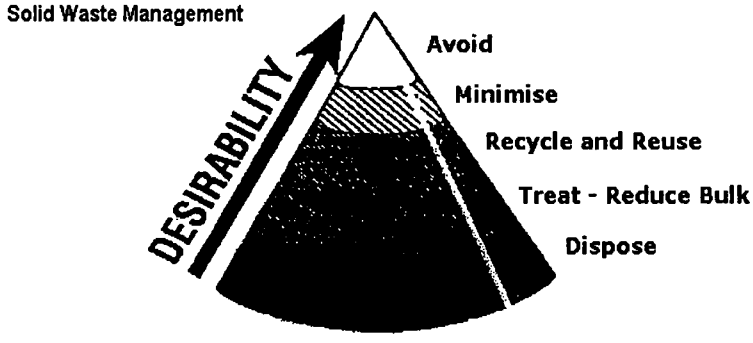


Figure A The waste management hierarchy in its cone shape

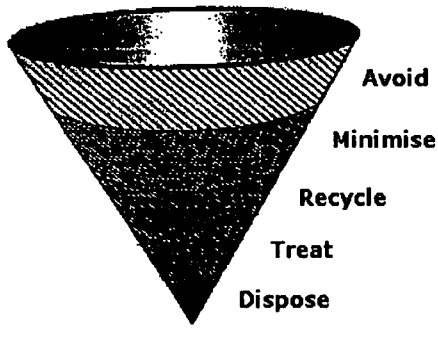


Figure B The waste management hierarchy in its inverted cone shape, indicating that the aim is for quantities of waste managed by each method to decrease as one moves down the hierarchy

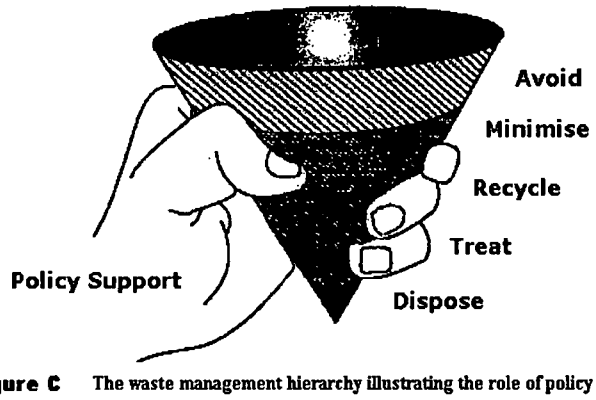


Figure C The waste management hierarchy illustrating the role of policy support in stabilizing

5. INTEGRATED WASTE MANAGEMENT

Definitions of the Integrated Approach

A Functional Definition: Integrated waste management (IWM) can be operationally defined as the integration of six functional elements:

1. Waste generation: its assessment, appraisal and evaluation of potential for its reduction.
2. Waste handling at source: separation, storage and processing at source.
3. Collection from source to e.g. materials recycling facility, transfer station or landfill.
4. Separation, processing and transformation of solid waste at various destinations.
5. Transfer and transport, e.g. from smaller collection vehicles to larger transport equipment or to larger distances, and the associated time and travel route optimisation and
6. Final disposal: to landfill, land spreading, or incineration directly from source or indirectly from recycling facility or transfer stations.

IWM, thus, involves an evaluation of the use of the functional elements, and the effectiveness and economy of all the interfaces and connections to arrive at the objectives of the IWM system. The definition emphasises the hierarchical element for selection and application of suitable techniques and technologies as well as management programmes in order to achieve a specific objective or goal.

The Source Book on environmentally sound technologies for MSWM defines IWM as a frame of reference for designing and implementing new waste management systems and for analysing and optimising existing systems. All aspects, since they are all interrelated, should be analysed together and as developments in one part affect the others such changers are ideally considered continuously and optimised. The system should provide for that over time in its conceived designs.

But for the above to be effective and comprehensive, policy aspects have to come into play. In other words, if waste management is to change significantly, the behaviour of individuals and groups in society will have to change. Policy tends to ensure stability of the system. All stakeholder groups are expected to participate in policy formulation and all other subsequent stages of planning and implementing the system. Only in such a manner their commitment and contribution can be ensured. If community members were made to discuss the need for the service, the costs and financing of the service, the workload at all stages from generation to disposal, their subsequent participation as promoters of the service is more guaranteed than them having instructions top-down from the city management to care for the service. They will also be in a better position to judge on the efficiency and effectiveness of the employees, and thus, more democratisation and effective governance is ensured. Each member of the major stakeholder groups feels not only addressed but directly concerned to fulfil his own perceptions. They will fulfil that either by taking part in the provision of the service or by *paying* for the service provided

in a satisfactory manner. Four groups in society are key to this process: government, industry and commerce, and other formal institutions like research institutions, universities, the media, etc. The fourth group, that is lobby groups, the community, CSOs and NGOs, are effective as a conduit of ideas, energy and implementation. Policies need to be designed to change the behaviour of the broad masses in all of these groups in order to reduce or even reverse the growth in waste generation in an integrated manner.

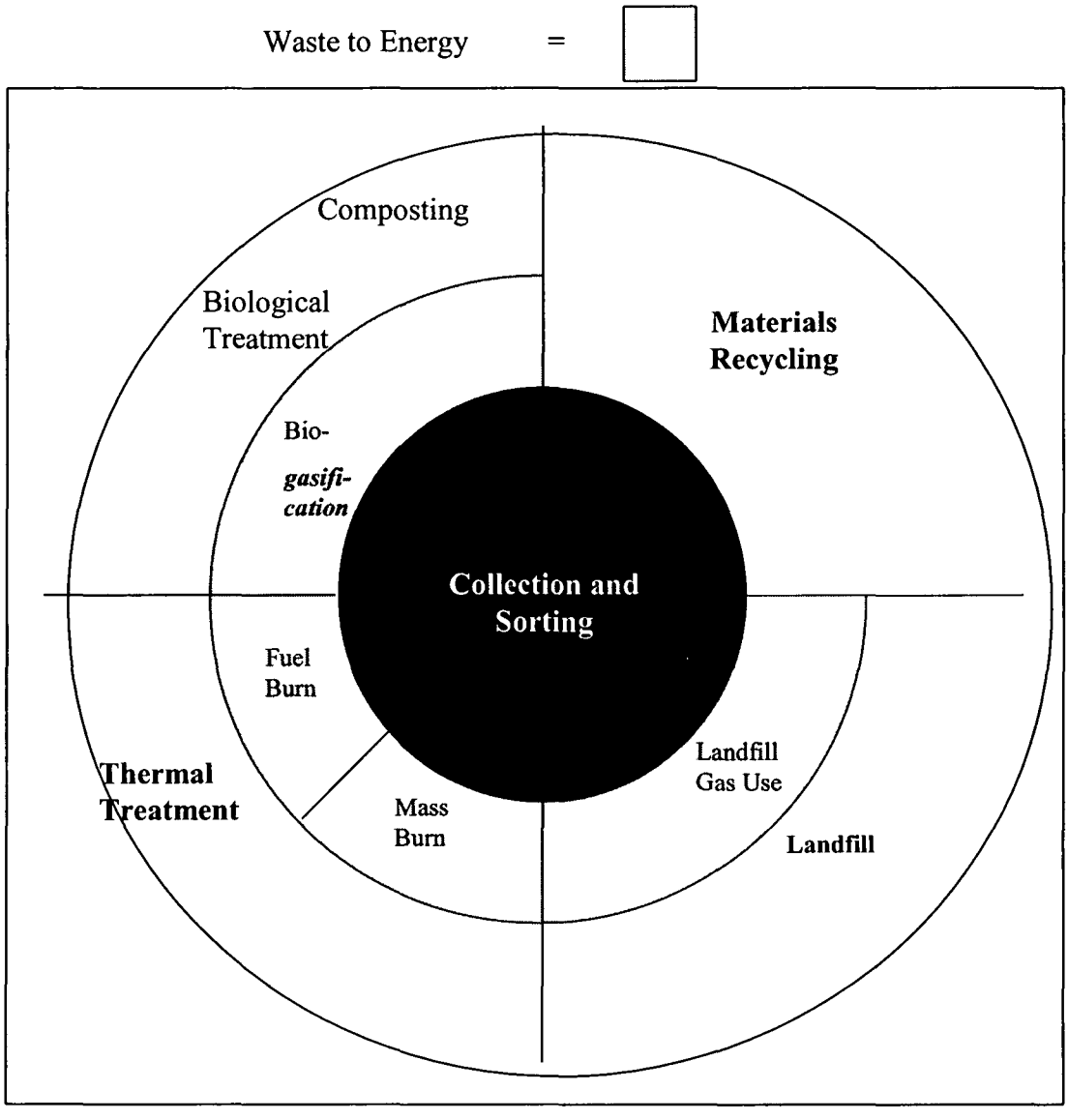
Effective policies generally operate on a two-pronged approach. Where possible, waste reduction policies should be implemented on a voluntary basis (partly enhanced and brought about by education and awareness creation), by all the above groups. In order to kick-start some initiatives, the government can provide an incentive or *'carrot'* in the form of financial or other support. Combined, these form the first prong. For the second prong, governments implement policies to tackle the underlying causes relating to waste generation and positively discourage it, *the stick.* The Zimbabwean Government's introduction of a landfill (gate) tax, which will focus attention on the costs of disposal, is such a policy. Some such measures need to be implemented alongside those from the first prong. In addition, it is essential that policies build on, rather than undermine, existing strengths. Where there are already efforts to reduce waste generation or recover materials for recycling and reuse on a voluntary basis or using current market mechanisms, policies must aim to reinforce these efforts and not be so invasive as to undermine such existing initiatives.
Finally, even with all these policies and measures in place and operational, some wastes will still be generated and require disposal. The provision of bulk waste reduction technologies will help to reduce the volume and weight of these remaining residues prior to final disposal.

IWM has also been defined as the integration of waste streams, collection and treatment methods, environmental benefit, economic optimisation and societal acceptability into a practical system for any region. IWM implies the use of a range of different treatment and disposal options, including waste reduction, re-use and recycling, landfill, incineration, and alternative options such as pyrolysis, gasification, composting and anaerobic digestion. But it also implies that no one option of treatment and disposal is better than another, that each option has a role to play, and that the overall waste management system chosen should be the best environmentally and economically sustainable one for a particular region.

Environmental sustainability means that the options, and the integration of those options should produce a WMS that reduces the overall environmental impacts of WM, including energy consumption, pollution of land, air and water, and loss of amenity. Economic sustainability means that the overall costs of the WMS should operate at a cost level acceptable to all areas of the community including householders, businesses, institutions and government. In assessing the most environmentally and economically suitable system, the local, existing WM infrastructure such as availability of landfill sites, existing incinerators, the types of waste to be managed, waste tonnages generated, etc. should all be considered. Financial sustainability denotes commercial/private or operational sustainability in the sense that financial and operational costs and proceeds are balanced or favourable. This is an important aspect that ensures continuity of the service.

Figure 1.2. shows that at the centre of an IWMS is the collection and sorting of the waste, since this influences the treatment and disposal options of that waste, e.g. recycling, composting, energy recovery, etc.

Figure 1.2.: Elements of an IWM System



5.1. THE ADVANTAGES OF IWMS

Advantages and disadvantages depend on the scope, context and mode of integration adopted. Yet generally we can speak of the following advantages:

- The system promotes waste prevention and awareness and involves all stakeholders.
- Cost effectiveness: it furnishes an easy approach to management cost reduction.
- Internal dynamic optimisation based on continuous change of WM hierarchy and policy.
- The interrelated and self-correcting mode of operation of the system. Full use/co-use of experts, skilled labour in a centralised pollution control system
- The system facilitates effective feedback and networking of operations: collection, transport, separation, recycling and disposal
- Scale-effective
- Information on waste: specific data on waste generation amounts and composition, etc. are readily available.

An integrated strategy for waste reduction requires a combination of all the types of measures detailed above.

In most African countries, these policies are a scattered and are expressed in sets of incoherent set of laws and regulations on waste treatment and disposal, and public behaviour in sanitary and other spheres. There is no coherent, consistent and comprehensive set of laws and regulations on waste collection, treatment and disposal. This comprehensive waste management structure is desirable not only within African countries, but regionally and at the continental level and beyond.

A policy statement may be applicable in its stated form or may require the enactment of legislation in order to create institutions or regulate behaviour in a specific manner and enforce compliance.

6. THE WASTE MANAGEMENT SYSTEM

The system of waste management is typically made up of:

1) The Policy Statement, a document stating objective, targets, and ways and means of achieving these objectives. The policy statement may take the form of a directive as in the case of the EC Waste Framework Directive (75/442/EEC) or its amendment EC Directive (91/156/EEC) which requires the formulation of national waste strategies from member states. The U.K. Strategy for Sustainable Waste Management is such a response and which set out policies in relation to the recovery and disposal of waste. It may also take the form of a separate document stating policy objectives and strategies needed to approach these objectives. Policy implementation is another stage at which policy is detailed out into specific spheres: laws and regulations, institutions, on the one hand and to implementable projects. The policy should then provide for specific operational guidelines and tools. Once these actions are in place the policy formulation can then be complemented by the development of a monitoring and evaluation system to measure the impact of policies on waste management service and its impact on the environment. The outputs of the monitoring and evaluation system adopted will result in correcting actions along the path of implementation and/or review and change the policy itself in case it proves beyond the available means or ruling circumstances conducive to its implementation. This should not be intermixed with monitoring and evaluation of specific projects (proposals), which is a different context (resource allocation) for measuring the performance of such investments/projects and the need to improve on their operation or their scope (managerial controlling function).

2) Policy Implementation Instruments which are typically made up of:

   a) The Legislative and Institutional Framework. The formulation of the institutional framework precedes that of the legal framework.
   b) Allocation of resources by planning of economic intervention, e.g. investments, location, infrastructure. and
   c) Other tools and instruments guiding behaviour at the different levels: technical management, community behaviour, government and other stake holder groups.

3) Other Operational Tools and Instruments

This will include all detailed plans at the operational level of implementation. It distinguishes itself from major and strategic plans, which are more general and macro in nature. A strategic action plan may state types and methods of collection in a given jurisdiction, the numbers and types of vehicles for transport, type, age or quality of landfills. An operational tool will guide action on the above but to a lower level of detail. This may take the form of a sub-plan, method(s), or procedure. Examples are survey methods, monitoring and supervision guidelines, routing of individual vehicles, participation methods, communication plans, etc.

7. WASTE MANAGEMENT POLICY FORMULATION

The policy document is expected to state objectives of the policy, guiding principles for each policy and strategies to achieve each objective in general.

Policy Objectives

Objectives are broad aims. They can be subdivided at lower levels of management (municipal or operational levels) into targets, which are more specific and location bound. Examples for the objectives are issues thought to be of paramount importance to the policy formulating organ: central or local government or a departmental organ. Specific objectives may relate to: prevention of waste, recovery of waste (the core of a waste management system), awareness creation, promotion of participation by the private sector or the community, consolidation of systems development, setting of regional or sectoral priorities, etc.

Guiding Principles

Policy Formulation is expected to follow certain guiding principles relating to the economic, environmental, social and legal conditions of providing the service on the one hand and to principles guiding other policies within the country. Important examples to such principles may be:

- The proximity principle:
- The self-sufficiency principle
- Environmental standards for waste management installations
- The polluter pays principle
- The hierarchy principle and the integration of the waste management system.
- The privatization principle
- The Producer responsibility
- Promotion of sound practices

In the absence of an African strategy, internationally recognized systems and conditions would influence the adoption and use of such principles in each country. The above principles can be contained in a national document aiming to establish and maintain adequate and sustainable waste management systems, on the one hand and, to achieve a high level of environmental protection on the other. As there are several alternative strategies for each waste management sub-system, there will be several principles guiding a specific strategy. Optimizing of such alternative would result in a limited number of alternative overall strategies of which one would be selected for implementation under given conditions of jurisdiction, technology and financial and administrative capacity. With respect to the above given examples the following can be said.

The proximity principle means that waste must be disposed of in the nearest installation to where waste is generated. Second, the self sufficiency reflects the general idea that waste which is generated within a given country should not be disposed of outside that country. It should be noted, however, that the consequent legislation should be aware of the fact that this would apply to waste disposal, but not to waste recovery – where waste is seen as a potential or actual good.

Strict environmental standards for waste management installations addresses the legitimate and far reaching concern of the population expressed in the NIMBY syndrome (not in my backyard) where waste should not find its way back to settlements while in transition, processing or at disposal. Closely related to this issue, though not quite apparent is the question of statistical data on waste generation and its types (listing of both hazardous and non-hazardous) as well as recycling and recovery data. The potential environmental impact is huge. An efficient management would require systematic data collection, esp. at the national level, using a standard and uniform scope, coverage, definitions and nomenclature.

The polluter pays principle emphasizes the shared responsibility nature of the waste management service. Along the generation, transport and use of products, the perpetrators of pollution by direct generation of waste have to bear the total costs of the wastes generated by their action. This allocates clear responsibilities on the producers, transporters, traders and the consumers with equal emphasis.

The waste management hierarchy principle is the most important practical, analytical and decision making (best solutions taking economic and social costs into consideration, internalization of environmental costs), and conceptual approach to waste management. It applies more clearly to the technical operations: collection, recovery and disposal. Recovery and disposal are significant, but the generation of waste is a form of pollution and at the same time a "waste" of resources. Therefore, the key objective of a policy based on the precautionary and preventive principles must be to prevent the generation of waste and minimize hazardous content in the waste. This will simultaneously lead to avoiding any *risk* to harm human health or the environment. Thus, integration means to associate the hierarchy principle with the policy vision such that they reinforce each other. In the long term such an integration will lead to life cycle considerations of waste avoidance – from cradle (design and production) to grave (disposal) consideration of no or minimal waste emanating from a product or process. It also incorporates other behavioral and managerial aspects, which lie beyond the technical sphere. From another stand point life-cycle-analysis for waste *per se* is most important in industrialized countries whereas in the African context most of the products are imported. Hence the need to extend the responsibility to border points where such products enter the countries and an appropriate measure to consider "producer responsibility" has to be met. The principle will be discussed below in more detail.

Recovery has to be understood in its dual dimension: reuse, recycling (the EU takes a triple dimension by including energy recovery, the potential for which is reduced in the African context as most of the waste is putrescible organics with high water content). This Manual is limited to municipal waste resulting from domestic and other sources, but not to industrial waste. Hence, recovery will mean more recycling at the community level:

composting, biogas, simple processing by micro- und small-enterprises and some industrial recycling, e.g. the waste stock exchange approach, some paper and glass, and plastic recycling in industry.

The integrated waste management system relates to associating the hierarchy principle with policy formulation and implementation. The latter has much to do with behavioral aspects influenced by legislation, creation of awareness, changing of attitudes, payment for the service and participation in decision making, advocacy, and direct provision of service.

The workload of waste service has proven to be far beyond the capacity and capability of the governments. Funds are limited and efficiency is low while the service can be very profitable, if efficiently and reliably provided – even in the poorest areas. Privatization would mean to transfer the burden on private operators and shedding out the service task, *per se*, from the municipal authorities. This will be discussed in more detail below.

The producer responsibility is a preventive policy approach compatible with the shared responsibility approach and it is aiming to prevent waste at the product and production processes levels. Traditional waste service has been paid for by either the tax payer or the environment. This approach is not compatible with the preventive, precautionary or the polluter pays principle. The producer responsibility is a principle aiming at closing the life cycle of substances, components and products from their production through their useful life until they become waste. The objective can only be achieved if economic operators can be made to provide efficient contribution towards protection, preservation and improvement of the quality of the product and the environment. Considering the life-cycle of a product all actors along the chain: producers, material suppliers, traders, consumers, and public authorities share specific waste management responsibilities. However, it is the product manufacturer who has a predominant role with respect to key decisions: design, conception, use of inputs, composition, marketing and use. He can thus influence utilization of natural resources, renewable inputs (energy and non-hazardous materials) and conceive products such that proper use and recovery are facilitated. Marking, labeling, issue of instructions for use and data sheets may contribute to this aim. Other practical designs to involve manufacturers will be discussed later.

Sound practices are a priority for African countries as the practice itself has been dwindling and losing in importance in the last few decades. Sound practices means the generation at source, collection, transport, recovery, and final disposal has to follow specific standards and efficiency rules. A sound practice, according to UNEP/ITEC, Source book on sound municipal solid waste management, (Osaka, 1996) is a technically and politically feasible, cost-effective, sustainable, environmentally beneficial and socially sensitive solution to an MSWM problem. What constitutes *sound* is context specific and applies to waste reduction, collection and transport, recovery and disposal. It includes planning, design, use and operation.

8. INTEGRATED WASTE MANAGEMENT STRATEGIES

Strategies at the formulation level are general and provide the basis for subsequent actions. They may be translated into laws and regulations or actions being the building blocks of action plans. Further formulation, if needed at the various levels of the service, may be more detailed such that they may be implemented – these then are termed operational guidelines/instruments because of their specificity.

In order to achieve an integrated approach to waste management, the following need to be included in any strategy:

- Policy and other measures to encourage the avoidance and minimisation of waste.
- Policy and other measures to encourage the recovery, recycling and reuse of materials that would otherwise enter the waste stream.
- Adoption of bulk waste reduction technologies which will effectively reduce the volume of materials remaining in the waste stream after the above measures have been put into place, thus minimising the amount of material requiring final landfill.

While there are options within each of these categories, a strategy, which omits the inclusion of measures from any one complete category is likely to achieve much lower levels of overall waste reduction than one which uses a more integrated approach. In support of this conclusion, reference is made to a series of hypothetical scenarios in **Figure 2.6**, which illustrates how a combination of policy and technical measures could be combined to reduce the final tonnages of waste dispatched to landfill.

The *first scenario* ('no change' or 'do nothing') shows an existing situation where approximately one third of the waste is recovered by recycling.
The *second scenario* indicates a simple 'technical fix' in which no policy measures are introduced, reliance being placed instead on a comprehensive programme of building incineration facilities. This scenario cuts landfill demand by 50% but does nothing either to tackle waste growth (a continuing programme of building new incineration plants would be needed) or to reduce expenditure on waste collection, transfer, treatment and disposal.
The *third and fourth scenarios* indicate 'low' and 'high' application of waste avoidance, reduction, *etc.* policies and technologies. The benefit of the integrated approach is not only a substantial increase in waste reduction, but also a substantial potential to reduce the costs of collection and disposal.

Figure 2.6 Combining Policy and Technical Measures into a Waste Management Strategy – Potential Waste Reduction under Four Scenarios

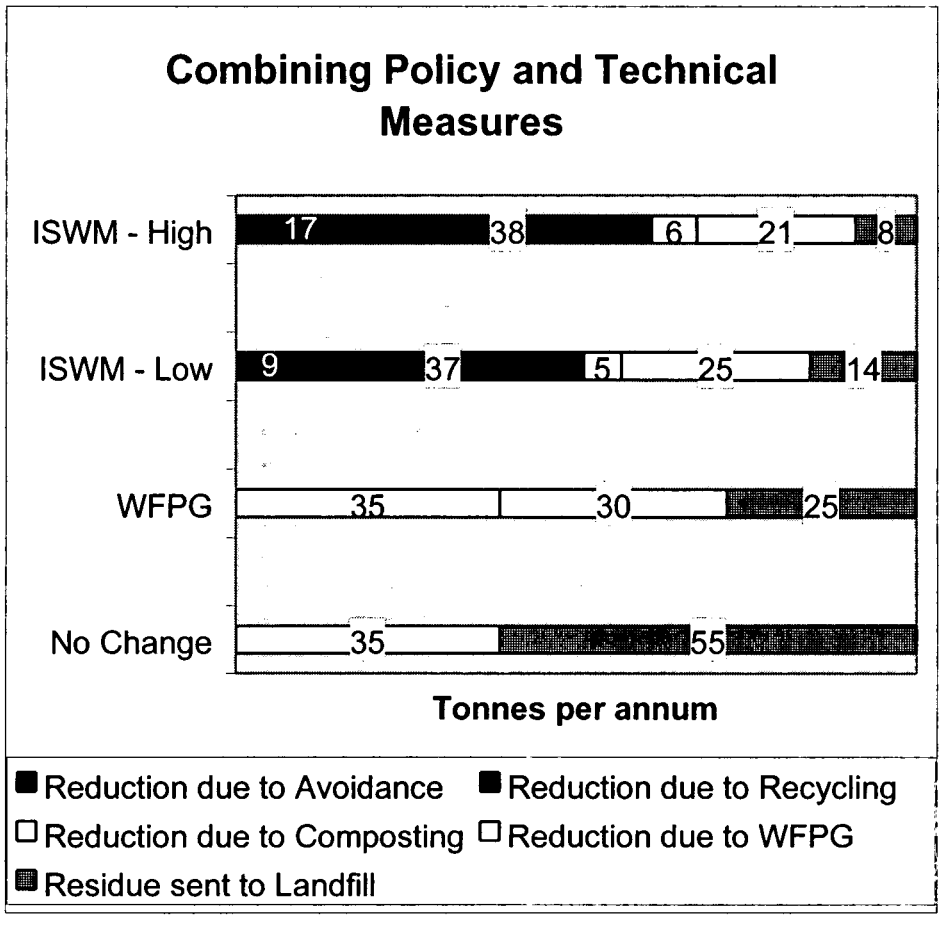


Table 2.6 summarises the combination of measures some countries are taking to strive towards sustainable waste management.

Table 2.6 The Use of Waste Reduction Policy Instruments in Some Countries

Country	Deposit Refund	*Producer Responsibility*	Voluntary Agree-ments (Recycling Targets)	User Charges	Waste Disposal Levies/ Taxes	Product Taxes	Recycling Credits	Market Support/ Preferential Purchase	Compulsory Collection/ Recycling	Grants/ Subsidies
Australia	✓		✓	✓	✓		✓			✓
Austria	✓	✓	✓	✓	✓	✓			✓	
Belgium	✓			✓*	✓	A				
Canada				✓			✓		✓**	✓
Denmark	✓	✓	✓	✓*	✓	✓		✓	P	✓
Finland	✓			✓	P	✓			✓	✓
France		✓	✓	✓*	P					
Germany	✓	✓		✓*				✓	A	✓
Greece				✓						
Ireland				✓*						✓
Italy		✓		✓*		✓				
Netherlands	✓		✓	✓*	✓	✓		✓	✓	✓
Norway	✓			✓*		✓				✓
Portugal				✓*						✓
UK		P	P	✓*	P			✓		✓
USA	✓**			✓*	✓**		✓	✓	✓**	✓
European Union			P						A	

Status: ✓ implemented, A agreed, P proposed
Notes: * through general municipal revenue, ** in some states (regions) only

In conceptual terms, what an integrated strategy seeks to achieve is to convert a linear transference of materials through the producer-user-disposer chain to a series of circular, and as far as possible, closed systems where beneficial aspects of the waste (materials, energy, *etc.*) are drawn out at each stage. However, the phrase 'waste management hierarchy' may suggest that after waste prevention and minimisation, the remaining options nearer the apex of **Figure 2.3** invariably represent more environmentally acceptable solutions and conversely, options such as landfilling invariably represent less environmentally acceptable and less sustainable solutions. This view could lead to anomalous and unbalanced waste management strategies which take insufficient account of local situations and economic sustainability. Reusable containers need to withstand repeated cleaning and handling and therefore require more material and energy in their manufacture than do single-trip containers. The overall energy consumption of a bring system which involves the householder in a 2 km car ride to a Civic Amenity site to deliver recyclables is over double that of a basic system involving non-segregated kerbside collection followed by landfilling.

In order to optimise the overall waste management strategy, with respect both to the environment and to economics, it is necessary to address the entire strategy in a holistic sense. The following section below discusses some comparative tools that are being developed for this purpose.

9. OPTIMISATION OF WASTE MANAGEMENT STRATEGIES

The development of a sustainable waste management strategy involves a structured approach. A powerful analytical framework for the comparison of waste management options or combinations of options is provided by Life Cycle Analysis (LCA). A more comprehensive approach leading to an overall strategy will be given under the Planning Module in this Manual. The methodology comprises the following stages:

- *Goal definition and scoping,*
- *Inventory analysis, Impact assessment,*
- *Improvement assessment.*

The main focus is presently on the collection of sufficient data on the resource, energy and emissions characteristics of waste management systems; most LCAs terminate at the inventory stage, a process called *Life Cycle Inventory* (LCI) analysis.

A hypothetical case study LCI analysis can be used to illustrate the methodology.

The following waste management options were examined:

- Unsorted collection of household waste followed by landfilling.
- Unsorted collection of household waste followed by mass burn incineration.
- Unsorted collection of household waste followed by composting and marketing of the compost.
- Separate collection and composting of putrescibles and landfilling of the rest.
- Separate kerbside collection of dry recyclables and incineration of the rest.

There is a net benefit in energy consumption and a reduction in global warming potential when waste is incinerated rather than landfilled (Scenario 1 *versus* Scenario 2). In the case of Scenario 3, there is no net reduction in energy consumption relative to direct landfilling of the waste, but this changes to a net benefit if account is taken of the savings resulting from product substitution. In general, Scenarios 2 and 5 (involving incineration) were more preferable in terms of net energy consumption than the remaining scenarios. Other scenarios and variations thereof can also be assessed. For example, the collection of waste can be supplemented by sorting and recycling of glass, or it can be assumed that the compost generated in Scenario 3 has no market.

Emissions of other pollutants can also be assessed on a comparative basis. For example, a comparison of emissions from the combustion of MSW *versus* the combustion of conventional oil or coal for the production of energy indicated significant decreases in emissions of acid gases and particulate matter were a replacement MSW incinerator to be installed.

10. THE WASTE MANAGEMENT HIERARCHY IN PRACCTICE (A)

Opportunities for Waste Avoidance and Minimisation

Waste avoidance and minimisation are the most desirable options in the waste management hierarchy as discussed above. This section explores the ways in which waste avoidance and minimisation have been or may be practised to reduce the amounts of domestic, commercial and industrial wastes that arise. In A and B below some non-legislative options will be discussed to explicate open possibilities for waste avoidance and minimization. **Table 2.4** lists some options, which may be appropriate and these are discussed in greater detail under each sector. Some of these waste avoidance and minimisation options may be applicable to all waste generators while some would be applicable only to industry (or even to specific industry sectors).

Domestic Sector. There are many ways in which individuals can avoid or minimise the amount of waste they put out for disposal. As consumers, they may select product types, packaging types that would lead to the generation of less waste. For example, waste can be reduced by buying in bulk, utilising reusable shopping bags, buying reusable and more durable products and by buying equipment that generates less waste (for example electrical equipment which runs off mains power or uses rechargeable batteries to reduce the quantity of primary cells used). A major factor is to change the public's perception of waste and how to deal with waste materials. Education and communication programmes therefore need to be built into any approach aimed at the domestic sector before significant take-up of the options offered can be achieved.
Good housekeeping can also contribute to waste avoidance and minimisation. For example, proper operation and regular maintenance of equipment is likely to significantly lengthen its useful life, reducing the need for replacement, and better household management can reduce the unnecessary purchasing of consumer durables and perishables, and hence waste. In a Dutch study on consumer habits relating to the purchase of milk and bread, it was found that about 15% of bread was wasted because it was stored too long in the home, resulting in 70 000 tonnes of bread being rejected as

waste and hence landfilled. The accompanying wasted packaging amounted to some 6000 tonnes of plastic and paper.

Collection and Sorting

A prerequisite for the cost-effective reuse and/or recycling of potentially valuable components in MSW is that these materials be separated out from the bulk waste. A number of options are available, as discussed below.

Source Separation. Collections of waste materials at source are termed 'kerbside collection systems'. This method involves the householder putting out recyclable materials for collection separate from the normal refuse. These recyclable materials may either be mixed, all materials being placed into one container for future sorting either by the collector or at a reclamation facility, or separated into individual materials.

Table 2.4 Ways to achieve waste avoidance and minimisation

Product Design Change	Product design with less waste Increase product life
Package Change	Produce in bulk or concentrate form Reusable or recyclable pack
Material Change	Substitution of less toxic materials Use of reusable or recyclable materials
Technological Change	Improved/more efficient equipment Cleaner technology, substitute oil- for water-based
Good Housekeeping/ Management Practices	Proper operating procedures and regular maintenance Inventory control Training and clear instructions Waste segregation

In the *separation at source* scheme, the householder is either required to place recyclable materials into one container for sorting by the collector at the kerbside when the materials are collected, or the recyclables are placed in separate containers. An example of the former is the 'Blue Box' scheme in Sheffield, where in the first year of operation some 277 tonnes of paper, 78 tonnes of glass, 39 tonnes of cans and 27 tonnes of plastic were collected from 3300 properties, resulting in a 17% reduction in the quantity of materials entering the domestic waste scheme. The latter scheme has been in operation in Leeds, Bury and Milton Keynes. The UK's first purpose-built MRF was opened in 1993: it currently processes approximately 20 500 tonnes of material per annum, or about one fifth of its potential capacity. Sorting from a co-mingled source can also be done at the kerbside using a specially adapted vehicle.

Bring systems are very widely used in many parts of the world and are typically employed for the recovery of glass or paper. In the UK, the recycling centres at Civic Amenity sites and recycling facilities, such as bottle banks and paper banks outside supermarkets and in town centres have been set up to permit the deposit of recyclable materials in separate facilities. Typically, separate facilities are used for glass, metals, aluminium and steel cans, paper, cardboard, oils and textiles. Occasionally, containers for hardcore, wood, car and domestic batteries, *etc.* are also provided. Refrigerators containing CFCs can also be recycled.

The overall diversion rate of materials from the waste stream destined for direct landfill varies widely, but is generally higher for kerbside collection, presumably because this involves less effort on the part of the householder.

In Mozambique, Ghana, Zambia, Nigeria, Kenya, Sudan and many other African countries the system exists with varying degrees of efficiency for the diversion of glass, paper and plastic from waste destined for the dumpsite. Particularly in Sudan and Nigeria there is a leading and pioneering effort for the conversion of a much neglected, waste stream – building materials – into useful goods. Building materials are, however, not yet subject to bring or specific collection system.

11. THE WASTE MANAGEMENT HIERARCHY IN PRACTICE (B)

Policy Options to Waste Prevention and Recycling

For recycling to become more effective, it is necessary to introduce measures to 'level the playing field' so that secondary materials can compete more fairly with virgin stock, and to provide direct support to increase the size of local markets. These measures can be grouped under the following options:

- voluntary participation;
- designing and producing for a longer life cycle;
- positive encouragement, generally in the form of some sort of government support (*i.e.* the *carrots* referred to above);
- persuasion or mandatory measures, enacted by the government to more forcefully encourage the adoption of waste reduction measures (*i.e.* the *sticks* as discussed above);
- provision of bulk waste reduction technologies to reduce the weight and volume of remaining wastes prior to final disposal.

The central objective of the application of these policy measures is to encourage waste avoidance, minimisation, reuse and recycling. In general, they each seek to change behaviour by making waste avoidance, minimisation, reuse and recycling more attractive options than disposal. The first three policy measures are discussed in this section. The fourth is addressed in the next section.

Voluntary Participation

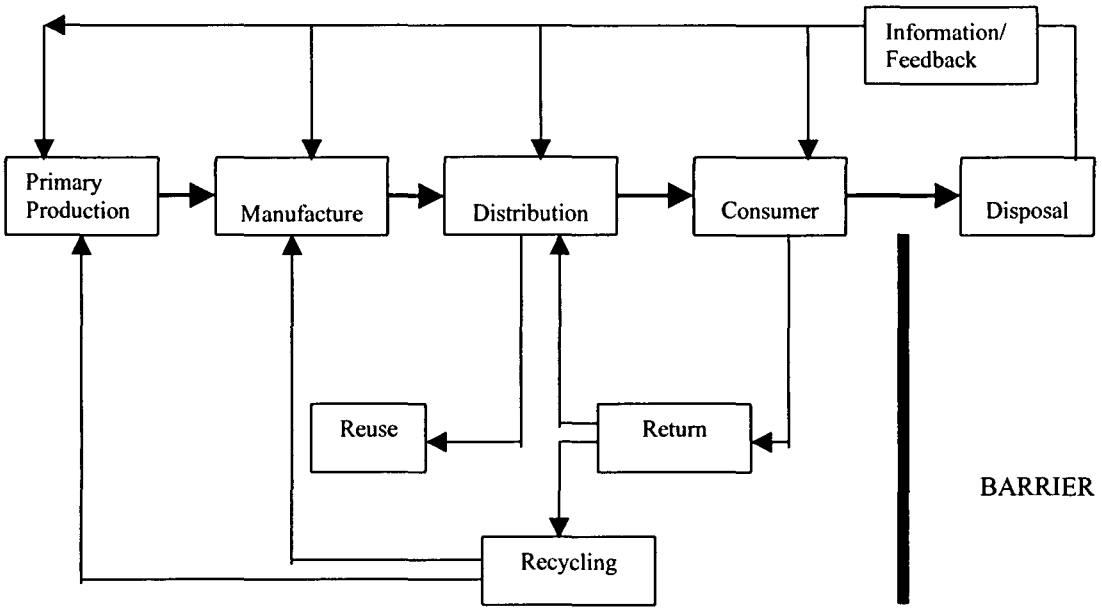
Waste avoidance, waste minimisation and the separation of waste materials at source to facilitate recycling, all require the active participation of the waste generators, including householders and commercial/industrial companies and their employees.

Sectoral and Cross-Sectoral Collaboration. Two vital aspects of any successful waste reduction strategy are an information and education programme directed at the various sectors of the community and a series of voluntary co-operative programmes to implement waste reduction in practise. Education and other communications measures to raise awareness of the issues relating to waste reduction and the actions necessary by all to achieve the desired results, form a major aspect of any waste reduction strategy. For *voluntary participation* to have a major impact, and to reduce the need for more formal intervention by the government, sectoral programmes of waste prevention and recovery are often initiated. This involves, for example, particular commercial or industrial sectors working together, in liaison with the government and perhaps also the voluntary sector, to devise and implement coherent waste reduction plans within a sector.
A useful complement to such sectoral or cross-sectoral approaches is one which focuses on particular components of the waste stream, such as packaging wastes, newspaper and magazines, wood in construction wastes, used batteries, used electronic goods, used automobiles, *etc.*

Producer Responsibility: There are various ways of improving the financial performance (in terms of reliving the public budget) of the waste management system. Some relate to large sectoral activity such as those mentioned under private sector participation. Others relate to utilisation of separate products or to some components of the waste itself. Producer responsibility – as a subset of the integrated product system based on the "producer pays principle" - is such a strategy.

In implementing the 'Polluter Pays Principle,' the concept of 'producer responsibility' is one which is rapidly becoming the norm rather than the exception around the world for the management of wastes. The concept is that the manufacturer or importer of the products giving rise to the waste should take responsibility for those wastes. These groups are thereby encouraged to consider the implications of disposal of their product and are given an incentive to investigate methods of reducing, reusing or recycling their wastes. The producer typically levies a charge on the product to finance the cost of recovery and collection of materials. The concept is illustrated in **Figure 2.5**

Figure 2.5 The Concept of Producer Responsibility



This concept has been implemented in a number of countries on a voluntary basis whereby industry negotiates agreed targets for waste prevention and recycling with the government and is then left to implement these in the most cost-effective manner. All voluntary schemes world wide have been negotiated between industry and the government on the understanding that if a satisfactory agreement is not reached, or if agreed targets are not met, then a mandatory scheme will be introduced.

Voluntary agreements have been reached between government and industry groups or local authorities to achieve waste reduction, reuse and recycling targets. For example, in the Netherlands voluntary agreements have been negotiated for a total of 29 separate waste streams. The agreements in the form of covenants, which are formalised in the Dutch Packaging Ordinance, incorporate targets for waste reduction and recycling. The success of the voluntary system in the Netherlands is partly due to the fact that Dutch industry negotiates through industry organisations, which have the mandate to establish regulations governing their members.

In other countries, voluntary agreements have been made in a less formal way and often under the threat of stringent legislation. For example, in Victoria, Australia, industry agreed to fund the establishment of kerbside recycling schemes following the drafting of deposit refund legislation. In the UK, the government gave the packaging industry's Producer Responsibility Group (PRG) a deadline of six months to develop a plan to recover 50-75% of all packaging materials. The resulting plan, *Real Value from*

Packaging Waste - A Way Forward, aimed for 58% recovery of all packaging waste by the end of the decade, overseen by a new organisation, VALPAK.

In Africa, not many countries are applying this concept. South Africa is applying it as a trade and domestic environmental policy to tyres and batteries. The traditional waste streams suited for this treatment are tyres, batteries, consumer durables and engine oil.

Among the several available systems, the producer deposit refund system is well known:

Producers		
⇓		
Production	⇒	Deposit
⇓		
Selling		
⇓		
Collection of Post-Consumer Waste	⇐	by Producers
⇓		
Recycling	⇐	by Producers or
⇓		Other Recyclers
Report the Amount of Waste Recycled		
Claim Refund		
⇓		
Investigation	⇐	by the Government
⇓		
Refund		

- *If producers do not collect/recycle, the government can use the deposit fund for recycling by other recyclers.*

- *In most cases, the association of producers establishes the recycling company that is wholly responsible for collecting and recycling of their post-consumer wastes instead of the producers*

Preferential Purchase Schemes. A concern with many recycling initiatives relates to identification of reliable markets for the recovery materials. Many recycling initiatives in the past have failed either because markets for the recovered materials could not be found or because they collapsed shortly after the scheme was initiated. Importance must therefore be given to stimulation of the demand side of the recycling process to ensure that sufficient markets exist to absorb the recovered materials. Preferential purchasing schemes is one of the options for achieving this: under a voluntary participation approach, such schemes will relate only to the private sector.

Eco-labelling. An eco-labelling scheme for products may complement these types of voluntary initiatives and encourage other consumers to purchase environmentally friendly (including low waste) products. Labels may help to facilitate recycling for materials which would otherwise be difficult to segregate (*e.g.* different types of plastics.)

Eco-labels seek to give a product a rating for environmental impact and are designed to help consumers make environmentally based purchasing decisions and to educate consumers about environmental issues. Some recent schemes in Europe have taken a 'cradle to grave' approach, evaluating a product from initial resource use through to final disposal.

Currently there are about thirty eco-labelling programmes operating in the world including those in Austria, Canada, France, Germany, Ireland, the Netherlands, the Nordic countries, Spain, Japan and Singapore. For example, the Austrian eco-label identifies plastic bags as being HDPE and fully recyclable.

Eco-labelling helps to support and reinforce other policy measures. For example, if a product charge were introduced, an eco-label could briefly explain the purpose of the product charge. As in Austria, an eco-label could also facilitate the recycling of materials such as plastic bags.

Longer Life Cycle

One of the problems of manufacturing and production – especially at the important broad base of the informal sector - is that production is substandard and weak in structure and finishing. Tables, other furniture, buildings, clothing, etc. are poor in quality and fragile. They also tend to consume items that are at the end of their lives. This results in a short life cycle of these products and hence, more litter and waste. The authorities should encourage the manufacturers to produce better and more durable quality. Direct assistance by secure plots for workshops, assistance in marketing avenues, intensive business and technical training, supply of credit, etc. should be encouraged. The observed higher waste per capita in Lusaka, Zambia is above the generally accepted norms of individual waste generation. This kind of negative trend can be treated if the quality, durability, and strength or refinement (where applicable) of outputs is improved.

Waste Stock Exchange

Waste Stock Exchange is typically applicable to recycling of industrial waste or recycling of MW. The system works through the direct exchange of waste produced by a source to be used as an input by others users. Waste can be bought for cash or exchanged for other waste. In Ghana, saw mills and wood workers collect their sawdust and sell it to mosquito coil manufacturers. Other wood workers sell chippings to a cutlass producing firm who use it for making the grip of the cutlass. The terms 'industrial ecology', 'industrial ecosystem' and 'industrial metabolism' are used as synonyms for WSE in industry.

An example from municipal waste can be drawn where private collectors of restaurant waste (food and vegetables leftovers) are sold by collectors and delivered by them to pig farmers or given in exchange for milk/meat from the farm to the waste collector.

Carrots Only: Positive Encouragement

Three types of positive encouragement are examined in this section:

- Grants and Subsidies;
- Recycling Credits; and
- Preferential Purchase Policies.

Grants and Subsidies. Grants in the form of low interest loans or one-off cash payments and/or tax allowances for investments may be used to encourage innovative projects on waste avoidance, waste minimisation, collection and processing of recyclables. This type of support is compatible with funding schemes for demonstration projects (such as the UK's DEMOS scheme operated by the Department of Trade and Industry) introduced at the inception stage before the innovation becomes a commercially viable option in the free market system. Grants and subsidies tend to be aimed at supporting the initial capital outlay for the introduction of new technologies or for 'kick starting' other waste reduction initiatives. Normally, grants would not exceed 50% of the total capital required.

Recycling Credits. A recycling credit can be defined as a payment to those who divert materials from final disposal for recycling. The recycling credit would reflect the saving in reduced collection, transfer and disposal costs. The level of recycling credits may also be set to reflect the weight and volume of the waste types, which may incur different collection, transport and disposal costs (*e.g.* lower density materials such as plastics may incur higher collection, transport and disposal costs per unit weight.)
The aim of recycling credits is to encourage the recovery of materials in situations where the economics of doing so would be marginal. Typically, these situations include operations where the amounts of materials recovered are small compared with the effort required and where the value of the recovered material is sufficiently low to make the recovery process marginal in financial terms. Recycling credits are not intended to support recovery activities that are already economically viable, those that are completely untenable (in that, for example, there is no market for the recovered material) or, indeed, recycling industries.
Recycling credit schemes have been introduced in the UK, Canada and Australia. In the UK, a scheme was introduced under Section 52 of the Environmental Protection Act, and implemented by Waste Disposal Authorities (WDAs) paying a credit to Waste Collection Authorities (WCAs) operating recycling schemes, and also to third parties collecting waste for recycling. WCAs in turn can make a discretionary payment to recyclers of a collection credit commensurate with the saving in household waste collection costs. A survey indicated that in 1992/93 about £2.65 million was paid by WDAs on 445 000 tonnes of recycled waste. In 1992, the value of the credit was set at half the long-run marginal cost of disposal, but in April 1994 the disposal credit was raised to its full marginal value.

Preferential Purchase Policies. Whilst preferential purchasing initiatives have already been discussed under voluntary participation, such schemes could also be implemented as part of *Positive Encouragement,* policies by the Government. For example, initiatives have been taken by the US Government in relation to preferential purchasing, initiated by President Clinton in 1993. The need for a preferential purchasing policy implies that the

products targeted cost more than other products. If the products receiving the preference could operate under normal market conditions, the preference would not be needed. For example, if recycled paper is more expensive than paper produced from virgin pulp because there is greater demand for the latter, then until the demand for recycled paper increases, the small market for recycled paper means that the prices are higher. The objective is to encourage further purchases of recycled paper. Another example of demand-side initiatives is the subsidising of energy from the incineration of waste under the Non Fossil Fuel Obligation (NFFO) scheme in the UK.

12. CARROTS AND STICKS: MANDATORY AND PERSUASION MEASURES

Most successful schemes for waste prevention and recycling work by combining the 'carrot' of financial incentives and other measures to encourage positive behaviour with the 'stick' of either financial penalties or legal requirements to discourage negative behaviour. Policies and other measures may target either those who provide the goods (*e.g.* manufacturers and importers) or those who use and dispose of the goods (*e.g.* householders), or both.

Producer Responsibility. Several alternatives for a mandatory producer responsibility scheme are available:

- ***Mandatory 'take back' requirements for producers;***
- ***Deposit refund systems on industry and consumers;***
- ***Product charges on producers and consumers;***
- ***Raw material charges on producers.***

In the 'take back' system, householders are required to return the waste to the retailers to enter a parallel, private waste collection/recycling/disposal system rather than the public system (*e.g.* the Austrian scheme); or it could be a compulsory deposit-refund system (*e.g.* as in Taiwan) or it could involve a charge levied on either raw materials used or on products sold.

The best known producer responsibility scheme is the German packaging waste system, introduced through the 1991 Packaging Ordnance. The Ordnance obliged distributors and producers to take back packaging from consumers. This obligation was implemented in three stages, for transit packaging (1991), secondary packaging (1992) and sales packaging (1993). Quotas were initially set for collection, sorting and recycling of different packaging materials and were scheduled to increase in 1995. However, a proposed amendment to the Ordnance was to abolish the quota system, replacing it with recycling targets to take effect from 1996. A number of organisations were established to organise collection, sorting and recycling on behalf of the manufacturers and retailers:

- Duales System Deutschland (DSD) for sales packaging;
- RESY for transport packaging; and
- Interseroh AG for transport and secondary packaging.

This has resulted in the setting up of a co-operative, industry-wide 'dual' waste management system, paid for by industry through a levy on all packaged products which must bear a 'green dot'.

It has been estimated that in Germany in 1993 the DSD scheme diverted 4.3 million tonnes of materials from landfill, representing 60% of the total amount of 7.3 million tonnes of post consumer packaging. In the same year, about 54% of consumer packaging (3.9 million tonnes) were recycled. First estimates from Germany suggest that the per capita consumption of packaging material has decreased by about 10% between 1991 and 1993.

Other schemes. In France, industry is working actively with the existing municipality waste management system to establish new collection schemes which will meet their agreed recycling targets. France is currently conducting preliminary studies of Producer Responsibility for batteries. In Austria, a producer/retailer recovery obligation, which relied on the environmental awareness of the consumer to return batteries, has resulted in a 30% reduction in the battery-derived mercury content of domestic waste since the implementation of the Waste Management Act in 1990. In most European countries silver recovery from films (x-ray, personal cameras, etc) is a thriving business with a fixed world market price for recovered silver per kilogram (250.- US$) and represent some 2.5 tons of total annual incremental supply in Hungary.

Product Charges and Product Taxes. Product charges are levied at the point of consumption on products that are harmful to the environment. The charges can be set at such a level as to achieve the desired reduction in usage, or to incorporate some or all of the costs of recycling or disposing of the product. The former is preferable.
Italy and Austria have introduced product charges on disposable carrier bags, in an effort to reduce waste and encourage consumers to use durable bags. In Italy, a mandatory charge of L150 on plastic bags was first introduced in 1988. The charge met with considerable opposition from the plastic bag producers but reportedly little opposition from consumers who appreciated the environmental objectives of the charge. In January 1994, the mandatory charge was withdrawn but retailers have continued to charge for plastic bags. Charging is widespread across all retail types. The charge ranges between L150 and L200. Paper bags are charged a similar amount. Immediately after the introduction of the charge in 1988, the consumption of plastic bags declined by 20-30%. The long-term reduction is estimated at between 20% and 30%. These reductions have been achieved through a combination of responses, namely: use of durable bags; reuse of plastic bags; substitution with paper bags and, to a lesser extent, use of the biodegradable corn-based bag. It is understood that where consumers purchase plastic bags, they reuse them several times on subsequent shopping trips.

Refunds. In the UK, the supermarket chain J. Sainsbury plc. launched an initiative in 1991 to encourage the reuse of plastic bags. The supermarket provides a refund of £0.01 when the consumer reuses a plastic or other type of bag. To claim the refund the consumer had to bring back and reuse a Sainsbury or, alternatively, another retailer's bag. Consumers are encouraged through the provision of in-store collection boxes to donate the refund to charity. Sainsbury refund, on average, 1.7 million pennies each week and they estimate that the scheme has saved over 60 million plastic bags per annum, which represents a reduction of about 13%. All of Sainsbury's bags contain 75% recycled material, which is obtained from post-use UK waste.

Compulsory Collection and Recycling. Legislation to force local authorities to collect and recycle materials is becoming a widely used means of achieving a reduction in the quantity of MSW which is sent for disposal. Measures of this type have proliferated in Europe during the early 1990s and usually focus on particular components of the MSW stream. For example, legislation has been enacted in both the Netherlands and Austria which obliges municipal authorities to set up source-separated organics collection programmes to collect and compost household organic waste. Similar legislation has been proposed in Denmark, Germany and Luxembourg.

Compulsory collection and recycling programmes usually have to achieve certain waste reduction or recycling targets (for example 50% diversion from landfill by the year 2000 in Ontario). Alternatively, disposal limits for recyclable waste can be set, for example in Austria, where the organic content of MSW sent to landfill must be below 5% since July 1994. The programmes are often funded by state or country-wide waste disposal levies.

Bulk Waste Reduction Technologies and Final Disposal

Whatever success is achieved in reducing waste and in separating materials for recycling, some waste will always remain. To achieve high waste reduction rates in terms of landfill demand, a technology component is required. Some options are listed in **Table 2.5**.

Other than the physical size and weight reduction technologies such as baling and separation, of the options listed in **Table 2.5** waste fired power generation and composting are perhaps the most widely used. These two options are discussed in this Section, along with landfilling, which remains the most common waste disposal option.

Table 2.5 A list of bulk waste reduction techniques

Size Reduction Technologies	Baling
	Pulverisation/Shredding
	Homogenisation
Weight Reduction Technologies	Separation
	Materials Separation Facilities
	Waste-Derived Fuels
Waste Fired Power Generation (WFPG)	Mass Burn Incineration
	Fluidised Bed Incineration
	Combustion of Prepared Waste Derived Fuels
Other Combusion Technologies	Aggregate Block Production
	Cement Firing
	Wood Burning Power/CHP Stations
	Tyre Burning Power/CHP stations
Biological Systems	Composting
	Vermiculture
	Hydrolysis
	Anaerobic Digestion

Others	Pyrolysis Gasification

***Mass Burn Incineration*:** Mass burn waste reduction has been practised as a waste management and volume reduction technique since the 1890s. It is an extremely effective bulk waste reduction technology, typically reducing waste volume by 90% and mass by around 70%.

In terms of waste processing, mass burn incineration is a relatively simple option, with unsorted waste being fed into a furnace and, by burning, reduced to one-tenth of its original volume. Typically the only materials removed from the waste stream prior to burning are large bulky objects such as refrigerators and mattresses, or potentially hazardous materials such as gas bottles.
The combustion gases then typically pass through a boiler system to recover energy. The most flexible means of recovering energy from the hot gases is to produce steam for direct use (at a lower temperature) or for electricity generation. To generate electricity, superheated steam is passed from the boiler system through a turbine generator. The gases are then cleaned prior to discharge into atmosphere through a tall stack, in order for the discharge to conform to the strict emission limits laid down by national governments.

Gas cleaning strategies aim to remove the following components:

- Acid gases such as nitrogen and sulphur oxides and hydrogen chloride.

A variety of wet and dry scrubbing systems can be applied, but in essence the gas cleaning method involves neutralisation of the acidity by dosing with an alkaline reagent such as lime. Chemical methods of controlling nitrogen oxide emissions (so called De-NOX systems) have also been developed.

- Particulate matter often associated with trace metals and semi-volatile organic micro-pollutants.

Electrostatic precipitators (ESPs) and fabric filters are generally used for this purpose. The particulate matter is retained in the ESP or the filter and is periodically removed from the system as ash which requires land disposal.

- Organic micro-pollutants such as dioxins.

Control of these emissions is achieved by control of combustion conditions, as well as by dosing with activated carbon or other adsorbents in the gas cleaning train. Simultaneous reduction of emissions of metals such as mercury and cadmium is also achieved.

The impact of materials separation and recycling prior to incineration on the calorific value of waste has been studied. UK research has indicated that the calorific value will fall if large quantities of only paper and plastics are recovered. However, if putrescibles

are also separated from the waste stream, there is little effect on the overall calorific value.

Composting: Composting is essentially the controlled aerobic decomposition of putrescible material. Of the various methods of aeration, windrowing (mechanical or manual turning of the material) and forced aeration of the static pile are the most common methods used. During composting, putrescible material is progressively broken down by micro-organisms in a series of distinct stages. In the mesophilic stage, micro-organisms begin to actively break down the organic material, the temperature of the composting material rising to around 50°C in about two days. During the second, or thermophilic stage, temperatures begin to rise so that only the most temperature resistant micro-organisms survive. As the micro-organism population reduces, the composting material cools and anaerobic conditions may develop unless sufficient air is introduced. In the third stage, the material continues to cool and micro-organisms begin to compete for the remaining organic material, in turn leading to breakdown of cellulose and lignin in the waste. During the final, maturation stage, levels of microbial activity continue to fall as the remaining organic material is broken down and the micro-organisms die off as their food sources are depleted.
Despite widespread use as a waste management strategy, many composting schemes have been unsuccessful in the past. Maintaining a consistently high quality and as such, a marketable compost product, and producing it in an efficient and environmentally acceptable manner, were the key problems facing early schemes. However, composting is currently enjoying a resurgence of interest, and prospects for composting schemes look promising. The key to this change of fortune has been a switch to the composting of uncontaminated source separated organic wastes rather than of mixed MSW. Operational experience in the US and elsewhere with mixed MSW feedstock has indicated that the end product is often of poor quality and has limited end use. Recent composting schemes have therefore increasingly focused on processing source segregated kitchen and garden wastes, 'green' wastes from parks and gardens, and food wastes from the food processing industry and large commercial generators.

Landfilling: Landfills are the final destination for the residues from incineration and other treatment and processing options, as well as for the primary waste stream - in the UK about 90% of domestic waste and 85% of commercial waste is dispatched directly to landfills. It is therefore a critical element in a waste management strategy, since despite the best attempts at waste minimisation, recycling and recovery, its use is unavoidable. The challenge is to design and manage the process of landfilling in a sustainable manner so as not to leave a long-term potential for environmental damage.
The process of landfilling consists of waste preparation (shredding, compaction, *etc.*), waste placement (involving deposition, compaction and covering of the waste within the landfill) and landfill completion. In this final stage, the completed landfill is capped with a low permeability layer to minimise the ingress of rainwater and covered with soil to return the area to the surrounding landscape. In practice, landfill restoration is a continuing process throughout the lifetime of the site: void space is typically utilised in a phased manner, with progressive contouring, capping and restoration.
Within the landfill, the constituents of the waste undergo biodegradation and stabilisation. The infiltration of rainfall and surface waters into the waste mass, coupled

with biochemical and physical breakdown, produces a leachate, which contains soluble components of waste.

The products of breakdown also include so-called 'landfill gas', which can be harnessed for its energy content. The maximum gas volume, which is generated from the decomposition of organic matter is in the region of 350-400 m^3 per tonne of MSW, amounting to about 6 m^3 per tonne per year. The gas typically consists of 50-70% methane and 30-50% carbon dioxide with traces of nitrogen, hydrogen, oxygen, hydrogen sulphide and a range of trace organic compounds. Landfill gas utilisation schemes can capture 50-60% of the gas released by the site: its combustion can potentially generate about 350-370 kWh of energy per tonne of MSW.

13. ENVIRONMENTAL CONSIDERATIONS

All bulk waste reduction technologies have the potential to produce gaseous, liquid and solid contaminants.

Waste Incineration. The key environmental issues of waste incineration are:

- Dust and odour from waste handling and storage;
- Ash management (grate ash and fly-ash from the gas cleaning system);
- Atmospheric emissions from the stack.

The potential effects of dust and odour from waste handling can be controlled by locating the waste unloading area within an enclosed building and using dust suppression waste sprays at the waste tipping bays. Another method of control is the extraction of air from above the storage bunker for use as combustion air in the incinerator, where any odorous compounds and dust entrained in the air will be destroyed. This also results in a slight negative pressure within the building which draws air inwards, thus minimising the escape of dust or odours.
These measures are now standard in most modern incinerator plants, and are not identifiable as separate environmental mitigation within a scheme.

Grate ash and fly-ash are produced at a rate of 20-30% and 3-4% of the waste input respectively. Grate ash is essentially inert; fly-ash has relatively high levels of heavy metals and is classed as a hazardous waste in some countries. Due to its inert characteristics, the disposal of grate ash is not generally considered a significant pollution risk and it is often used for beneficial purposes such as road building, in construction materials, for intermediate cover at landfill sites, *etc.* Prior to disposal, the ash is normally scavenged for ferrous material.

The cleaning of combustion gases prior to their release to atmosphere has been discussed above. Additional information of the environmental impact of atmospheric releases can be obtained from other references.

Composting. The key environmental issues of the composting process are as follows:

- Fugitive emissions of litter and dust. These emissions may arise from wind dispersal of the waste feedstock, especially paper, during preparation and from compost piles.
- Odours arising from trace organics produced in anaerobic conditions are permitted to occur in the composting process.
- Leachate generation. The requirement for moisture in the composting process may lead to excess water and run-off from the composting pile, which may be contaminated by materials present in the waste.

Dust, litter and odour from waste material preparation can be mitigated by enclosure of the operation, both with respect to individual items of equipment (shredders, *etc.*) and by locating the process within a building with appropriate ventilation systems. Dust, litter and odour from the composting process can also be mitigated by enclosure of activity, or by in-vessel composting. However, since these measures are relatively expensive due to the large volume of material which needs to be processed, windrow composting is most commonly applied. This is normally conducted out of doors, although Dutch barn buildings are sometimes used (*i.e.* roofed buildings with open sides). Regular wetting of the windrows and proper management of the composting process assist in minimisation of dust, odour and litter.

The requirement to keep the compost pile wet increases the potential for leachate generation from excess water and run-off. The control of this leachate is important for the protection of water resources. Typical design features include organisation of the windrows or compost piles to retain water inflow and avoid run-off, or the use of a concrete plinth equipped with a controlled drainage system to collect run-off.

Landfilling. Of the potential releases and environmental effects of landfilling, the following have raised most concern:

Leachate: leachate arises from the moisture contained in the deposited waste, from the infiltration of water into the site and from the biodegradation process itself. Escape of leachate, for example due to engineering failures of landfill caps, covers and liners, has been linked to contamination of water resources.
Landfill gas: landfill gas, a mixture of methane and carbon dioxide, can cause damage to vegetation, and is also an explosion hazard. Methane and carbon dioxide are also greenhouse gases.
Trace organics: a variety of trace organic compounds can be entrained with landfill gas, for example vinyl chloride, benzene, toluene, alkanes, organic-sulphur compounds, *etc.* While many of these compounds are potentially toxic, their concentration in offsite air is generally too low to pose a threat to public health. Odour nuisance is potentially a more common problem.
Litter, vermin, noise, etc: The nuisance aspects of landfills and their operation are potentially the most intrusive in terms of disturbance and disruption to the comforts enjoyed by the surrounding population. Careful consideration is given to operational work plans, traffic movements on and off site, the fitting of screens to reduce the visual intrusion and dispersal of litter, daily cover of the waste, *etc.* to mitigate the possibility of nuisance.

Landfilling provides a method of reclaiming existing excavations as well as the development of new landforms. Hence, it can be used to return unproductive land to beneficial use. However, after landfilling operations are complete and the site has been capped, the *in situ* processes of biodegradation continue for a significant length of time, measured in decades. As biodegradation is still active, the generation of leachate and landfill gas also continues, as does the potential for offsite migration of these releases. Post closure management of the landfill is therefore a key consideration: typically this takes the form of the installation of a landfill gas utilisation/control scheme, provision for leachate collection and treatment, and regular monitoring of releases from the site.

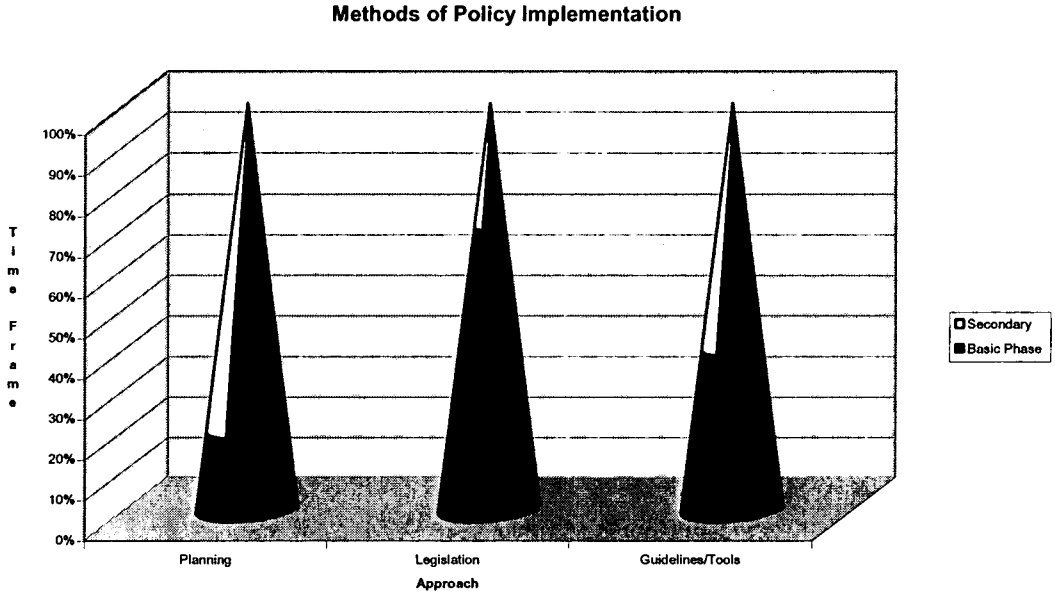
14. LEGISLATIVE FRAMEWORK

A policy document may be too general to be operational or specific. Two major steps will be followed to implement a stated policy. These are the institutional and legislative framework. A synopsis study would identify the existing set up of institutions (Organizations) at the central, local and lower levels as well as their powers and responsibilities. This will clarify initiatives for legislation (within the government) and the roles and responsibilities of other organizations (private, public or other) for waste management. Subsequent legislation (laws, directives, ordinances, acts or by-laws) - depending on the country and its legislative structure and on the level of body issuing the legislation - then follows.

Institutional Arrangements for the Implementation of Policies

The institutional element to policy implementation has been discussed at the beginning of this chapter. Framework laws are the initial steps in creating institutions. Sectoral and regional legislation complements the creation of necessary structures for a concerted and co-ordinated operation of such. Two other elements are of equally high importance. These are the outputs from the planning process guided by stated policies on the one hand; and the process of resource allocation (budgeting) meant to facilitate the investment in and funding of the waste management activities and thus making their realisation possible.

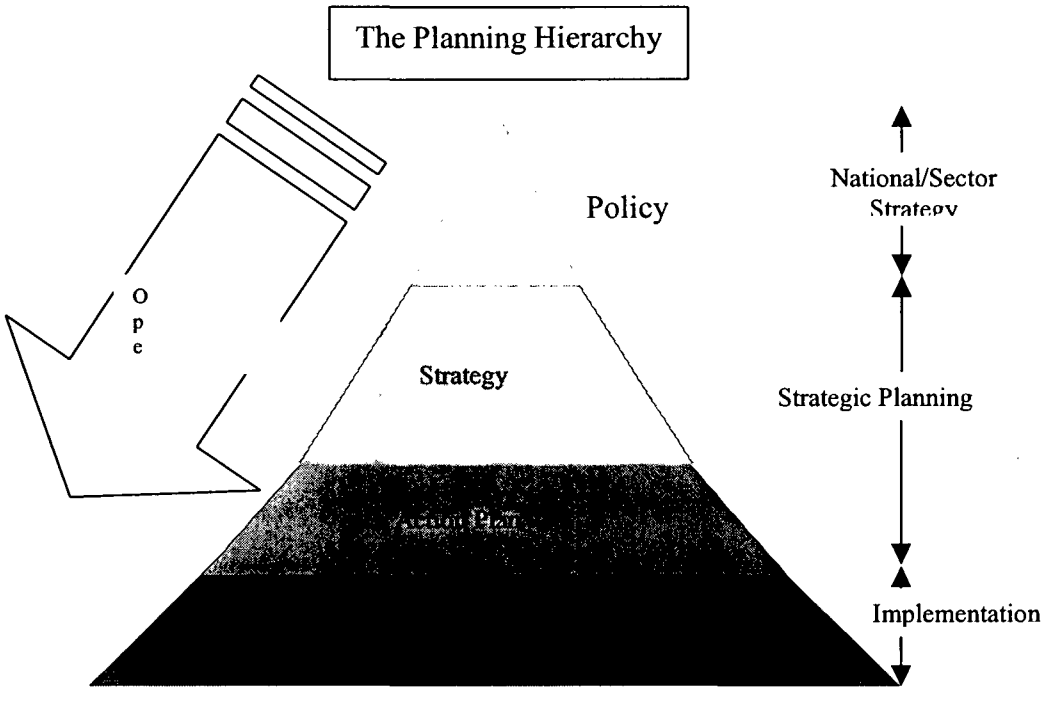
Figure 1.,2:Three Pillars of Policy Implementation



15. WASTE MANAGEMENT PLANNING

Waste management planning refers to the actual action undertaken within the framework of a policy to handle the waste management problem. This covers several aspects ranging form handling waste at all stages (from generation to disposal) through creation of awareness and commitment on the part of the public to incorporation of production considerations at the extraction of raw materials, design of products and their marketing. This comprehensive process will be developed overtime and initially we will concentrate here on the stages of providing the direct service: generation to disposal.

This is necessary because by doing so we can establish a basis for learning and understanding of the current practices and the aspired sound practices and level of service. This, in turn, will form the basis for identification and communication of where we are and where we want to be, who is doing what, relevant and contextual financial and cost information and meaningful analysis for the waste management process.



16. CAUSES OF WASTE MANAGEMENT PROBLEMS IN AFRICA

In general adopted policies on the management of urban waste emanating from residential areas, including markets, institutions, etc, and industries have shown little effect to alleviate the SWM problems. Fines for perpetrators were constantly being manipulated or somehow evaded. This has been attributable to a number of factors the most important of which are:

- Lack of political commitment
- The unattended negative attitude towards the WM service
- The attitude that waste collection and disposal are a free service and are the responsibility of the local authority
- Lack of education and awareness
- Lax enforcement and lack of relevant regulation
- Continued externalisation of such costs by industries in particular and the public at large – especially households, micro-business and micro-industry in the cities' formal and informal sector.
- Technical aspects relating to the technical management capacity: equipment, system configuration and operation, adequacy of manpower skills and availability of personnel. In addition to the above type of waste and quality of life are themselves factors, which may make waste generation and handling easy or complicated. Examples are housing conditions, type of service area: residential, industrial, commercial, public zones, etc.

The first two reasons are interrelated and reinforce each other. Unless decision makers (politicians) begin to think differently and put their priorities in different manner the situation will continue to deteriorate. A highly placed politician, just to give an example, in a West African country was telling an interviewing team that he can bring the problem of waste management to the attention of the people, but he would not dare to impose to either impose waste management as a priority or enforce compliance to laws – especially those laws relating to payment for the service.

The following two points are also interrelated in such a way that one negates the other. Awareness is important for both the public and the leaders. Unless both – the leaders and the community members – are convinced and committed, it will be difficult to bring about the desired change. The two reasons before the last are a result of the above four

weaknesses. Education, awareness and focused action are extremely needed to break the vicious circle.

Technical problems lie at the crux of the issues to be handled. Type of waste, collection, transport, reduction and recycling and final disposal deserve a lot of attention.

Among the most critical factors affecting policy failures in the African urban environment is the housing conditions in African cities, seasonal changes (wet and dry seasons) and the composition of waste.

Apart from few, low density areas, housing conditions in medium and high density areas are characterised by overcrowding and inadequacy of essential facilities. Among city dwellers in Africa more than 95% of the population live in non-storied residences with an average of 2.5 rooms per housing unit. In most cases the same room is used for living and sleeping purposes. The average house size is about 5.5 persons per housing unit. The average household number per housing unit is 1.5 persons. The average number of persons per room is 3.8. The number of persons per any type of existing bed-room is estimated to be at least 5 – which indicates a very high housing density, room deficiency and a very high possibility of transmitting communicable diseases. About 50% of the population dwell in high density areas. Most residential housing units (over 80%) are built with simple primary local materials. The wall is made of grass, wood or mud, the floor is plain earth and the roof is wood and mud or corrugated iron sheets. Traditional kitchens, missing primary sanitary and bathing facilities, etc. are bound to increase the unhealthy conditions of life, litter and pollution. The risk of faeco-oral communicable diseases is substantial. Huge medical bills and deteriorating health conditions, loss of workdays and increased suffering are some of the costs on nations.

The environment is bound to suffer from seasonal changes, which are very significant in the wet and dry seasons. In the former, the possibility of harmful insects breeding and spreading disease is much higher. The effect is environmentally risky in the medium and long run: greater quantities of leachate especially in (mostly illicit) landfills can seep into underground water reserves, further affecting water quality and human health. Seasonal variations differ from country to country, yet their effect displays the same pattern.

In order to practically be able to understand the problem we should avoid getting entangled in the common problems wirwar causing the waste management difficulties. We have to identify problems in conjunction with their possible remediation, recognition of their characters and possible solutions. Problems can thus be categorised as either being internal, both internal and external or external to the system of waste management.

Internal problems to the system include lack of equipment, planning capacity, shortage of qualified and trained staff, lack of efficiency, institutional deficiencies (activities under several scattered departments, lack of coordination, ignored beneficiary community at desgin and planing stages, NGOs and community not fully involved in service provision, involvement of recycling industries: formal and informal, not fully used, staff not trained) and poor collection of fees.

Internal and external may include accelerated waste generation, attitudes, inadequate legal provision (laws and regulations outmoded and fragmented, too partial: address generally street tidiness, collection and disposal away from residences, laws are not fully enforced), resource constraints (funds are just enough for collection and partly transfer, no funds for capital investments: equipments, landfills; no funds for training, communal bins and facilities), lack of transparency, lack of interest and changing patterns of consumption and production. External factors are represented by population expansion, uncontrolled urbanization, inconsiderate behaviour and the like.

Simultaneously, or alternatively, problems can be categorized in a context as being either institutional (legal, organizational and system related), attitudinal (social value and behaviour related) or technical (operational including financial and technical management). The context would be to look at them as emanating from market zones, central city (core area), planned areas (low, medium and high density areas), and unplanned areas.

Box 1: Policy Issues

Banning, Improving or Selective Treatment for Plastic?

Battle rages over Bangladeshi government's ban on 'killer' plastic bags.

Arshad Mahmud
The Guardian, Wednesday March 27, 2002

Ten days after Bangladesh officially banned all polythene bags last month, Hossain Shahriar received an anonymous email. It read: "You hampered our business. You don't know our power. We can purchase minister and secretary any time. So you're a little fly for us. We can kill you anytime". And then came the chilling warning: "Give up your activity against plastic and us or leave the country forever. So take this final chance".

Shahriar, an environment journalist who is also executive director of the Environment and Social Development Organisation, a Bangladeshi NGO, was unmoved, although he admitted he was worried about his staff members. "I'm used to this kind of threat," says the man who had spent 13 years campaigning against the bags and was the main architect of the ban.

The police couldn't track down the emailer, but the message left no one in doubt that it had been sent by someone from the powerful plastic bag manufacturers' lobby, which had fought tooth and nail up to the last minute to save its multi-million dollar business.

If the ban works, then it is expected to have a significant effect not just on people's health, but on the whole environment. Plastic bags are a relatively new phenomenon in Bangladesh, and only began to appear in the early 1980s. Within a few years, they had become popular largely because they were cheap and easy to carry. So some people decided to cash in, setting up a few manufacturing units.

The low-cost investment and the huge profits - almost six times the production cost - resulted in a huge growth of the industry. The number of factories rose from 16 in 1984 to more than 300 in 1990.

Within a few years, plastic bags became a feature of everyday life. It was, however, not until 1988, after the pernicious effects of the bags' widespread use became apparent, that the environmentalists and policy makers got worried. The non-degradable bags proved to be the main source of water-logging during the 1988 and 1998 floods that submerged nearly two-thirds of the country.

Almost 10 million bags are used in Dhaka city alone everyday and of them, only about 10-20% are thrown into dust bins. The rest, discarded haphazardly, cause serious waterlogging by choking the drainage system. Shortly afterwards,

researchers found that bags stuck in farmlands, have reduced fertility in the soil, raising concerns about agricultural production.

They also posed a serious threat to human health, especially to people involved in the production and recycling of polythene. A large number of people in old Dhaka, where most factories are located, were found to be suffering from respiratory problems, eye sores, dizziness and even skin cancers. Experts confirmed that two deadly substances, dioxin and hydrogen cyanide, were released into the air when polythene was burned.

The industry has fought the ban legally and illegally. "I was offered hundreds of thousands of pounds in bribes," says Shajahan Siraj, the forest and environment minister who saw the ban through into law. "But we cannot hold the entire nation hostage to the greed of a handful of people. We must save the environment for our posterity.

"Industry leaders claimed that the dangers were exaggerated, though they admitted the bags were the main cause of waterlogging. "But if they were that serious, why is the developed world still using them," asks KM Alamgir Iqbal, president of the Bangladesh Plastic Goods Manufacturers Association. "The drainage system should be managed by the municipal authorities – not us"

He also argues that banning the bags would mean the collapse of a £38m-a-year industry that employs more than 7,000 people. The government estimates it will lose about £20m in taxes and other duties.

The minister dismisses the industry claims, saying the losses would be temporary. "We will be able to employ far more people through reviving the moribund jute industry, producing environment-friendly jute bags," he says.

So far, the ban seems to be working. People are once again getting used to buying jute and paper bags, and plastic bags are no longer seen in the markets. Yet scepticism persists over whether the ban will work and whether the government will be forced to yield to the manufacturers, as it did when the bags were first banned in 1993.

"The situation is different this time", said Khondoker Bazlul Haq, a leader of the Bangladesh Environment Movement. The tremendous awareness created by the anti-polythene bag movement, he says, ultimately will scupper any sinister move.

This week, the government is introducing a bill in parliament imposing 10 years' imprisonment and a £12,000 fine on people who continue to make the bags - and a mandatory £6 fine for anyone found using one.

Box 2: On Plastic Bags

An Opinion [1]

[1] From the Internet, *Delta Discussion Group*

The problem is what do we do with plastic bags when we no longer need them and not the plastic itself.

If they are littered or recycled or burned properly then the problem will almost disappear. The problem comes from the fact that only about 10-20% are thrown into dust bins as mentioned. I understand that proper waste management in some countries is more difficult to implement than to enforce a ban. And if there is a conflict between two economical sectors, one can understand that Bangladesh favours jute over plastic . We should say those realities and not use wrong arguments to explains decisions.

As a plastic specialist, I want to say that polyethylene can be burned without any damaged to the environment or human health. Burning raw polythene does not release any dioxin and hydrogen cyanide. If those substances are present it is the indication that harmful additives are used or that the bags have been contaminated during usage. If plastic bags causes harm to worker during production it means that either wrong processes are used or that some harmful (and unnecessary) additives are added. Minor changes in production process can avoid that.

It is also the first time that I hear that plastic bags have negative Effect on soil fertility (can one give me the source). I can only explain it if the soil contains more plastic than earth. Plastic films (identical to what is used for producing bags) are used largely to protect soil in modern agriculture to increase soil productivity. I may agree that the ban of plastic bags is the best available solution to solve the problem of optical pollution they cause to the landscape or other problems (waterlogging). However we should not explain decision using false arguments. We should share true and fair information and not be mislead by biased information. Honesty is a plus environmentalists should have over economical or political leaders.

Best regards

D. B. T.

Box 3: Still on Plastic Bags

A Response

Dear Chris and Imad,

And I agree with you that they have started on the top of the waste hierarchy, and therefore they have taken a good decision, and surely the best according to local conditions.

My point was not to criticize the Bangladesh decision to ban plastic bags, but to stop the disseminating of wrong information over a forum which should share true and fair information (as your waste management hierarchy is) to be able to take wiser and better decisions in future.

The smoke from a burning polythene plastic bags is not more harmful as is the smoke of a candle, and polythene does not affect soil fertility.

LCA using European real usage parameter of shopping bags have shown that plastic bag are better than paper bags, so that a lot of the European supermarket which have eliminated plastic bags some 5-10 years ago for some environmental marketing reasons are now again proposing plastic bags, and let the consumers make the choice between plastic and paper.

The best practice which is the use of handbag or backpack is only used by a minority of people in Europe and mostly in Nordic countries. It is surely good if we can keep that practice alive in the rest of the world. However cross contamination from multi-use, and possible lost of food, has to be considered.

Be fair and true, and not playing the lobby game! is my motto . Therefore stop using plastic bags if a better alternative is available.

Regards

D. B. T.

Next Step

1 Test your comprehension of the information by answering the questions below, discuss them with the group, and compare with the answers are suggested at the and of the pamphlet

Questions:

1. What economic indicators do you think would signify the changing patterns of consumption and production in your city? How do these affect waste generation?

2. Do you have a national policy/strategy on waste management?

3. What is the difference between the traditional health and sanitation approach and the environmental approach to municipal waste management?

4. What a re the main elements of a WM Policy, in general terms.

5. How can governments improve their interaction with citizens?

6. What is your opinion to the plastic issue discussed in the boxes above as it relates to your locality?

7. What do you understand by the term integrated waste management?

8. What do you understand by the concept of producer responsibility?

Answers

1. National and per capita income of the country, the growth in area and number of industries producing consumption and capital goods, the growth in service facilities: health care, schools, market places, per capita consumption of processed food, building and construction materials and style, etc.

2. Yes/No.

3. While the traditional approach:

- concentrates on collection, transport and disposal to a far destination,
- is partial in treatment of wastes, and
- considers waste management service as a public good where the responsibility solely lies with the Government.

The environmental approach

- adopts an integrated treatment for waste management, i.e. it considers the product from the extraction, processing, design, consumption and reuse and eventual safe disposal as well as it integrates policy and technical management together; it is also
- holistic in nature, i.e. in addition to the above it considers participation by the various community sections and the private sector in decision making and implementation of waste management policy and projects. In the course of this it seeks to change behaviour and attitudes, e.g. understanding the service costs and paying for the service by beneficiaries, adopt a life-cycle approach to management of resources and products, it promotes and suggests operational approaches to WM.

4. These are generally:
The policy framework – usually a basic and general document stating goals, objectives and the methods to implement them and review them over time.
The policy implementation framework, which may include legislation, investment projects and programmes, and operational tools and instruments to assist in implementation at the middle and lower operational levels on the one hand and the public on the other. It usually also includes an evaluation process for the both the policies and for its products, like projects, laws, and guidelines.

5. This is a complex issue, yet very important. Governments have to be prepared to relinquish their fist on public affairs and give more room for participation by the public, civil society organizations including advocacy groups and service providing community organisations. Chances should be offered for formulation of policies, plans, and regulations as well as means of their implementation and enforcement. The following key words and phrases may give rise to more discussion of the issue:

i. Problem, Adversary debate, Legitimacy, Action, Cooperative deliberation.
ii. New areas of behaviour?

iii. Transparency.
iv. Environmental issues.
v. Awareness creation
vi. Democratisation (Grass-root, election and Beyond).
vii. What participation mechanisms?

6. Discussion.

7. Integration relates to two levels:

i. Integration within the technical system; i.e. optimising the combination of measures relating to waste avoidance, waste minimization, waste reduction, recycling, final disposal. See the functional definition on page 12.

ii. Integration of the technical system with policy issues relating to non-technical parameters of the system, e.g. attitudes, participation, and other policy elements. See Figure 1.1. a. – c.

8. Producer responsibility sets several alternatives for a mandatory producer responsibility scheme for treatment and collection of the waste resulting from products. These alternatives may comprise:

- Mandatory 'take back' requirements for producers;
- Deposit refund systems on industry and consumers;
- Product charges on producers and consumers;
- Raw material charges on producers.

An interesting system is the Duales System of Germany which puts responsibility for producers for packaging materials at different stages of the distribution system. See page 35.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UP-DATED TRAINING MANUAL OF WASTE MANAGEMENT IN HIGH DENSITY AREAS OF THE AFRICA REGION

MODULE 2.
LEGISLATIVE AND INSTITUTIONAL FRAMEWORK FOR WASTE MANAGEMENT

Contents

1. LEGISLATIVE AND INSTITUTIONAL FRAMEWORK

A policy document may be too general to be operational or specific. Two major steps will be followed to implement stated policies. These are the institutional and legislative framework. A synopsis study would identify the existing set up of institutions (Organizations) at the central, local and lower levels as well as their powers and responsibilities. This will clarify initiatives for legislation (within the government) and the roles and responsibilities of other organizations (private, public, community or other) for waste management. Subsequent legislation (laws, directives, ordinances, acts or by-laws) - depending on the country and its legislative structure and on the level of body issuing the legislation - then follows.

Economywide then the organization of waste management service can be reflected by the set up of institutions involved in waste management. These are the public sector, the private sector, the community and community organizations and the civil society organizations. The public sector is a special case which may need attention in our context here as their structure: central, state (regional) and local government levels reflect the centralized policy which would regulate, mandate and identify roles for itself and all other stakeholders. As mentioned above legislation and planning (allocation of resources) as well as other detailed guidelines are the tools used to implement the centralized policy which is expected to utilize the energisend capabilities of operators in the outlying sectors and at the same time see to it that opportunities are clearly and transparently created for them in order to fully participate and provide the service.

Legislation is necessary because:

- It facilitates prioritizing the waste management service at the national level; e.g. through budget (as a legal document) allocations at the national level or levies at the local level.
- Creates appropriate institutions to carry out the tasks as outlined in the laws.
- It sets clear outlines for standards and hence for yardsticks against which performance and behavior can be judged. It also facilitates monitoring, evaluation and compliance enforcement.
- Because of its normative nature it largely concretizes criteria for cost benefit analysis and sets high societal values and norms as behavioral yardsticks.
- More specifically a regulatory framework would provide for the following in more detail:
    - Project appraisal and environmental impact assessment (EIA)
    - Public domain lands, reserve land areas for public use such as those for landfills and treatment of waste.
    - Deposition of litter and unofficial disposal; e.g. anti-litter laws, open dumping or burning, operational standards.
    - Landfill siting and construction standards which may be handled in other legislation documents: public health, town planning, EIA, etc.
    - Public and occupational health and safety
- Financing of waste management service is facilitated by providing for allocations and empowerment for revenue generation.
- Control over imported packaging and industrial goods with a view on shared responsibility for resulting wastes.
- Organizing institutional participation as within the public sector and creating conducive conditions for the private sector operation and the community as well.

Box 3 below lists some pieces of legislation which may provide the set-up within which local governments may have to operate.

BOX 3: National Legislation setting the Frame for Local Level Legislation

- *Public Health/Municipal/Waste Collection Legislation*
  - Duty of municipalities to collect, transport and dispose of municipal wastes
  - Fund raising for service provision within their jurisdiction
  - Specific standards and requirements, e.g. storage media, frequency of collection, powers of municipalities, legislative capacity, penalty and compliance enforcement.
- *Waste Disposal (Environmental Protection) Legislation*
  - Permitting (licensing) scheme for waste management (collection, transfer, treatment and disposal) and facility standards.
  - Responsibilities placed on waste generators and their responsibility for proper transfer, treatment and disposal.
  - Specific systems for hazardous waste, e.g. a manifest or trip ticket system to ensure disposal at designated location, health care waste or other special waste.
- *Special laws relating to recycling*
  - Producer responsibility laws and other voluntary agreements meant to cover transport and recycling costs of specific waste streams.
- *Codes of Practice and other Statutory Guidance (Guidelines)*
  - Issued at the national level guide specific behavioral aspects under a legislation or
  - Provide a framework within which municipalities have to work or cooperate; e.g. standards for landfill designs, code of practice for street sweeping and litter prevention (thrice sweeping for central city roads and twice for marginal roads once for expressways, prohibition of waste disposal in public parks, health and sanitary procedures for restaurants and hotels).
- *Physical Planning Laws and other Sectoral Laws*
  - Building development (industrial, waste facility, residential, etc) licensing.
  - EIA legislation requirements.
  - Industrial development and industrial waste management and handling arrangements.
- *Legal Framework for Privatization*
  - Designation of limit and type of privatized activity, may hinder size and extent of private sector involvement in MSWM by municipalities.
  - Competitive tendering requirements specified for national contracting and those for public goods especially for waste collection, street sweeping, waste disposal: performance criteria, term of contract, etc.

Source: ERM

Municipal By-Laws

Regulations enacted at the local level are usually known as by-laws. They require local individuals, households, owners and businesses to meet certain rules to ensure efficient service delivery. Examples are public health (prevention of disease and epidemics, notification of infectious diseases, burial of the dead, cremation facilities, hospital waste, air pollution, control of slaughterhouses and markets), popular local restaurants, shops, etc. Anti-litter, cleansing standards and frequency are examples of requirements for MSWM service. The include penalties for contraventions and other enforcement mechanisms (frequency of supervision, complaints management, etc). Limitations are usually confronted when considering levies and charges for the service. Municipalities can in most cases charge businesses and industries but have difficulty (political and administrative) on imposing such on households. Special penalties such as fines and imprisonment are conducted through the local magistrate courts. Few are conducted directly through municipalities' own supervisors and inspectors – especially nowadays. Most by laws on waste management are to be found in other legislative pieces, e.g. public health, labour laws (occupational safety and health), environmental legislation or planning authorities (e.g. EIA). The control of activity may also lie beyond the immediate department responsible for waste management or the municipality itself, e.g. those relating to occupational health and safety, employment laws, fire protection, surface and ground water protection, environmental licensing, sectoral planning and control.

The following are typical by-laws which may give some overview of common by-laws in most municipalities or those particularly relating to MSWM service (adapted from ERM):

- *Duties on the General Public:*
    - Use of specific waste containers.
    - Anti littering on streets, parks and public places.
    - Time and place for deposit of waste.
    - No burning of waste
    - Disposal of dead animals and noxious materials
    - No throwing of waste into water courses, storm drains, or the like.
    - Liaison with municipal authorities.
    - Complaints against employees and for contraventions by others.
    - Public health matters.
    - Payment of franchise charges by contractors.

- *Duties on Traders and Shopkeepers (In addition to the above)*
    - Payment of charges levied by the municipality.
    - Use of licensed private contractors for collection and disposal.
    - Hygiene and disinfection of containers and waste stores.
    - Cleaning of forecourts and pavements in front of premises.
    - No holding of animals in premises – unless licensed.
    - No slaughter of animals unless at licensed places.
    - No illicit disposal of discarded food and other waste.
    - Care of storm drains and sewers.
    - No backyard mechanical or industrial/manufacturing activity – unless permitted.

- *Duties on Private Waste Contractors (In addition to general provisions above)*

    - Operation only on issue of permits
    - Administrative procedures for issue and revocation of licenses.
    - Grounds for revocation of licenses.
    - Payment of lawful charges levied by the municipality.
    - Use of appropriate vehicles and containers.
    - Use of licensed disposal sites.
    - Register of customers and locations (zones) served.
    - Keeping of waste records.
    - Prevention of public health nuisance.

- *Duties on Commerce and Industries (In addition to the general obligations above)*

    - Use of licensed private contractors for collection, transport and disposal.
    - Use of licensed waste disposal facilities.
    - Storage and control of hazardous waste.
    - No burning of waste in the premises.
    - Waste handling plans and agreements.
    - Cleanliness of areas in and around the premises.
    - Disposal of food processing, slaughterhouses waste and other noxious materials.
    - Prevention of public health nuisances.
    - Keeping of records.
    - Guidelines on well digging and water abstraction.

- *Duties on Waste Recycling Enterprises and Small Enterprises (In addition to the general obligations above)*

    - Recycling and recovery activity only in approved locations.
    - No cutting and burning of PVC cables and other materials.
    - Controls on metal smelting, cutting and welding, or chemical processing.
    - No elicit deposit of effluents or liquid wastes.
    - Storage of recycled materials.
    - Disposal of discarded materials at licensed locations.
    - Other public health measures

Non-Regulatory Instruments

Economic (Subsidies and Taxes) and Non-Economic (Persuation, Information, Education and Awareness-Raising) instruments discussed above.

2. INSTITUTIONAL ARRANGEMENTS FOR THE IMPLEMENTATION OF POLICIES

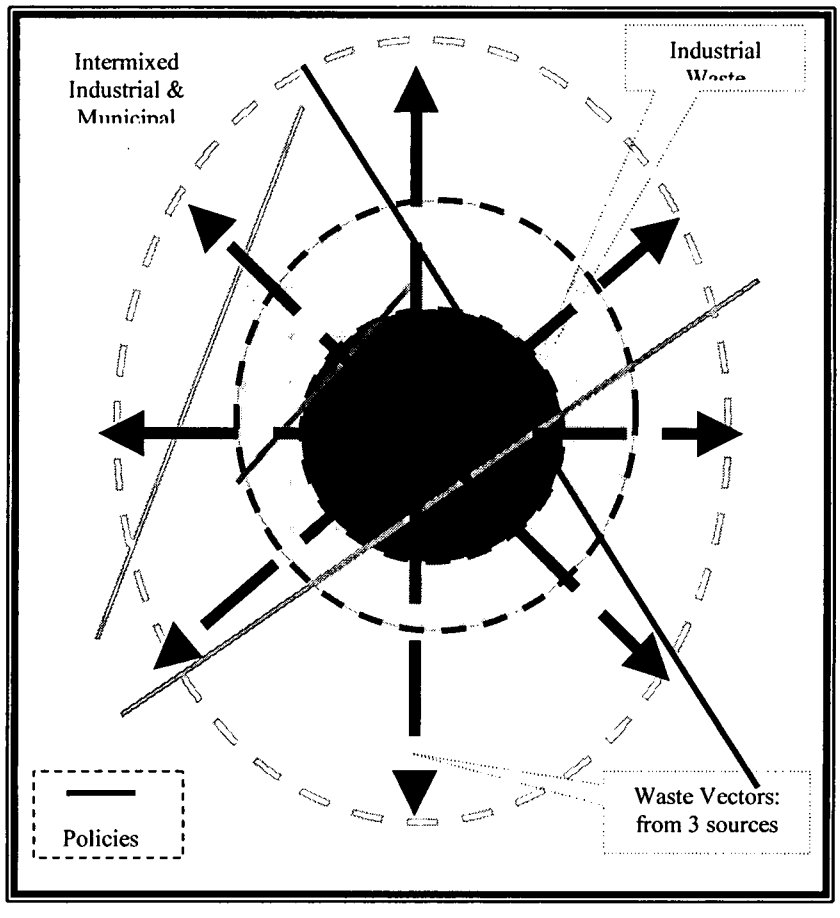
The institutional element to policy implementation has been briefly discussed in Module 1. Framework laws are the initial steps in creating institutions and in identifying their roles and mandates in general but unambiguous manner. Sectoral and regional legislation complements the creation of necessary structures for a concerted and co-ordinated operation of such. Two other elements stemming from the planning exercise are of equally high importance to the realization of institutional structures. These are the outputs from the planning process guided by stated policies (objectives, strategies, etc.) on the one hand; and the process of resource allocation (budgeting), on the other hand, which is meant to facilitate the investment in and funding of the waste management activities and thus making their realization possible – especially infrastructures. According to new approaches such investments are seen as an undesirable intervention when undertaken by the public sector in activities profitable to the private sector alone. The role of the public sector is more seen as a client for the service provision and as a regulator (making laws, guidelines and procedures for the service provision and supervising and monitoring performance by the private sector and other service providers). The trend now is for the private sector (formal and informal) to provide the service. The transition is just beginning in Africa.

For the purpose of this Manual institutional considerations is not limited to the city management structures alone but extends to include all stakeholders: municipality, private sector, the community and all others mentioned in the introduction. The problem will be to consider the pivotal role of the municipalities in stimulating and motivating all outlying groups to contribute to the MSWM service. It is also important to enlighten such groups and draw their attention to the importance and benefits of participating in the MSWM. This is done under the awareness section below. The private sector is a special case as they avail of managerial skills, funding resources, and the potential to recycling and innovation. Participation methods for the private sector will be discussed under Participation Methods in Module 3.

2.1 MUNICIPALITIES INSTITUTIONAL BUILDING AND STRENGTHENING

Within the public sector effective organizational responsibility and clear mandates as well as revenue generation capacities are very important for an effective SWM. This applies to allocation of such responsibilities as among the national, provincial and metropolitan and its associated municipal authorities. At the metropolitan level relations between city management (metropolitan authority) and related municipal and other local authorities at the urban agglomeration (contagious areas spilling over defined boundaries) should be defend and clear. A special case of contagious areas to metropolitan areas is the settlements of workers around industrial zones in what may look like informal villages around the industrial zones. These groups not only generate waste in unplanned areas but are also exposed to hazardous industrial waste and gases from industries. A special attention may have to be given to such groups and settlements. See Figure 5 below. Other Problems arising due to shortage of capacity, e.g. investment planning – usually done at provincial or central level; and duplication of services, e.g. metropolitan workshop may be responsible for service and maintenance for the waste collection vehicles and equipment, but also for ambulance under health department and the fire engines under administrative as well as septic tank emptying vehicles. Personnel for all of these may be under the central transport department and, to compound the problem, acquisition of all these equipment may be under different or a single central department. This may be partly solved by maintaining a good integrated cost accounting system. This is usually lacking at local government levels and need to be provided.

Figure 5: Mixed Industrial Municipal Waste Areas: A special action is needed



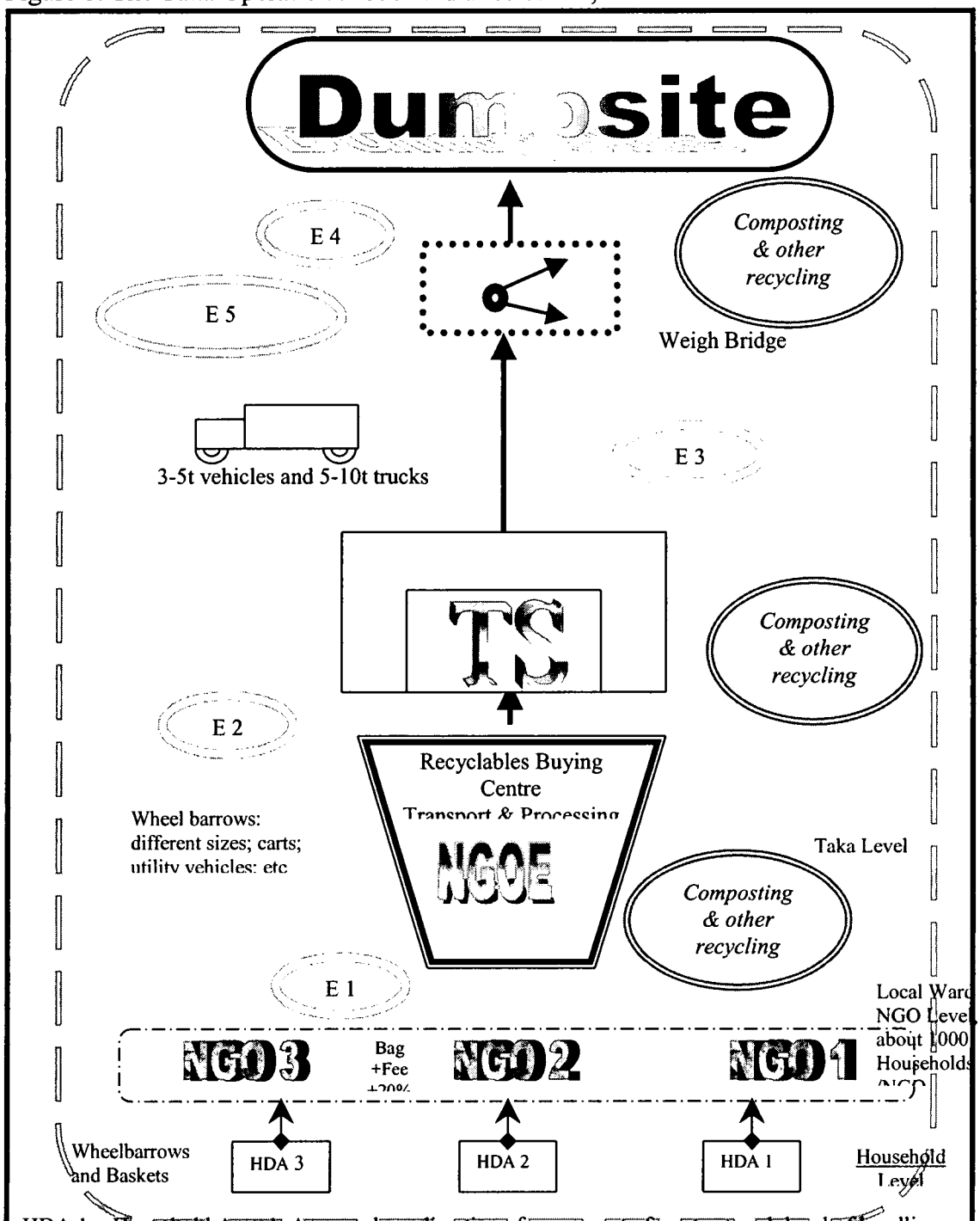
The organizational functions may be carried out effectively if managerial functions (provided by management theory to include: planning, directing, organizing, staffing, and controlling while functional areas can be seen as operations: collection, transport, etc.; personnel, finance, sales and commerce, administrative support) were made to correspond to appropriate systems of functional areas. These would enable an efficient and result oriented operation of the system.

Intermunicipal cooperation is very important in terms of centralizing some activities susceptible to centralization: common landfill, recycling facility and/or management, strategic planning, transport, etc. This will lead to economies of scale. Waste collection would not be suited to such centralization and is much more location bound (locality or ward level: approximately 50-100,000 people). For collection and street sweeping more liaison and coordination is needed between the supervising management, the ward heads and the community (self help or food for work programs). Such a scheme has taken a comprehensive form including recycling and supply of recyclables to industries by community based organizations at the local level and up to transport to the "dumpsite" at a city wide scale in Daressalam, Tanzania. See Figure 4 below.

Within the local government or the lowest unit of an independent municipal structure (i.e. core city, metropolitan authority, surrounding municipalities) responsibilities for waste collection have to be clearly distributed. Waste collection, waste treatment and disposal and waste transport and transfer have to be allocated to clear levels of responsibility. Collection is best done at the lowest levels with much community and service NGO participation while maintaining close cooperation with ward level achieves. Treatment and disposal are organized at a higher level in larger facilities caring for the whole city or larger zones of it as may conform to economies of scale of operation. Disposal and transfer can also be treated at city level or even better – especially for disposal – at intermunicipal level. Transfer networks and stations are best optimized in consideration of the whole network vehicle stock, workshop and maintenance, travel route optimization, etc. Disposal can be made with responsibility lying on a central metropolitan body (overall planning, monitoring, control and financing functions) while day to day operation may be laid on a zonal department or an outlying locality where the disposal facility is located. Depending on the type of city management structure and the arrangement made to allocate responsibilities among municipalities agreements may be drawn between the participating municipalities to manage a disposal facility or a treatment plant.

Strengthening the institutions will mean identifying specific operational functions relating to collection, transport, disposal, revenue collection and costing of service and at the same time ensuring enough resources (financial, trained and skilled personnel, motivational aspects, etc.). The aim is to improve on service performance (by recording and measuring the above functions) and approach higher operational standards.

Figure 1: The Taka Operation Model in Dar es Salam, Tanzania



HDA 1 = Household Area 1. Arrows show direction of movement of waste at each level of handling.
NGOE = Taka & Monoko, an NGO & an Enterprise, served by local satellite NGOs and are involved in recycling at the ward level and in industry, and in transport to dumpsites.
TS = Transfer Station at the Ward Level or at its subdivision, drop-off site.
E1,2,..5 = Reflect the 3E UNIDO motto: Economy, Employment and Environment, or the indicators of sustainability. They reflect creation of value at each level of activity or at the overall city level.

Economies of scale and efficiency of operation may require sometimes that services may have to be performed by an external (private sector, or NGO body). Examples for these may be specialised (cost) accounting services may have to be bought in from another department within the municipality or from the private sector at reasonable cost, or vehicle maintenance may be sourced from a central workshop or from a private one. Even the collection and transport services may be contracted out. An example for a service contract is given in the Annex to this Module.

Separating functions for more efficient operation may be realized through establishing separate departments (depending on the size of the municipality this may be a unit, department, agency or an outlying or annexed body) which need to observe the basic functions of WM: client (providing adequate service at reasonable cost), regulator (enforcing environmental and health legislation including standards) or operator (directly delivering service of collection, transport, treatment, accounting, revenue collection, disposal or recycling). While establishing separate departments it is important to consider performance measurement. To realize this the following has to be done to arrive at clear responsibilities and roles and at the same time efficient operation:

1. Establish autonomy.
   1.1. Separate WM functions from other municipal functions
   1.2. Establish separate WM (cost and financial) accounts

2. Separate basic functions
   2.1. Client function: responsibility for ensuring service delivery.
   2.2. Regulator functions: responsibility for delivery standards, and a major separate function
   2.3. Operator functions: Direct or indirect service.

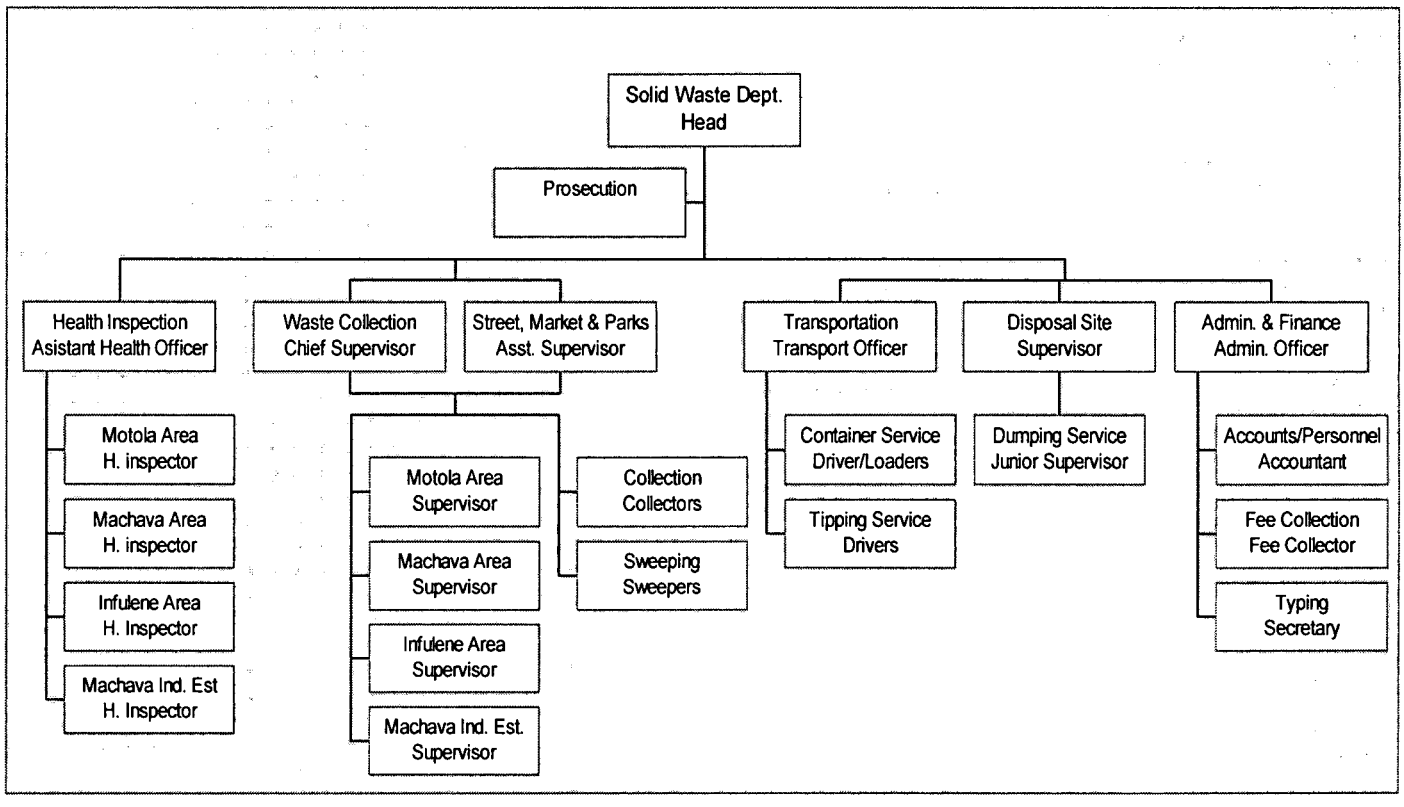
3. Enhance cost effectiveness
   3.1. Privatize service: competitive tenders, franchise, or concessions.
   3.2. Commercialize service department

N.B.: *Privatization is not a guarantee for effectiveness and low costs: there must exist sufficient competition, transparency (meaning well regulated) and accountability (indicated by productivity associated with income). Note that the economists' model of efficient private sector is a theoretical construct which presumes perfect markets that does not exist in developing countries. Rather "predatory pricing, collusion, cartels, unsafe labour practices, hidden subsidies, unnecessary costs and excessive risks" are much more rampant.*

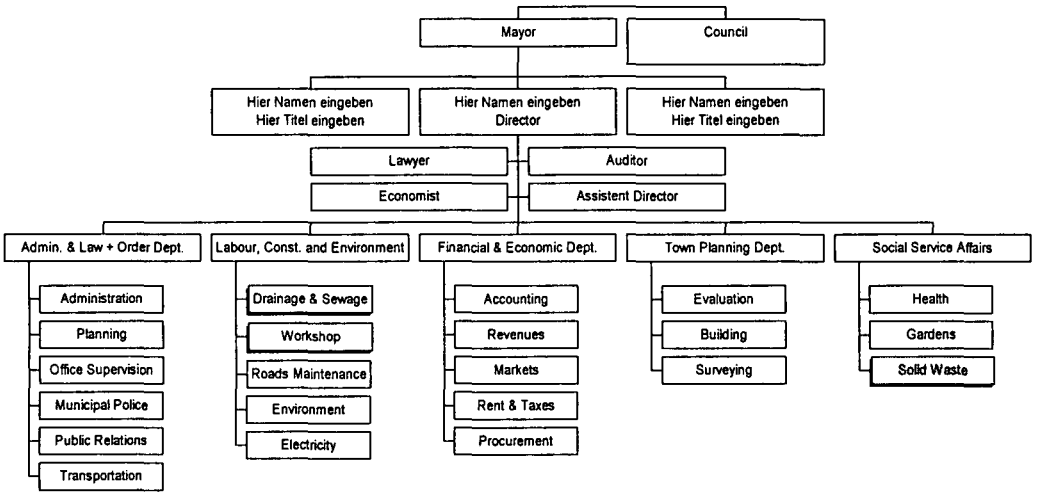
The separation of functions has specific importance in that it reflects the prioritization of the WM. service. Separation and organization within the municipality can take different forms. Examples are given below to show the possible arrangements that can be made to fully separate WM. services or incorporate related activities like the

workshops for maintenance, transport and engineering for vehicle fleet and landfill operations, if any, revenue collection, and other related health and sanitation services. The organizational structures of some local governments are given below.

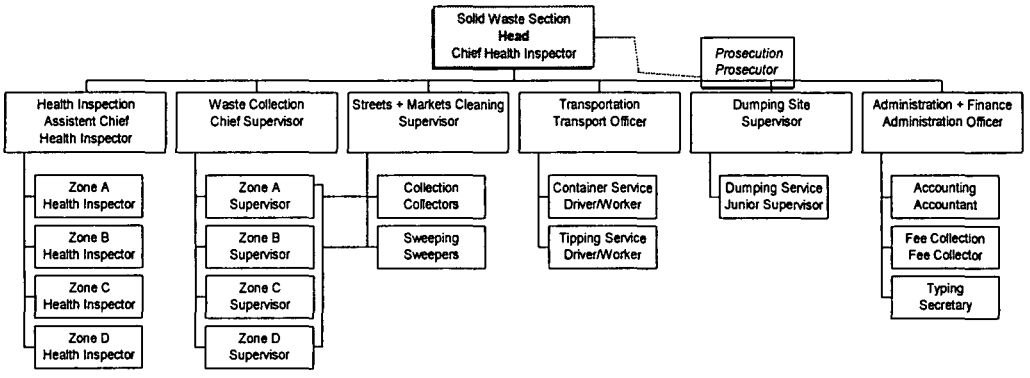
Organisation Chart
Solid Waste Department, Motola City Council,
Motola, Mozambique



Organization Structure of Zanzibar Municipal Council

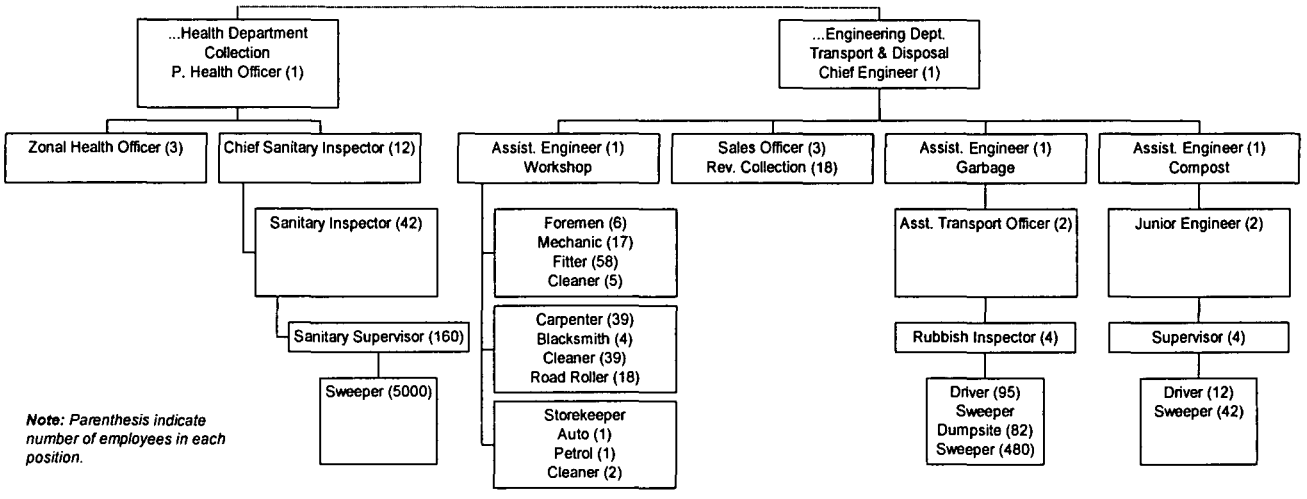


Organization Chart Solid Waste Section (SWS)



Staff under seperate Departments

Refuse Management Staff (Within LA Structure)

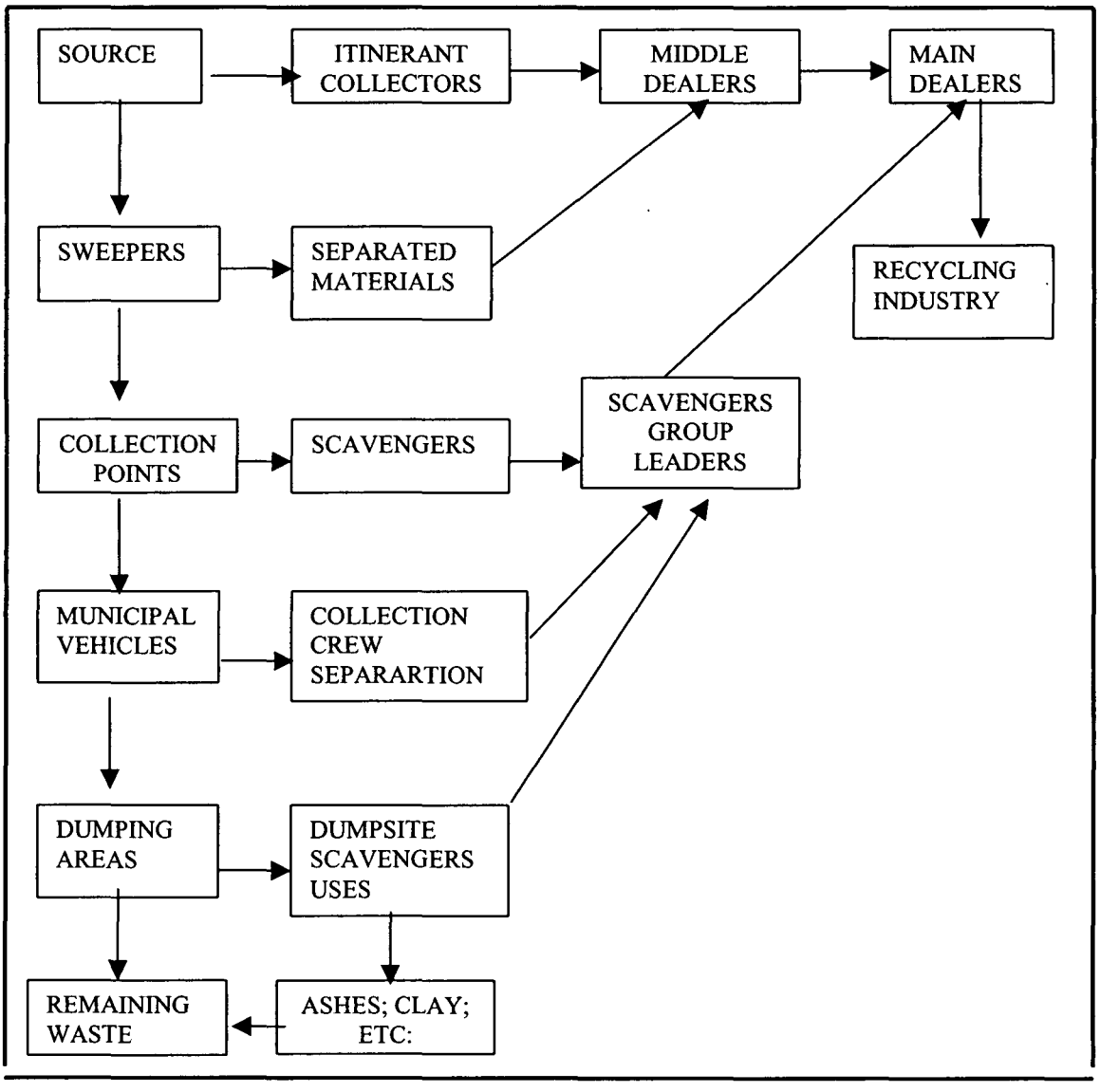


***Note:** Parenthesis indicate number of employees in each position.*

3. AWARENESS AND ATTITUDES

Among the major aims of MSWM is to promote productivity and raise standards of living in the major cities – especially for the urban poor by improving SW services; to build the capacity of the assemblies to manage sanitation, drainage and core solid waste services; and to effect environment and health improvements. Hence, the need for exchange of information between the municipalities and the beneficiaries. This required special effort in informing and sensitizing the public and educating them on the importance of the integrated approach to solid waste management. It is not enough to make policies or laws without properly educating the public about the importance of these laws and policies and how best to deal with them. Only by doing so can the authorities be sure that behavior and attitudes are in congruence with the environmental aims of the government. Attitudes are particularly important in respect to caring for waste collection directives, response to anti-littering campaigns, and the willingness to pay for waste management services.
An individual may not know how to make sound judgements about the products he consumes in terms of their packaging, their effect on the environment or their toxicity and method of disposal. In most African cities, the solid waste cycle is predominantly influenced by the behavior of individuals in the informal sector and the high density population areas. **Figure 2.1** below shows how the solid waste flow comes into the urban environment.

Figure 2.1 Flow Chart for Informal Sector Solid Waste Management in an African City



Box 1

A Ghana Experience

In Ghana, we observed that fish in the Chemu II Lagoon in Tema and in other wetland fishery at the outskirts of Accra and other cities were displaying very meagre sizes. Fish had continued by time to be smaller in size although the species were known to be of greater sizes few decades ago. We also observed that – which is also quite visible to any visitor or resident – some large parts of the city of Accra, e.g. around the lighthouse along the shores. On asking about the reasons for the decreasing fish size and the careless and meandering behavior of residents: unhygienic and hazardous habits like excretion in the wide open, broken and choked public drains, mounting refuse and filth, lack of street cleaning and clearing systems, uncontrolled private dumps, stagnant house drains, offensive pools of sludge around houses in mass residential areas, etc.

The answer for the first question came from a scientist involved in research on fish. She said that the reason for the ever decreasing size of fish was the changing structure of the society and the social values among the greatly increasing number of fishers. Traditionally in the past, people used to fish in a particular time of the year, in particular months and on specific days of the week ... and particular times of the day. Prohibited fishing times were adhered to because of the gods. The gods will be angry and may cause disruption to rainy seasons, cause hurricanes, or some social upheavals, if in certain times of non-fishing periods people dare to do it. This was according to handed-down traditions. Recently, a few decades before, people living around fish-rich zones increased. Although they came mostly from within the country to Tema, they were "folks" with different beliefs. They neither knew about these beliefs nor did they respect them when they knew. Fishing and survival was their preoccupation. Nothing happened to those of them who initially broke the "warning". They had the courage then to fish even more. As time went on, the fish population began to diminish. Simultaneously, fish began, by themselves, to shrink in size in order to get released back into the water as this was the immediate response of fishers to small fish caught. Now there is not much large fish and the available population of swarms of shrunk fish is also being caught.

The interpretation: the actual indigenous behavior was not really purely superstitious, but was an old value and wisdom developed over the centuries to prevent and circumvent over-fishing and had to be embedded into tradition and superstition. Over-reliance on fish as a source of protein has to be regulated now, otherwise the shrinking would continue indefinitely.

The explanation of the urban settlements case in Accra was also similarly explained. Newcomers to town from surrounding villages and towns were increasing very fast in number. They were not ready to adhere to the

quarters' chiefs authority of keeping the surroundings clean. Their allegiance was more to their day-to-day struggle for survival and their worry was much more about their "home chiefs," not to those in the city here.

The official response was that poverty or other problems in life could not be accepted as a reason for dirtiness. The problems, however, lie elsewhere.

Along all these stages the relevant sector of the population is supposed to be made aware of the environmental consequences of their actions. The formal sector, the NGOs, the CBOs and the community at large should be the target of awareness campaigns launched by the municipal authority. A communication study, strategy and plan can be adopted to implement this awareness campaign. A study made in Ghana identified women and children as the primary targets of such a campaign (women manage waste at home and children are sent to dispose of the waste and are, at the same time, the pupils in schools who will be responsible to adopt and maintain sustainability of the behavior in the long term). Secondary targets were the policy makers, assembly men, opinion leaders, committee members, household heads, landlords, organized groups (market women, drivers, lorry station workers, etc.) traders, and the informal sector. The major information need identified by the same study for each of the target groups was determined to be education on the management of waste in the homes and communities: proper collection, storage and disposal of waste in the home. Associating WM. with health and economic benefits of reduced medical costs is important in approaching such groups.

It must be stressed during the campaigns and awareness raising that popular participation is of utmost importance in ensuring success in solid waste management. The example of Durban, South Africa is a witness to this. A landfill was built at the outskirts of the city. Nearby was a suburban village whose residents were very furious about the location of the landfill and the traffic around their village which disturbed their life. After several meetings with the municipal authority's responsible office explaining to them the importance of the landfill for the city and the way it functions, they were asked to suggest their own locality as a suitable site for the landfill. They did not agree to it being there but they went further to suggest operators and watchmen for the site. They eventually benefited not only from the posts of truck drivers, sorting out crews but also supervisors and private recycling crew. It became a source of living for the villagers.

Appreciation of the costs of WM. and awareness of final disposal costs is also important in appreciating and reducing reluctance to pay for the service. Eventually, availability of receptors and an efficient service are the best to convince beneficiaries to observe proper behavior and to pay for the service.

3.1 OPERATIONAL MECHANISMS FOR AWARENESS BUILDING

Awareness building is a decentralised and a centralised policy object. In as much as it is centralised, the government - local or upper level – is responsible for initiating such programmes. As a decentralised policy, it is a function that the community or its organised establishments, ranging from universities and research institutes to CBOs and NGOs, can undertake in order to communicate to the population how best to carry out and execute the aims of the environmental protection tasks. There are many ways whereby these can be done. Meetings and participation in the

identification of environmental/solid waste management problems is one. A method of organising meetings is suggested here as a project or a case study on how to approach the community and tap suggestions about solving waste management problems and about soliciting their commitment to such actions.

Other methods of communications are radio talks, programmes, plays and television shows and competitions with a content in this direction. Newspaper articles, public lectures, exhibitions, press releases, etc. are another vehicle of communication. The main disadvantage of these vehicles is that they may be costly, require special capability to prepare, and may best be achieved with government support. Their greatest disadvantage is that it cannot reach the majority of the population in the rural areas or people with less education or no means of owning radios or televisions. These are, however, the most important section of the population generating and handling waste. They are also the most affected by diseases and unhygienic living conditions.

Attitudes Toward Changing Conditions, Work, etc.

Awareness and attitudes are not limited to intellectual and mental exercises but are vital to action as well. The Case Study from Burkina Faso goes very far to explain this exercise. It is no more an acceptable fact of life in African countries that dirt and litter is condoned by most of the citizens. They all frown at unattended parks, uncollected waste, etc. The very changing conditions of heaps of waste blocking roads, lying in front of houses, etc. have brought to the fore much attention among most of the city dwellers. Quite a number of respected and educated individuals have committed themselves to relief people of this burden. They are not extending their hands to co-operate with city managers to solve the problem, but they are taking this a full time job and are offering their services to citizens as well. A large number of individuals, out of recognition of the importance of waste collection services, are using the services of such individuals and groups. The same trends are also observable in the popping up of many NGOs, CBOs, and CSOs and whole communities who are actively participating in the activity of waste management.

However, the number of effective waste management services in most African cities remains very low – below 3%. Waste collection, being a non-excluding activity, has to be done and sponsored by all. Non-exclusivity means that if some do it, it benefits all, but if others do not do it then all will be exposed to harm from it. This calls for intensive effort by way of education, sensitisation, and the creation of more awareness through the media, the press, public addresses and exhibitions, etc.

Education: Formal and Informal

If the MWM system and the policies adopted are to be successful, all sections of the population have to understand the functioning of the system and the problems it presents. This implies that environmental education and the waste management philosophy, policies and approaches have to reach all sectors of the community. Indeed, there are sectors responsible for providing education in all forms throughout the country. These can be identified as a network system through which waste management education can reach all sections of the community.

A practical approach is to develop a waste management education strategy. The education strategy would obviously explain the mechanisms by which waste arises and the manner in which prevention, minimisation, handling and disposal are expected to be achieved.

Of course, the main target is the formal education system in the country. Curricula at all levels of basic education, university and post-university should be made to contain material relating to the problem. Informal education, extramural and extension educational courses have to be designed to deliver knowledge on how to go about solving the problem. Additionally, it is not enough to educate people. School leavers and graduates must be prepared and equipped with skills to man public and private sector institutions dealing with SWM. Finally, the same institutions should establish training programmes for L.A. employees involved in SWM:

The following instruments and forums for sensitisation can best assist with immediate and direct education and change of attitudes towards waste and waste management and towards financing the activity, i.e. through payment of charges and dues for MWM and services provided.

Sensitisation

Sensitisation is the exercise of creating awareness among the public at large but particularly those responsible for solid waste in the first place. The local authority functionaries and leaders are the first to be sensitised about their roles in waste management planning and execution. The mayor, for instance, should always be on the alert when undertaking essential activities: e.g. consultation, employing specialist consultants without adequate integration of local political processes, the formation of indigenous capacity, and technical monitoring and follow up. These have to be clearly interrelated and integrated along with the necessary consciousness and care. Another example is participation. City administrators have to look at public discussions as the means to develop best solutions to problems. An agenda for participation should be defined, involving different levels and scales of participation.

City managers must distinguish themselves as sensititors by being creative themselves and providing new solutions to old problems. In doing so, they tend to appear more convincing and caring. They should also challenge technological dogma and resist the temptation to import capital-based solutions. They should seek to strike a balance between appropriate and affordable technology hardware with the "software" of human experience and contact with their neighbourhood. They should remember that they do not work alone or in a vacuum: there are the tools of local government reforms, institutional innovation, private sector support, etc. for local governance to work effectively.

Mass Media

The mass media has the following functions and roles to play:

(a) Create and sustain awareness
(b) Reach a wider public
(c) Provide documentation for reference
(d) Act as a pressure group
(e) Serve as a watchdog
(f) Serve as a change agent
(g) Facilitate feedback

The media is divided into a number of institutional areas:

- The film industry

- Television and radio broadcasting services
- The information service
- The press and related journalist activities
- Institutes of journalism

The central government and the L.A.s have to get all of these institutions involved. These institutions, on the other hand, have to collaborate closely with other educational institutions – especially institutes of journalism - and other related institutions, including the private sector. The areas of co-operation would be production of documentaries, articles and discussion forums, formation of committees to plan and implement waste management educational programmes, and the establishment of official policies on waste management education.

International organisations usually help a lot with such efforts by direct training, technical assistance, etc.

The Press

The press is one of the most important means of sensitisation and creation of awareness. Articles written in the papers, magazines, etc. reach a large number of educated and literate citizens. This section of the population is very important because of their influence on the other members of the society. Papers may not reach every person, they may not be affordable by each person who can read, but articles and critical views reach a broad spectrum of the society, hence its importance.

Exhibitions, Workshops,

Exhibitions, workshops and seminars are among the important vehicles that communicate information, furnish a good atmosphere to the exchange of ideas and experiences, and as a result, form pressure or work groups which will be engaged in combating the problem directly or disseminating information.

Among the effective actors in the above are individuals, initiative groups and institutions. Most important among these are:

- Local Government functionaries and councillors
- Community development departments
- Women organisations
- NGOs
- Extension services
- Religious organisations
- Traditional rulers and opinion leaders
- Celebrities, famous and respected individuals (business men, philanthropists, etc.)

Public Meetings and Seminars

Public meetings and seminars are of extreme importance in sensitizing a broad spectrum of target people and stakeholders. They are interactive and their educational value is not to be overlooked.

Also, commitment before the group by individuals and groups meaning action tend to be more binding on them – at least morally. They tend to enlighten those who listen to them and thus stimulate their initiatives and positive reactions.

BOX 2

ISSUES IN THE TRANSFER OF ENVIRONMENTAL TECHNOLOGY TO DEVELOPING COUNTRIES

Making leather has traditionally been a dirty and often unsociable exercise. Tanneries have been located outside towns, downwind and downstream to carry away noxious smells and wastes. Today, leather production still involves considerable use of water and generation of wastes. On average, one metric ton of raw hide yields only 200 kilograms of leather. The by-products include 50 cubic meters of wastewater, containing a range of chemicals, and half a metric ton each of wet sludge and solid wastes.

Increasingly, however, industrialists and researchers are finding ways both to reduce the generation of pollution and waste and to upgrade the efficiency of the production process. A wide range of techniques and approaches can be applied, from simple low-cost housekeeping improvements through the substitution of less damaging chemicals to the introduction of intrinsically cleaner production technologies. Innovative ways of using tanning wastes as raw materials for glue, fertilizer, and animal fodder are also being developed.

The challenge of diffusing "best practice" has been increased by the relocation of leather making during the last 30 years from the industrial to the developing world, where pollution control regimes are often weaker and where resources for environmental protection are scarce. In many developing countries, the leather industry has played a central role during industrialization; it is agro-based, labour-intensive, and adaptable to small-scale, low-technology production.

There is no such thing as a standard tannery; processes differ widely depending on location, sophistication, and the market for the final product. International best practice has to be translated into the local context; pilot projects are often needed to demonstrate the feasibility of change. Research institutes and trade associations together play a vital role in this process. In Kenya, the lead agency for the tanning industry is the Leather Development Centre (LDC) at the Kenya Industrial Research and Development Institute (KIRDI).

A weak institutional and legislative framework has meant that Kenyan industry has, to date, not received a sufficient regulatory push for improved environmental performance. In addition, lack of information and financial resources has limited the ability of local companies to assess and install cleaner technologies from abroad. An expert working at the Leather Development Centre sums up the challenge thus: "It is common among Kenyan tanneries to rely on traditional methods of processing leather, resulting in heavy production and discharge of pollution in the

wastewater."

Collective efforts led by research institutes and/or industry associations can help spread the costs of improvement while minimizing the inherent risks of innovation. This is the role that the Leather Development Centre plays. It has been developed in phases over 10 years with technical and financial assistance from the United Nations Industrial Development Organization (UNIDO) and the Federal Republic of Germany. The centre's aim is to provide advice and support to local companies on two interconnected issues: identifying and developing enhanced process and product technologies, which will boost the industry's domestic and export potential, and developing and diffusing better ways of reducing the environmental hazards from leather production. The LDC has established a pilot tannery plant, a leather design and production unit, a quality control laboratory, and a wastewater demonstration unit at its facilities in Nairobi. Although most of its funding comes from domestic and external government sources, a nominal fee is charged for the centre's services.

The first step toward sustainable development for the leather industry is the creation of awareness among industrialists of the need for change. Once awareness has been raised, the centre can provide tools to help companies overcome pollution problems. It uses its pilot production and treatment plants as models for training and demonstration purposes during seminars and workshops. This is coupled with regular visits to the tanneries themselves by LDC experts, and targeted assistance programs.

Source: [5] Stephan Schmidheiny, Changing Course: A Global Business Perspective on Development and the Environment (Cambridge, Mass.: MIT Press, 1992) 224-226. Copyright © 1992 by MIT Press, reprinted by permission.

4. PARTICIPATION AND BUILDING OF PARTNERSHIPS

The Emerging Role of the Public Sector (Local Authorities)

Increasingly, governments, the private sector, and civil society agree that successfully addressing the complex social ills and issues besetting the world, its cities and its peoples in the 21st century will require partnership. In Istanbul in 1996 at the City Summit, local actors and partnerships were seen as central to building sustainable human settlements. Thus, as governments the world over move toward more participatory approaches to problem solving and management, the local level of government increasingly represents one of the most important elements in this transition. Mayors, as representatives of the local level, are a direct link to the local level. Citizens normally do not or cannot reach and interact with their central government. However, they do directly interact with, or complain to, their mayors about jobs, waste, water, safety, and other basic issues. L.A.s can thus be the most effective conduit for the public's problems. Secondly, cities are characterized by the following:

- Cities are engines of economic growth, centres of employment and opportunity, hence the importance of their performance;
- Cities and towns are seriously affected by overcrowding, environmental degradation, underemployment, social disruption and inadequate housing infrastructure and services, including waste and sanitation;
- The origins of many global environmental problems are related to patterns of production and consumption, and the consequent waste, air and water pollution occurring in cities.

So, where in the past, the local level of government and its mayors often represented a mere extension of central government, signs today point to a new role of L.A.s characterized by changing responsibilities.

Changing Responsibilities

In the past, an L.A.'s role was restricted to voluntary , or involuntary, management of the city's budgets, making isolated decisions that do not necessarily take into account people-centred priorities. Mayors were responsible for individual public works, without a strategic vision for their cities and without regard for their people's aspirations.

This role is changing in response to decentralization, globalization and the new philosophy of partnership outlined above, though certainly not in the same pace and the same way everywhere in Africa. Many obstacles prevent full implementation of the new responses to turn cities into instruments for change. These include excessive centralization (mayors want more power and capability) still existing in many countries and resulting in a lack of administrative, technical, and financial autonomy at the local level; resistance to change; bureaucracy; corruption; selfishness; isolation and a lack of dialogue among public, private and voluntary sectors; lack of technical capacity; partisan politics; and a lack of trust among the levels of government.

Notwithstanding, innovative management strategies and participatory concepts can be taken on board to attain objectives:

- In Accra, Nairobi and Dakar partnerships are being developed in their communities between public and private sectors and within city neighborhoods.
- In Bombay, a partnership between public authorities, hospitals, schools, and foundations implemented a successful initiative to educate children of low-income areas about preventive health and immunization. These children became "min-doctors", performing a monitoring role in their respective slum areas.
- Curitiba, Brazil represents perhaps the most comprehensive of such examples. Counting on the leadership and political will of its mayor, Curitiba began in the early 1970s to manage, control and direct its growth process, develop an efficient public transport system, and pioneer innovative programs such as the exchange of garbage for food in a self-financing manner.
- In Casablanca and Johannesburg, mass housing projects for low income people successfully involves formal and informal organizations to run different aspects of community life such as security, gardening, and waste management.
- In Tijuana, Mexico, a program developed by the local administration distributes a percentage of the city budget to community groups committed to developing specific public works. These projects are selected through neighborhood consultations.

Towards a New Agenda

The above examples illustrate that L.A.s cannot do everything on their own. Their role is becoming one of a facilitator, a catalytic force pushing together innovative shared responsibilities. The mayor has the responsibility (power?) to delegate, not only to city hall employees, but also to the private sector (through the instruments of tendering policies and regulations),and to the civil society as a whole, and co-responsibility for developing collective objectives within a city or town. Rather than being a mere executor of technical prescriptions, a local administration can now be a key actor in the transition toward improved forms of urban governance.

It is impossible to outline an agenda for local officials. Rather, one can suggest some general principles and techniques local administrators should keep in mind as they move toward sustainable city development:

- ***Improve governance for sustainable urban development.*** This can be accomplished through a participatory role of public administration and civil service (civic groups), by encouraging stakeholders to participate in decision-making, and by developing forms of participatory municipal budgeting and enhanced ownership of programs and projects. This should not be an occasion for corruption, nepotism or blind favoritism.
- ***Promote the alleviation of urban poverty.*** This can be accomplished through equity based social development policies, access to social services by disadvantaged groups, an enhanced role for NGOs and civil society organizations, empowerment of women and the poor, access to management skills and credit facilities, income-generating programs, and support of informal enterprises.
- ***Preserve the urban environment.*** This can be achieved through community-based environmental programs such as waste management, tree planting, low-income sanitation, private sector involvement in service delivery (waste management, recycling, landfill management, sanitation), and enactment of environmentally sound land-use legislation.

- ***Support local capacity development.*** This can be achieved through networking/twining and information technologies; cross fertilization of experiences; and capacity development within local systems (judicial, financial, managerial); and improving municipal finance and revenue generation.

The above would very much rotate about the character of a dynamic mayor who has to be simultaneously: an entrepreneur (improve private sector, "see participation methods below", informal sector, and community participation), a conductor (it takes a very good ear to discern silent majorities "i.e. the most needy", from noisy minorities), a cook (seeking out different ingredients and trying new recipes as daily routine), a magician (balancing multiple complaints and needs against an inadequate budget), a doctor (to handle common urban planning diseases such as "consultivitis and Participants"), and an inventor (using people and local capability help create new solutions to old problems, contraptions and gadgets do not replace knowledge about the local context).

To fulfil this new agenda, mayors have to do less by giving communities an opportunity to act through responsible participatory approaches; however, mayors need to do more by monitoring trends and making the most of their communities in a changing national and international scenario.

2.2 4.1. THE PRIVATE SECTOR

Emerging Role of the Private Sector

The private sector (formal or informal) is an important section of the community. It is mostly unrivalled because of its efficiency if well monitored, paid and placed. There are several personal initiatives of operators in waste collection, recycling and disposal. These range from very small businesses based on individual effort to full fledged service companies. These are prepared to undertake their new role as service providers and constructors of infrastructural and mobile gear for the municipal solid waste service sphere. They can be drawn into waste management so long as they can complement the local authority's resources given that:

- The private sector realises a profit over and above their incurred costs,
- The local government would relatively save money by using the private sector's efficiency (lower cost) and capacity (capital investment),
- The government, occasionally and in larger project cases in order to realise the point above, may consider public values and address macro-economic issues beyond the market price used by the private sector.
- The private sector is not a panacea but an opportunity.

Participation Methods for the Private Sector

However, private sector participation is very important. Below we will discuss some examples and experiences for the methods of private sector participation most common to solid waste management - namely, contracting, franchise, concession, and open competition. * Before discussing these we will briefly describe some of the most frequently met types of organization ranging along a continuum from private markets to municipal ownership and operation. More detailed discussion can be seen in Chapter 4 below.

Private. The Government leaves the provision of refuse collection services to the free market, imposing only minimal health regulations. Also known as open competition.
Franchise. The Government, by franchising private collectors, limits the number of firms competing in the market. This may be temporarily appropriate for African countries in situations where there are no large franchising companies.
Regulated: The city permits a monopoly but regulates the prices it is allowed to charge and the type of service it provides.
Contract: The Government specifies the level of service and contracts with a private firm. Sub-contracting to smaller private establishments is also common practice where micro- and small-scale operators are suitably qualified to undertake the job.
Non-profit: The municipality (or mostly local initiative today) creates a non-profit refuse collection agency which is independent of the city government.
Municipal: The municipality provides the service itself through a public agency or department.

4.3. COMMUNITY AND ORGANIZED GROUPS

The organized groups of the community like the civil society organizations, non-governmental organizations and the community groups: women, etc. have a very important role to play. They are to participate as advocacy groups, direct service providers, and as active participants to the policy formulation and implementation process. Depending on the conditions of the country, they are expected to augment and complement the efforts made by the public sector and the private sector.

* This section draws on the private sector participation of the [6] UNDP/UNCHS/World Bank Urban Management Programme 13. The purpose of the Chapter is twofold: to explain methods of private sector participation and, simultaneously, throw some light on some pertinent research areas relating to private sector participation and measurement of efficiency.

BOX 3

POLICY ISSUES (PLANNING FRAMEWORK)

Presentation by Dr M. Eisa, UNIDO

Solid Waste Management

Solid wastes (including sludge from sewage) are serious threats to:

- Surface water and ground water
- Soil and air
- Poor SWM will affect:
  - Health and quality of life
  - The potential for development
- Half of the urban population in developing countries has no service for SW disposal
- Globally the amount of SW produced will double by the end of century and double again before 2025.
- By the end of this century disposal costs will double or triple
- Two billion people will be without basic sanitation.
- 5.2 million will die each year from waste-related diseases. (4 million are children – about half are in Africa).

Agenda 21 Program Areas (4)

- Waste minimization require all countries to:
  - Establish targets for waste reduction that influence patterns of: **production and consumption.**
  - Set goals that would hold per capita waste production at levels that prevail in the year 2000 (industrialized).
  - Investing in WM. 1% of expenditure on SW and Sewage disposal. (equivalent of $6.5 billion at current levels/industrialized).

- Refuse and recycling
  - National programs shall be in place (by the year 2000 in industrialized countries and by 2010 in developing countries)
  - Recycling programs must be expanded through economic, market and legal incentives.
  - Priority for recycling technologies should be for plastics, rubber and paper.
  - Setting home and community based programs including separate collection of recyclables.
  - More research on clean technologies, new methods for sharing information internationally and incentives for reducing wastes.
  - Improve ability and capacity to monitor and understand the SW production and disposal cycle

- Establishment of international standards for:
  - Environmentally sound treatment and disposal of waste.
  - By the year 2000 all countries must establish waste treatment and disposal criterion and develop the ability to monitor the environmental impact of waste.
  - By 1995 all industrialized countries should ensure that half of the waste waters, sewadges and SW is disposed according to national and international guidelines.
  - Safe disposal programs in developing countries will cost US$15 billion a year including US$3.4 billion in international grants or concessional financing

- Extending waste services
  - Mainly deals with lack of basic sanitation services.
  - These needs must be factored in the national development plans.
  - By the year 2025 full waste services should be available in all urban areas and sanitation services be extended to rural areas.
  - The estimated annual cost

Next Steps

1 Read the excerpt

2 Test your comprehension of the information by answering the questions below, discuss them with the group, and compare with the answers are suggested at the and of the pamphlet

Questions:

1 There are two views to the organization of municipal solid waste management in a country. What are these?

2. What policy options may be open to a municipality in order to achieve MSWM goals?

3. Industrial estates are mostly attached to city outskirts. Due to transport and other problems workers settlements grow around these estates – sometimes villages happen to be in the vicinity. Do you have such phenomenon in your city? Does it represent any problems in terms of waste management? Are these groups particularly vulnerable and exposed to industrial hazardous waste (chemicals, effluents, etc.)? What measures have been undertaken to handle this problem? Is that adequate?

4. What arrangements have you made in your locality to incorporate the efforts by NGOs to collect waste in the high density residential areas.

5. What procedures do you think are appropriate to create awareness among the public?

6. In which areas of waste management do you think privatization would work well?

ANNEX 1: SERVICE CONTRACT, NAIROBI CITY

CONTRACT ENV/1/97

CITY COUNCIL OF NAIROBI
ENVIRONMENT DEPARTMENT

TENDER DOCUMENT FOR:
REFUSE COLLECTION, ROAD SWEEPING, LITTER COLLECTION
AND DISPOSAL CONTRACT
CONTENTS

1. INSTRUCTIONS TO TENDERERS
2. FORM OF TENDER
3. FORM OF TENDER BOND
4. CONDITIONS OF CONTRACT
5. NOTICE TO TENDERED
6. SPECIFICATIONS

FORM OF AGREEMENT OF CONTRACT

COL (RTD) F.R. NTHIGA
DIRECTOR
ENVITONMENT DEPARTMENT

CITY HALL
NAIROBI

FEBRUARY, 1997

CITY COUNCIL OF NAIROBI

REFUSE COLLECTION, ROAD SWEEPING,
LITTER COLLECTION AND DISPOSAL CONTRACT

(NOTE: The appendix Form part of the tender. Tenderers are required to fill all blank spaces in this Tender and Appendix).

TO: The City Council of Nairobi

Gentlemen,

Having examined the Notice to Tenderers, Conditions of Contract annexed hereto, we the undersigned, offer to collect litter and refuse, sweep roads, and dispose waste material in conformity with the conditions of the contract for the sum of

Kshs. (Figures) _____

Kshs. (Words) _____

Or such other sums as may be ascertained with the conditions.

If our tender is accepted, we will, when required, obtain the guarantee of an insurance company or Bank in compliance with Clause 35 of the Conditions of Contract, to be jointly and severally bound with us in a sum amounting to 10 per cent of the above named sum for the due performance of the contract.

Under the terms of Bond to be approved by you (A sample of the Form of (Performance) Bond is included. Only the successful Tender/Tenderers will be required to complete this). We agreed to abide by this Tender for a period of 90 days from the given for opening of Tenderers in the Tender Advertisement (A). The tender bond is the sum of Kshs. advance) receipt if required. Or (B) the Form of Tender Bond has been completed (Delete as appropriate).

Unless and until a Formal Agreement is prepared and executed, this tender, together with your written acceptance thereof, shall constitute a Binding Contract between us (A sample of the Form of Agreement is included). Only successful Tender/Tenderers will be required to complete this.

We understand that you are not bound to accept the lowest or any tender you may receive and that this tender may be accepted in part or in entirely.

We hereby agree that any errors in our Tender will be adjusted in accordance to Tenderers.
Dated this ..... day of .....

Signature ..... In the capacity of .....
.....

duly authorised to sign Tenderers for and behalf of
.....
.....
(IN BLOCKCAPITALS) .....

Address .....
.....
.....

NAIROBI CITY COUNCIL
ENVIRONMENT DEPARTMENT
REFUSE COLLECTION, ROAD SWEEPING, LITTER COLLECTION
AND DISPOSAL CONTRACT
CONTRACT ENV.D/REF 1/97

(To be completed by successful tenderers).

1. Every successful contractor shell be bound to submit a performance bond in this within fourteen days (14) of the receipt or the Town Clerk's letter of acceptance, failing which amount to the tender bond and a sum equal to 10 per cent (10%) of the contract price shall not be released by the City Treasurer until the performance bond has been issued.

2. BY THIS BOND _____
OF POST OFFICE BOX NUMBER _____(HEREINAFTER CALLED
"THE CONTRACTOR" AND _____
OF POST OFFICE BOX NUMBER _____
(herein after called "the Surety") are hereby jointly and severally bound unto the Nairobi City Council.
(hereinafter called "the Council" in sum of Shillings
_____
(Shs. _____)

3. W H E R E A S. by Agreement dated this _____ day of _____One Thousand nine Hundred and Ninety Seven mad between the contractor contracted with the Council to collect litter and refuse, sweep roads and dispose waste materials therein specified and subjected to such terms provision and stipulatin as the said agreement are particularly set forth.

4. NOW THE CONDITION of the above written bond is such that if the contractor or its successor or assigns shell well and truly, perform and keep all and every covenant clauses, provisions, terms and stipulations in the said agreement mentioned, performed fulfilled and kept according to the true purport, intent and meaning thereof or if no failure by the Contractor so to do

the surety shall satisfy and discharge the liquidated damages sustained by the Council up to the amount of the above written bond, then the above written bond shall be void but otherwise it shall be and shall remain in full force and giving by the Council of any extension of time for the said agreement or anything therein mentioned or contained and on the forgiveness of forbearance on the part of the Council the contractor or its successor or assigns not in any way release the surety from the surety's liability under the mentioned-written bond.

Dated at Nairobi this _____ day of
One Thousand nine Hundred and Ninety Seven

FORM OF TENDER BOND

TO BE COMPLETED BY THE TENDERERS UNLESS TENDER BOND PROVIDED AS BANKERS CHEQUE OR CASH RECEIPT.

REFUSE COLLECTION, ROAD SWEEPING, LITTER COLLECTION AND DISPOSAL CONTRACT

CONTRACT ENV.D/REF 1/97

TO: The Town Clerk,
Nairobi City Coubcil,

P.O. Box 30075,
NAIROBI.

BY THIS BOND I,/WE _____

_____

(A Limited liability company its registration office situated in)

_____

of Post Office Box Number _____

_____

House/Street Road _____

Telephone No. _____ (hereinafter called the Tenderer)

and I/WE _____

_____

DULY AUTHORISED ATTORNEY/ director for _____

(Bank/Insurance Company) of Post Office Box Number _____

herein called "the Surety") are firmly held and bound unto the City Council of Nairobi (herein called "the Council") in the sum of

Kenya Shillings _____

Kshs. _____)

for the payment of which sum to the Council the Tenderer and the surety bond binding themselves jointly and severally by his bond,

WHEREAS by these presents and in consideration of the sum of

_____

Kshs. _____

Above mentioned the tenderer bonds unto the City Council of Nairobi that he/she/it shall not withdraw the tender/quotation until the expiry date and in breach of this clause the amount of bond she be forfeited to the Council (Only cash/bankers cheque acceptable).

SIGNED and Sealed by _____

(surety) _____

(Tenderer) _____

SIGNED and SEALED by

_____

Contractor in the presence of:-

SIGNED AND SEALED by

_____

the surety in the presence of:-

SIGNED and SEALED by

TOWN CLERK

SCHEDULES

A. CONDITIONS OF CONTRACT
B. SERVICE SPECIFICATIONS
C. PLAN A

SCHEDULE A

CONDITIONS OF CONTRACT : INDEX

CONDITIONS OF CONTRACT

1. DEFINITION OF TERMS: In these Documents the following terms have the meanings set forth and assigned to them namely:-

(a) "The Council" means the City Council of Nairobi and any Officers of the Council empowered to act on the Council's behalf.

(b) The "Town Clerk" means the Town Clerk for the time being to the Council.

(c) The "Tenderer" means the firm or person who has offered to collect litter and Refuse, Sweep roads and Dispose Waste Materials in the Document.

(d) The "Contractor" means the firm or person or persons whose tender has been accepted by the Council and includes Contractor's personnel, representatives, successors and assignees.

(e) The "Work" means the whole work to be undertaken in accordance to the Contract.

(f) "Refuse" means all refuse which the Council is required to remove by Law, or refuse which it has undertaken to remove from any premises.

(g) "Commencement Date" means the date referred to in the Contract or agreement in writing between the parties as the date from which the Contractor commences to provide services.

(h) "Commissioning Period" means the period of not more than two weeks prior to the commencement date during which time the Contractor shall provide the necessary premises, vehicles, and equipment as set out in the Contract and during which periods the default provisions in Clause 20 shall not apply.

(i) "Conditions" means these Conditions, any Supplementary Conditions, and any notification thereto.

(j) "The Contract" means the Contract and includes any agreement in writing entered into between the Contractor and the City Council extending the services to additional areas of the CITY OF NAIROBI and includes the documents incorporated herein and forming part hereof

(k) "The Central Business District" means the area designated as shown on the map.

(l) "Authorised Supervising Officer" means the Director of Environment of the Council or his successor or his Representative as may be appointed by him either in a general capacity or specifically to watch and supervise the completion of work.

(m) "Programme" means any programme or programmes of work submitted by the Contract in accordance with the requirements of the Contract.

(n) A reference to an Act of Parliament or any order, Regulation, Statutory Instrument or any other delegated legislation shall include a reference to any amendment or re-enactment of the same

(o) "Week" means Seven(7) consecutive days starting on Sunday and ending on the following Saturday and "month" means a Calendar month

(p) "Review Dates" means every two months of the Commencement Date as the Contract requires.

(q) "Services" means the whole of the work to be executed under the Contract including any goods or materials to be supplied by the Contractor in accordance with the Contract.

(r) "Waste Disposal Charge" means the Charge to be paid by the Contractor at a Disposal Site for the disposal of the Refuse collected under the Contract.

(s) "Waste Disposal Contractor" means the firm or body carrying out the function of waste Disposal and to whom the Contract has been directed to deliver the refuse collected under the Contract.

(t) The Clause heading shall not be constructed as part of these Conditions.

(u) The proper law of the Contract shall be the City Council by-law.

2. VARIATIONS OF CONTRACT

(a) Without prejudice to any other of the Conditions thereof no Ommission from addition to variation of the Contract shall be valid or of any effect unless it is agreed in writing and signed by the authorised representative of the Contract.

(b) Save for an omission, additions or variation agreed pursuant paragraph (a) where there is any inconsistency between these conditions and any provision in any other document or oral agreement these conditions shall prevail.

3. THE AUTHORISED SUPERVISING OFFICER

The functions, rights and powers conferred by this Contract upon the Council shall be exercised by the Authorised Supervising Officer. The Contractor shall in no circumstances question the existence or extent of the authority of any person authorised by the Authorised Supervising Officer to act on his behalf.

4. CONTRACT PERIOD

This Contract shall extend for the period of 12 months Commencement Date as specified in the Contract and shall not be terminable by either party within that period save in accordance with Clause 22 hereof.

5. CONTRACTORS OBLIGATIONS

(a) During the Contract Period the Contractor shall perform the services (any modification thereof authorised under the Conditions) in a manner consistent with the Contract and to the satisfaction of the Authorised Supervising Officer.

(b) The Contractor shall at all times perform such service in accordance with the Programme (and any modification thereof) agreed with the City Council as required in the Contract.

(c) The Contractor shall pay the Waste Disposal Charge to the Waste Disposal Contractor or Contractors in respect of all refuse delivered to any waste disposal site as directed by the Authorised Supervising Officer.

(d) The Contractor shall at all times during the Contract Period allow such persons as may be nominated from time to time by the Authorised Supervising Officer, access for the purpose of (i) inspecting work being carried out pursuant to this Contract (ii) inspecting records and documents in the possession of the Contractor in connection with the carrying out of the such work and (iii) inspecting materials, stores and spare parts in order to ensure that they comply with manufacturer's specifications.

6. MODIFICATION

The Authorised Supervising Officer shall be entitled to issue the Contractor instructions in writing requiring the Contractor to do all or any of the following:-

(a) To omit and cease to perform any part of the Service such period as the Authorised Supervising Officer may determine.

(b) To perform the Services or any part, thereof, in such manner as the Authorised Supervising Officer may require.

(c) To perform such additional services outside the scope of the services as to the Authorised Supervising Officer may require provided that such additional services shall be the same as or similar to the services under the Contract and shall be paid for by the City Council in advance or a rate of pay to be agreed.

(d) To vary the Programme and to perform the services in accordance with the

programme as so varied and the Contractor shall forthwith carry out all such instructions.

7. AMENDMENT OF CONTRACT

Should the City Council at any time after Commencement Date wish to alter vary or change the method of work specified in the Specification it may be written notice to the Contractor offer to negotiate such alteration variation change or terms to be agreed with the Contractor and any such alteration variation or change agreed to in writing by the Contractor shall be drawn up by the City Council as an amendment to the Contract and signed by both parties to the Contract.

8. METHOD OF PAYMENT

The Council shall pay the Contractor the Contract money by 15th of the following months by cheque. Any additional services shall be paid for at rates and prices to be agreed.

9. COPY CERTIFICATE

A copy of the valuation, including amendments, which Supervising Officer has used to prepare the Certificate of Payment shall be sent to the Contractor

10. ASSIGNMENT

The Contractor shall in no circumstances assign, sub-let or purport to assign or sub-let any part of this Contract to any person whatsoever PROVIDED that if agreed with the Authorised Supervising Officer any assignment occurring as a result of any internal reconstruction of a Contractor which is a limited company may be acceptable.

11. PREMISES

(a) The Contractor shall at all times during the Contract period provide and maintain such premises as are necessary for the proper performance of the Services.

(b) The Contractor shall reimburse the Council for the cost of repairing any damage arising from any negligence wilful or criminal act on the part of the Contractor or any person for whom it is responsible or any consequential costs arising from any negligent, wilful or criminal act.

(c) The Contractor shall at all times permit the Authorised Supervising Officer access to all premises occupied for the purpose of this Contract.

(d) The City Council may lease to the Contractor any Equipment at a rent and upon conditions to be agreed upon.

12. VEHICLES, PLANT AND MACHINERY

(a) The Contractor shall at all times during the Contract Period provide and maintain all such vehicles, plant, machinery and equipment (hereafter together referred as "Plant") as are necessary for the proper performance of the Services and in particular shall provide before the end of the Commissioning Period the Plant listed in the Specification as required before the end of the Commissioning Period. Period the Plant listed in the Specification as required before the end of the Commissioning Period.

(b) The Contractor shall at all times be fully responsible for licensing fees, taxes and insurances required in connection with or arising out of the possession or of all part employed in the performance of Services.

(c) The Contractor shall at his own expense put and keep plant employed in the performance of the Services at times in good and serviceable repair and in such conditions as incommensurate with the proper performance by the Contractor of his obligations under the Contract and to ensure compliance with all statutory requirements relating to vehicles and plant.

(d) The Contractor shall at all times permit the Authorised Supervising Officer access to all plant employed for purposes of the Contract . The Authorised Supervising Officer shall be entitled to serve upon the Contractor notice in writing requiring the Contractor to put an item of plant into such condition as is required paragraph (c) above and the Contractor shall upon receipt of such notice his best endeavours cause all necessary works to be carried out to comply with such notice.

(e) At the expiry of the Contract Period or upon the determination of Contract in accordance with the Conditions whichever shall first occur the City Council shall be entitled to serve upon the Contractor a notice requiring the Contractor to sell to the City Council at a price to be agreed such Plant as may be specified such notice and to transfer to the City Council the benefit of all Contracts relating to the hire of such plant as may be specified in such notice and in neither case need such notice be confined to such items of Plant as the Contractor may have acquired from the City Council .

(f) Upon receipt of the notice under (e) requiring the Contractor to sell any plant to the City Council the Contractor shall forthwith sell and deliver such items to the City Council in such condition as it may be at the date of the notice at a price to be

agreed.

(g) Upon receipt of notice under (e) requiring the Contractor to assign to the City Council the benefit of any agreement for the hiring of any item of plant the Contractor shall forthwith and execute all documents necessary to effect such assignment without any payment from the City Council in such condition as it may be at the date of the notice. The City Council shall thereafter indemnify and hold the Contractor harmless in respect of any liability arising, under such hiring Contract after the date of such assignment save where such liability arose from or was contributed to by any breach of the hiring Contract by the Contractor prior to such assignment.

(h) The Contractor shall cause all Plant bear such words devices or insignias as the Authorised Supervising Officer may approve and in addition shall cause all new plant to be painted in such colours as the Authorised Supervising Officer may approve. No Plant shall bear any advertising matter of any sort without prior written consent of the Authorised Supervising Officer .

(i) The Contractor shall give to the Authorised Supervising Officer full details of all new plant acquired or hired by him in connection with this Contract and in relation to hired Plant full details to the agreement for hire.

(j) The Contractor shall ensure that he has an adequate level of reserve vehicles available to him at all times as lack of suitable vehicles will not be considered as a reason for non-performance of the requirements of Contract. (k) The City Council shall hire to the Contractor the Plant listed in the Specifications at the hiring charge there set out.

13. VEHICLE OPERATION

The Contractor shall ensure that:-

(a) Drivers and operators of the Plant are licensed and responsible for the operation and use of Plant

(b) Drivers drive safely and correctly at all time in accordance with statutory regulations and instructions of Contractor. Speed limits are to be observed and reversing should only take place underguidance.

(c) Drivers are trained and thoroughly competent in the safe use of the Plant, paying particular attention to the tipping at Waste Disposal Sites which shall be as directed by the Waste Disposal Contractor.

(d) The routes to be taken by the Plant for all the purpose required in connection with the performance of the services are clearly defined and agreed with the Authorised Supervising Officer .

(e) Plant operations are carried out in a reasonable and workmanlike manner without causing obstruction or annoyance to the public.

(f) The plant is cleaned internally and externally and maintained in such a condition so it presents a professional and pleasant image to the public.

14. STAFF

(a) The Contractor shall at all times during the Contract period employ sufficient persons with appropriate qualifications, abilities and skills for the satisfaction of the services.

(b) The Contractor shall at all times during the Contract Period employ sufficient persons with appropriate qualifications, abilities and skills to supervise the performance of the Services in proper and continuous manner. The Contractor shall supply the Authorised Supervising Officer with a list of the staff he proposes to employ and include on it the qualifications of each person.

(c) The Contractor shall notify the Authorised Supervising Officer of the name, address and telephone number of the person who will be in charge of the Contract at the local level.

(d) The Contractor shall at all times take all such Precautions as are necessary to protect the health and safety of all persons employed by him.

15. UNIFORMS AND IDENTIFICATION

(a) The Contractor shall ensure that all persons employed in the performance of the Services shall at all times properly attired and presentable and appropriately identifiable uniforms or clothing which shall have been approved by the Authorised Supervising Officer .

(b) Representatives of the Contractor shall carry out at all times identity cards in a form approved by the Authorised Supervising Officer and make such cards available for inspection by any Officer of the Council who similarly discloses his identity or by a member of the General Public.

16. AGENCY

(a) The Contractor is not and shall no circumstances hold himself out as being the servant of agent of the City Council save as expressly authorised in the Contract.

(b) The Contractor is not and shall no circumstances hold himself out as being authorised to enter into any contract on behalf of the City Council or in any other way to bind the City Council to the Performance, variation, release or discharge or any obligation save as expressly authorised in the Contract.

(c) The Contractor has not and shall in no circumstances hold himself out as having the power to make, vary, discharge or waive any by-law or regulation of any kind.

(d) The employees of the Contractor shall not hold themselves out to be and shall not be held out by the Contractor as being servants or agents of the Council save as express by authorised by the Contract.

17. LIABILITY OF CONTRACTOR AND INDEMNITY

The Contractor shall indemnify and keep indemnified the City Council against injury to or death of any persons, or loss of or damage to any property, which may arise out of the act default or negligence of the Contractor, his employees or agents and against all actions, claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof, or in relation thereto, provided that the Contractor shall not be liable for, nor be required to indemnify the Council against, any compensation or damages for or in respect of injuries loss or damage resulting from any act default or negligence on the part of the City Council its employees or agents not being the Contractor or employed by the Contractor.

18. INSURANCE

(a) The Contractor shall at all times maintain in force such policies of insurance with reputable insurers or underwriters, approved by the Council as shall fully insure and indemnify the Contractor against liability:-

(i) To the City Council and to any employee of the City Council.

(ii) To the Employees of the Contractor.

(iii) To any other person.

(b) The Contractor shall, prior to the Commencement Date and thereafter annually, and at such other times as the Authorised Supervising Officer may require, supply the Authorised Supervising Officer with copies of all insurance policies, covernotes, premium receipts and other documents necessary to comply with paragraph (a) above.

(c) The Authorised Supervising Officer shall be entitled to notify the Contractor in writing that in the opinion of the Authorised Supervising Officer any such policy

of insurance does not effect sufficient cover to comply with the conditions and to require the Contractor to effect such insurance as will so comply. Upon receipt of such notice, the Contractor to effect such insurance as the Authorised Supervising Officer may himself cause such insurance to be effected whereupon the Contractor shall pay to the Council as liquidated damages such sum as the Authorised Supervising Officer shall certify as being the cost to the Council of effecting such insurance.

19. DEFAULT IN PERFORMANCE

At any time after the Commencement Date:-

(a) The Authorised Supervising Officer may investigate each case where he has received a complaint in writing that the Contractor has failed to perform the Services in accordance with the provision of the Contract. Any complaint not made in writing shall be put in writing by the Authorised Supervising Officer and signed by the complainant. Any complaint to be valid must be made within seven days for the alleged default. A copy therefore shall be send to the Contractor within seven days to its receipt by the Authorised Supervising Officer of signature by the complainant. If the Contractor considers that the complaint is unjustified or if he considers the complaint to be justified and within seven days does not reach agreement with the Authorised Supervising Officer as to how to resolve the Complaint the Complaint shall immediately be referred to panel of three persons one appointed by the Authorised Supervising Officer one by the Contractor and one by the office of the Minister responsible for Local Government who shall seek such information as they see fit in order to decide upon the validity of the complaint and the resolution thereof and whose decision shall be final.

(b) Where the Authorised Supervising Officer is satisfied or following the procedure in Clause 20(a) it is determined that in any particular case the Contractor has failed to perform the services in accordance with the provisions of the contractor to remedy the failure in order to comply fully therewith within such reasonable period as the Authorised Supervising Officer may determine.

(c) If the Contractor fails to comply with the instructions of the Authorised Supervising Officer issued under (b) above the Authorised Supervising Officer shall be entitled to record in writing a Notice of Default (hereinafter called "a Default Notice") which shall be sent to the Contractor

20. WORKS IN DEFAULT

If by reason of any accident of failure or other event occurring to or in connection with any premises or Plant of any part thereof either during the performance of the Services of any other times any remedial or other work or repair shall in the opinion of Authorised Supervising Officer be urgently necessary and the Contractor is unable or unwilling at once to do such work or repair as the Authorised Supervising Officer may consider necessary the City Council may do the work itself or arrange for it to be done and if the work or repair so done is work which in the opinion of the Authorised Supervising Officer the Contract was liable to do at his own expense under the Contract all costs and charges properly incurred by the City Council in so doing shall on demand be paid by the Contractor to the City Council or may be deducted Contract money when the payment become due to the Contractor provided always that the Authorised Supervising Officer shall as soon after the occurrence of any such emergency as may be reasonably notify the Contractor thereof in writing.

21. TERMINATION

(a) The City Council shall be entitled forthwith upon the happening of any of the following events to terminate this Contract such events being:-

(i) The events referred to in clause 20 hereof concerning defaults in performance.

(ii) A substantial breach by the Contractor of any fundamental provision of the Contract.

(iii) A failure by the Contractor to provide the plant mentioned in clause 13 (a), and listed in the specification within the Commissioning period.

(iv) The Contractor having failed to perform a substantial part of the Services for a period of one week.

(v) The Contractor having a receiver or a receiver and manager appointed or being subjected of a resolution or order for winding up provided that an amalgamationor reconstruction of a limited company shall be deemed not to be breach of this Condition if agreed by the Authorised Supervising Officer .

(b) Upon such termination an addition to such consequences as are set out in the other provision of the Contract:-

(i) The Contractor shall forthwith cease to perform any of the Services.

(ii) The Contractor shall fully and promptly indemnify the City Council in

respect of the cost of causing to be performed such services as would have been performed by the Contractor during the remainder of the Contract period to the extent that such cost exceeds such sums as would have been lawfully payable to the Contractor for performing such Services performed by any person (whether or not servants of the City Council) as the City Council shall in its discretion think fit.

(iii) The City Council shall be under no obligation to make any further payment to the Contractor and shall be entitled to retain any payment which may have fallen due to the Contractor before termination until the Contractor has paid in full to the Council all sums due under this Contract or to deduct therefrom any sum due from the Contractor to the Council under this Contract.

22. NOTICES

(a) No Notice to be served upon the City Council shall be valid or effective unless it is sent by prepaired registered recorded delivery post or delivered by hand to the City Council at its principal office or to such other address as the Authorised Supervising Officer may notify the Contractor in writing.

(b) Any notice to be served upon the Contractor shall be valid and effective if it is sent by prepaid recorded delivery post of delivered by hand to the Managing Director and his signature obtained acknowledging receipt of the same.

23. ARBITRATION

(a) All disputes between the parties arising out of or connected with the Contract or the performance of the Services by the Contractor shall be referred to an Arbitrator to be agreed upon by the parties or in default of such agreement to be nominated by the High Court of Kenya such reference to be one month after the Service of notice by either party requiring such a reference.

24. (b) The Arbitrator shall be entitled to make such decision or reward as he thinks just and equitable having regard to the circumstances then existing the cost of such arbitration to follow the event or in the event neither party succeeding to be apportioned between the parties by the Arbitrator in such proportions as he in his absolute discretion thinks fit.

25. (c) Any reward or decision of such Arbitrator shall be final and binding on the parties hereto.

26. OBSERVANCE OF STATUARY REQUIREMENTS

The Contractor shall comply with all statutory and other provision to be observed and

performed in connection with the Services provided under the Contract and shall indemnify the City Council accordingly.

27. RIGHTS AND DUTIES RESERVED

For the avoidance of doubt nothing herein contained or implied shall prejudice or affect the Council's rights, powers, duties and obligations in the exercise of its functions as a local authority for the enforcement of or pursuant to any enactment by-law regulation or order for the time being in force.

28. LEGAL FEES

Each party shall bear their own legal and other fees in relation to the preparation and submission of the Tender documents and any formal Contract documents arising therefrom.

29. PROVISION OF STATISTICAL INFORMATION

The Contractor shall provide in writing any statistical information as set out in the Schedule 'B' Service Specification and which the City Council may from time to time require.

30. COPYRIGHT

Copyright in the Contract Conditions plans drawings and Specification shall remain with the Council and the Contractor and either any make such copies and use as they see fit.

31. SERVANCE

If any provision of the Contract shall become or shall be declared by any Court of competent jurisdiction to be invalid or unenforceable in any way such invalidity or unenforceability shall in no way impair or affect any other provision all of which shall remain in full force and effect.

32. REFUSE COLLECTION CHARGES

There shall be the following categories of Refuse:-

(a) DOMESTIC REFUSE

Waste arising as result of domestic activities including food preparation, sweeping, cleaning, fuel burning, gardening and recreation. It includes junk such as old clothing, old furnishings, obsolete appliances packaging and reading matter.

(b) TRADE REFUSE including:-

(i) COMMERCIAL WASTE

The Waste from retail outlets, offices, service stations, restaurants, hotels and warehouses.

(ii) INSTITUTIONAL WASTE

The waste from Schools, Government offices, hospitals, Police stations, army

quarter and religions buildings.

(iii) INDUSTRIAL WASTE

Waste from processing and non-processing industrial plants and utilities.

(iv) SPECIAL WASTES

Wastes which may require a special treatment during or before disposal including chemical, waste engine oils, animal carcasses and waste from hospitals and clinics. And any other waste which is not Domestic Refuse.

31. WASTE DISPOSAL

(i) The Contractor shall take all refuse collected under the Contract to a site or sites within the City as directed by the Authorised Supervising Officer and deposit the refuse at that site or sites in the manner and so directed and pay the Waste Disposal Charge to the site Supervisor.

(ii) The City Council shall ensure that a Waste Disposal site is available for the Contractor during the hours of operation of the Contract as required during by the Programme. If there is any breach of this provision the Default provision in Clause 20 shall not apply.

(iii) If the Contractor is required to take refuse to a site other than the site at Dondora there shall be an immediate special Review.

32. 6. CONTRACT DOCUMENTS. The several documents forming the Contract are to be taken as mutually explanatory of one another and in case of ambiguities or discrepancies, the same shall be explained and adjusted by the Director, who shall thereupon issue to the Contractor written instructions as to the Contract.

33. 7 FORM OF TENDER Tender must be submitted on the Form of Tender attached hereto in accordance with the Notice to Tenderers.

8.Perfomance Bond. The Contractor shall, immediately on the acceptance of his tender, deposit with the Council a sum equal to 10% of the Tender sum, as surety for the due performance of the Contract. This surety shall be in form of either cash deposit or in the way of Insurance Bond or Bank Guarantee.

Such sum without interest will be repaid to the Contractor on completion of the Contract. The cost of obtaining an Insurance Bond of Bank Guarantee shall be repaid by the Contractor, but such cost may be included in the contract sum.

34. 10. Accuracy of Tender. Tenderers shall be entirely responsible for the accuracy and sufficiency of their Tenderers and inaccuracy or insufficiency

of Tender shall not be considered to be adequate reason to release the Contractor from performing the whole of his obligations under the contract. Where inaccuracies or insufficiencies are revealable during the Tender evaluation and the Tenderer shall accept the Directors adjustment as herein described such adjusted Tender sum shall be deemed to be as from the Tenderer and shall bind the Contractor as above prescribed.

Failure during the tender evaluation to detect any inaccuracy or insufficiency shall not release the Contractor from his obligations under this Clause.

35. Acceptance of Tender. The Contractor's Tender and the formal acceptance thereof by the Council together with the Standard Conditions and their Extensions, Specifications and Notice to Tenderers shall pending the execution of a formal agreement of the Contract between the Contractor and the Council form a Contract binding both the Council and the Contractor.
36. 12. Contract Agreement. The Contractor, when called upon to do so shall enter into and execute a Contract Agreement to be drawn up by the Council, which shall include references to these conditions and this Specifications.

NOTICE TO TENDERERS

1. SCOPE CONTRACT

1.1 The Contract is for REFUSE COLLECTION, ROAD SWEEPING; LITTER COLLECTION AND REFUSE DISPOSAL listed in the Bills of Quantities which is for use by the City Council of Nairobi, DEPARTMENT OF ENVIRONMENT:

1.2 Successful Tenderers should observe strictly clause 5 of conditions of contract.

2. THE DOCUMENTS

The Documents are:-

1. The Notice to Tenderers
2. The Conditions of Contract
3. The Forms of Tender
4. The Form of Performance Bond
5. The Form of Tender Bond
6. The Schedule of Particulars
7. The Specification

3. INTERPRETATION OF DOCUMENTS

3.1 If any points in the Documents issued for the purpose of tendering are not clear, the Tenderer shall request an explanation of such points from the DIRECTOR. Such request shall reach the DIRECTOR not less than 14 days prior to the fixed for delivering of tenderers.

3.2 Any such explanation will be made by the DIRECTOR not less than 10 days prior to the date fixed for delivering of Tender and a copy of such will be despatched to all parties who have taken out a set of documents. Such explanation will be incorporated in the Documents.

4. TENDERER TO INVESTIGATE BEFORE TENDERING

The Tenderer will be deemed to have informed himself fully as to the location of the Place of to be serviced and to have read and examined all the Documents and contingencies which can in any way influence his Tenderers.

5. STATEMENTS PRIOR TO TENDER

5.1 Except as provided for in Clause 3.1 hereof no representation explanation or statement made to a Tenderer prior to the Council written acceptance of his Tender by the DIRECTOR, or any his assistants or by any Officer or Member of the Council's Staff or by anyone as the meaning of any of the documents dorming the Contract or as to anything to be done or not to be done by the Contractor

shall bind the Council or letter or bind the judgement or powers of the DIRECTOR in the exercise by him of his duties under the Contract.

6. INSURANCE – Refer to Conditions of Contract Clause 19

7. SCHEDULE OF PARTICULARS

7.1 The Tenderer shall insert in the Schedule of particulars full details of the firm, its premises, bankers etc. and shall give information on its operations and policy so that the DIRECTOR may assess the Firm's capabilities and intentions.

7.2 The Tenderer shall insert the Schedule of particulars the name and the registered address of the Insurance Company (or Companies) which shall affect the insurance require by the Contract and shall if requested produce for the inspection of the Council details he has received from the Insurance Company (or Companies)

7.3 Failure to provide all or any of the information require in the Schedule of particulars may preclude consideration of the tender by the Council.

8. OTHER INFORMATION TO BE PROVIDED BY TENDERERS

8.1 The Tenderer s shall supply with each set of complete tender documents three copies in English of descriptive literature, and any other particulars prepared by the Tenderer to accompany his Tender.

8.2 Tenderers shall if required by the Council furnish additional information relating to their financial situation or any other matter which may be required for the evaluation of the Tender's ability to fulfil the contract.

9. ISSUE OF DOCUMENTS

9.1 The Tenderer will be issued with two complete sets of documents.

9.2 All documents which have been issued for the purpose of tendering shall remain the property of the Council

10. RETURN OF TENDERS AND DOCUMENTS

10.1 Tenders shall be sent to:-

The Towns Clerk
City Council of Nairobi
P.O.Box 30075
NAIROBI

Or deposited in the Tender Box in Room 105 City Hall.

10.2 Tenders shall reach the above address or be deposited in the Tender Box not later than 12 noon on the date given in the Tender advertisement.

10.3 Tenderer s shall be submitted on the appropriate Form of Tender included in the Contract Documents and not detached therefrom and shall be placed in a plain sealed envelope or package bearing no indications of the identity of the Tenderer but endorsed with the Contract Number and title.

10.4 The Tenderers received will be publicly opened in the offices of the Town Clerk at the date and time give in the Tender advertisement and Tenderers or their representatives may be present at the opening of Tender.

10.5 The Tenderers may keep for his records one complete set of documents. Where documents have been taken but no Tender submitted then all sets of documents have to be returned to Room 112, City Hall by the Due Date.

11. TENDER BOND

11.1 The Tenderers shall provide a Tender Bond for the amount showing in the Appendix to Tender, bonding him to abide by his Tender for the 90 days referred to in the Tender.
Either (A) A receipt for cash paid on or before the date of opening Tenders
or (B) A Bankers Cheque
or (C) A fully complete Form of Tender;
is required. The bond (A, B or C) must accompany the Tender, and the Tender will not be considered without the Tender Bond. After the Contract was awarded. The Tender Bond will be refunded to Tenderers without interest, unless forfeited or applied as part of the performance bond. In the event the Tender being successful the Bond will remain valid until the execution of the performance Bond.

12. EVALUATION OF TENDERS

12.1 Any alteration made by a Tenderer to the Documents issued to him or omission to complete fully and return on set of documents may preclude consideration of the Tender by the Council.
12.2 In evaluation the Tenders the following points will be taken into account:
(a) the cost and quality of work
(b) the Tenderer's financial status and experience
12.3 The detail of the method of adjusting any errors will be by the DIRECTOR as he may consider reasonable for the particular circumstances. The Tender will be informed as to the extent of

the errors, if any, and may accept the DIRECTORS corrections or withdraw his Tender. There will be no negotiations over the adjusting of the errors.
12.4 The Tender sum as corrected will be used in comprising Tenders and the Contract will be awarded in this corrected figure.
12.5 The Council is not bound to accept the lowest or any Tender and may accept a Tender in part or in entirety.

13. COST OF PREPARING THE TENDER

13.1 The cost of preparing and submitting the Tender shall be borne by the Tenderer.

14. INVALIDITY OF TENDERS

The Tender shall be considered to be valid

(a) If all the Tender Documents have not been completed in ink in typescript.
(b) If any corrections and amendments to his submitted figures and information have not been initialled by the Tenderer.
(c) If the Tender is not received on the Form of Tender issued by the City Council of Nairobi.
(d) If any unauthorised additions, alterations or omissions have been made to Form of Tender or any other document.
(e) If the Terms of Notice to Tenderers have not been fulfilled in particulars if the Tender Documents have not been delivered to the Town Clerk's by the specified time and date.
(If delivered is post the parcel should be registered.)
(f) If any of the Documents have not been properly completed by the Tenderer.

15. SCHEDULE OF PARTICULARS

The following particulars are to be provided by the Tenderer in accordance with Clause 8 of the Notice to Tenderers:-

(a) Particulars of Firm
(b) Particulars of Insurance.

these particulars are to be entered in the appropriate places on the following pages. Failure to complete all or any of this Schedule fully may preclude consideration of the Tender by the Council.

PARTICULARS OF FIRM

Refer to Tender Clause 8.1

Name of Firm _____

Postal Address _____

_____

_____

Telephone No. _____

Full Name of Partners _____

Nationality/Ties _____

Registered Office Situation _____

_____

Workshop, Yards/Godowns _____

_____

Name and Address of Firms Bankers _____

_____

_____

_____

Give sufficient information to enable the DIRECTOR to assess the type of service you are able to provide.

_____

_____

_____

_____

_____

PARTICULARS OF INSURANCE

Refer to Notice to Tenderers Clause 8.2 state the name and registered address of Insurance Company (or Companies) with who it is proposed to insure. The Council approval will not be unreasonable withheld.

SCHEDULE B

SERVICE SPECIFICATION

DESCRIPTION OF THE SERVICES

1. ROAD SWEEPING AND LITTER COLLECTION

   It is proposed that this should also come under the same contract so that the Contractor is responsible for the complete cleanliness if the area served. Litter collection will be carried out throughout the collection area but this will not include the collection of sand off the roads except in areas where the roads are hard surfaced up to continuous buildings on each side of the road.

2. SERVICE STANDARDS

   Standards will be set for the quality of the collection service, cleanliness to be achieved under the collection contract for sweeping and litter collection as well as for the transfer and delivery to the landfill site.

3. MONITORING SYSTEMS

   Nairobi City Council through the Director of Environment will retain responsibility for monitoring and controlling the quality of the work which is carried out under this contract.

4. DATA COLLECTION AND PROCESSING

   A data collection system will be set up which will accurately record all the data required for the future costing and control of the service. The data collection and processing will be under the control of the City Council and available to the Contractor they will monitor all the Contractor. The processing will be carried out using the UNCHS/Habitat "WAGS" computer software. The Contractor will provide the following collection data:-

   The hours worked by vehicle:

   The number of loads collection each day vehicle.

   The volume and weight of wastes collected in each load.

   The area from which each load collected.

   Fuel and maintenance costs for each vehicle.

   Wages and salaries paid.

   Overhead costs.

   Capital investments.

   Breakdowns and accidents

   Details of each load arriving at the disposal site including truck number, weight and

capacity.

Details of all "special"

The weight-bridge records at the landfill (if available) will be used as a cross check on the collection data.

5. PLANT

(a) A list of vehicles and plant to be acquired and leased by the Contractor prior to the end of the commissioning period and in respect of which Clause 13.a) applies shall be agreed.
(b) A list of vehicles rehabilitated and leased from the City Council under Clause 13.1) shall be agreed.

6. HOSPITAL AND INDUSTRIAL WASTES

Prior to the Commencement of the collection service for Hospital and Industrial Wastes a study should be carried out to identify all hazardous wastes and other "special" wastes which are generated with the contract area. These will include Hospital wastes, industrial wastes such as glass cullet, chemical wastes.

No such wastes shall be collected and delivered to the Waste Disposal Site without the prior approval of the Authorised Supervising Officer .

REFUSE GENERATED IN THE CENTRAL BUSINESS

DISTRICT-NAIROBI CITY COUNCIL

The Central Business District has an estimated static population of 50,000 people. This estimate has been arrived at from a projection based on FARID report of 1996. It is also estimated that during the day the population reaches about 650,000 people. These people generate an average of 0.25 kg/capita/day. This is because most of them are on transit and hence their generation is about half of the accepted figure.

This would give an estimate of 162 metric tonnes. The markets and the light industries produce about 100 metric tonnes. This ultimately gives a total figure of 260 metric tonnes.

An Analysis of vehicle beats in the Central Business District has shown that an ideal situation could be maintained by the following No. of vehicles.

i) 5 refuse compactors
ii) 1 Be vehicle
iii) 3 Bin vehicles
iv) 4 side loaders (one for clinical waste)
v) Wheel loaders

These vehicles would be able to collect the 260 metric tonnes when working day and night. Out of the 260 tonnes about 6.5 tonnes (2,5%) is made up of clinical waste.

CATEGORISATION OF THE WASTE IN CENTRAL BUSINESS DISTRICT

Paper and cellulose material	=	8.22%
Plastic and Rubber Material	=	3.74%
Aggregate Material: Glass/stones	=	2.63%
Metallic Material	=	1.18%
Clinical Wastes	=	2.5 %
Vegetable Material	=	80.01%
Non-classified fine material	=	1.92%
Toxic Material (electric batt. Etc.)	=	0.05%
Total	=	100%

NAIROBI CITY COUNCIL

REFUSE COLLECTION AND DISPOSAL CONTRACT

PLAN "A"

LOCATION 5A

New Pumwani road, Machakos Country Bus stop, Ladhies road, Muthurwa estate, Kamukunji Lane, Ring road Pumwani, Racecourse road, Ukwala estate, Kamukunji Lane, Ring road Pumwani, Racecourse road, Ukwala road, Yatta road, Gwasi road, Rendile Lane, Elwak Lane, O.T.C. area.

LOCATION 5B

Raile-Sellasie Avenue, Wakulima Market area, Exchange Lane, Racecourse road, Tembo road and Lane, Uyoma street, Kenya bus station car Park, Mfangano street, Bakati road Ronald Ngala Street.

LOCATION 6

Mfangano Lane, Tom Mboya street, Moi Avenue, Hail-Sellanie avenue, Tumbo avenue, Harambee Avenue, Agha Khan Walk, Gichamu car park, Country Hall Lane, Red-Cross Lane, Uhuru Highway, Workshop road, Ngaira, Railway station road, Pate bay road, Haille-gellasie Lane, Parliament road and Lane.

LOCATION 7

River road, Riverlane, Racecourse road, Kirinyaga and go-down, Accra road, Voi road and Lane, Cross road, Lane, Duruma road, Kumasi road, Price road, Ambala road and Cresent, Muimbi road and lane.

LOCATION 8

River Road, Tom Mboya street, Latema road, Timboroa road, Lagos road and Lane, Five station Lane, Kirinyaga Go-down, Ngenda Lane, Kilome road, Ngomeni road and lane, Jainsala road, Keekrok road, Ngariama road, Ndumberi road, Voi road and Lane, Duruma road and Lane, croca road and Lane, Accra road, Sebatia Lane, Magadi Lane, Sotik Lane.

LOCATION 9

River road, Accra road, Latema road, Tom Mboya street, Moi Lane, Ambassadeur area, short street, Bannk street, Ronald Ngala street, Dubois road and Lane, Taveta road and Lane, Timboroa road, Tsavo road and Lane, Munyu road, Siafu Lane, Gaberone road and lane, Kamae lane, Sheik Kharume road and Lane, Tiriki Lane.

LOCATION 10

Moi Avenue and Lane, Modlane Street, Tom Mboya street, River road, Nyakach Lane, Muranga road, Ngida Lane, Slip road, Kijabe street and go-down. Harry Thuku road, University way, Uhuru Highway, University crescent.

LOCATION 11

Moi Avenue, University way, Uhuru Highway, Kenyatta Avenue, Leita street, Utalfi street, Monrovia street and Lane, Mokter daddah street and Lane, Koinango street, Muindi Mbingu street, Jani Lane, Biashara street, Market street, Banda street, Play House Lane, Jamia Lane, Soko Lane, Njugu Lane, Tubman road, Kimathi street and Lane, Kigali road.

LOCATION 12

Kenyatta Avenue, Uhuru Highway, Harambee Avenue, Moi Avenue, Kimathi street and Lane, Standard street, Kaunda street, Mama Ngina street, Wabera street, Prliament road/Tafia road, Simba street, Agha Khan walk, Central car Park, Nkurumah road and Lane, General Kago street.

REFUSE COLLECTION, ROAD SWEEPING, LITTER
COLLECTION AND DISPOSAL CONTRACT

NAIROBI CITY COUNCIL
REFUSE COLLECTION AND DISPOSAL CONTRACT

THIS CONTRACT made this ..... day of .....1997 BETWEEN The CITY COUNCIL OF NAIROBI P.O. Box 30075 NAIROBI (hereinafter referred to as "the COUNCIL") of the one part

_____

_____

("hereinafter referred to as "the CONTRACTOR") of the other part WHEREAS the CITY COUNCIL is desirous that certain services set out in this Contract (hereinafter referred to as "the SERVICES") be carried out;

AND WHEREAS the City Council and the Contractor have entered into an agreement dated the .....day of .....1997 to carry out those services; AND WHEREAS the Contractor is ready and willing to carryout the Services in accordance with the Contractor;

NOW THE CONTRACT WITNESSES AS FOLLOWS

In the Contract words and expressions shall have the same meaning as are respectively assigned to them in the Condition of Contract hereinafter referred to.

The following documents shall be deemed to form and be read and construed as part of the contract for the performance of the Service by the Contractor:

(a) Conditions of Contract;

(b) Service Specification

(c) Appendices A and B

(d) Plan A

The Contract shall provide the Services in accordance with the provision of the Contract and to the satisfaction of the City Council in the area of the City of NAIROBI described in the Contract Appendix A and Appendix B.

The Contract shall commence on the day of February 1997 or upon such other date shall be agreed to writing("hereinafter referred to as the Commencement Date") and shall remain in force for a period of six months from the commencement Date unless terminated in accordance with the provision of the Contract.

If the Contractor shall have performed the Service in accordance with the terms of the Contract and to the satisfaction of the City Council, the City Council shall have the options to renew the Contract for a period to be specified on the same or similar terms and conditions.

If the Contractor and the City Council so agree in writing the Services will be provided by the Contractor in additional areas of the City AND THE PROVISION OF THIS Contract shall apply to such additional areas from a date to be agreed in writing and such date shall be referred to as a Supplementary Commencement Date. The Contract for the Services in such additional areas shall remain in force until the expiration of the period of six months from the Commencement Date, or any renewal thereof.

If the Contractor shall have performed the Services in accordance with the terms of the Contract and to the satisfaction of the City Council during the period of the Contract or any renewal thereof, the City Council shall not appoint or authorise any person to provide the same or similar services within those areas of the City of NAIROBI the subject of the Contract without the agreement in writing of the Contract.

In Witness whereof the .....)
COMMON SEAL OF NAIROBI CITY COUNCIL)
Hereunto affixed in pursuance for a)
Resolution of the Council passed on the)
.....1997)
in the presence of :-)
THE MAYOR.) _____
) MAYOR
) _____
)
AND THE TOWN CLERCK)
) THE TOWN CLERK
Witness in the presence of)
)
)
THE COMMON SEAL of Company was)
Hereunto affixed in the presence of:-)
)
)

Annex 2: Data Collection Workbook

Environmental Management of Urban Solid Wastes in Developing Countries

A Project Guide

DATA COLLECTION WORK BOOK

(For Project Preparation, to be used
by Solid Waste Management Specialists)

Project Preparation:

Once the need for solid waste improvements has been identified, preparation of the project is performed. This activity is largely the responsibility of the local government and its consultants. This workbook is not designed for use by a novice to solid waste management planning.

Solid waste management specialists involved in project preparation are encouraged to augment this workbook with information which they believe is germane to their study area. If the format is not suited to the way in which their information is available and recorded, it should be changed o augmented.

Furthermore, there are data collection items presented here which may prove too difficult or time-consuming to fulfil, relative to the need for and usefulness of specific items. This workbook provides a checklist of questions to ask. However, the final analysis would necessarily depend on data that are either readily available or can be developed within the allocated level of effort and time-frame of the planning effort.

There are two critical items of information to be developed during the preparation stage of project development. The first is volume of waste to be handled by collection and transfer system. The second is the baseline capacity, appropriateness and reliability of existing equipment and facilities including information on manpower effectiveness and productivity within the collection and transfer system, basic maintenance system, overall urban administrative, and financial practises in managing solid waste.

Project Preparation Questionnaire

Date: _____

Urban area: _____

Please note the names and titles of persons filling out this form, with regard to:

Sweeping and collection _____

Transfer and haul _____

Equipment maintenance _____

Disposal _____

Please enter the name and address of the person responsible for this questionnaire, and to whom questions could be addressed:

_____

_____

_____

Provide a map of the refuse service area, indicating the following:

- Municipal boundaries
- Refuse service districts or zones
- Central workshop facilities for refuse equipment
- Central parking facilities for refuse equipment
- Central administrative offices and zonal office
- Transfer stations
- Land disposal sites (existing and prominently pending)
- Resource recovery, practices, and facilities

Provide a land use map, including the following

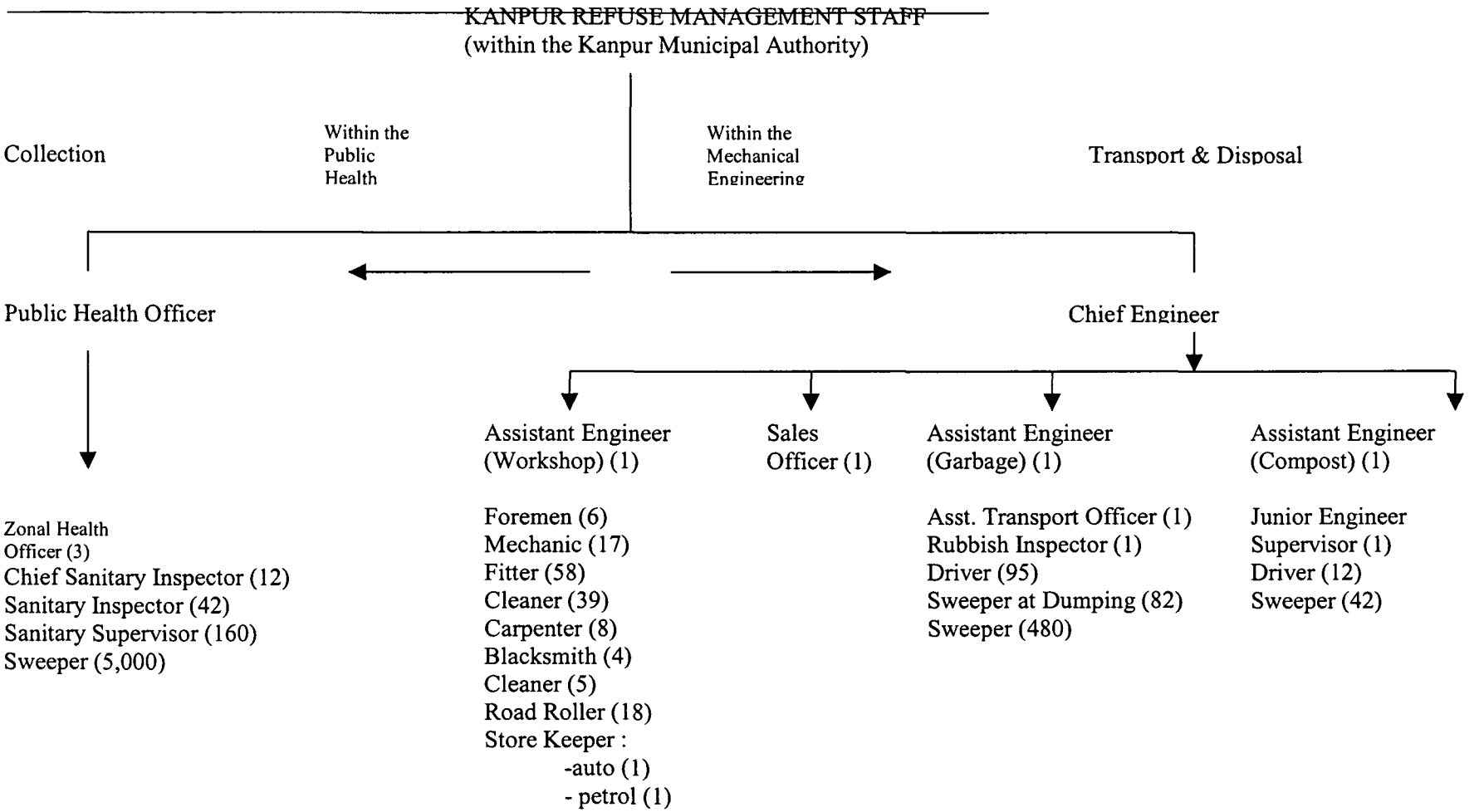
- Residential areas
- Cantonments
- Commercial areas
- Markets and motor pools
- Institution of large scale
- Industrial areas (existing and prominently pending)

Briefly, describe the solid waste management organization for your urban area. Provide a schematic of the organizational hierarchy, and indicate the number of full-time employees at each level. Also enhance the description by filling out Data Collection Guide #1. A sample schematic is provided on the following page; it is based on the Kanpur, India system existing in 1981.

Do you have information on waste generation rates for : combined municipal refuse (___yes; ___no), individual residential refuse (___yes, ___no), commercial establishments (___yes, ___no), institutions (___yes, ___no), markets (___yes, ___no), nightsoil and sewage sludges (___yes, ___no), street sweepings (___yes, ___no), industrial establishments (___yes, ___no).

If yes, how was this information developed: Through sampling? Through surveying? Through measurements of wastes collection?

Provide information of waste generation rats on Data Collection Guide #2.



Note: Information provided by the Department of Mechanical Engineering. Parentheses indicate number of employees in each position.

How many residents are there within the boundaries of the local government's refuse collection service area: _____. Are there additional transient residents _____.

Using a municipal waste generation rate derived from Data Collection Guide #2, or using a range of 500 to 800 grams/capita/day, estimate the quantity of municipal refuse being generated daily in your service area:

_____ to _____kilograms/day

Using a waste density, as collected, derived from Data Collection Guide 3, or using a range of 200 to 500 kilograms/cubic meter, estimate the volume of municipal refuse requiring collection service in your service area:

_____ to _____ cubic meters/day

Based on the vehicle fleet capacity regularly engaged to haul refuse from the area of collection service to the disposal site, estimate the level of city-wide service provided:

_____ to _____ % collected

If there is a shortfall between the amount of refuse generated, and the amount of refuse regularly collected, where is this waste accumulating:

? drains ? poor neighborhoods ? market areas ? illegal dumps

? other _____.

Can you rank the reasons for any shortfall which may exist:

Worker productivity

_____

Shortage of equipment

_____ Inappropriate methods of collection _____

Poor maintenance of equipment, frequent breakdowns

_____

Inadequate access to certain neighbourhoods with equipment available

_____

_____

Lack of citizen cooperation with the collection system

Other _____

Has there been any research performed to determine the density (___yes, ___no), moisture content (___yes,___no), practical size (___yes,___no), or compositional nature (___yes, ___no), of various types of solid waste in your area ?

If so, who performed this research, when was it done, and what methods were used? Please explain:

For the types of refuse which may have been described by the above research, provide information on the waste character on Data Collection Guide #3.

Please describe your basic refuse collection system, with respect to:

Household or dwelling storage

Discharge of wastes

Direct and indirect collection methods

Transfer points and hauling methods

Provide a schematic of your basic system, as has been done on the following page shoeing the system in Kano, Nigeria.

Typical Organogram of a WMD

Are there special systems for collection of the following:

Bulky or garden wastes _____

Market or motor pool wastes _____

Institutional wastes _____

Construction/demolition debris _____

Commercial and light industrial wastes _____

Industrial wastes _____

Other _____

_____

Provide schematic accordingly as you have for your basic system.

On Data Collection Guide #4, provide information about your refuse collection and transfer (haul) equipment.

Based on the number and utilized capacity of vehicles employed in hauling refuse from the collection service area to the disposal area, and on the average number of trips per day, estimate the amount of refuse collected per day:

Vehicle type 1 ___ vehicles x ___ capacity x ___ % full x ___ trips = ____

Vehicle type 2 ___ vehicles x ___ capacity x ___ % full x ___ trips = ____

Vehicle type 3 ___ vehicles x ___ capacity x ___ % full x ___ trips = ____

Vehicle type 4 ___ vehicles x ___ capacity x ___ % full x ___ trips = ____

Vehicle type 5 ___ vehicles x ___ capacity x ___ % full x ___ trips = ____

Total daily haul of fleet = _____

Total daily haul of ___ x number of days of collection service per week _____ : number of days in a week ___ = average amount of refuse collected daily ___ in cubic meters ? or yards ? .

What are the problems and issues you perceive regarding productivity of the various types of equipment (i.e. access to the waste source, delays in traffic, long travel times off the collection route, breakdowns while on route, slow loading and unloading systems):

What are the problems and issues you perceive regarding productivity of workers (i.e. union conditions, time spent on picking or scavenging, laziness, procedures are slow, lost time in travel to the disposal site, lack of supervision):

Observe the time and motion of the principal methods of collection in the study, and record data on Data Collection Guide #5.

If there seems to be a discrepancy of workers or equipment among districts, perform the time and motion studies in those districts exhibiting large differences, and record the findings on Data Collection Guide #5.

Relative to productivity, are there existing organizational arrangements or financial arrangements that act as disincentives to improvement of the system? Are there social or cultural constraints to improvement of the system's productivity?

Are there special incentives to improve productivity?

Is maintenance of equipment a serious problem in your study area?

If equipment is managed at a central facility for all municipal equipment, list the priority sequency followed to service equipment (i.e. (i) fire, (ii) ambulance, (iii) refuse collection, (iv) public works).

Is there good planning and procurement of supplies and basic spare parts, or are major delays incurred in order to await these items?

What type of daily maintenance program is conducted?

Please provide additional data on maintenance on Data Collection Guide #6.

What type of disposal system do you have?

Are this options available for your continued use for: 5 years _____, 10 years _____ 15 years _____, more?

For land disposal sites, please fill out Data Collection Guide #7: one form for each site.

Do you feel that resource recovery is technically or economically feasible in your area?

What type of system would you consider appropriate (i.e. biogas, methane recovery from landfills, composting, incineration):

If you feel composting is feasible for your area, please address questions on its application to various crops, Data Collection Guide #8.

Is there scavenging:

From door to door ? At the communal bins ? At transfer depots ?

At the disposal sites ?

Is scavenging organized by middlemen, is it operated as a collective or community, or is each scavenger an independent entrepreneur?

Is scavenging a life-long work, an entry employment for migrants, or the traditional territory of certain religious or cultural groups?

Approximately how many people are engaged in scavenging:

In direct picking and sorting _____

As middlemen organizers or buyers _____

As users of recycled materials _____

Are municipal workers involved in the scavenging activities? _____
If so, do they co-operate in some way with the private scavengers?

Does the local government rely on scavenging to provide a part of their refuse collection or disposal service?

Is this a cooperative effort in refuse management, or do the private and public systems clash a certain intervals, explain:

Please provide information to the extent possible (and as needed) on Data Collection Guide #9, concerning the economic viability of scavenging.

By using Data Collection Guide #10, determine the costs of refuse management for vehicle depreciation, labor, operation and maintenance. Based on this cost information, estimate the cost per metric ton and per capita.

For each type of equipment (including manual carts, trucks, and loaders) multiply the number of equipment units by the investment cost and divide by the estimated life, then multiply by the portion of time that the equipment unit is allocated to refuse management ... to get the average annual cost of all units of each equipment type. Then total these costs to get the total vehicle depreciation amount.

For each labor category (including overhead categories) multiply the number of persons in each category by the average annual salary (including an average amount of overhead wage), than add a percentage of this amount to account for fringe benefits ... to get the average annual cost of all persons in each labor category. Then total these costs to get the total cost for salaries.

From the basic budget, obtain operating and maintenance costs for supplies, utilities etc. These are generally not broken down by equipment and labor units for which operation and maintenance costs are incurred.

Add up the entire cost of vehicle depreciation, salaries and fringe benefits, operation and maintenance.

Divide this number by the estimated amount of refuse collected and transported to disposal sites, to get a cost per metric ton.

Divide this same number by the population served, to a cost per capita.

If there is refuse management service by the private as well as the public sector, or in lieu of the public sector, indicate the setoff Data Collection Guide #10 being for the private sector.

What percent of the local government budget does the above estimate of refuse management costs comprise? _____%

What is the average annual income per capita in the project area? _____What percent of income is required for refuse management? _____

Depending on the time and information available, it may be possible to generate information on the costs per metric ton and cost per worker of various collection equipment units existing in the project area. This exercise is also possible for various equipment types for the future.

To this end, Data Collection Guide #11 is provided. Based on the annualised investment cost, operation and maintenance, and wage cost; the typical amount of waste hauled coupled with the number of trips per day; and the number of collection service days per year ... a cost per unit volume is determinable. Using an as-transported density based on weighing the equipment full and empty, cost per metric ton can be estimated.

Data Collection Guide #12 Through #19 are provide to assess the unique needs of specific collection service districts or neighbourhoods.

Completing these data guides may indicate inequities of service among districts attributable to allocation of equipment and labor, road and access conditions, poverty groups, presence of substantial market activity or commercial activity, etc.

Unique baseline conditions in specific areas may require equally unique methods of refuse management.

In the event that data are not available on the quantity nor character of waste generated in various categories of activities (household, commercial, institutional, market, etc.), Data Collection Guide #20 is provided as an example of how information may be recorded from a survey and sampling effort of homes.

In Frank Flintoff's manual, entitled Management of *Solid Waste in Developing Countries* (WHO Regional Publications, South-East Asia Series No. 1, published in 1976), Chapter 2 is developed to explaining how a sampling program should be performed. This standard procedure is recommendable for purposes of project preparation discussed here.

RECORD OF DATA COLLECTION ASSISTANCE, PEOPLE AND SOURCES

Guides:

Parking and maintenance facilities

_____

Markets

_____

Residential Collection

_____

Land disposal facilities

_____

Other disposal facilities

_____

Other

_____

_____

Name of driver(s)

_____

Sources of Information:

Data Collection Guide #1

_____

Data Collection Guide #2

_____

Data Collection Guide #3

_____

Data Collection Guide #4

_____

Data Collection Guide #5

_____

Data Collection Guide #6

_____

Data Collection Guide #7

Data Collection Guide #8

Data Collection Guide #9

Data Collection Guide #10

Data Collection Guide #11

Data Collection Guide #12

Data Collection Guide #13

Data Collection Guide #14

Data Collection Guide #15

Data Collection Guide #16

Data Collection Guide #17

Data Collection Guide #18

Data Collection Guide #19

Data Collection Guide #20

Other sources of information:

People:

Published and Unpublished Reports:

PHOTO REQUIREMENTS

Photos needed of the following:

- each type of household container and storage
- each type of communal bin
- each type of market bin
- representative market scene at central market and local markets
- condition of drainage systems
- neighbourhood conditions with respect to refuse collection
- each type of vehicle for hauling containers
- each type of refuse collection vehicle
- each type of sweeper cart
- each landfill
- neighbourhood housing types representative of each district
- representative commercial areas
- parking and maintenance facilities for refuse equipment
- landfill equipment

It is necessary to keep a photo log, writing down the number of the photo and the location of the photo being taken. Be sure to get correct spellings of names of places and people.

PHOTO LOG – ROLL No._____

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

16. _____

17. _____

18. _____

19. _____

20. _____

21. _____

22. _____

23. _____

24. _____

25. _____

26. _____

27. _____

28. _____

29. _____

30. _____

PHOTO LOG –ROLL No._____

31. _____

32. _____

33. _____

34. _____

35. _____

36. _____

37. _____

38. _____

39. _____

40. _____

DATA COLLECTION GUIDE #1

Organization of Solid Waste Management Responsibilities

Which organization develops:

National environmental policy _____

National solid waste management policy _____

Municipal solid waste collection ordinances _____

Municipal solid waste disposal ordinances _____

Municipal solid waste plans _____

Which organization provides:

Enforcement of national policy _____

Enforcement of municipal ordinances _____

Direction of plan implementation _____

Which organization performs or manages:

Street sweeping _____

Minor drain cleaning _____

Major drain cleaning _____

Direct collection of municipal refuse _____

Indirect collection of municipal refuse _____

Transfer and haul of municipal refuse _____

Disposal of solid waste _____

Resource recovery _____

Marketing of recovered by-products

For new civil works, i.e. garages and transfer depots, who would perform:

Procurement of equipment _____

Acquisition of land _____

Construction of facilities _____

Management of contractors _____

DATA COLLECTION GUIDE #1 (continued)

What are the methods of communication and co-ordination among agencies performing various steps in refuse management or formulating policy and regulations:

What are the methods of communication and co-ordination within agencies performing various steps in refuse management:

How are priorities established:

For maintenance of refuse vehicles _____

For allocation of equipment to districts _____

For allocation of municipal budget _____

For other activities _____

DATA COLLECTION GUIDE #2

Waste Generation Rates

What is the residential per capita waste generation rate for:

Low-income neighbourhoods _____

Medium-income neighbourhoods _____

High-income neighbourhoods _____

Mixed residential neighbourhoods _____

What is the commercial waste generation rate for:

Food service establishments _____

Grocery stores _____

Apparel stores _____

Office service establishments _____

General retail stores _____

Other _____

(Indicate above whether the commercial rate is: per employee, per unit of floor space, per unit of sale, or has been allocated to a per capita basis.)

What is the institutional waste generation rate for:

Hospitals _____

Schools _____

Barracks _____

Government offices _____

Other _____

(Indicate above whether the institutional rate is: per bed, per unit of floor space, per employee, or per capita.)

What is the market and motor park waste generation rate for:

Markets _____

Motor pools _____

(indicate whether the rate is by stall, motor transport unit, surface area of the trade and parking space; is the combined rate for all the city's markets; or has been allocated to a per capita basis.)

If construction and demolition debris is separately collected, how much of it is there on a daily basis?

Is there any estimate on the amount of street dust and dirt, and drain cleaning, requiring collection on a daily basis?

Are yard wastes and bulky wastes collected separately?

What is the estimated quantity of these wastes?

List the main industries in your area. Indicate the number of employees, floor space areas, or production values within each category; and provide waste generation data, if available:

1.
2.
3.
4.
5.
6.
7.
8.

9. _____

10. _____

DATA COLLECTION GUIDE #2 (continued)

If only a combined waste generation rate has been estimated, please provide it, and indicate which categories of refuse are included in it:

City-wide rate _____ grams/capita/ day

Mixed residential rate _____ grams/capita/ day

Other _____ grams/capita/ day

Includes:

? residential ? commercial
? institutional
? market
? street sweeping? construction/demolition debris
? yard waste
? light industrial? heavy industrial
? other

For categories of refuse which might be handled by the municipality, indicate which are directly collected, indirectly collected, and permitted to be disposed within the municipal dump:

	Directly Collected	Indirectly Collected	Municipal dump
Residential	_____	_____	_____
Commercial	_____	_____	_____
Institutional	_____	_____	_____
Market, motor pool	_____	_____	_____
Street sweepings, drain cleanings	_____	_____	_____
Construction, demolition debris	_____	_____	_____
Light industrial	_____	_____	_____
Heavy industrial	_____	_____	_____
Other	_____	_____	_____

DATA COLLECTION GUIDE #3

Waste Character _____

% by weight

(___ wet weight basis, or ___dry basis)

Waste category	1	2	3	4	5	6	7
Constituent:							
Vegetable/putrescible							
Above 50 mm							
10mm – 50 mm							
Below 10 mm							
Total							
Paper							
Metals							
Ferrous							
Aluminium							
Total							
Glass							
Coloured							
Clear							
Total							
Textiles							
Plastics							
Polyethylene							
Other							
Rubber							
Tires							
Other							
Bones, wood, straw, shells							

Miscellaneous							
Combustible							
Non-combustible							
Inserts below 10 mm							
Moisture content							

DATA COLLECTION GUIDE #3 (continued)

For waste categories whose character was defined on the preceding page – where was the source of the sample and when was it taken:

Waste Category	1	2	3	4	5	6	7
Source of Sample	?	?	?	?	?	?	?
Household bin	?	?	?	?	?	?	?
Closed portable bin	?	?	?	?	?	?	?
Open masonary communal bin	?	?	?	?	?	?	?
Open collection bin	?	?	?	?	?	?	?
Manual cart	?	?	?	?	?	?	?
Vehicle	?	?	?	?	?	?	?
Season	?	?	?	?	?	?	?
Nov-Feb	?	?	?	?	?	?	?
Mar-May	?	?	?	?	?	?	?
June-Aug	?	?	?	?	?	?	?
Sept-Oct	?	?	?	?	?	?	?
Year	___	___	___	___	___	___	___

DATA COLLECTION GUIDE #4

Existing Waste Collection and Haul Capacity

Type of Equipment	Number	Capacity	Number of Trips/Day	Number Days/Week
Manual (i.e. Wheelbarrows, donkey carts, dollies with baskets):				
1.				
2.				
3.				
Direct collection and haul vehicles (from dwelling to disposal site):				
1.				
2.				
3.				
4.				
Transfer Vehicles (from collection rendezvous with sweepers or transfer depot to disposal site):				
1.				
2.				
3.				
4.				
Portable communal containers and hauling equipment (i.e. tractor w/trailer):				
1.				
2.				
3.				
Other:				
1.				
2.				

3.				

Note: Capacity expressed in cubic meters ___; or cubic yards ___?

DATA COLLECTION GUIDE # 5 Equipment Type: _____

Times for Calculation of Payload Capacity and Study of Productivity
(to be done for each type of equipment used in collection)

Start-up time, for sign-in, refuelling, getting out of parking area: _____

Loading tome per stop: _____

Number of stops on first route: _____

Number of stops on second route: _____ other routes: _____

Travel time on first route: _____

Travel time on second route: _____ other routes: _____

Time for morning break: _____

Time for lunch break: _____

Time for afternoon break: _____

Haul distance from first route to dump site: _____ haul time: _____

Haul distance from second route to dump site: _____ haul time: _____

Travel times to scavengers, buyers, other diversion; _____

Time spent at scavengers, buyers, other diversions: _____

Dumping time: _____

Traffic delay at dump site: _____

Travel distance from parking to first route: _____ travel time: _____

Travel distance from dump site to parking: _____ travel time: _____

Hours of regular working time: _____ to _____

Hours of overtime each day: _____ to _____

Hours of overtime on weekends: _____ to _____

Amount of waste collected on first route: _____

Amount of waste collected on second route: _____

other routes: _____

Note: duplicate for each type of equipment.

DATA COLLECTION GUIDE # 5

District _____ Vehicle _____ Crew Size _____ Street _____ Direction of Travel _____
Time of Day _____ Type of Service _____ (i.e. curbside, door-to-door)

Stop-to-Stop Times			Loading Times		
1.	9.	17.	1.	9.	17.
2.	10.	18.	2.	10.	18.
3.	11.	19.	3.	11.	19.
4.	12.	20.	4.	12.	20.
5.	13.	21.	5.	13.	21.
6.	14.	22.	6.	14.	22.
7.	15.	23.	7.	15.	23.
8.	16.	24.	8.	16.	24.

Total travel time on route: _____
Total volume collected on route: _____
% Dustbins (regulation) % Dustbins (nonregulation) % Crates, etc.
_____% _____% _____%
Uncontained % _____
Loading Volumes (as observed at each stop where timing was performed above):

1.	9.	17.
2.	10.	18.

3.	11.	19.
4.	12.	20.
5.	13.	21.
6.	14.	22.
7.	15.	23.
8.	16.	24.

Note: duplicate for each type of equipment .

DATA COLLECTION GUIDE #5 (continued)

District: _____

Equipment type(s):

_____

_____

Are there any incentives (i.e. bonuses, early releases from work, recognition awards) for workers to provide more effective and/or productive collection efforts:

_____

_____

_____

_____

Is each crew assigned to a specific service area, where citizens know who is responsible for
their collection service, and where a rapport may develop between the crew and the residents:

_____

_____

_____

What type of "upward mobility" opportunities are available to collection workers? For example, can they be advanced to become drivers, foremen, supervisors?

_____

_____

_____

If so, is there any training or are there any tests that are regularly scheduled to enable and encourage upward mobility?

_____

_____

_____

How do unions affect worker effectiveness and productivity?

_____

_____

_____

DATA COLLECTION GUIDE #6

Maintenance Information

Area size of main garage(s): _____ ea. How many:

_____

Area size of local garage(s): _____ ea. How many:

_____

Location and time required for major overhaul: _____ per vehicle

Location and time required for bodywork:

_____

Location and time required for repairs:

_____

Location and time required for daily service:

_____

% of useable truck usually down: _____

% of useable tractor fleet usually down: _____

% of useable landfill equipment usually down: _____

mechanics per usable equipment items: _____ # assistant mechanics per usable
equipment items _____ (i.e., 1 mechanic per 10 trucks)

Availability of spare parts:

_____

Discuss availability and conditions of maintenance equipment:

Lifts or pits for access to underneath parts of vehicles _____

_____

Engine lifts and stands _____

Tool sets _____

Air compressor for tools _____

Parts cleaning and solvent recovery _____

Heavy duty jacks _____

Steam cleaner _____

Tire machine _____

Machine making equipment _____

Body work equipment _____

Other equipment _____

DATA COLLECTION GUIDE #6 (continued)

Vehicle Type	Date of Purchase	Mileage	% Down Time	Major repair Issues
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				

DATA COLLECTION GUIDE #6 (continued)

Is refuse equipment assigned to one operator or driver, or is it generally available to various users as part of an equipment pool?

If there are two or more shifts of equipment use per day, how is the assignment of equipment arranged?

Does each driver or operator have a checklist of daily maintenance activities to perform?

If so, does a supervisor ensure this activity is performed?

Do drivers and operators receive any training on equipment operation and maintenance?

If so, are there refresher training programs?

Are there any incentives for good operation and maintenance of equipment, or for good safety records?

What is the system for drivers and operators to report and/or record maintenance needs:

DATA COLLECTION GUIDE #7

Disposal Area:

_____

Location:

_____

How long has this site been used?

_____

Surface area available:

_____

Topographical Character:

_____

Presence of Surface Waters:

_____

Soil Type(s):

_____

Surrounding Land Use:

_____

Initial Land Cost/Value: _____ Land Cost Value Upon Completion_____

Distance to Nearest Dwelling with Well:

_____

Distance to Nearest Dwelling without Well:

_____

Presence of Scavengers:

_____

Condition of Access Road:

_____

Length of Access Road from Main Road:

_____

Width of Access Road:

_____

Equipment available on Site:

Facilities available on Site (i.e. water, sanitation, fire-fighting):

Method of Landfill:

Existence of an Operational Plan:

Availability and Cost of Daily Cover:

Hours of Daily Operation: _____ Days of Operation

Estimated Cost of Disposal: _____Depth Groundwater:

Environmental Issues:

Note: Duplicate form for use regarding each major disposal site.

DATA COLLECTION GUIDE #8

Existence of composting experience in the area

Crops which may use compost:

Availability of competitive products:

Cow manure _____ cost _____

Chicken manure _____ cost _____

Chemical fertilizer _____ cost._____

Subsidized?

Application rates of current organic amendments with fertilizing capability:

Crop 1 _____

Crop 2 _____

Crop 3 _____

Crop 4 _____

Crop 5 _____

Crop 6 _____

Acreage of crops which may use compost:

Crop 1 _____Distance from Service Area

Crop 2 _____

Crop 3 _____

Crop 4 _____

Crop 5 _____

Crop 6 _____

Availability of sites for compost facilities _____

Main access routes to compost facilities _____

DATA COLLECTION GUIDE #9

	Buyer 1			Buyer 2			Buyer 3			Buyer 4		
Describe facilities for transport, handling & storage of scavenged items												
Number of employees engaged in scavenging												
Average income per employee												
	Quantity/kg/day	Price paid/kg	Resale price/kg	Quantity/kg/day	Price paid/kg	Resale price/kg	Quantity/kg/day	Price paid/kg	Resale price/kg	Quantity/kg/day	Price paid/kg	Resale price/kg
Paper—total 1. Corrugated 2. Kraft 3. Cardboard 4. Newsprint 5. Other												
Ferrous metal												
Aluminium												
Copper												
Other metal												
Plastics												
Bottles—total 1. Clean 2. Dirty												

DATA COLLECTION GUIDE #10

Equipment depreciation costs

Equipment type	Investment Cost	Life Expectancy/ Average age	% life used for refuse
1.		/	
2.		/	
3.		/	
4.		/	
5.		/	
6.		/	
7.		/	
8.		/	
9.		/	
10.		/	
11.		/	
12.		/	

DATA COLLECTION GUIDE #10 (continued)

Type of Labor	Required Weekly Hours	Average Weekly Overtime	Regular Salary	Overtime Salary
Supervisors				
Foremen				
Inspectors				
Mechanics				
Mechanic Aids				
Drivers				
Vehicle Crew				
Sweepers				
Drain Cleaners				
Landfill Equipment				
Landfill Labor				
Administration				
Other				

For Municipal Employees: No. of sick days _____ No. holidays _____ No. of vacation days _____

Fringe Benefits: Retirement fund _____ health insurance _____ life insurance _____ unemployment compensation _____ disability _____ uniforms _____ bonuses _____ longevity benefits _____

Safety equipment _____

Approximate % of salary added to costs for fringe benefits _____

Turnover

DATA COLLECTION GUIDE #10 (continued)

Salaries of Personnel:

Number of Employees	Position	Average Annual Salary	Total
	Directors		
	District Supervisors		
	Foremen		
	Inspectors		
	Mechanics		
	Mechanics Aids		
	Drivers		
	Loaders/Collectors		
	Sweepers		
	Drain Cleaners		
	Landfill Equipment		
	Landfill Labor		
	Administrative		
	Other		
	Other		
	Other		
		TOTAL	

(TOTAL x expenditure for fringe benefits as a % of TOTAL) x (TOTAL) =

Overhead salaries for local government leader, comptroller, attorney, personnel advisors, etc. plus
fringe benefits

DATA COLLECTION GUIDE #10 (continued)

Operation and maintenance Expenses

Equipment Operations and maintenance (fill in annual cost attributable to refuse management):

Tires _____

Fuel _____

Oil _____

Lubrication _____

Spare parts _____

Other supplies _____

Utilities, etc. _____

Total _____

Administrative expenses (fill in annual cost attributable to refuse management):

Telephone _____

Office supplies _____

Rent, utilities _____

Radio Communication _____

Mail, billing _____

Public education materials _____

Other _____

Total _____

Insurance and taxes:

Vehicles _____

Personnel _____

Property _____

Damage, liability _____

Total _____

Interest:

Equipment _____

Facilities _____

Total _____

DATA COLLECTION GUIDE #11

Equipment Type	Capacity (cubic ?)	Investment Cost (money units)	Annualized Investment Cost	O&M Cost Per year	# trips/day : %full to capacity
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					

DATA COLLECTION GUIDE #11 (continued)

Equipment Type	Crew Size (includes driver)	Description of Crew	Average Cost of Crew per year	Cost per Metric Ton
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				

DATA COLLECTION GUIDE #12

District	Population	Area	Density	No. of Floors in Residential Dwellings
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				

Total				

DATA COLLECTION GUIDE #13

District	Residential: Commercial: Institutional: Industrial Land Use Mix (ratio by area)
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	
21.	
22.	
23.	

24.	
Total	

DATA COLLECTION GUIDE #14

District	Average income Per Capita	Population Below Urban Poverty	Comment on Income Status of Residents
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
21.			
22.			
23.			
24.			

Total			

DATA COLLECTION GIUDE #15

District	Km of Paved Road	Km of Truck Route	Type of Service on Paved Road (i.e. door-to-door curbside)
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
21.			
22.			
23.			
24.			
Total			

DATA COLLECTION GUIDE #15 (continued)

Describe conditions of paved roads:

Width of one-way roads

_____

Width of two-way roads

_____

% of road encroached upon by stalls and refuse

_____

_____ and parking

_____

Average of vehicles

_____

% of slow-moving traffic versus motorized traffic

_____

Days of heavy traffic

_____

Times of heavy traffic

_____

Upkeep of road surface

_____

Lights at night on any roads

_____

Extent of hilly terrain, degree slope

_____

Discuss issues of refuse collection which are obstacles or constraints to effective, efficient collection:

_____

_____

_____

DATA COLLECTION GUIDE #16

Communal Bins

District	No. of Bins Type 1 ____ m^3	No. of Bins Type 2 ____ m^3	No. of Bins Type 3 ____ m^3	Frequency of Service 1	2	3
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						
19.						
20.						
21.						
22.						
23.						

24.						
Total						

DATA COLLECTION GUIDE #16 (continued)

Communal Bins:

Describe Type 1 Bin:

Construction material, size, number of sides

Method of loading

Loading by who? Age?

Method of unloading

Time for unloading

Scavenging activity

Describe Type 2 Bin:

Construction material, size, number of sides

Method of loading

Loading by who? Age?

Method of unloading

Time for unloading

Scavenging activity

Describe Type 3 Bin:

Construction material, size, number of sides

Method of loading

Loading by who? Age?

Method of unloading

Time for unloading

Scavenging activity

DATA COLLECTION GUIDE #17

District	No. of Markets Per capita	No. of Stalls	Stalls Ratio Produce: Food Service: Apparel: Appliance: Other	Frequency Of Service
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
Total				

DATA COLLECTION GUIDE #17 (continued)

Describe the condition of the central markets:

What are the market days?

_____

When are goods delivered?

_____

What are the water supply, drainage and sanitation facilities?

_____

_____

_____

Are there bins at each stall? With lids?

_____

Are there communal bins? With lids? Portable?

_____

Method of loading and unloading communal bins?

_____

_____

_____

Discuss access and traffic conditions for collection service

_____

_____

_____

Describe overall cleanliness of sites

_____

Describe the condition of the local markets:

What are the market days?

_____

When are goods delivered?

_____

What are the water supply, drainage and sanitation facilities?

_____

Are there bins at each stall? With lids?

Are there communal bins? With lids? Portable?

Method of loading and unloading communal bins?

Discuss access and traffic conditions for collection service

Describe overall cleanliness of sites

DATA COLLECTION GUIDE #17 (continued)

Market Name	District/Location	Bin Size m^3	Quantity Waste/Day m^3
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
21.			
22.			
23.			
24.			

Total			

DATA COLLECTION GUIDE #18

District	Km Length of Commercial Establishments	No. of Establishments	Type of Service (Door-to-Door or Curbside)
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
21.			
22.			
23.			
24.			

Total			

DATA COLLECTION GUIDE #18 (continued)

District	Mix of Commercial Activity (ratio of food service: grocery: apparel: appliance: office services: other	Gross Sales Or Floor Area

Total		

DATA COLLECTION GUIDE #18 (continued)

District	Type of Bins for Commercial Establishments	Type of Communal Bins and size m^3	Quantity Waste/Day m^3	Frequency of Service
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				

23.				
24.				
Total				

DATA COLLECTION #19 (continued)

District	No. Drivers	No. Truck Crew	No. Sweepers	No. Drain Cleaners
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				

22.				
23.				
24.				
Total				

DATA COLLECTION #19 (continued)

District	No. Supervisors	No. Foremen	No. Inspectors	No. Mechanics & Aids
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				

22.				
23.				
24.				
Total				

DATA COLLECTION GUIDE #20

Describe each Household: location, condition of dwelling, neighbourhood type, income level of family(ies), monthly cost of rent or mortgage, floor space:

Household 1.

Household 2.

Household 3.

Household 4.

Household 5.

Household 6.

Household 7.

Household 8.

Household 9.

Household 10.

DATA COLLECTION GUIDE #20 (continued)

Household 11.

Household 12.

Household 13.

Household 14.

Note: The basic description requested above will probably require the judgement of surveyor. Other information for the following forms will probably be more readily provided by the residents living in the household.

DATA COLLECTION GUIDE #20 (continued)

	Number of People	Head of House/ Occupation	# of Animals	Kitchen	# of Bedrooms	#of Baths
Household 1.						
Household 2.						
Household 3.						
Household 4.						
Household 5.						
Household 6.						
Household 7.						
Household 8.						
Household 9.						
Household 10						
Household 11						
Household 12						
Household 13						
Household 14						

Remarks:

DATA COLLECTION GUIDE #20 (continued)

No. of Toilets	Electricity	Water Connection	Sewer Connection	Owned or rented	Cooking Method	Yard or Garden
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						

Remarks:

DATA COLLECTION GUIDE #20 (continued)

Weight of household samples in _____

Day	1	2	3	4	5	6	7	8	9
Household 1.									
Household 2.									
Household 3.									
Household 4.									
Household 5.									
Household 6.									
Household 7.									
Household 8.									
Household 9.									
Household 1(									
Household 1									

Household 12									
Household 13									

Remarks:

DATA COLLECTION GUIDE #20 (continued)

Diet	Religion	Cultural Information	Recycling Activities
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			

Remarks:

DATA COLLECTION GUIDE #20 (continued)

	Weight in kg			% by Weight		
Constituent	Sample Number	Sample Number	Sample Number	Maximum %	Minimum %	Average %
Vegetable/Putrescible						
Above 50 mm						
10 mm- 50 mm						
Below 10 mm						
Paper						
Metals						
ferrous						
aluminium						
other						
Glass						
coloured						
other						
Textiles						
Plastics & Rubber						
Bones						
Miscellaneous						
combustible						
non-combustible						
Inert matter below 10mm						
Total						

Moisture Content (%)						
Source of Sample						

Answers

1. These are the immediate structure within the public sector represented basically by the municipalities (including ministries of local government) and the other related institutions like the ministry or agency responsible for environment, health, finance, education, industry, trade and commerce, etc. Effective MSWM depends on appropriate distribution of functions, responsibilities, authority and revenue between national, provincial and local governments and within their subdivisions.

The other view has to do with the extent of consideration and involvement of the private sector and the community in decision making and the provision of service: the extent to which their participation is clearly regulated their roles and mandates clearly defined and the extent of transparency while – with fair recognition – dealing with them. The public sector, namely municipalities, have to perceive and facilitate – by legislative, regulatory and other instruments – action and participation by the stakeholder groups, the community and the private sector.

2. This can be done by considering the following tableau:

Economic and Financial Options	*Information and Educational Options*
Waste taxes and disposal levies	Community-right-to-know, waste reporting
Charge/rebate systems, tax preferences	Support for research and development
Producer responsibility	Formulation of targets and timetables with agreement from stakeholders
Raw material taxes	Waste Stock Exchange Systems
Producer charges	Public awareness programmes
Subsidies for waste prevention, recycling, etc.	Voluntary agreement between government and industry groups.
Tax preferences	Role of public, industry, and trade associations
Liability instruments	Role of technical, research and academic institutes
Compliance/Emissions trading mechanisms	Training
Source: ERM	

3. Discussion. See Figure 5., Page 8

4. Discussion. See the Taka Model in Figure 6, page 9.

5. A good procedure is to develop a communication plan based on a situation analysis measuring attitudes, affordability, willingness and ability to pay, preparedness to participate in the provision of service, etc. A communication strategy and programme should incorporate all possible efforts to explain the importance of WM. service, risks involved in its absence, cost of service, etc. The media, celebrities, theatre, booklets, posters, lectures, public meetings can planned as activities to effect the creation of awareness.

6. Privatization tends to work well in the following areas:

i. Collection of waste or recycleables, pay for service by households based on a standard volume of service provided, area or number of households served.
ii. Construction of waste facilities.
iii. Operation of transfer stations, compost facilities, etc.
iv. Service for densely populated areas.
v. In conditions where the government avails of sufficient infrastructure and experience to assess and control competitive bidding and monitor and control the delivery, and clear jurisdiction areas.
vi. In conditions where the public is aware and seeks transparency and accountability from the government and the service providers.
vii. Support for small scale enterprises

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(1 of 2)

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UP-DATED TRAINING MANUAL OF WASTE MANAGEMENT IN HIGH DENSITY AREAS OF THE AFRICA REGION

MODULE 3.
MANAGERIAL ASPECTS AND THE COST OF MUNICIPAL WASTE MANAGEMENT

Contents

1 THE COST OF MUNICIPAL WASTE MANAGEMENT

INTRODUCTION

In many instances in Africa it has been observed that the greatest impediments to efficient and environmentally sound handling of MSWM are managerial weaknesses rather than technical capabilites. With respect to MSWM poverty could not mean being dirty or negligent in attitude. More so improving the managerial and operational capabilities of individuials and institutions involved in MSWM at the local level is of utmost importance. That would not mean that technical capabilty is not important, but the extent of efficient utilization of the rersources available could simply made much more efficient than what obtains today. In addition to the techniques of planning, and training, issues relating to costs and financing will be discussed in the these two Modules 3 and 4.

From a policy standpoint, almost every decision faced by local officials concerned with refuse collection, recycling or disposal affects costs. For example the fundamental question about sector organisation requires some understanding of those factors affecting the cost of collection, recycling or disposal and the relative magnitudes within each category. Basic questions regarding the type of service and frequency of collection requires informed estimates of the costs of alternatives. Also if the government is seeking to evaluate alternative methods of financing, say collection, such as user charges or special service fees, reliable cost data are essential. Estimates of collection costs are also needed at a somewhat more detailed level for operational decisions such as route design and the choice of equipment and crew size. Finally, cost estimates are required to evaluate proposed changes in disposal practices. Moving the disposal site farther from the centre of town will increase hauling distances and hence collection of bottles, metal, and other refuse will typically increase collection costs.

In short, informed choices among major policy alternatives and routine operational decisions require knowledge of the relationship between collection costs, service and frequency levels, method of organisation and the spatial characteristics of the city.

It is intended here to give some few schemes of cost calculation which may assist in later efforts to detail the framework for analysis. Initially a general background about the present cost structure of WM activities will be given, a brief presentation of analysis needed to differentiate managerial costing from social cost benefit analysis, and a more important brief introduction to cost and managerial accounting will be given in this Chapter.

2. BACKGROUND INFORMATION

2.1 SOCIAL COST BENEFIT ANALYSIS AND FINANCIAL VIABILITY

Two methods of project analysis have to be differentiated: financial viability and social cost benefit analysis (CBA). In a project proposal financial viability is used for commercial or private profitability analysis while CBA is used for economic analysis (mostly investment decisions on public projects rather than private ones) from the national economy (or society's) standpoint rather than the private one.

Financial viability relates to the viewpoint of the individual (i.e. private operator - which can be a local authority, too). It looks at the commercial profitability by looking at the actual monetary costs of resources used in the course of providing the service. Social cost benefit analysis internalise external costs and include other indirect and outlying, but related, costs in the economic analysis.

In order to assess the desirability, from the community's point of view, of any separate collection or recycling scheme or programme it is necessary to develop a framework which will enable judgements to be made of its economic efficiency. This involves securing the largest possible net gain to the community as a whole by operating with the least possible total revenue and welfare costs. The efficiency criterion is not restricted to consideration of the financial (i.e. private), costs and benefits and private profitability of a given collection or recycling scheme, but incorporates an assessment of the wider and sometimes less tangible (but nonetheless real) external costs and benefits associated with recycling and waste disposal. A given separate collection scheme is, therefore, judged not only on whether it is privately profitable but also on whether or not, after taking into account all social costs and benefits, the scheme generates a net benefit.

The disposal of waste materials to the environment (air, water and land), imposes costs on society; including various financial costs (for labour, equipment and treatment plant) plus a range of external costs of environmental pollution and damage. Equally collection or recycling and re-use are not costless activities and themselves involve collection, sorting, baling, etc. and processing costs and, in certain circumstances, pollution costs.

2.2 THE COST STRUCTURE OF MUNICIPAL WASTE MANAGEMENT: SOME GENERAL COMPARATIVE INDICATORS OF COST OF OPERATIONS

In low income developing countries , recyclable materials comprise about 15% of the solid waste stream. As an economy improves, residents are likely to consume more packaged goods and to generate more waste. In middle income developing countries, recyclable materials comprise about 30% of the solid waste stream. In industrialised countries, recyclables comprise about 60% of the stream. Again the highest recovery of recyclables (paper, glass, metal, and plastic) is possible only if source separation is

practised. Because of the above we will concentrate on waste collection and disposal cost analysis - without having to forget the limited practice of recycling.

The emphasis above would direct us to concentrate on solid waste collection, cleansing, disposal, and transfer. This will be undertaken with a view on formulating the framework for analysing the costs and advantages of private sector participation arrangements in comparison to existing services. The examples below are from experience or desk research as mentioned in the UNDP/UNCHS/World Bank Urban Management Programme. It is to be borne in mind that in most cities the costs of MSW is between 20-50% of total municipal expenditure. Despite the high level of expenditure made collection service levels are low. Only 50-70% of urban residents receive service and most disposal is by unsafe open dumping. Figure 1-4 below – Type and Strucutre of Activity - shows the general schema of sequence of MSWM operations.

General Cost Indicators

Waste Generation and Income

Although the waste generation rates in developing countries are substantially lower than those in industrialised countries, these rates are not proportionally lower relative to income. These rates are 30-50% as high as those in industrialised countries, while income levels are 2-10% as high, as indicated below.

TABLE 3.1: Waste Generation Rates and Income

	Low-Income Country	Middle-Income Country	Industrialised country
Solid Waste Quantity (tonne/capita/year)	0.2	0.3	0.6
Average Income (US$/capita/year, 1988US$)	$350	$1,950	$17,500

Solid waste service consumes a higher share of income in developing countries than in industrialised countries. Although labour costs are lower in developing countries , the purchase price of equipment is much higher, and fuel costs are greater. Because most residents do not discharge their wastes in easy-to-unload containers at convenient curbside locations, more effort is required to perform collection. Because of inadequate public education and political-cultural obstacles to the enforcement of anti-litter and clandestine dumping laws, more effort is also required to perform public cleansing.

3 COLLECTION COSTS

In most developing countries, about 95% of the solid waste management costs are attributable to collection and public cleansing. On the other hand, in industrialised countries, about 70% of the solid waste management costs are attributable to collection and public cleansing.

For comparative purposes, the following collection costs (including all capital, debt service, operating, and maintenance costs) have been estimated [1].These are based on municipal solid waste collection conditions observed in a wide range of countries in different regions of the world.

TABLE 3.2: Collection Costs

	Low-Income Country	Middle Income Country	Industrialised country
Collection Cost (US$/tonne)	15-30	30-70	70-120
Capital, Labour and Operating & Maintenance Costs (as %age of total costs)	40 15 45	30 40 30	10 70 20
Collection Costs (US$/capita/year)	3-6	9-21	42-72
Collection Costs (as %age of income)	0.9-1.7	0.5-1.1	0.2-0.4

3.1 CLEANSING COSTS

When citizens litter indiscriminately and collection service are inadequate, waste accumulates in streets and on open lots. The cost for cleaning up these areas can be very high. The costs/tonne of public cleansing (including general clean up of open areas and street sweeping) are two to three times the costs/tonne of collection. The obvious way to minimise the expenditures required for street sweeping and general cleansing is through:

- Public education on waste management which would inherently raise awareness.
- Inspection, and enforcement of laws regulating citizen behaviour,
- Adequate provision of collection service to all residents.

For purposes of this estimate of MSWM costs, it is assumed that a well-run city in a developing country would have no more than 10% of its total waste quantity collected through public cleansing, whereas a well-run city in an industrialised country would have no more than 5% of its total waste quantity collected through public cleansing. Assuming

[1] S. Cointreau, Private Sector Participation in Municipal Solid Waste Services in Developing Countries, IBRD/WB, 1994.

that the cost per/tonne for public cleansing are roughly two times higher than the costs/tonne of collection, the costs for public cleansing are estimated below.

TABLE 3.3: Costs for Public Cleansing

	Low-Income Country	Middle-Income Country	Industrialised country
Collection Cost (US$/tonne)	30-60	60-140	140-240
Capital, Labour, and Operating & Maintenance Costs (as %age of total costs)	30 50 20	20 70 10	25 65 10
Collection Costs (US$/capita/year)	0.6-1.2	1.8-4.2	4.2-7.2
Collection Costs (as %age of income)	0.2-0.3	0.1-0.2	0.02-0.04

3.2 DISPOSAL COSTS

If environmentally safe disposal were required in developing countries, the most cost-effective technique for most cities would be sanitary landfill. Incineration is rarely technically viable because of the moisture content of refuse (typically between 45-85% moisture) is too high, and because the calorific content is too low (typically between 900-1,200 kcal/kg lower heating value). Refuse-derived-fuel technology is not viable because the content of combustibles is too low (paper, plastic, and textiles content typically total less than 25%). Compost is technically viable because the content of vegetable and putrescible material is high (typically more than 40%). The market is commonly poor, however, because most farmers exist at subsistence levels and cannot afford to cover the cost of composting and transporting of the compost product. While specialised markets exist (i.e. pottery, soil, horticultural farms, and intensive vegetable crop farmers) this total demand is usually small. Huge potential for composting exists in Africa, if:

- Source separation is started as early as possible in course of the awareness campaign
- Backyard or small scale composting is adopted in the cities or farms.

Because in most African cities sanitary landfills are yet to be constructed it is important to draw attention to an important aspect in sanitary landfill planning: location and design. Location in particular should usually observe the following:

1) Landfills should not be located at the following sites

a) Nearby airports: keep away over 2 km from airport periphery. Birds tend to go to landfills seeking prey in the wastes. This hinders safety in the air.
b) Wetlands, floodplains, etc. are areas with a high water table.
c) Areas which experience frequent seismic activity, areas which have geological faults.
d) The upstreams of the water reservoirs which supply drinking water.

2) Best sites for Landfills: above clay soils, above igneous rocks, where cover materials are available nearby. Usually designed as a 3 meter clay basement with $1x10^{-9}$ permeability.

3) Buffer zone (greenbelts ususally 1 km from residential areas nearest to location) to minimise the health risks: greenbelts surround the landfills and minimise the health risk and pollutants such as odours and noise.

4) Possibility of using nearby wastewater or sewage treatment system for treating the leacheate.

In industrialised countries, sanitary-landfill design standards impose strict requirements for environmental protection, resulting in costs that are substantially higher. Yet these standards do not require a larger fraction of per capita income for cost recovery. Sanitary landfill cost would generally fall within the ranges shown below.

TABLE 3.4: Sanitary Landfill Costs

	Low-Income Country	Middle-Income Country	Industrialised Country
Disposal Cost (US$/tonne)	1-3	3-10	15-50
Capital, Labour, and Operating & Maintenance Costs (as %age of total costs)	55 10 35	50 20 30	40 35 25
Disposal Cost (US$/capita/year)	0.2-0.6	0.9-3.3	9.0-30.0
Disposal Cost (as %age of income)	0.05-0.2	0.05-0.2	0.05-0.2

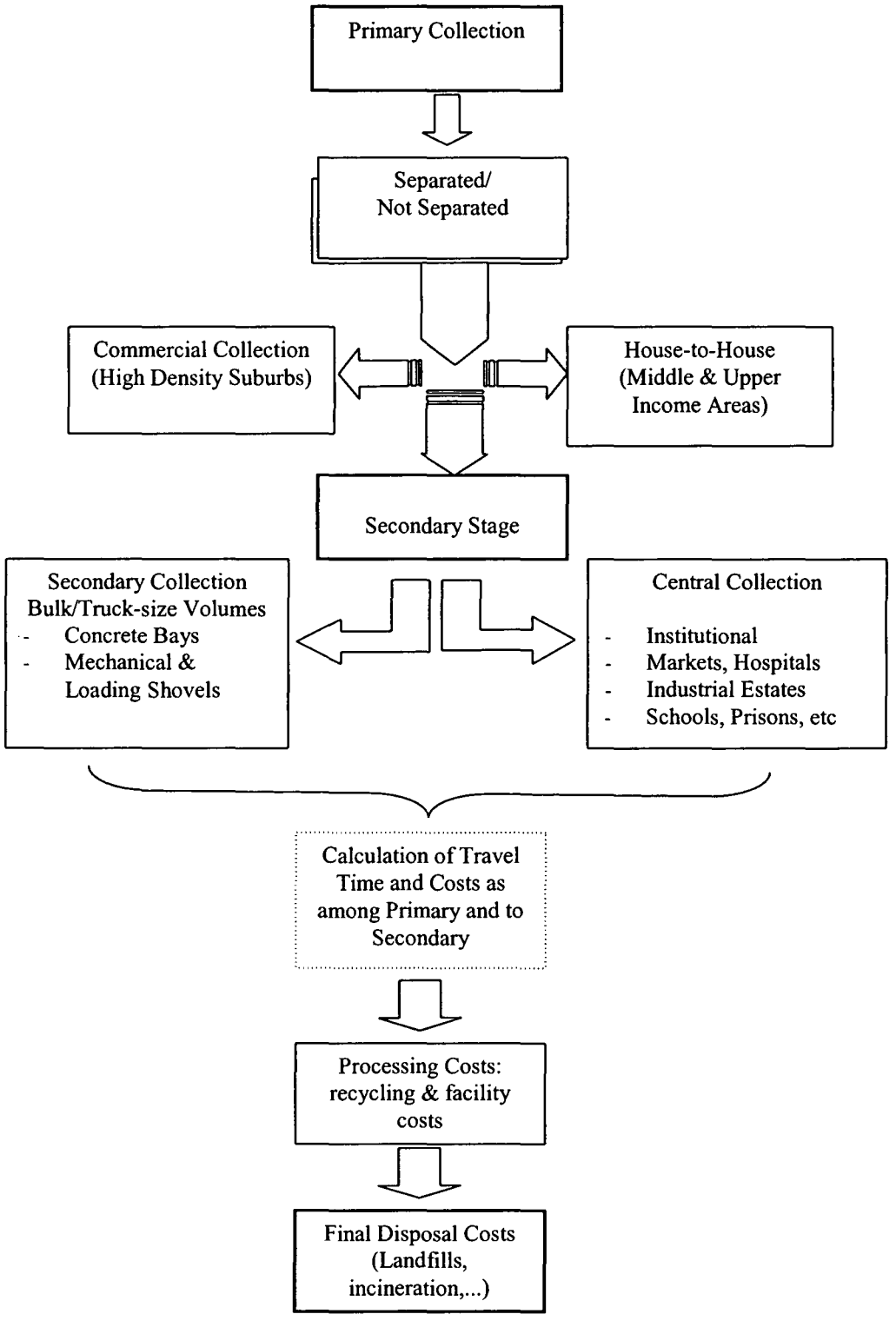
3.3 TRANSFER COSTS

To locate a suitable site for sanitary landfill, it may be necessary to look beyond what would be viable transport distances for collection trucks. Generally sanitary landfill are substantially lower than other disposal techniques, even when the cost for the implementation of transfer stations and the long-distance haul in transfer vehicles are added. Transfer system costs tend to fall within the ranges shown below.

TABLE 3.5: Transfer System Costs

	Low-Income Country	Middle-Income country	Industrialised country
Transfer cost (US$/tonne)	3-5	5-15	15-20
Capital, Labour, and Operating & Maintenance costs (as %age of total costs)	65 10 25	50 25 25	35 45 20
Transfer cost (US$/capita/year)	0.62-1.0	1.5-4.5	9.0-12.0
Transfer Cost (as %age of income)	0.2-0.3	0.1-0.2	0.05-0.07

Figure 3.1. **Type and Structure of Activity**



3.4 PRODUCTION COSTS

Production costs for the waste management activity are either capital or operating costs. Capital costs are those outlays on equipments, land, promotion, etc. Operating costs are day to day operation expenses comprising labour (collectors, drivers, announces and promotions, supervisors, mechanics, etc.) and materials (fuel and energy, spare parts, handling equipment, trucks, bags and bins, etc.). See Figure 3.1.

The overall cost of risk have to be built-in in the form of contingencies or mere, but informed judgements about expectations of future developments, e.g. catastrophies, unforeseen events or crisis like the Nairobi/Dar bombing.

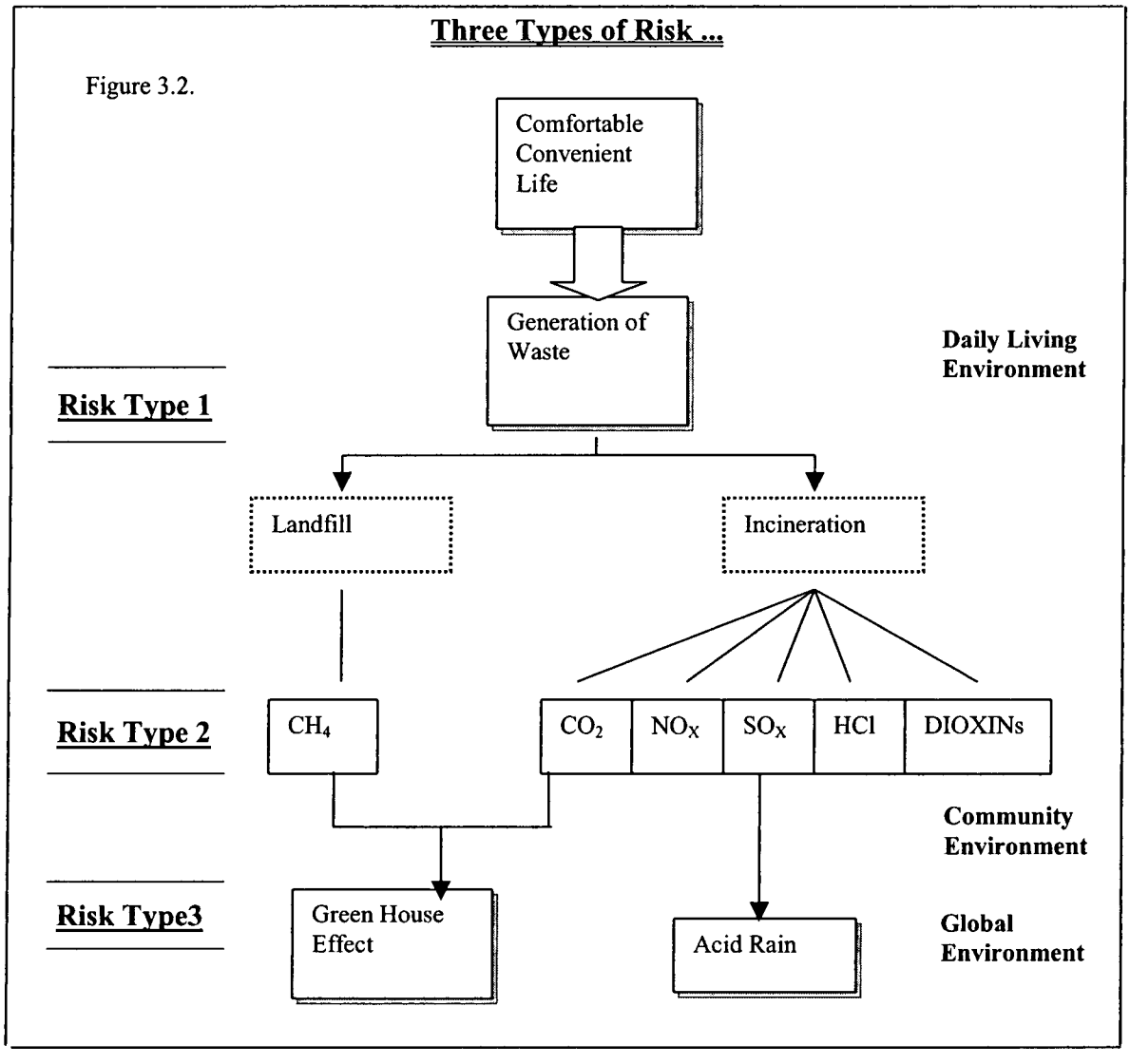


Figure 3.2.

EXAMPLE: THE COST OF REFUSE COLLECTION (WITH RECYCLING)

Before we can calculate and analyse the cost of refuse collection, we need to know what costs to include under this heading. For example, the costs of operating a bring collection system, is made up of capital costs such as the costs of the collection containers for primary and secondary collection and the cost of collection vehicles and equipment plus the annual operating costs such as those for the crew and materials. However, if we consider a curbside collection scheme which collects both recyclables and refuse, the identification of the costs attributable to recycling and those attributable to refuse collection is less straightforward. We will take the direct case here which is relevant to our simple recycling model. Units of measurement are usually either based on the cost per tonne, or the cost per household.

To determine the collection cost

All constituent elements of cost have to be identified and a standard reporting structure has to be defined.
Consistent and comparable data are to be produced on a regular basis (ideally monthly) to provide accurate management information on performance.

Assuming a system with a recycling [2] component the basis of the standard is the following costing statement (no infrastructure costs by government will be included like roads, culverts, etc. as these fall under a different category with respect to our present framework of analysis):

TABLE 3.6: Total Costing Statement

	$	$
Total material sales income		*A*
- Total Collection Expense	(B)	
- Adjustment for Collection Depreciation	(C_d)	
Less Total Collection Costs		*(D)*
- Total Processing Expense	(E)	
- Adjustment for Processing Depreciation	(F_d)	
Less Total Processing Costs		*(G)*
Total Recycling Costs		*(H)*

[2] Using the Coopers & Lybrand/ERRA recycling costing standard

TABLE 3.7: Calculation of Collection Costs

	$
Capital Expenditure	
- Land (premises)	(a)
- Land (drop-off sites)	(b)
- Buildings	(c)
- Collection Vehicles	(d)
- Collection Containers (Banks)	(e)
- Equipment (Collection)	(f)
- Equipment (Other)	(g)
- Promotion (on scheme establishment)	(h)
Total Capital Expenditure	*(C)*
Expenses	
Staff costs	
- Wages and overtime payments	(i)
- Other staff costs	(k)
Transport	
- Vehicle maintenance and repairs	(l)
- Road Tax and Insurance	(m)
- Fuel	(n)
- Vehicle Hire	(o)
- Other	(p)
Site Expenses	
- Rent and Rates	(q)
- Heat, light and power	(r)
- Insurance	(s)
- Maintenance and Repair	(t)
Other Expenses	
- Promotional Information Preparation and Distribution	(u)
- Consumables	(v)
- Office Supplies and Professional Services	(w)
- Telephone and Postage, etc.	(x)
- Other	(y)
Total Expense	*(B)*

Collection Costs

The collection costs are calculated either for a single collection round or for a scheme as a whole as shown in **Table 3.7** above. Promotion costs on the establishment of a new scheme are included since this is often a significant expenditure item and the benefits of such promotion last beyond the first year of operation. Initial promotion costs are therefore capitalised and depreciated over three years.

Total collection costs (D) are then the sum of the collection expenses (B) and the depreciation on the capital costs of collection (C_d).

$$\text{Collection Costs } D = B + C_d$$

Processing Costs

The processing costs are calculated on the basis of a discrete processing operation, such as MRF, irrespective of how many collection rounds feed the processing operation as shown in Table 5.8 The capital costs of processing can be significant, in terms of land and buildings and of the equipment involved, particularly if the processing involves a high degree of automation. The total processing costs (G) are the sum of the depreciated capital cost of processing (F_d) and the associated expenses (E).

$$\text{Processing Costs } G = E + F_d$$

Table 3.8: Calculation of Processing Costs

	$
Capital Expenditure	
- Land	(a)
- Buildings	(b)
- Equipment (processing)	(c)
- Equipment (other)	(d)
Total Capital Expenditure	*(F)*
Revenue Expenses	
Staff costs	
- Wages and Overtime Payments	(e)
- Other staff costs	(f)
Site Expenses	
- Rent & Rates	(g)
- Heat, light and power	(h)
- Insurance	(i)

- Maintenance and repair	(j)
Process Costs	
- Fuel	(k)
- Consumables	(l)
- Storage	(m)
- Maintenance	(n)
- Waste Disposal	(o)
Other Expenses	
- Promotional Information preparation and distribution	(p)
- Office supplies and professional services	(q)
- Telephone and postage	(r)
- Other	(s)
Total Expense	(E)

The Cost of Recycling

Having calculated the costs of collection and processing, a cost per tonne needs to be calculated to allow standardised data to be produced. It must be remembered that not all of the material collected will be retained during the processing operation, so that the post-processing tonnage will be less than the collected tonnage. The costs per tonne are calculated as follows:

$$\text{Cost of collection per tonne} = \frac{\text{Total cost of collection (D)}}{\text{Number of tonnes collected}}$$

$$\text{Cost of processing pr tonne} = \frac{\text{Total cost of processing (G)}}{\text{Number of tonnes processed}}$$

Overall cost per tonne = Total cost of collection & total cost of processing (H)
/Number of tonnes processed

. = (D+G)/t

. = Overall recycling cost/ton

It should be noted that the combined cost of collection and processing is not simply the sum of the cost of collection and the cost of processing /t. See the example below.

Let the:

Cost of collection (D)	=$150,000
Cost of Processing (G)	=$100,000
Number of tonnes collected (t)	=$5,000
Processing rate	=$80%

Therefore the:

Cost of collection/t	=$150,000 /5,000 = $30.- /tonne
Cost of processing/t	=$100,000/(5,000X0.8) = $25.- /tonne
Overall recycling cost/t	=$250,000/(5,000X0.8) = $62.50 /tonne

The Net Cost of Recycling

Tables 3.7 & 3.8 and the above discussion of costs per tonne of material report the actual cost of collection and processing. If the collected and processed material is sold for reprocessing an income received from such sales, when this income is set off against the gross costs of collection and processing, we have the net cost of recycling, since the costs of reprocessing have already been reflected in the price offered for the recyclable material (as discussed above).

Allocation of Costs to Specific Materials

The application of the above method of calculating the cost of recycling is straightforward when applied to a recycling scheme which collects, processes and reprocesses only one material. Examples of such schemes are the collection of glass, cans, or some separated organic material through a kerbside scheme. However, when the collection is of commingled materials which have to be separated in a subsequent processing operation, the problem arises of how to allocate the costs of the collection and processing activities to the different materials involved.

The problem is illustrated by the example shown in Table 3.9. Let us take a kerbside scheme which incurs a collection cost of $25 and a processing cost of $40 per tonne of commingled material. We could allocate these total costs on the basis of material volume or by material weight. However, as the table shows, the different basis for cost allocation result in very different costs of recycling per material.
The simple answer to this problem is that there is no single correct basis for the allocation of recycling costs to individual materials in a commingled material scheme. Some

methods of allocation are more logical than others, for example, volume is more appropriate measure for collection, since this is usually the limiting factor. However, in reality whichever unit of measurement is chosen as the basis of allocation, the material being handled must be capable of being measured in this way.

Table 3.9: Allocation of Costs by Material

	%age by volume	Cost allocated by volume ($/t)	%age by weight	Cost allocated by weight ($/t)
Paper	50	32.50	60	39.00
Glass	10	6.50	20	13.00
Aluminium cans	10	6.50	1	0.65
Steel cans	15	9.75	13	8.45
Plastic Bottles	15	9.75	6	3.90
TOTAL	100	65.00	100	65.00

Given that there is no single correct basis for allocating costs, what is needed is a universal agreement as to which basis is to be used. This may be difficult to achieve, since different methods of allocation will favour different materials, and the industries associated with each material, notably the packaging industries, will argue for the basis which is more advantageous to their material. For example, allocating costs on the basis of weight rather than volume will reduce the apparent recycling costper tonne for aluminium cans and plastics, as illustrated in Table 5.9 above, and vice versa.

This is an area of ongoing research, notably by Coopers & Lybrand, but in the absence of further information and until a common agreement on the basis of cost allocation is reached, a workable proposal based on research conducted in the USA is to allocate costs as follows:

- direct allocation of a cost if only one material is involved, for example labour or equipment which is handling only one material;
- pro-rata allocation on the basis of material weight for equipment used for mixed materials, such as conveyors and for sorting staff;
- allocation by time usage for resources which are used for more than one segregated material, for example if a baler is used 50 per cent of the time for baling plastics and 50 per cent for metals; and
- allocation on the basis of material volume for items such as building storage space.

Avoided collection and disposal savings

As was mentioned earlier, the introduction of recycling can result in decreases in the costs of refuse collection and will result in decreases in the costs of waste disposal. For example, the introduction of intensive bring collection schemes or of a Blue Box kerbside collection scheme could reduce the amount of the remaining refuse to be collected so much that the weekly collection of refuse could be reduced to a fortnightly collection, with an obvious reduction in refuse collection costs. This poses the question as to whether such a saving, the so-called avoided collection saving, should be attributed to recycling or to refuse collection. The same question arises when savings arise as a result of avoiding disposal as a result of recycling.

This concept of avoided collection and disposal savings is one which is often misunderstood. The argument for avoided collection and disposal savings being attributed to recycling is based on the fact that if no other method of waste management is used, waste will always have to be collected and disposed of. Waste disposal is thus the base method of waste treatment and the costs of refuse collection and disposal are the base costs which will be incurred. If a system of recycling is introduced which reduces this base cost in terms of collection and/or disposal, then it is argued that this saving should be credited to the new recycling system. However, what must be clearly understood is that this approach simply identifies the relative costs of the two methods of waste management.

This is best explained by way of example. Taking the case of collection first, let us assume the following:

1) a weekly cost of $500 for the collection of 10 tonnes of refuse;
2) a weekly cost of $200 for the kerbside collection of 2.5 tonnes of recycling material; and
3) a cost of $750 if 15 tonnes of refuse were collected once per fortnight.

In the situation where there is no recycling, the refuse collection cost for a two week period would be $1,000. If kerbside recycling were introduced, the collection cost for the same period would be $750 for refuse collection and $400 for recyclables collection - a total of $1,150.-.

The earlier definition of a cost of recycling is any cost which is incurred which is in addition to the costs which would have been incurred for the standard collection of household refuse. In this example therefore, the collection cost for recycling is $1,150.- minus $1,000 or $1.50. If we now consider the concept of a collection saving, we can see from this example that the cost of refuse collection will be reduced from $1,000 to $750, a saving of $250. This saving arises as a direct result of the introduction of recycling, so it would seem reasonable to credit this saving against the cost of recycling collection of $400, giving the same cost of recycling of $150.

Let us now examine an example relating to recycling and disposal. Let us assume the following:

- 10 tonnes of waste to be treated;
- a disposal cost of $20 per tonne;
- a recycling processing cost of $45 per tonne; and
- 2 tonnes of the 10 tonnes of waste is recyclable.

In the situation where there is no recycling, the cost of disposal would be $200. With recycling, the cost of disposal would be $160 and of processing $90, a total of $250. Again using the above definition of a cost of recycling, the processing cost of recycling would be $250 minus $200 or $50. Equally, the saving in disposal costs would be $40, which when credited against the $90 cost of processing, gives a cost of processing of $50.

Both of these examples show that the definition of a cost of recycling being any cost which is incurred, which is in addition to the costs which would have been incurred for the standard collection and disposal of household refuse, automatically takes into account any collection and disposal savings which arise as a result of recycling.

What these two examples also clearly demonstrate is that this definition and the concept of collection and disposal savings, report the cost of recycling relative to those of the basic refuse collection and disposal service. This is not the same as the absolute cost of recycling. In the two examples above, the *absolute* cost of collection for recycling is $400 for two weeks and the *relative* cost $150, and the *absolute* cost of processing is $45 per tonne, compared with the *relative* cost of $25 per tonne.

If we are considering the absolute cost of recycling, therefore, any collection or disposal savings are ignored. If, however, we are interested in the cost of recycling relative to that of disposal, then collection and disposal savings are credited against the absolute cost of recycling. In general, when people talk about the cost of recycling, it is the latter to which they are referring and it is the latter which has been defined as the cost of recycling here. The only time that the absolute costs of recycling are important is when for example a number of recycling schemes are being compared and differences between the schemes in terms of the base costs of refuse collection or disposal could distort the comparison of recycling costs.

The cost of recycling is one measure of the performance of a recycling scheme.

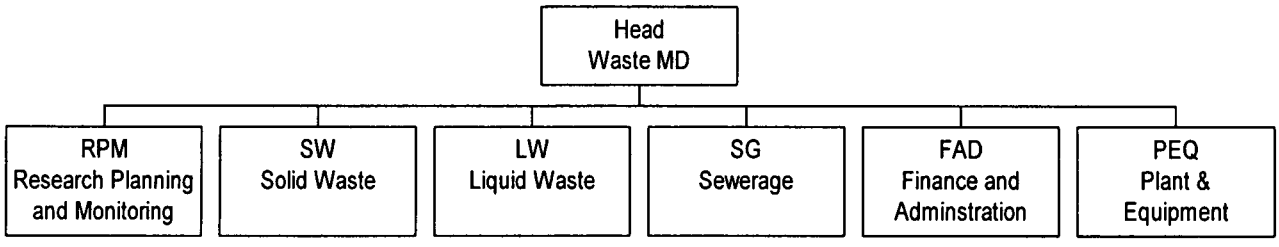
While it is very important, it is not the only measure of performance.

A PROCEDURAL FRAMEWORK FOR THE MANAGEMENT OF COSTS

Organization and Operation of aWMD

Generally speaking WMD are structured as depicted below:

Typical Organogram of a WMD



The activities of the Department are either operations or support services. Operations represent the mainstream of activity: service delivery in solid (collection, transport and disposal or treatment) or liquid waste. Collection would involve block system, house to house, cleansing (streets, parks and drains) and/or central containers. Support/Services are those relating to plant and equipment, research, planning and monitoring, and finance and administration.

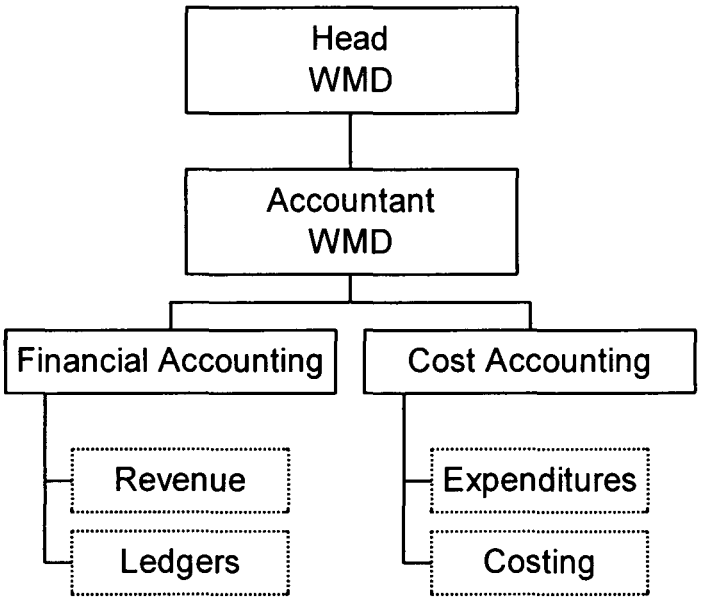
3.5 ORGANIZATION AND FUNCTIONS OF THE COSTING SYSTEM

A subsection in the finance and administration department will be responsible for the costing function with the following functional structure:

The functions of the costing system will be:

- Provide detailed analysis of expenditures.
- Collect and compile cost data on all forms of expenditure of the department.
- Determine periodically the total/unit costs of service delivery and establish a basis for pricing.
- Provide cost information to assist in managerial control of operations and other activities, e.g. decision making and planning and budgeting.
- Ensure that all costs incurred in service delivery are identified and recorded.

Structure of
Cost Accounting Sub-section
WMD



The accountant will perform the following functions

- Ensure that proper documents are obtained to cover all expenditure.
- Help managers to ensure cost control in the department and oversee the costing process and ensure accuracy and reliability of computations.
- Review cost data and determine their accuracy and adequacy for management information.
- Provide relevant cost reports and assist in decision making based on such reports.

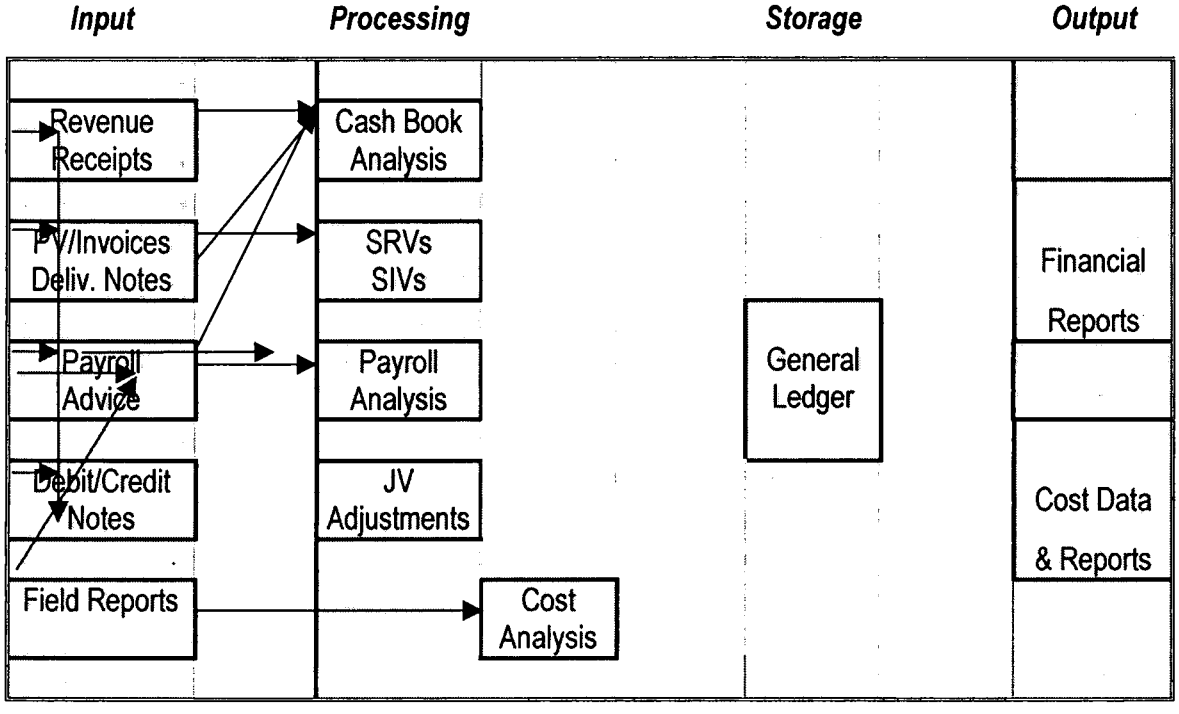
The accounting assistant will perform the following functions:

- Maintain relevant books for expenditure and costing on daily basis.
- Check data compiled elsewhere and accuracy and basis.
- Perform routine computations and compile cost data in format prescribed by the accountant.
- Prepare cost data and reports as and when required by the accountant.

In an integrated accounting system these functions are performed concurrently with financial accounting in the financial accounting records.

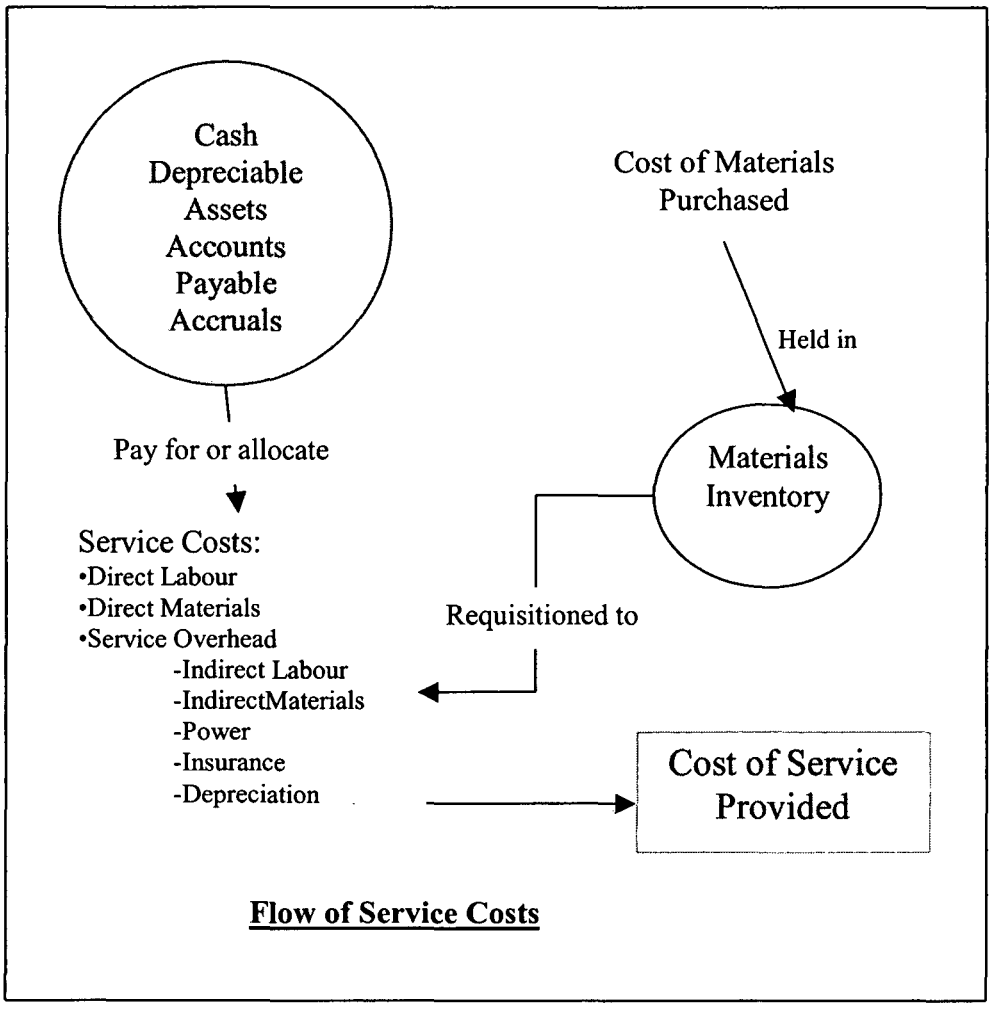
The main components of the system are: input (documentation of expenditures), processing (analysis and computations need to arrive at specific information), storage (keeping of collected data or reports produced) and output (reports and intermediate documents for subsequent processing).

Components of the Costing System



The components of the system reflect the flow of costs as shown below. Cost accounting does not affect the financial accounting system but attempts in parallel to measure and record precisely cost elements as they originate and flow through the service delivery process.

The flow of cost information to ledger accounts is based on source (transaction) documents (input) which are analysed in the journal voucher control system (extensive subsidiary records in the form of control accounts). This does not affect the normal posting of journal entries to the general ledger from which final accounts are prepared. The relationship between general accounts and cost accounts is also shown below.



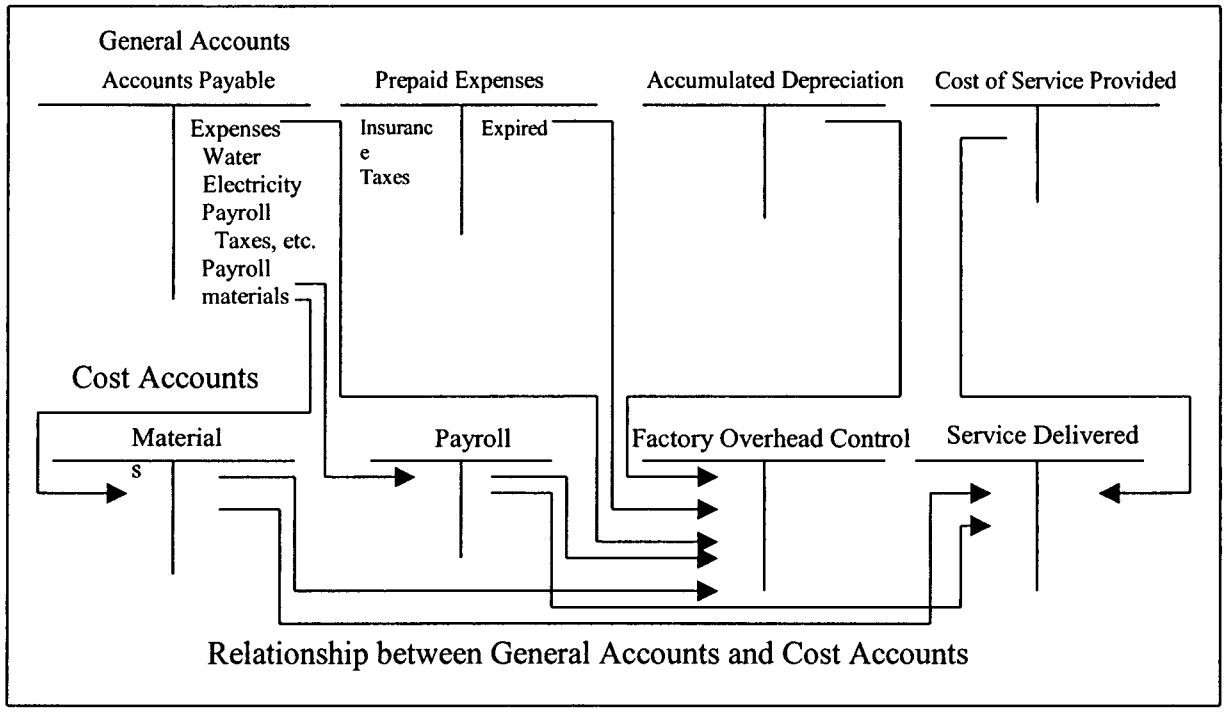
Flow of Service Costs

3.6 THE RECOGNITION OF COSTS

To identify a cost – whether it should be charged to an activity – the accrual/matching principle will be the basis rather than the cash approach adopted by the municipalities. Source documents like invoices and notes are more important than cheques – especially when payments are advanced or delayed.

Cost Elements

Costs incurred by a unit are either direct (mainstream of operations) or indirect (support units or overheads). Costs are either incurred in the operations or in the support services. But the *operations* comprise direct and indirect costs: being *direct* labour, material or other expenses (eqipment rentals, contracts fees, cleansing material, or PPE); or *indirect* (operational overheads) being insurance on vehicles, vehicle licences, truck depreciation, tyres, repairs, and routine maintenance, etc. All *support* expenses are treated as overhead.



Relationship between General Accounts and Cost Accounts

Cost Centres

Cost centres are the basis to charge or accumulate expenses and they correspond to the general strucutre of the WMD. They constitute the primary level cost centre. The secondary level is arrived at by analysis of the first level: segments or subsections of the primary category. Further analysis of the second level will result in the third level. These are usually accumulating centres for direct costs, assets employed and capsules of miscellaneous costs. The purpose of the third level is to enable close monitoring of expenditures on majoe assets and workstations. Codes are then allocated to cost centrers as shown below.

The cost centres are are shown in the tableau below.

Cost Centre Structure

The Dept	Sections	Sub-sects /Services	Major Assets /Capsules
WMD	R	00	01
	Q	10	02
	S	20	03
	L	30	04
	G	40	05
	F	50	06
		60	07
		70	08
		80	09
		90	10
			11
			12
			...
			99
Example: The Dept	Solid Waste	Container Service	Multilift GV 2213R

	First Level	Second Level	Third Level
1	*Research, Planning, Monitoring and Public Relations Section*	Research	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Other Items
			Miscellaneous
		Planning	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Other Items
			Miscellaneous
		Monitoring	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Other Items
			Miscellaneous
		Public Relations	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Other Items
			Miscellaneous
		General	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Other Items
			Miscellaneous
2	*Plant and Equipment Section*	Fleet Management	Furniture/Fittings/Office Equipment
			General Vehicles
			Buildings/Structures
			Other Items
			Miscellaneous
		Workshop	Furniture/Fittings/Office Equipment
			Machinery and Equipment
			Buildings/Structures
			Loos Tools
			Other Items
			Miscellaneous
		General	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Other Items
			Miscellaneous
3	*Solid Waste*	Landfill 1, 2, ...	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Operational Vehicles
			Machinery and Equipment

			Other Items
			Miscellaneous
		Compost Site 1, 2, ...	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Operational Vehicles
			Machinery and Equipment
			Other Items
			Miscellaneous
		House to House Service	Buildings/Structures
			Operational Vehicles
			Machinery and Equipment
			Other Items
			Miscellaneous
		Container Service	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Other Items
			Miscellaneous
		Cleansing Service	Buildings/Structures
			Operational Vehicles
			Machinery and Equipment
			Other Items
			Miscellaneous
		Private Sector (Cleansing, Container,...)	Operational Vehicles
			Machinery and Equipment
			Other Items
			Miscellaneous
		Shared Operational Vehicles #	
			Operational Vehicles
		General	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Other Items
			Miscellaneous
4	*Liquid Waste*	Treatment Plant 1, 2, ...	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Operational Vehicles
			Machinery and Equipment
			Other Items
			Miscellaneous

		Desludging Service	Buildings/Structures
			Operational Vehicles
			Machinery and Equipment
			Other Items
			Miscellaneous
		Public Toilet Service	Buildings/Structures
			Other Items
			Miscellaneous
		Private Sector	Operational Vehicles
			Miscellaneous
		General	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Machinery and Equipment
			Other Items
			Miscellaneous
5	*Sewerage*	Reticulation Zones 1, 2, ...	Buildings/Structures
			Operational Vehicles
			Machinery and Equipment
			Other Items
			Miscellaneous
		Pumping Station 1, 2, ...	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Operational Vehicles
			Machinery and Equipment
			Other Items
			Miscellaneous
		Treatment Plant	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Machinery and Equipment
			Other Items
			Miscellaneous
		General	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Machinery and Equipment
			Other Items
			Miscellaneous
6	*Finance and Administration*	Finance	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Machinery and Equipment
			Other Items
			Miscellaneous

		Admin.	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Machinery and Equipment
			Other Items
			Miscellaneous
		HOD's Office	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Machinery and Equipment
			Other Items
			Miscellaneous
		General	Furniture/Fittings/Office Equipment
			Buildings/Structures
			Machinery and Equipment
			Other Items
			Miscellaneous

General: provides a capsule to accumulate overhead costs which are shared between units/sub-sections within a station.

Other Items: This should capture any asset group not identified here but may exist in a particular WMD

Miscellaneous: Where an expense is not a direct cost and is not a maintenance or repair of an asset it should be captured under "Miscellaneous". Examples are Staff Costs (salaries of managers and supervisors, overtime for supervisors, travelling and transport, medical, welfare, special allowances, housing, and training); Utilities/Services (water, electricity, telcommunications, postage, e-mail); Administrative (entertainment, donations, cleaning, stationery and printing, publicity); and other (other miscellaneous items not listed here).

Shared Operational Vehicles: A capsule of operational vehicles frequently shared by the various cost centres in both Solid Waste and Liquid Waste segments. Examples are tippers, and payloaders. Costs accumulated here should be apportioned to General under the two segments.

Account Codes

The costing system is integrated with the financial accounting system. As a result, the account codes used for line expenditure items (Accra Assembly) in the computerised *chart of accounts* apply.

Expenditure Line Item Codes

The expenditure items should correspond to the Budgetary Framework itemisation. Group and individual codes should be the same as used in the computerised accounts, e.g.

Personal Emoluments	71
Salaries	71-01
SSF Contribution	71-06
etc.	

Cost Centre Codes

Codes for the cost centres are

1st Level: One alphabetic character.

Cost Centre		Code
1.	Research, Planning, Monitoring and Public Relations Section	R
2.	Plant and Equipment Section	Q
3	Solid Waste Section	S
4	Liquid Waste Section	L
5	Sewerage Section	G
6	Finance Section	F

2nd Level: Two digits (00-99) where each code represents a service type like Container Service or a workstation like Treatment Plant depending on the section involved.

	Cost Centre	*Code*
1.R	Research – Solid Waste	01
	Research – Liquid Waste	02
	Planning – Solid Waste	11
	Planning – Liquid Waste	12
	Monitoring – Solid Waste	21
	Monitoring – Liquid Waste	22
	Public Relations	30
	General	90
2.Q	Fleet Management	10
	Workshop	20
	General	90
3.S	Landfill 1	01

	Landfill 2	02
	Landfill 3	03
	Composting Plant 1	11
	Composting Plant 2	12
	House to House Service	20
	Container Service	30
	Cleansing Service	40
	Private Sector (House toHouse)	51
	Private Sector (Container Service)	52
	Private Sector (Cleansing Service)	53
	General	90
4.L	Treatment Plant 1	01
	Treatment Plant 2	02
	Desludging Service	10
	Public Toilet Service	20
	Private Sector 1	31
	Private Sector 2	32
	General	90
5.G	Reticulation Zone 1	10
	Reticulation Zone 2	11
	Reticulation Zone 3	12
	Pumping Station 1	21
	Pumping Station 2	22
	Pumping Station 3	23
	Treatment Works 1	31
	Treatment Works 2	32
	Treatment Works 3	33
	General	90
6.F	Finance	10
	Administration	20

HOD's Office	30
General	90

3rd Level: Three digits (000 – 999)

- The first digit indicates the cost type involved, whether a direct cost (0-3) or an overhead (4-9).

Type of Cost	*Item*	*Code*
Direct Costs	Fuel	0
	Other Materials (Non-fuel)	1
	Labour	2
	Expenses	3
Overheads	Repairs and Maintenance	4
	Insurance, Licences and Depreciation	5
	Miscellaneous	
	Staff Costs	6
	Utilities	7
	Administrative	8
	Other	9

- The last two digits (01- 99) identify uniquely the asset by use or in respect of which costs are incurred.

Where the cost is not linked to a specific asset the last two digits are "00".

Detail Codes for the 3rd Level (last two digits)

	Asset Group	Item	Code
0	Non-Asset linked		00
	Furniture/Fittings/Office Equipment	By rooms/location	01–09
1-2	Machinery/Equipment	Generators	10-29
		Spraying Equipment	
		Welding Equipment	
		Other	
3	Buildings/Structures	Block A, Fuel Store, etc.	30-39
4-6	Operational Vehicles	Multilifts Roll-on-roll-off	40-69
		Suction Tankers	
		Compactor Trucks	
		Tippers	

		Pay Loaders	
		Bulldozers	
		Tractors	
		Power Tillers	
		Mobile Sieving Drums	
7-9	General Vehicles	PR Van	70-99
		Pick-up	
		Buses	
		Motor Cycles	
		Other	

The Codes for the 3rd level cost centres have been set broadly for readily identifiable groups of assets. Specific codes should be allocated according to the number or quantities of items in each group. This is especially necessary in categories 4-6 and 7-9. Each vehicle, for example, should have a unique code.

Examples of codes

	Expense Item	**Cost Centre Code**
1.	Wages of a Container Service Driver	S-30-200
2.	Repair of Generator A at Treatment Plant 2	L-02-410
3.	Repair of Generator B at Treatment Plant 2	L-02-411
4.	Medical for Administration Staff	F-02-600
5.	Telephone Bill	F-90-700
6.	Electricity Bill for Landfill 1	F-01-700
7.	Protective Clothing for all LW Labourers	L-90-900
8.	Repair of Staff Bus GV1289N	Q-10-470
9.	Repair of Compactor GV1288N	S-20-440
10.	Depreciation of Compactor GV1288N	S-20-540
11.	Fuel for Compactor GV1288N	S-20-040
12.	Tyres for Compactor GV1288N	S-20-440
13.	Stationery for SW Office	S-90-800
14.	Out of Station Allowance for Desludging Field Supervisor	L-10-200
15.	Out of Station Allowance for LW Manager	L-90-600
16.	Tyres for Septic Clearing Truck GV1006A	L-10-445
17.	Tyres for Septic Clearing Truck GV1006A	L-10-545
18.	Depreciation of HOD's Office Block	F-30-530

4 TREATMENT OF COSTS

Direct Costs

Direct costs relate only to main stream operational activities. Accounting transaction entries should be made direct to the relevant account code provided for each sub-section.

In some cases trucks and other inputs are used to work in more than one service zone. In such cases the direct costs should be apportioned on day-to-day basis to the relevant zones immediately *before* entering them into the books so that the appropriate portions go direct to the relevant account codes. Direct costs should not be pooled for apportionment later.

Apportionment should be on the basis of relative distances covered or time spent on the number of service points cleared. Whichever method is adopted should be applied consistently.

Overheads

Whencosting an item (whether a service delivered or for a section of the department)care should be taken to include an appropriate share of indirect or fixed costs or overheads. This share of overheads should be determined on an equitable basis.

Allocation and Apportionment

Allocation is the process by which cost items are wholly charged directly to the cost unit or to a cost centre because it can clearly be identified with that cost centre or unit.

Apportionment is the process by which cost items or cost centre costs are divided between two or more other cost centres.

When an expense can unambigously be identified with a cost centre the whole of the amount involved should be charged to that cost centre – by allocation. On the other hand, where a number of cost centres are identified it should be apportioned between them fairly.

Costs to be allocated: allocation of costs wherever they may be will automatically be accomplished as and when entries are made, given that suggested coding is done and applied properly.

Costs to be apportioned: apportionment should be applied to costs accumulated under "General". Since "General" is a pool of different expense items the basis of apportionment chosen should fairly reflect weighted consumption rates by the

sub-sections involved. The following will provide a guide to arriving at a fair weighted average.

Expenditure Type	Basis for Apportionment
Emoluments of managers	Relative time spent on sub-section
Telecommunication	Number of INTERCOMS AVAILABLE
Cleaning and Sanitation	Estimated floor space occupied
Depreciation of Buildings/Structures	Relative area of the strucutre occupied
Etc.	

Description

Major assets used by the MA, like trucks, buildings, structures, etc. should be depreciated systematically and appropriate portions included in the cost build-up of operations.

Entry Values: the principles mentioned under Stores Control (Transitional Arrangements) below should be applied for establishing entry values to be used.

Method: The depreciation policy adopted should be agreed upon by the management of the department. For simplicity, the straight-line method should be used and applied as follows:

C/Y, where, C= Capital cost (or entry value) of the asset; Y= Number of years of economic useful life.
The Residual Value of the item is assumed to be nil.

Absorption

Absorption or "full" costing should be used to determine the unit costof service. Under this method all overheads wherever incurred by the department should be added (absorbed) unto the unit cost. This will give a complete picture of the full costofservice delivered.

Different absorption basis should be used if necessary for different sections so that charging of overheads will be equitable and the full cost of service will be representative of the cost of effort and resources put into it.

Basis for Absorption: The basis on which to absorb overheads may be:

i) Rate per machine, or ii) Percentage of direct labour cost.

Absorption Rates: Absorption rates should be set in advance. These pre-determined rates should be based on budgeted expectations of cost and activity for the ensuing period.

1st Step: estimate the overhead which is likely to be incurred during the coming year. (This will be done during the ususal annual budgeting. Applicable estimates are those approved by the Local Assembly).
2nd Step: estimate the level of activity. This will be the quantity or volume of waste planned to be lifted, the total number of hours of machinery input, etc.
3rd Step: divide the budgeted overhead (1) by the budgeted activity level (2).

- *Machine/Truck-hour rate should be used for Q cost centre overhead*
- *Percentage of direct labour cost should be applied to R, and F cost centres*

Example 1:

Assume the Assembly's approved budget for WMD for 1999 showed:

Budgeted Overheads

	¢ '000
Research, Planning, Monitoring and P. Relations (R)	07,000
Finance and Administration (F)	12,000
Plant and Equipment (Q)	16,000

Budgeted Operations

Direct Laboour Cost D_L	¢ 12m
Truck-hours	8,000 hrs

Given these figures the amount of overhead from the support cost centres will be:

Truck-hour rate 16,000,000/8,000 = ¢ 2,000 per hour for Q overhead

Direct Labour percentage 19,000,000/12,000,000 = ¢ 158.3% for R, F, and Q overhead.

Suppose that during the year actual figures for the first week are:

Wages for direct labour	¢ 1.5 m
Truck time	520 hrs

Usingthe above pre-determined rates, the overhead to be absorbed unto the week's unit cost will be:

R & F	= 1.5m x 158,3% = ¢ 2.345 m
Q	= 520 x 2,000 = ¢ 1.04 m

Over/Under Absorption

Because overhead absorption or recovery is based on estimated rates it is most likely that the amount absorbed will be more or less than the actual overheads incurred for the period. This situation will occur if:

a. Actual overhead expenses and/or
b. Actual activity level

are different from the budgeted amounts.

When this occurs the absorbed amount should be adjusted to agree with the actual amount incurred. The adjustment should be done at the end of the accounting period.

5 ACCUMULATION OF COSTS

Basic Procedure

Having established the relevant absorption rates the following procedure should be used in building up the total (or unit) cost of service provided.

Use the Cost Sheet (Form 1) below.

a. Ascertain and charge the items of prime cost
The prime cost cosists of:
- Direct Labour Costs
- Diect Material Costs
- Direct Expenses

See Costs in the operations sections (Direct Costs)

b. Charge the appropriate amount of operational overhead
See Costs in the operations sections (Indirect Costs or Operational Overheads)

c. The sum of (a) and (b) is the full operational cost of service delivery.

d. Charge the appropriate amount of support sections' overhead.
At this point use the required absorption rates (pre-determined) and find the respective overheads to be absorbed as illustrated in Example 1 above.

e. The sum of (c) and (d) is the total cost of service

The unit cost is found by dividing the total cost by the number of units involved – tonnes, kilometres, etc.

Unit of Cost

The unit of cost should normally be per tonne (solid waste), m3 (liquid waste) and kerb m (for cleansing). Other units of cost may be required from time to time according to the decision making needs of the department: being per capita, kilometre, household, etc.

Segmented Operations

Some of the department's operations involve clearly segmented stages. For example, operations on Sewerage go through clear stages like Reticulation Unit, Pumping Station and the Treatment Station. Costs at these points should be collected and processed separately before combining them to obtain the total for the whole process. The cost format should be the same as shown in Form 1 below.

Special Jobs

The department may occasionally have to perform some jobs on order. For example, a request from a private Waste Collection firm.

Job Estimates: Before any job is given final approval, an estimate of cost should be prepared by a team comprising:

The Operations Manager, (Solid, Liquid or Sewerage) and
The Accountant.

The Operations Manager will prepare a Bill of Quantities for the job. The Accountant will furnish with the relevant cost data for a draft costing. This should then be discussed by the two before submission to the HOD for finalization and approval.

Estimates should be based on current or prospective market prices, as the case maybe. The cost build-up should follow the format outlined in Section 6.1. The appropriate absorption or overhead recovery rate should be applied. Existing ascertained costs may provide a guide.

A *contingency* component should always be included.

Once the job begins, cost data should be collected on existing forms and should be analysed for comparison with the initial estimates. Significant variances should be explained (Form 11).

STORE CONTROL

An efficient stores management is an important ingredient for an effective costing system. Stores must therefore be controlled with optimum diligence.

Receipts and Issues

Procedure for receipts and issues of stocks should be maintained. Stores Receipts Voucher (SRV) or Goods Received Note (GRN) Form 2 and Stores Issue Voucher (SIV) (Form 3) as well as Tally/Bin Cards (Form 4) should continue to be used.

Issues from stores should be initiated through approved requisitions (Form 5). The practice of "emergency" purchase for immediate use at source should be discouraged. Such purchases should be routed through the storekeeper for the proper documentation to be made.

Perpetual and Continuous Inventory

Perpetual inventory system should be used. This is where store balances are recorded after every receipt and issue of materials, so that balances of stock at any time can be ascertained from the books immediately.

This system shouldbe used in conjunction with the system of Continuous Inventory, under which stock balances are physically checked at frequent, irregular intervals.

- A *few* items should be checked each day,
- Items to be checked should be selected at *random*,

- All items should be counted at least once a year and certain items twice or more times,
- All discrepencies should be investigated and noted for further action if necessary.

Annual Stock Taking

At the end of every accounting period *all* stocks on hand should be counted. Counting should be meticulous and should involve staff of the Finance Section. The External Auditor should be notified in advance to observe if he so desires. Physical stocks should be checked against book balances and differences recorded for subsequent investigation.

Stock Sheets (Form 6) should be completed and signed by stock takers.

Stock Valuation

The stocks on hand should be valued at the end of the year to confirm issues made. Valuation should be on the basis of "First-In-First-Out" (FIFO).

After valuation, a *priced* Stock Sheet should be prepared and a copy sent to the External Auditor.

Price List: A price list of all items of stock should be compiled by the Costing Unit.

Transitional Arrangement: It will be found at the commencement of this costing system that, the items of stock in the stores do not have readily available book values. It is thereofre, necessary to count all items in stock at the commencement date. The Accountant, in conjunction with the Storekeeper and with the approval of the Head of Department, should establish entry values for these items using Replacement Cost.

Where stores are kept at a central point for the whole MA, stocks requistioned from there should be given values in a similar manner.

For subsequent receipts and issues, actual costs should be used for the price list.

Stores Ledger

The Costing Unit should maintain a Stores Ledger. Accounts of all items of stock should be kept in this ledger. Each stock item will have a separate account. Informationon the account is the same as what the storekeeper records on the corresponding Tally/Bin Card, with additional columns for money values (Form 7). The received (Debit) side is completed from the SRV and the related Invoices, the Issues (Credit) side from the Requistions or SIV.

6 REPORTS

The following Reports/Returns should be submitted:

Document	*By*	*To*
Daily		
1. Log Book (Form 8)	Driver	TO
2. Landfill/Treatment Works Report (Form 13)	Supervisor	Mgr/A
Weekly		
1. Weekly Performance Report (Form 9)	TO	A/C
2. Fuel Issues Summary (Form 12)	Fuel Depot-Keeper	A/C
3. Cost Sheet (Form 1)	A/C	Mgt
Monthly		
1. Cost Sheet (Form 1)	A/C	Mgt
2. Operating Cost Statement (Form 10)	A/C	Mgt
Quarterly		
1. Cost Sheet (Form 1)	A/C	Mgt
2. Operating Cost Statement (Form 10)	A/C	Mgt
Yearly		
1. Cost Sheet (Form 1)	A/C	Mgt
2. Operating Cost Statement (Form 10)	A/C	Mgt

Besides these standard Reports other Reports may be prepared as and when required.

6.1 BUDGETING

The Cost Accounting can, and should, be made to play a key role in the budgeting process. Where costing is effective, data for budgets and other planning requirements are more reaadily available. Cost Accounting deals with actual, historical figures while Budgeting looks at the expected future costs.

Information gathered from the costing apparatus should therefore form the basis for building up the budget.

Outline Procedure

i. Although the limiting factor in the whole MA's budget is Revenue, it is more appropriate for the department to start its budget by working out its expected expenditures or costs.

ii. Management must first establish its objective for the plan period. That is, the level of activity it intends to perform.

iii. Programmes for all segments of work involved shouldbe mapped out.

iv. Resources (Bill of Quantities) for the various programmes should then be planned, costing information on input quantities is prepared. Relevant cost data from the costing system is useful. Itshouldbe recognized that cost data is historical and should therefore be further processed to obtain *expected* costs for the plan period. Realistic assumptions should be made to take into account such environmental factors as inflation, foreign exchange rates, market forces, etc. Variouscost estimation techniques used in costing can be applied.

From the above, the relationship between Costingand Budgeting is quite clear. Indeed, not only does Budget utilize input from the costingsystem, the former in reverse uses input from the latter. Budgeted activity levels and budgeted overheads are used to compute the absorption or overhead recovery rates discussed above.

Budgetary Framework: The Budgetary Framework provided by the Ministry of Local Government should be adhered to as much as possible in the preparation of Budgets. It provides principles and guidelines for budget preparation as required of the Assemblies.

Budgeting Cycle: The following timetable maybe adopted for the department's Budgeting

The following timetable may be adopted for the Department's Budgeting Cycle:

1.	1st June	HOD circulates Budget Holders to commence preparation of next budget beginning with current mid-year revision.
2.	End of July	First estimates ready
3.	1st week of Aug.	Budget Committee (BC) calls for justification of budgets by respective BHs.
4.	3rd week of Aug.	Accountant completes collation of proposals and submits department's draft budget for review by the BC.
5.	End of August	BC reviews and comes out with final draft budget.
6.	1st week of Sept.	HOD submits budget to Metropolitan/Municipal Chief Executive
(This should be done even if instruction from Head Office has not come yet)		

7.	October	Review and revise budget in the light of new developments from Head Office.
8.	December	After Assembly's service fee-fixing resolution revise budget again to reflect funds available.
9.	End of December	Final approval of budget should be ready.

Use of Computers

Computers can be used advantageously in the costing and budgeting process. Spreadsheet ready application software can be particularly handy. It can be used for:

- Detailed computations required in costing.
- Several columns of analysis at the same time.
- Templates designed in specific formats. These can be retrieved whenever required and readily used for periodic reports.
- Budgeting models linking together base data, quantified assumptions, functional (subsidiary) budgets, cashflows, and the master budget.
- Cost estimation using a variety of techniques better handled by the computer than manually.

Enhanced presentation of Cost and Budgetary Reports can be done on various computer programmes.

7 SPECIMEN FORMS, REPORTS AND DOCUMENTS

FORM 1: COST SHEET [3]

Location: ***Date:***
Service Type:

Volume Lifted ***Distance Covered:***

	This Week/Month		Last Week/Month
	Total	Per Unit	Per Unit
Direct Materials			
Fuel			
Other			
Total Materials			
Wages			
Direct Expenses			
Prime Cost			
Operational Overhead • Repairs and Maintenance of Trucks/Equipment • Staff Costs • Insurance and Depreciation of Trucks/Equipment • Utilities • Other			
Operational Cost			
Administrative and General Overhead			
RPM FAD PEQ			
Total Service Cost			

[3] Computer generated report, if system exists

Form 2: STORES RECEIPT VOUCHER

Supplier: ***Date:***

L.P.O. Nr.:

	Quantity	Description	Remarks	

Instructed by: ..... Received by: .....

Form 3: STORES ISSUE VOUCHER

	Section:			*Date:*	
Quantity	**Description**	**Stock Code**	**Rate**	**Total Cost**	**Remarks**

Issued by: ..... Cost by: .....

Received by: ..... Checked by: .....

Form 4: TALLY/BIN CARD

Item: *Stock Nr.:*
Unit: *Minimum Stock:*

Date	Issued to/ Received from	Invoice/ Requistion Nr.	Receipts	Issues	Balance	Sign.

Form 5a: MATERIALS REQUISTION

Requistion to: *Date:*
Please, Supply to: *Cost Centre Code:*

S/N	Description	Stock Code	Unit	Qty.

Prepared by: ..... Approved by: .....

Form 5b: FUEL/LUBE REQUISTION

Section: ***Date:***

Vehicle/Equipment:

Quantity	Details	Odometer Reading	Distance

Approved by: ..... Issued by: .....

Form 6: STOCK SHEET

Date

S/N	Item	Physical Quality	Book Quantity	Difference	Remarks

Storekeeper: ..... Checked by:
.....

Officer Counting: .....

Form 7: Stores Ledgr Account

Item: *Min. Level:*
Code:

Date	Received				Issues (Cr)				Balance	
	SRV	Qty	Price	Amt.	SIV	Qty	Price	Amt.	Qty	Amt

Form 8: VEHICLE LOG BOOK

Vehicle Nr.

Date	Officer	Sig.	Trip		Time		Odometer Reading		Distance	Fuel	Oil
			From	*To*	*From*	*To*	*From*	*To*			

Form 9: Weekly Performance Report

Vehicle Nr.	Fuel	Nr of Trips	Vol. Lifted	Distance	Remarks
1					
2					
3					
4					
5					
Etc.					

Officer in Charge: ..... Date: .....

Form 10: OPERATING COST STATEMENT

Month: ***Date:***
Total Volume Lifted: ***Total Distance Covered:***

	This Week/Month		**Last Week/ Month**
	Total	*Per Unit*	*Per Unit*
Direct Materials: Fuel Other			
Total Materials			
Wages			
Direct Expenses			
Prime Cost			
Operational Overhead: • Repairs and Maintenance of trucks/equipment • Staff Costs • Insurance and Depreciation of trucks/equipment • Utilities • Other			
Operational Cost			
Administrative and General Overhead RPM FAD PEQ			
Total Service Cost			

This report is computer generated if computerized system is used.

Form 11: Special Jobs

Job: ***Date:***

Location:

Time Started: ***Time Completed:***

Total Volume Lifted: ***Total Distance Covered:***

	Actual	Estimates	Variance
Direct Materials			
Fuel			
Lubricant			
Other (Specify)			
Total Materials			
Direct Labour			
Specify Staff			
Direct Expenses			
Prime Cost			
Operational Overhead			
Admini. & Gen. Overhead			
Total Cost			

Form 12: WEEKLY FUEL ISSUES SUMMARY

Opening Stock Balance: *Closing Stock Balance:*

Date	Vehicle Nr.	Quantity	Remarks

Signature: .....

Form 13: LANDFILL/TREATMENT STATION REPORT

Location/Site: *Date:*

Veh. Nr.	Driver	Arrival Time	Waste Type	Tonnage	Remarks

Signature: .....

Next Step

1 Test your comprehension of the information by answering the questions below, discuss them with the group, and compare with the answers are suggested at the and of the pamphlet

QUESTIONS:

1. What typical cost of solid waste service applies to your region?

2. What measures can be adopted to improve budgetaryand accounting systems for MSWM?

3. What do you think are the factors responsible for poor financial management and control in your locality?

4. Why is an effective financial management and information system needed?

5. What are the main weaknesses of the budgetary system?

6. What are the main deficiencies of municipal accounting systems?

7. what are the main functions of a WMD accountant?

8. What is the definition of "Level of Service"? Do you think you will need proper cost accounting to make judgements on the elvel of service?

Answers

1. A general indicator can be seen in the following table:

Type of Service	Typical Range of Cost (US$/T)
Disposal	1- 3.5
Transfer	4 – 10
Collection	15 -30
Street Sweeping	30 – 60

2. These may comprise the following (See the cost accounting section):

   i. Adoption of a unified organizational strucutre with a parallel budgetary allocation system.
   ii. Create separate cost and responsibility centres, each managed by a manager responsible for service provision,financial control, monitoring and evaluation of performance, preparation of an annual budget and accountable for service quality and costs.
   iii. Strucuture financial information systems along cost centre lines and establish separate accounts for each cost centre.
   iv. Systemtically collect physical and financial performance data needed to estimate costs and review performance of each MSWM component (i.e. collection, transport, etc).
   v. Make the MWM agency responsible for revenue collection.

3. The reasons can be traced to lack of sound management and reliable information which may lie along the following:

   i. Poor organizational arrangements
   ii. Poor budgetary systems
   iii. A lack of accountability and transparency
   iv. Poor accounting systems
   v. Poor revenue collection systems
   vi. A lack of suitably qualified personnel

4. These are necessary for:

   i. Focusing responsibilty and accountability for service costs and quality.
   ii. Preparing statutory financial statements and accounts.

iii. Establishing full service costs.
iv. Establishing the adequacy of revenue sources.
v. Establishing the strucutre and levels of user charges.
vi. Demonstrating a capacity to meet financial obligations, such as debt service.
vii. Monitoring and evaluating service quality, costs and performance.
viii. Involving the private sector in the provision of MSWM services, and
ix. Future planning.

5. The main weakness of the budgetary system is the fragmented organizational arrangement, hence the absence of a consolidated budget for MSWM which makesit difficult to measure performance, relate physical output to financial application of funds or to make cost estimates. Other deficiencies in a budgetary system may include:

i. Allocations are made to departments on a line-item basis (all personnel) ratherthan on an activity or functional basis. Departments with multiple responsibitlity makes it even more difficult to measure performance or actual costs.

ii. Budgeting is trnd-based, governed by past allocations rather than future projections. Allocations and extrapolations on committed expenditures (e.g. personnel) create serious misallocations.

iii. Committed expenditure (personnel, O&M) make a significant share of expenditures and contribute to the rentier attitutde towards work and rigidity in responding to new programmes and service expansion. Changes in population (school turnout) are responded to by more planned posts than adjustment to service efficiency and need.

6. Municipal accounting systems fail to allow the costs or efficiency of MSWM service to be evaluated. Costs are subsumed in the municipality's chat of accounts making it impossible to establish direct costs associated with MSWM. With the absence of cost and revenue required tofinance the service itbecomes impossible to measure efficiency, performance, focus accountability for service costs, efficiency and quality. Other deificiencies are:

Accounts are often on cash rather than accrual basis.

i. Cash basis makes it difficult to make reliable cost estimates – especially accounting for capital costs. Ability to improve on service will be impossible, if full costs are not known and annual or periodic comparison is not possible.

ii. Aggregate cash-basis accounting provides inadequate basis to gauge overall performance in terms of value of money for service provided.

iii. Poor budgetary systems does not allow working financial statements like the balancs sheet income statement and flow of funds statements.

iv. Asset and cost registers specific to MSWM tend not to be kept.

v. Lack of computerized information systems made it difficult to obtain accurate information.

vi. Lack of accountability makes it difficult to press costs downwards, hence no incentive to be cost effective. Rentier attitude of employees and loos public money perceptions are equally responsible and causing persistence of the, otherwise, undsirable system.

7. The accountant will perform the following functions

i. Ensure that proper documents are obtained to cover all expenditure.
ii. Help managers to ensure cost control in the department and oversee the costing process and ensure accuracy and reliability of computations.
iii. Review cost data and determine their accuracy and adequacy for management information.
iv. Provide relevant cost reports and assist in decision making based on such reports.

8. The level of service refers to the quantity and quality of the waste collection service, the efficiency of waste handling and treatment and the waste disposal operation. Sometimes the level of service is considered only in terms of collection and, thus, taken ot cover: coverage, frequency and schedule. L of S cannot be set in isolation from likely costs (at least cost recovery objectives) and affordability (supplementedby studies on ability and willingness to pay).

Yes. It will be futile or too compromising to deal with service plans in the absence of a proper cost system.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UP-DATED TRAINING MANUAL OF WASTE MANAGEMENT IN HIGH DENSITY AREAS OF THE AFRICA REGION

MODULE 4.
FINANCING MUNICIPAL WASTE MANAGEMENT

Contents:

1. FINANCING MUNICIPAL WASTE MANAGEMENT

1.1 INTRODUCTION

One of the most important decisions facing those cities which provide municipal waste services is the funding of operations and capital costs of the service. The basic question that must be answered is deceptively simple: How should the costs of publicly provided goods and services be apportioned among the residents of the jurisdiction? Below we address this question with reference to budgetary funding and with special emphasis on user charge financing. After describing alternative methods of financing and existing financing practices, we analyse the case for user charges. As mentioned before the importance of theme relates to how we are going to select financing methods such that the service provided is broader. Use of private sector as well as NGO initiatives and resources are recommendable within this framework. Awareness on the part of citizens is extremely important from the demand side perspective. Awareness is important becausebecause, beyond the recognition of the importance of the service, it promotes appreciation for the efforts and resources involved in providing the service, hence the willingness to pay for it. This will help erode the false impression that publicly provided service is exclusively a government responsibility and, thus, is a free good for the society. A special case for capital costs of MWM is that of large scale waste treatment like those employed for final disposal alternatives e.g. landfills, recycling plants, composting, and incineration. See example at the end of this chapter.

1.2 BACKGROUND INFORMATION

1.2.1 Methods of Financing

Although they vary in many details, three broad types of financing methods can be distinguished: general revenue, service charge, and user charge. General revenue sources are typically used for capital (in the form of equity, loans, grants or subsidies) and WM operations (mostly from recurrent budgets). The last two relate directly or indirectly to the known "polluter pays principle".

In this taxonomy, *general revenue* financing includes several commonly used methods of financing, such as raising fund from *ad valorem* taxes on property, income, sales, and the like; from separate property taxes earmarked for a particular service; or from special assessments. General revenue financing is invested directly in projects at the local level or paid as allocations for operations at the local level.

Municipalities levy *service charges*, flat fees which vary with other characteristics of properties, such as the type of land use or the number of dwelling units in a structure. The

customary term, service charge, is a misnomer because the charge need not vary with the service provided.

There is an important conceptual distinction between these two methods of financing and the third category, user charges. A true *user charge* varies with the type of service provided to a particular user. The distinguishing test is whether the charge varies with the consumer's choice of service. Implicit in our use of the term user charge is the assumption that the consumer has some choice about those aspects of collection service for which charges vary. For example, if a city chooses to collect residential refuse weekly and commercial refuse daily, and to charge the commercial properties more for their more frequent service, we would call the charge a service charge rather than a user charge, because neither user has a choice of the frequency of collection.

The "*polluter pays principle*" is a special case of the user charge discussed bellow. "*Pay-as-you-dump*" is also a special case of the polluter pays principle. It is namely used in Ghana to ensure contribution and collection in high density areas household waste management. See Case Study.

1.2.2 Traditional Sources of Finance: Public (Central/Local Government vs. Private Finance)

Current services in most African countries is restricted to collection, public clean-up and sanitary services (with very limited sewage reticulation coverage and more scattered latrines and simple implements). The available infrastructure is, thus, mainly receptacles, bins and transport equipment and workshops. Apart from few and scattered efforts in some capital cities, disposal and disposal facilities are almost forgotten in most cities in Africa. The traditional trend in Africa is that infrastructure is financed by central governments while operations are financed by the central government's budget allocations as well as by local charges. Contract financing (i.e.initially using private sector own resources to provide the service and then expand) and community participation is limited. We will show the practice in the USA in the sixties as a base for comparison. Although this is not the most relevant example, yet the information has not been reaadily available elsewhere in the African context. Methods of financing in this context will mainly show financing as divided between public sometimes including user charges and contract (private) financing based on organisations (public/other; geographical region; and city size as the discussion below shows). The African examples given rarely display any presence of contract financing or some sort of private sector participation which is an excellent vehicle of funding. Exact figures will be taken from workshop participants' localities and compared to the data given below. This will be reproduced with comments and guidelines in subsequent versions of the Manual.

Table 1.1 presents a summary of a survey on methods of financing contract and publicly financed municipal refuse collection. In 1964 about half of the

jurisdictions surveyed financed collection exclusively out of general revenues. Moreover, although there may be discrepancies between the coverage in the three surveys, there is apparently a trend away from the use of general revenues as a means of financing collection.

Table 1.1: Methods of Financing Refuse Collection, by Organisation, 1956, 1961 and 1964.

Financing Method	*Organisation*				*Total*		
	Municipal only		*All other (PPP, etc.)**				
	1955	*1964*	*1955*	*1964*	*1955*	*1961*	*1964*
General Tax Revenue	71.7%	48.7%	59.2%	51.4%	67.6%	58.6%	50.1%
Service or User Charge	28.1	50.8	40.0	47.9	32.3	41.4	49.4
Exclusively		34.7		35.0		29.0	34.9
Partially		16.1		12.9		12.4	14.5
Other	0.2	0.5	0.0	0.7	0.1	0.0	0.6
Sample size	572	429	277	428	849	307	857

* Excluding jurisdictions with private collection only, but including jurisdictions with both municipal and contract service.

Source: Refuse Collection Practices, Chicago, American Public Works Association, 1966.

The percentage of jurisdictions with some form of either service-or-user-charge financing increased from 32 percent in 1955 to 49 percent in 1964. A similar increase in service- or user-charge financing has occurred in those jurisdictions which provide municipal collection.

From the raw data gathered in the 1961 survey, it is possible to distinguish between jurisdictions imposing service and user charges. Of the 127 jurisdictions which did not finance collection out of general tax revenues, only 25 assessed true user charges against private households. These charges varied with the amount of refuse generated or the type of service chosen, often together with other parameters. Most of the jurisdictions assessing user charges against households were in the western states.

As shown in **Table 1.2**, general tax financing is the rule in the Northeast. In contrast, in the Southwest and West, general revenue financing is far less common. In the western states only one-sixth of the jurisdictions reported financing refuse collection exclusively out of general revenues.

Table 1.2 : Methods of Financing, by Geographical Region.

Region	*General Tax Revenues**	*Service or User Charge*		*Franchise*	*Total**	*Sample Size*
		Exclusively	*Partially*			
Northeast	89	6%	6%	0%	100%	62
Southeast	62	23	14	2	100	65
Midwest	64	20	14	1	100	87
Southwest	29	62	6	0	100	45
West	17	39	9	33	100	64

* Exclusively
** Possible rounding gap.

Source: Lennox L. Moak, Refuse Collection and Disposal Service Charges, Chicago: Municipal Finance Officer's Association, 1961

Financing patterns also vary with city size. **Table 1.3** indicates that in both 1961 and 1964 larger cities relied more on general revenue financing than smaller cities.

Table 1.3 . Methods of Financing Refuse Collection, by City Size

A.1961

*Financing Method**	*Population*			*Total*
	Over100,000	*50,000 to100,000*	*Less than50,000*	
General tax revenues	59.4%	64.9%	52.6%	58.6%
Service or user charge	40.6	35.1	47.4	41.4
Exclusively	21.9	25.8	37.8	29.0
Partially	18.7	9.3	9.6	12.4
Sample size	***96***	***97***	***114***	***307***

* For survey respondents with municipal or contract service.

B.1964

Financing Method	*Population*			*Total*
	Over 100,000	*50,000 to 100,000*	*Less than 50,000*	
GENERAL TAX REVENUES	60.0%	58.0%	47.9%	50.1%
Service or user charge	40.0	40.9	51.6	49.3
Exclusively	25.0	28.0	36.8	34.9
Partially	15.0	12.9	14.8	14.4
Other	0.0	1.1	0.0	0.6
Sample size	**80**	**91**	**677**	**850**

Source: Refuse Collection Practice, American Public Works Association,m1966.

In short, while all three types of financing are observed in practice, general revenue financing is the most common method used, and true user charges are relatively uncommon. In addition, patterns of financing vary by region and city size. Cities outside the West and Southwest are more likely to finance out of general revenues; larger cities in all regions are also more likely to rely upon general revenue financing.

1.3 ALTERNATIVE METHODS OF FUNDING: THE ORGANISATION OF SWM & PRIVATE SECTOR PARTICIPATION *

Private sector participation is a very important vehicle of finance. The private sector can participate mainly either by directly providing services – usually where they are more efficient than L.As, or by directly investing in entities serving the MWM system. The organisation of SWM to facilitate this participation can be looked at from 3 important standpoints:

* This section is adapted from S. Coiontreau, Private Sector Participation in Municipal Solid Waste Services in Developing Countries, IBRD/WB, 1994

- The local authority structure: i.e. MWM service within the local authority like dividing the service into Waste Collection and Waste Disposal Departments, without involving the private sector.
- The Private (Formal and Informal) Sector plus Community Participation with the L.A., and
- Private Sector participation with the public sector.

Of the above three choices we will consider the last one as it establishes the basis for future public-private sector participation and, thus, drawing on the private sector's financial capability and efficiency.

SWM is a ***nonexclusive service*** provided by local authorities, meaning that once it is provided to section of the community it benefits all within the vicinity irrespective of each paying for the service. It is also ***non-rivalled*** because the accrued benefit falls equally on everyone, i.e. it is not possible to exclude those who do not pay and everybody benefits in terms of the improvement in public health, environmental protection and the aesthetic enhancement.

This strict public good nature places the direct responsibility on the local authority, but it does not imply that the local government has to provide the service with their own resources alone. The private sector can be drawn into this so long as they can complement the local authority's resources, given that:

1. The private sector realises a profit over and above their incurred costs,
2. The local government would relatively save money by using the private sector's efficiency (lower cost) and capacity (capital investment),
3. The government, occasionally and in larger project cases in order to realise the point above, may consider public values and address macro-economic issues beyond the market price used by the private sector.
4. The private sector is not a panacea but an opportunity, hence measures of efficiency and monitoring are well in place by the government.

In addition to the above there are several contextual issues which may have to be addressed before deciding eventually whether to involve the private sector in municipal activity in SWM. These briefly include:

Cost Recovery:

- Public goods are not free goods and some activities like tipping, collection or landfill have to be paid for.

Efficiency:

- Public spending is relatively high in poorer countries and provides low returns. In poor countries expenditure for MSW is between 20-50% of total municipal expenditure while the service is only 50-70% (sometimes 20 – 30%) collected from

total waste generated. The private sector may be more efficient in providing some of the SWM services by means of direct comparison.

Public Accountability:

- A municipality is accountable to the public at large, and measures of efficiency have to incorporate elements of equity, satisfactory performance of service, etc.

The Management Context:

- Private sector management may enjoy more flexibility (hire and fire, working time, overtime authorisation, supervision, etc) than the public hand.

The Finance Context:

- In Africa cities are pressed to have enough capital funds to finance their SWM system due to inherited values of inability to raise revenue or political constraints (agenda). Open competition may make possible for the private operators to overcome this hurdle, given their attraction power.

Economies of Scale:

- In most services which can be efficiently provided by the private sector, economies of scale may not exist sufficiently to justify public monopoly. This explicable on technical/capital indivisibility basis on most of the services provided, e.g. collection in low- and high-income areas, transfer systems, sanitary landfills, composting, waste-to-energy, etc.

The Legislative Context:

- The private sector will invest, e.g. in sanitary landfill, if they are aware that environmentally sound safe disposal is not only required by law, but also enforced by penalty; that government procurement regulations exist and are fairly administered. Foreign private investment and know how may have to be attracted in a similar manner, as well.

The Cost Context:

- At first glance a private sector cost would seem lower than a public authority's cost even if private sector performance monitoring cost is added. But, apart from the cash-flow as opposed to the accruals accounting system in developing countries, not all participating public agencies costs are taken into consideration.

Sustainability of Operations

- The above has to be conceived, planned and implemented with a view on continuing the operations and such that the long term implications are not neglected. Otherwise peacemeal and interrupted operation would prevail. The IWM approach (in the sense of economic and environmental sustainability) and the sound budgetary planning process are indispensible instruments to achieve this.

1.3.1 Participation Methods and Experiences

However, the private sector participation is very important. Below we will discuss some examples and experiences for the methods of private sector participation most common to

solid waste management - namely, contracting, franchise, concession, and open competition. * Before discussing these we will briefly describe some of the most frequently met types of organisation ranging along a continuum from private markets to municipal ownership and operation:

Private. The Government leaves the provision of refuse collection services to the free market, imposing only minimal health regulations. Also known as open competition.
Franchise. The Government, by franchising private collectors, limits the number of firms competing in the market. This may be temporarily appropriate for African countries in situations where there no large franchising companies.
Regulated: The city permits a monopoly but regulates the prices it is allowed to charge and the type of service it provides.
Contract: The Government specifies the level of service and contracts with a private firm that service. Sub-contracting to smaller private establishments is also common practice where micro- and small-scale operators are suitably qualified to undertake the job.
Non-profit: The municipality (or mostly local initiative today) creates a non-profit refuse collection agency which is independent of the city government.
Municipal: The municipality provides the service itself through a public agency or department.

1.3.1.1 Contracting

Solid waste collection contracts

Solid waste collection is the greatest opportunity to involve the private sector under contract with the local government. The informal and micro enterprises are the most suited for this purpose as noted by John D. Donahue in his comprehensive book on privatisation in industrialised countries, which includes private sector participation: "One key is the absence of barriers to entry. The service involves low economies of scale, technological simplicity, and moderate investment costs". Local firms with modest financial resources can enter into the business of solid waste collection. (See the case study on the Kenyan micro-enterprise). Study of private sector participation in Latin America showed that most of the firms were small- to medium-sized, indicating that there were virtually no barriers to entry. In Seoul (Korea), approximately 35 percent of the solid waste is collected by 85 private contractors, each of which is a relatively small firm with an average of 6 vehicles. In Lagos, there are nearly 100 private contractors, most with only 1 or 2 vehicles and less than 10 with more than 5 vehicles.
Among the various options for private sector participation, contracting for solid waste holds the greatest promise to developing countries as a way of lowering cost. Even when

* This section draws on the private sector participation of the UNDP/UNCHS/World Bank Urban Management Programme 13. The purpose of the Chapter is twofold: to explain methods of private sector participation and, simultaneously, throw some light on some pertinent research areas relating to private sector participation and measurement of efficiency.

only a small portion of the city is served under private contract, significant efficiencies may be achieved because of contestability of market principles, wherein the government monopoly over service delivery is contested.
Based on studies conducted in 317 cities in England and Wales and in 126 cities in Canada,
contracting of solid waste collection service was 22 percent to 41 percent-less costly, respectively- than public service. In those cities in which a private contractor provided refuse collection and thus eliminated public monopoly, costs were lower.
The two principal studies on costs in the United States (one covering 1,378 cities, and the other, 340) showed contracting was 10 percent to 30 percent less costly as compared with those for a public monopoly. These studies included government's cost to monitor its contractors, estimated to average roughly 25 percent of overall costs (government plus contractors).

No comparable study has been conducted in developing countries to document where contracting versus a public monopoly leads to lower costs in these countries. The World Bank conducted case studies in Latin America that examined contract systems in cities of different countries-namely Caracas (Venezuela), Santiago (Chile), Buenos Aires (Argentina), and Sao Paulo (Brazil). Only in the case of Brazil was data also obtained from a city whereas the service was provided by the government of Rio de Janeiro (Brazil). As observed by the World Bank's report, the country-to-country cost and productivity data are not comparable. Not only are the working conditions unique, but there is a wide difference in costing factors, including salaries, benefits, fuel cost, duties on imported equipment, taxes, inflation, interest on loans, and currency exchange.

In 1988, Jakarta began to experiment with the private contracting for collection in 261 sub-districts (10 percent of the city's waste generating area), which were comprised of middle- to high income residents in relatively laid out developments. Jakarta has been unable to determine the true cost of public service and whether private sector participation has brought about savings. Thus, comparative cost information is not available. When surveyed, residents in the neighbourhoods served by the private sector - as well as those served by government - expressed satisfaction with the quality of service and the price they were paying.

In 1985 in Nigeria, after a five-year period of open competition among private refuse collection companies, the Lagos State Waste Disposal Board (LSWDB) divided the city of Lagos into zones and awarded contracts to selected contractors to collect industrial and commercial waste from large generators in these zones. The LSWDB collected user charges from the industrial and commercial establishments serviced, paid 60 percent of the monies collected to the private contractors, and kept 40 percent for covering its own administration, billing, and disposal costs (as well as for providing a cross-subsidy for residential collection).

In the same zones, the LSWDB operated with its own trucks to service all small generators and government establishments. Unfortunately, some contractors reportedly were able to manipulate the system by paying money to some of the LSWDB's refuse collection crews that were to serve customers designated for private service. Also, some contractors reportedly were able to obtain spare parts from the LSWDB's inventory for the repair of their privately owned trucks. Complaints of clandestine dumping by the private contractors also were made. Partly in response to these problems and partly to ease the commercialisation of its own operations, in 199 1, the LSWDB revoked the licenses of private refuse haulers and declared its monopoly over service delivery.

The LSWDB is now considering how to adequately regulate and control the private sector, given the extent of corruption that is locally prevalent. The LSWDB has already taken a bold step toward control by commercialising its own operation. By this measure, the LSWDB is making each section manager accountable for costs and now has the management flexibility to hire and fire freely and to provide incentives to his staff.

Competition

Competition is a key factor to getting low-cost solid waste service from private contractors. This was recently demonstrated in San Jose, California (United States). San Jose has had for many years private collection and disposal of wastes. In 1984, the city re-examined the prices they were paying and decided that they might lower their waste management costs by actively increasing competition. They focused attention on helping a competitive waste management firm develop a new landfill site, so that there would then be two private landfills owned by competing firms in the San Jose area. They also separated the procurement of disposal services from collection services. Furthermore, they contracted for disposal and collection by zone, so that it would be possible for the city to have more than one disposal contractor and more than one collection contractor. In 1986, the disposal contract cost was 33 percent lower than what had been paid in the previous year, and the collection contract cost was 23 percent lower. Over a six-year contract period, this amounted to savings of US $25 to US $31 million.

In cities where there is not a public monopoly, but where the public sector competes with the private, there is no evidence that contracting costs less than public service. In fact, data from several cities suggest that competition encourages the public sector to significantly improve its efficiency and lower costs, as discussed below.

Public and private competition

Because public solid waste systems in developing countries are commonly plagued by excessive staff, obsolescent equipment, cumbersome procurement procedures for spare parts, inflexible work schedules, limitations on management changes, inadequate

supervision, and strong worker unions, it is difficult for the public service to implement the changes necessary to match the efficiency of the private sector. Nevertheless, it has been shown that when the public service agency is a) placed in competition with private contractors, and b) is allowed to make the necessary adjustments to become competitive, the public agency has been able to attain costs comparable to those of the contractor.

For this reason, the ideal arrangement may be a mix of public and private service-for example, contracting for the collection of solid waste from some zones of the city, while retaining public service to the remaining zones. This is the way that Bangkok has approached private contract.

service of solid waste collection in some districts. In this way, Bogota has also recently contracted for solid waste collection in two zones covering 40 percent of its service area. The competition between the private and public systems has led this city to streamline its roles by 30 percent, largely through the attrition of unproductive office employees. It is also the basis for continued negotiations with the government labour union over work schedules, overtime pay, and worker performance requirements for collection workers.

In Great Britain, a number of local governments allowed the public sector service to challenge the private sector in bid competitions. In those cities where the public sector won the competition, as compared with public monopoly, the city saved about 17 percent in service cost.

South Korea has a successful blend of public and private sector activity for hazardous waste disposal. A public corporation established under the ministry of the environment built and operated two state-of-the-art hazardous waste treatment and disposal facilities. Using the knowledge and practical experience gained from this activity, the Ministry has been able to license and monitor the development of at least six privately owned and operated hazardous waste treatment and disposal facilities.

Contracting for transfer and disposal

Contracting is a viable means of securing service so long as it is possible to adequately describe outputs anticipated from the contract. Thus, contracting is well-suited for discreet activities within the solid waste system, such as the operation of a transfer station or sanitary landfill. In Caracas, a private firm operates the city's transfer station under contract with the solid waste organisation. Similarly, in Buenos Aires and in Bogota, private firms operate the sanitary landfills under contract with the solid waste organisation.

Cost recovery

In many countries, local governments have successfully contracted their billing and collection of solid waste user fees to regional water and electric utilities. For example, Surabaja contracts with the water authority and allows it to keep 10 percent of the collections as payment In areas not served by the water authority, Surabaja has an agreement with elected neighbourhood leaders for them to collect the fees in return for payment in a similar manner.

Leasing

In developing countries, the available equipment for solid waste service Leasing typically has been fully depreciated during private sector use in construction or haulage. Most Leasing involves open tipper trucks or bulldozers that are readily available from construction contractors, especially in recent years when construction activity has declined in most developing countries. Until this year, metropolitan Manila has been heavily dependent on leased trucks for use in solid waste collection. In 1989, private contracts provided, through Leasing agreements, 76 percent of the solid waste collection fleet (432 open tipper trucks). Because the trucks were more than fifteen years old, it was typical for 30 percent of the fleet to be down for repairs on any given day.

During the 1980s, the city of Onitsha (Nigeria) relied heavily on leased equipment until a new fleet was purchased through a World Bank project The cost for leasing old open tippers was roughly equivalent to the estimated costs for owning and operating newly purchased open tippers. Because the market demand for bulldozers and wheeled loaders was greater, the Leasing cost was roughly 100 percent greater than the estimated costs for owning and operating newly purchased dosers and loaders.

Contract specifications

To foster competition, a key factor is a good tender document-one that recognises the capabilities and limitations of the local private sector and enables it to bid competitively toward providing an acceptable standard of service.

Because contracting has been used extensively as the primary mode of privatising in the United States, substantial guidance is available in the literature issued by various American associations. For instance, contracting issues are discussed and a model contract is provided in the excellent book entitled *Solid Waste Collection Practice,* which was written by the American Public Works Association (1975). Model contracts are also available in the United States from the National Solid Waste Management Association, whose members are predominantly private contractors, and from the Solid Waste Association of North America, whose members are largely from municipal government. In addition, the city of Phoenix has a well-conceived document entitled "Management Procedure for Preparing Cost Estimate for City Services under Consideration to be Performed by Private Industry on a Contractual Basis," which provides a framework for how to establish public-private competition to optimise cost-effectiveness.

Monitoring

It would be a mistake to assume in the absence of well-defined contract performance measures, enforceable contract sanctions, vigilant contract monitoring, and cost accountability that private contractors would deliver a lower cost than that of public service. The monitoring of the performance of the private sector is very important. A good contract clearly defines measurable outputs of service required of the contractor and thus enables performance monitoring. A good contract also clearly defines the sanctions that are to be imposed for non-performance.

Complaints from residents about solid waste service should be received by the local government, even when solid waste service is being provided by private firms. Singapore has set up its complaint bureau for the receipt of complaints about all public services. The central complaint bureau processes each complaint with the appropriate government agency and follows up on whether the problem resulting in the complaint has been adequately addressed, a process that they feel increases the accountability of each government agency.

In 1991 in Bogota, two private contractors serviced about 40 percent of the city's households and establishments, while the local government serviced about 55 percent. The city hired a private company of consulting engineers to monitor both the public and private service delivery and to provide a monthly report on performance by each. The cost of the monitoring contract amounted to 2.5 percent of the total cost for contracting with the two private firms.

Length of contract

For low cost to be achieved by contracting, it is generally agreed that the contract should have a long enough duration to enable the private sector to depreciate capital expenditures for appropriate equipment. Given that collection vehicles have an economic life of six to eight years under single-shift use and a life of four to five years under intense use, in solid waste collection contracts the length of contract should be at least 4 years. In a well-developed market in which substantial competition and private sector participation already exists, the issue of the length of contract is less important, because a private firm can sell its collection vehicles to other contractors if their contract is not renewed. Few developing countries, however, are at this stage, and thus length of contract is an issue to consider.

Many developing countries have limits on whether local government can contract beyond its current fiscal year and commit funds beyond its current budget allocation. As a result, the contracts for collection in Seoul are solely for one year. For political reasons, some cities have contracts of less than one year duration. For example, the solid waste

collection contracts in Surabaya (Indonesia), and truck Leasing contracts in Manila, are for three and six month periods, respectively.

1.3.1.2 Franchise

By national law in most countries, local governments own all waste within their boundaries, once it has been discharged for collection and disposal. A local government has the authority to give exclusive franchise to a qualified private firm for the right and responsibility to provide service to customers within a zone. In return for such an exclusive franchise, the private firm pays a license fee to the government. The fern subsequently charges their customers appropriate fees to cover the cost of service.

Solid waste collection by franchise

Franchise is applicable to solid waste systems because economies of service are attainable only when waste is collected along a contiguous route or within an exclusive zone.

In contracting, the private firms are paid by the local government from general revenues or through monies raised by direct user charges. The costs to local government for cost recovery are insignificant when general revenues are used. When local governments bill for service, this is typically part of a combined bill for a number of services (water, sewerage, parks), and the portion of the billing costs attributable to solid waste is estimated to amount to only about 3 percent.

In 1985, private franchise of residential collection in high-income laid-out areas was implemented in Ibadan (Nigeria). These areas were divided into ten zones for private sector participation purposes. Based on availability of equipment and business credentials, six firms were selected to collect refuse from the zones. Each firm paid a license fee of 5,000 Naira (then equivalent to about $US 1000). Significant improvements in city cleanliness resulted. Many Ibadan residents, however, complained that they were not given free choice to select their designated company. And indeed, some of the companies turned out not to be reliable performers.

For developing countries, franchise is applicable only in the areas of the city wherein *all* of the households and establishments can be readily educated to be concerned about public cleanliness. Only in such areas would it possible for the private company holding the franchise to obtain full co-operation and cost recovery.

Informal sector solid waste collection

In many developing countries, the informal sector provides waste collection services to low-income neighbourhoods, especially in Latin America where government solid waste

collection service has not been able to keep pace with the huge influx of rural immigrants to the cities' marginal zones. It is common to see these areas served by individuals with donkey carts or old dump trucks. Unfortunately, because the collectors in the informal sector do not have equipment to travel far to the official landfill and are also outside of the officially sanctioned system, the collectors are prone to dump solid waste illegally. In 1988 in Barranquilla (Colombia), there were more than 600 clandestine dumps, many of which were created in the informal sector by collectors using donkey carts. For this reason, it is worthwhile for government to explore organising these collectors into a co-operative and developing a franchise arrangement whereby the rights and responsibilities of the informal sector collectors are defined.

In Cairo (Egypt), an informal sector solid waste collection system involving 12,000 workers has existed for the past century. The private collectors are part of a single community, known traditionally as the Zabbaleen. The private collectors worked closely with another community, known as the Wahis, which originally had purchased the long-term rights to the refuse from various buildings. Over the past century, the Zabbaleen provided collection free-of-charge to residents of upper income neighbourhoods, in return for the opportunity to recover and recycle the materials present in the wastes. For their livelihood, the Zabbaleen sold recovered paper, plastic, glass, and metal to manufacturing plants for recycling, and they raised pigs on the recovered organic wastes. Fees were paid to the Wahis for access to the wastes from these upper income neighbourhoods.

Unfortunately, there was no incentive for the private collectors to provide collection from lower income neighbourhoods, because the waste from these neighbourhoods did not have much recyclable material content. In 1987, the Wahis and the Zabbaleen were assisted in setting up a private company (called the Environmental Protection Company) for purposes of providing solid waste collection under contract. So that private collection service arrangements could be developed, technical and financial assistance was provided by volunteer organisations and international agencies for the upgrading of collection equipment and the routing of vehicles for networking with the residents of the lower income neighbourhoods. The outcome was the extension of private service to lower income neighbourhoods in return for payment of user charges by the residents. The basis of the charges was established so that the system could be self-sustaining.

Recycling and *resource recovery*

Several Indonesian cities have awarded co-operatives and private companies the exclusive rights to recycle and recover resources from municipal refuse. For example, Surabaja gives the official co-operative of registered waste pickers the franchise to recover secondary materials at the city's communal transfer depots. Medan gives two private companies the franchise to mine compost from the city's two disposal sites, respectively. In Medan, the private firms share their profits with the city.

1.3.1.3 Concession

Under concession arrangements, the private sector finances and owns (for a period of time sufficient to depreciate investments and to provide a reasonable return to the equity investors) solid waste management facilities. In return, the government typically grants and enables access to a specified quantity and quality of solid waste and provides some form of tipping fee. In cases in which the government is the only purchaser of the product or output service of the concession, the government will normally be required to enter into a binding long term agreement to purchase on a "take or pay" basis. The concession agreement might specify performance standards, methods of judging performance, penalties for delay or non-performance, risk assignment, insurance requirements, dispute resolution, and standards for worker safety and health protection and for environmental protection.
In developing countries, governments need to be wary of unsolicited proposals from a single vendor with unsupported exaggerated claims that its technology would lead to substantial revenues from sales of recovered resources (compost, steam, electricity). When politically motivated decisions are made to buy equipment or facilities from such vendors, the customary procedure of city-wide master planning and feasibility study to determine the most viable waste disposal option is often bypassed - as are those of competitive procurement. Unfortunately, some of these facilities are unwittingly financed by grants or soft loans from bilateral donor agencies, which gives the appearance of minimal risk.

A. Build, own, operate, and transfer (BOOT)

BOOT involves private sector participation in building, owning, operating, and, after a pre-specified number of years, transferring infrastructure. It provides a means of having the private sector finance facilities whose ownership will eventually be transferred over to government. While governments, especially those of developing countries, favour the concept of BOOT, very few have been able to implement these arrangements. In many developing countries, the private sector is not willing to risk its investment money in such long-term and large-scale projects. As a result, one of the few BOOT examples within the solid waste sector is for a transfer station in Hong Kong (notably a city where the investment risk is considered minimal relative to what would typically be found within a city of a developing country).

The city of Hong Kong and a private firm reached a BOOT agreement several years ago for the construction and operation of solid waste transfer facilities (a transfer station and fleet of transfer trucks). Several firms were pre-qualified, based on their past experience in designing and operating transfer stations. The government's bidding document specified technical performance requirements (on-site storage, vehicle washing, compaction, and through-put requirements), environmental performance requirements (noise and odour detection at the station's perimeter, wastewater treatment, bird and rodent control, and air emission standards), equipment and building maintenance

requirements, and equipment replacement schedules. The station is now built and operating. The government makes regular inspections to determine whether all of the contract performance specifications are being met.

In this example, ownership was transferred to government after only one year because Government wanted to feel free to fire the contractor if there were inadequate performance. Thus, the objective of the BOOT agreement was *not* that of obtaining private sector investment but that of obtaining private sector design and construction expertise. Also, by having the private sector design and build the facility this sector will eventually operate, the contractor has fewer excuses available for non-performance.

BOOT agreements require meticulously developed specifications. Most important, these agreements outline the regular maintenance requirements that the private sector must provide to the facilities, as well as the final condition in which the facilities must be presented to the local government at the time of ownership transfer. Without such specifications, one could well anticipate that the facility would have a planned obsolescence matching the schedule for transfer.

B. Build, own, and operate (BOO)

A private firm, through turnkey contracting, may build, own, and operate (BOO) a facility that provides solid waste service, such as transfer, disposal, or resource recovery. Such turnkey contracts became a popular means of financing major resource recovery projects in the United States, where about half of the waste-to-energy plants are privately owned. In this country, private ownership was encouraged by financial incentives established by the federal government, including tax benefits and opportunities for accelerated depreciation.

BOO is not as popular with developing countries, because the private sector does not eventually transfer ownership of facilities to government. For many reasons, however, this is a much better arrangement to pursue for the following simple reason: If the private sector is willing to build, own, and operate a solid waste facility, it indicates that the fundamental risks and economic benefits have been satisfactorily managed to create a real-world market opportunity.

From 1976 to 1986 Surabaya operated under a variation of a BOO arrangement with a private company for the implementation of a composting facility. Unfortunately, there was not an adequate quality control of the solid waste quality delivered to the facility by the local government nor an adequate development of markets by the private sector. Also, the private fern did not choose the most appropriate technology for the local conditions. Given Indonesia's low labour cost, a labour-intensive composting technique should have been built rather than a mechanised technique. Finally, under more favourable BOO arrangements, the firm would have received a tipping fee from the city that would have been priced to cover costs that might have otherwise been incurred for comparably safe disposal. The firm struggled along for many years but is presently not operating. For BOO arrangements to succeed, they need to be as carefully developed as BOOT arrangements.

C. Solid waste recycling concessions

For the self-serving reason of reducing its work load and cutting its costs, if not for humanitarian recycling from the source by private sector initiatives. The best way to encourage recycling is to provide financial incentives (low-cost loans, loan guarantees, tax exemptions) and to set up concession arrangements with the private sector, including the informal sector waste pickers.

At the heart of recycling is the buy-back centre. The buy-back centre purchases recyclables from individuals, processes them to meet industrial requirements, and sells them to industry. Because buyback activity could lead to significant reductions in the quantity of waste that the government has to collect,thegovemmentshouldbewülingtoprovidebuy-backcenterswithfinancialsupport.

For example, in New York City (United States), buy-back centres are given a payment for every tonne of waste that they can demonstrate is recycled back to industry and, hence, saved from land disposal.
In most developing countries, buy-back centres are purely market driven and receive no government support. Their profits are solely based on the difference in price received from industry versus that paid to individuals (dump-site waste pickers and door-to-door waste collectors). Unfortunately, until governments in developing countries stop open dumping and recognise the cost associated with disposal, it is unlikely that they will give buy-back centres the equivalent of a tipping fee for every tonne recycled and thus diverted from disposal. In recognition of the savings in solid waste collection costs that buy-back centres cause when they recover wastes directly from the source, local governments ought to provide some from of financial incentive.

In some cities of developing countries, limited competition exists among buy-back centres, because there is limited competition among industries or because access to the waste is politically manipulated by local government officials. In these cities, the price paid for recyclables is both controlled and nominal. As a result, the waste pickers enter into a patronal relationship with and become highly dependent on one buyer. During times of hardship, the waste pickers may need to borrow money from their patronal buyer and may remain forever indebted owing to the subsistence levels at which they are working.

In many cities of the developing world, a large work force is informally employed in waste picking at city dumps. There are, notably, about 8,000 waste pickers at the dumps of Jakarta, 10,000 in Mexico City (Mexico), and about 7,000 in metropolitan Manila. On the surface, friction exists between local governments and dump-site waste pickers. To resolve the problem in Ciudad Juarez (Mexico), dump-site waste pickers were organised into a recycling co-operative and the co-operative was given a concession to operate the city landfill. In Ecatapec (Mexico), dumpsite waste pickers were granted the concession to recycle at a city-operated landfill.

1.3.1.4 Open Competition

In open competition (often termed *private subscription)* of solid waste collection services, each household and commercial establishment hires a private collection firm and pays the solid waste removal fee that the firm charges. Generally, this form of privatising of solid waste collection

a) leads to substantially higher costs than those incurred by government contracting with private firms and,
b) is often more costly than public service. When a number of competing firms operate in the same area, along the same streets, each loses the "economies of

continguity" that would be received if one firm served the area and in turn picked up the waste from each establishment.

Collusion is an issue of concern when open competition is allowed. In developing countries that do not have true competition at a significant level, collusion is a common practice. Price setting occurs and is viewed in some cultures to be an accepted practice. In Nigeria, there are associations of private refuse companies in the states of Lagos and Oyo, and agreements on prices are made among companies. In countries where private companies can be relied on not to be excessively greedy, such price setting might be tolerable. But in other countries, where the hardship imposed by unreasonable prices does not affect the drive of private companies toward disproportionately high profits, such price setting is clearly unacceptable.

Solid waste collection

Private subscription has been found to be the most costly method of solid waste collection service for urban areas. Private subscription among solid waste collection firms takes away the opportunities to achieve economies of contiguity, as illustrated by the case of Ibadan, noted below. In addition, competitive firms must bear the cost of billing and collecting user charges from customers. Billing has been estimated in the United States to comprise about 15 percent of the total cost of service. Studies done in the United States, Canada, and England differ in their assessment of the extent to which costs are elevated by private subscription, reporting private subscription costs from 26 percent to 63 percent more than contracting.

From 1987 to 1992, the local currency, Naira, became significantly devalued. Yet, the price that customers are willing to pay for service has not increased over time. The result is that the private firms no longer generate enough revenue to purchase the imported spare parts necessary to keep their vehicles in operation. The number of licensed private firms in Ibadan has dwindled. Also, the fleet that each firm has available has deteriorated in condition and decreased in number. As illustrated by the Ibadan example, open competition can only work in areas where customers are able and willing to pay enough to fully cover the costs and enable private firms to renew their fleet as well as make a profit.
Despite conditions of open competition and unrestricted entry into the refuse collection business in various cities within Nigeria, the private sector has waxed and waned in response to general economic conditions, providing service when the economy is good and retreating from service delivery when bad. Only a handful of the private firms operating in Nigeria (no more than 10 out of more than 100 firms) have made an investment in appropriately designed refuse vehicles. The remainder use depreciated equipment from construction (open tipper trucks), which they can readily use for other business activity when the profit potential of refuse collection business is down. At this juncture, it is interesting to observe that the one argument most often used for privatising

refuse collection (no barriers to *entry)* is essentially the same as one reason for private sector failure in Nigeria (no barriers to *exit).*

Solid waste recycling

Recycling of secondary materials (cans, bottles, paper, textiles) is commonly conducted under open competition arrangements. Various redemption centres, junk yards, or buy-back centres compete with each other to. obtain recyclable materials and to process them for sale to industry.

Solid waste disposal

Once environmental regulations clearly specify minimum standards of safe disposal, open competition between private owners of disposal sites can occur. If environmental protection is well-regulated, private firms can assume the risk of investing in safe disposal systems. As sites that do not meet environmental criteria are phased out of operation, there is increasing competition for clients among firms owning proper disposal sites. In the United States, it is not uncommon for a local government to have to transport its waste from 100 Kilometres to 300 Kilometres to a privately owned sanitary landfill.

Maintenance and repair

One of the most typical services for which governments turn to open competition is maintenance and repair service. For minor repairs of solid waste collection trucks, several quotations from private workshops are obtained within a matter of hours, and the repair job is given to the lowest qualified bidder. For example, even though Bangkok operates a central garage for major repair and overhaul of the city's entire fleet of rolling stock, equipment is sent by the districts to private workshops for minor repairs. The same situation occurs in Seoul. Both cities have enormous traffic congestion problems, and it can take hours to drive across the city. It is expeditious and generally less expensive to have a minor repair done locally, in the vicinity of each district office, than to send it to the central garage.

Corruption

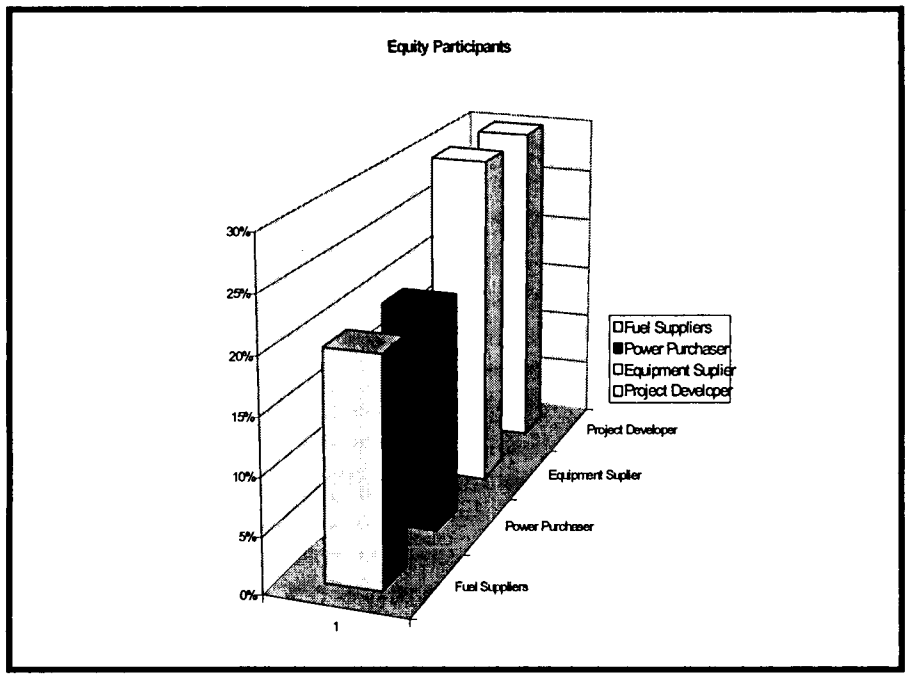
Corruption, nepotism, favouritism and connivance defeat the purpose of competition in SWM and results in less efficient, and detrimental, outcomes. It also bars efficient, capable and honest operators. Although this is a world-wide phenomena, yet the scale and gravity of the practice has to be checked up in Africa. Competition operates best where there is transparency. Transparency does not mean only regulation, but also laws and work results governed by these laws be legibly and openly presented and made available without request to the public. Poverty and need should not be an excuse to avarice and inefficiency. The responsibility lies on all stakeholders and operators from the policy making level down to the lowest level of operators and to every citizen.

1.3.2 Project Finance

Large scale waste treatment and disposal projects like mass burn MSW,incineration, landfill or large scale collection services require huge funds which a municipality may not be able to afford. Joint ventures are a possible alternative between the L.A. and the private sector. Needed bank loans can be secured against the on-going project's cashflow. The will usually be born by the borrowing company.

Alternatively the risk to the investors may be based on the success of the project (i.e. its profitability). If the project fails there is no recourse to recover the debt from the company. This is usually a complex arrangement where investors would seek defined risks and returns for their investments. The sources of funding are various and the structure is as depicted in **Figure 4.1**. The senior debt is usually a bank loan which constitutes the major portion of the cost of the project. Banks reckon the proven technical capability of the shareholders and the market conditions. The size of the loan will be determined by the risk involved in the project. Suppliers guarantee their supplies against each other and non-proven technologies find loans difficult to get. Detailed contracts are needed to secure each participant's objective: L.A. would require a waste treatment plant to dispose of its waste, equipment suppliers would want to develop their business, the bank wants a good return on its loaned funds, the project developers would wish a return on investment. Detailed contracts also apportion the risk among the participants.

Subordinate debts bridge the gap between the bank loan and the direct investments by participants. The equity comes from the participants' (such as the fuel or waste suppliers "=L.A.", energy purchaser, equipment suppliers, and project developer), direct equity contributions (i.e. shareholding).


Equity Participants
30%
25%
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Project Developer
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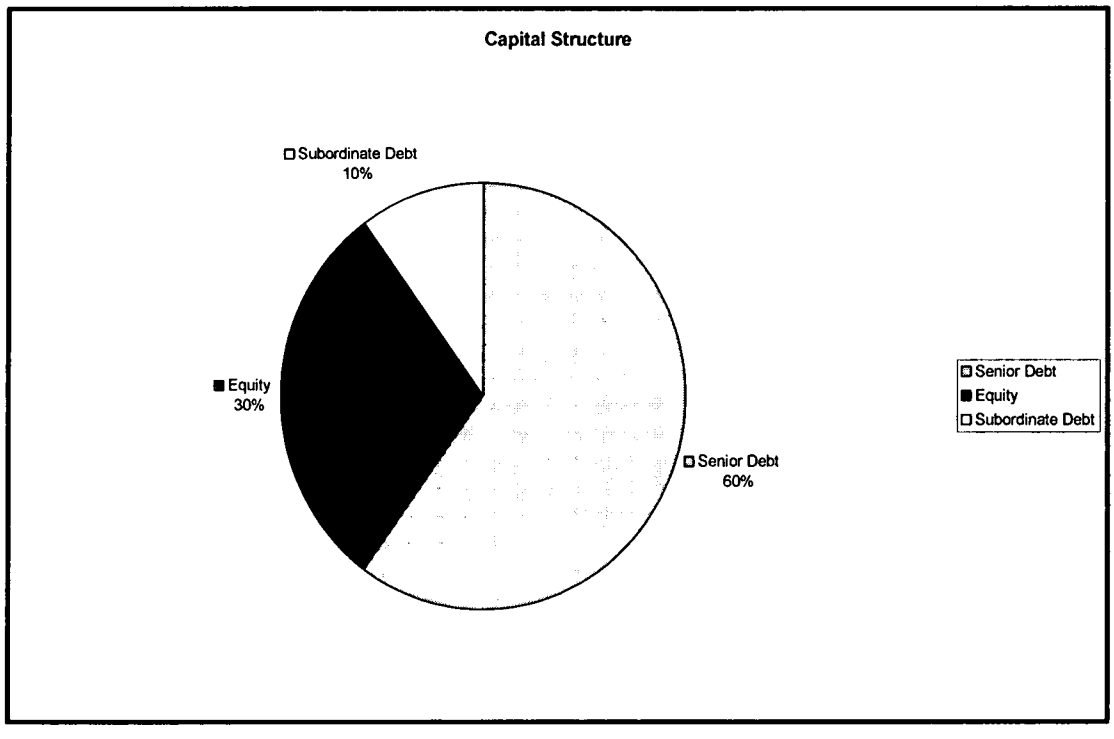
Capital Structure
Subordinate Debt
10%
Equity
30%
Senior Debt
60%
Senior Debt
Equity
Subordinate Debt

2. FINANCING OF OPERATIONS: SOME EXPERIENCES

In most African countries charges for the services represent a very insignificant part of the expenditure on the service. This may have been mainly necessitated by the low incomes of the population benefiting from the service (where it constitutes a significant proportion of their incomes), low collection effort and capacity and absence of appropriate measures and arrangements for collection. The reasons may thus be socio-economic, institutional, technical or attitudinal. The technical may have to do with the level and quality of service whereas the attitudinal are a result of all the above plus lack of awareness.

The major resources in most local government may come from revenue collections represented by rats, rents, and other non service sources. Grants from the central government budgets are not adequate either to cover WM activity costs and may be decreasing continuously. International sources may supplement capital costs but these cannot be relied upon on the long term and their economic effect may not be quite desirable in the and long term – unless when they are given as grants. Grants, however, are not always without repayment burdens.

The examples below on Zambia, Ghana and Ethiopia show a departure position where budget deficits are rampant and can be generalized to most African countries. This is not a desireable situation. The purpose of the policy introduced in this Manual is to facilitate movement upwards towards a more desireable position. A target situation would be one where the private sector would provide the service and would, by definition, not only cover its costs but also make profits – given that most of the "initially lucrative" service is passed to the private sector and the community. A next step would be to create public private sector participation for the more capital intensive activities like sanitary (or more appropriate to African conditions: controlled) landfills and waste treatment and recycling ventures. For now, we will iluustrate the present condition in some MA in selected examples given below.

Zambia

In Zambia total expenditures of the Lusaka City Council (LCC) devoted to waste management amounted to only US$679,338 in 1995. Applied to the estimated quantity of waste collected by the LCC (30,000 t per a) it represents a ratio of US$22.60 per ton collected and a ratio of US$2.80 per ton generated (being 243,000 t per a). The Table below shows the relation between revenues generated as a result of billing for the service and the cost of the service (simply equated with actual expenditure on the service).

Table 7: Cost and Revenues of Solid Waste Management for 1995, LCC

Section	*T. Cost US$*	*%age of Cost*	*T. Revenue US$*	*%age of Revenue*
General Administration	37 641	05.5	32 418	59,1
Cleansing Depot	164 396	24.4	0	00.0
Refuse Removal	434 985	64.0	22 482	40.9
Street Cleaning	42 316	6.3	0	0.0
TOTAL	679 338	100	54 900	100

Revenue collected through billing (fees for refuseremoval or fees for derelict vehicles removal) contributes only 8.1% of the cost of refuse collection, showing that billing is almost not existent. The balance is coveredby collection from rates and rent. These expenditures do not include any expenditure on vehicles (capital costs for the year were zero) and not any provision for depreciation of the existing fleet either. The Vehicle Replacement Fund remained dry.

A further analysis of income and costs is shown in Table 8 below.

Table 8

Costs and Revenue pf Solid Waste Management for 1995, LCC, (US$)

SECTION/DESCRIPTION	*T. COST*	*%*	*T. REVENUE*	*%*
General Administration				
Salaries and benefits	12 984	1.9		
Premises	1 259	0.2		
Supplies and Services	1 267	0.2		
Transport	846	0.1		
Establishment Expenses	4 616	0.7		
Revenue Contribution to Capital Outlay	12 963	1.9		
Miscellaneous	3 704	0.5		
Inspection Fees Sundry			*32 376*	*59.0*
Government Grant			*42*	*0.1*
S-Total: General Administration	**37 641**	**5.5**	**32 418**	**59.1**
Cleansing Depot				
Salaries and Benefits	85 673	12.6		
Premises	53 333	7.9		
Supplies and Services	5 556	0.8		

Transport	3 315	0.5		
Establishment Expenses	16 519	2.4		
Revenue			*0*	**0**
S-Total: Cleansing Depot	**164 396**	**24.2**	**0**	**0**
Refuse Removal				
Salaries and Benefits	265 337	39.0		
Supplies and Services	78 889	11.6		
Transport	77 300	11.4		
Establishment Expenses	13 459	2.0		
Fees – Refuse Removal			**22 482**	*40.9*
S-Total: Refuse Removal	**434 985**	**64.0**	**22 842**	**40.9**
Street Cleaning				
Supplies and Services	22 222	3.3		
Establishment Expenses	3 427	0.5		
Revenue Contribution to Capital Outlay	16 667	2.5		
Rvenue			*0*	*0*
S-Total: Street Cleaning	**42 316**	**6.3**	**0**	**0**
TOTAL INCOME (COST) OF SERVICE	**679 338**	**100%**	**54 900**	**100%**

The fee structure is based on a number of waste receptacles emptied every month. Each refuse collection vehicle records all the premises cleared of waste stating the number of bins emptied per collection. This information is confirmed by the signature of the owner or agent of the premises. The refuse collection charts are used to settle disputes in the alleged non-collection of waste and also from the basis of billing refuse collection charges. In low density areas (elsewhere typical for private sector) a flat monthly fee of US$ 0.56 per bin is charged. Billing has not been regular. In governmental houses collection charges have been incorporated into the rent charges, but never separately treated for any reason. For peri-urban areas, there has been no regular billing has been undertaken till 1990 and the exercise is still unstable.

For commercial, hotel and industrial refuse monthly charges are based on a standard refuse bin equivalents and on frequency of collection: US$ 0.56 per bin per month. The figures recorded have been inaccurate and irregular. For markets, permanent and non-permanent stalls the Council collects daily levies for non-permanent and a monthly levy for permanent sheds from owners – no consideration for waste charges has been made in these levies. There is no charge as well for government offices and hospitals.

The Intercity Bus Terminal is self-supporting in terms of revenue generation and collection. The levy (US$ 33.3 for mini and US$ 4.44 for big buses) is collected after loading and before departure from the park and includes a covering of waste collection costs.

For special waste, e.g. demolition rubble, US$77.7 is charged per load for the first two hours and thereafter US$ 93.33 per load. Payment is made in advance.

In general billing is fraught with disputes with clients. There is no comprehensive regular billing system and the system above is seldom applied –except in hotels and industries. For residential areas it is only effected if the collection service is demanded by the resident(s). LCC has not been able to provide an effective and reliable service which could attract prompt payment.

Ghana

The Kumasi Metropolitan Assembly in Ghana has the following sources of financing: (See Table 8 below showing revenues for the period 1990 to 1996).

- Rates including basic rates, special rates and property rates.
- Lands including revenue sale of stool lands.
- Fees, licences, including fees charged for waste management services, self-employed licences, etc.
- Rents including rents on residential properties and income from guest house operations.
- Investments including interest accruing on bank balances.
- Central government transfers including District Assembly Common Fund, Ceded Revenue, etc.

Table 8: Sources of Financing: Kumasi Metropolitan Assembly (1990 – 1996) (Million Cedis/Dollars)

Direct Local Revenues	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
Basic Rates	25	15	4	21	18	8	12
Property Rates	84	104	84	145	152	314	456
S-total: fees and Charges	**109**	**119**	**88**	**166**	**170**	**322**	**468**
Market Fees	204	449	403	559	832	987	954
Lorry Park Fees	32	50	57	65	115	172	209
Solid Waste	0	0	0	0	0	3	7
Liquid Waste	0	0	0	0	0	13	18
Hiring of Equipment	0	0	0	0	0	0	0

Food Stuff Exit Fees	0	0	0	0	0	0	0
Fees on Entering Tourists (WM)	0	0	0	0	0	0	0
Other Fees and Charges	131	195	178	311	215	252	334
Miscellaneous	85	24	4	0	56	62	44
Trading Services	0	0	0	11	0	0	0
S-total	**452**	**718**	**642**	**946**	**1,218**	**1,489**	**1,566**
Total Direct Revenue	**561**	**837**	**730**	**1,112**	**1,388**	**1,811**	**2,034**
Central Government Transfers							
Salaries Grant	129	158	186	240	249	460	836
Grant in lieu of Rates	0	0	0	0	105	0	0
Ceded Revenue	3	11	40	0	357	42	321
Other Grants/DACF	0	0	0	28	0	1,366	0
S-total	**132**	**169**	**226**	**268**	**711**	**1,868**	**1,157**
Total Source of Funding	**693**	**1,006**	**956**	**1,380**	**2,099**	**3,679**	**3,191**
In US$	**2**	**3**	**2**	**2**	**2**	**3**	**2**

It can be observed that revenues exploded in 6 years – from Cedis 693 m in 1990 to a peak of Cedis 3.6 b (519%) in 1995 and a slight decrease to 3.2 b (461%) in 1996. In real terms (i.e. adjusting to US$) these figures were $2,011,000 and 1,838,000 in 1990 to 1996 respectively, a decrease in total funding of 9%. Over the period total direct revenue has moved from Cedis 561 m in 1990 to 2,034 b in 1996 (an increase of 362%). Central government transfers steadily increased from Cedis 132 m in 1990 to a peak of Cedis 1.8 b in 1995 and dampened to Cedis 1.8 b in 1996 depicting a phenomenal increase of 1,415% in 1995. In relative terms, total direct revenue sources have been more important of the two funding sources for KMA. In 1990 total direct funding accounted for 80.9% while central government transfers represented 19.9% of toal funding. Contribution by total direct funding, however, has gradually declined to a low of 49.2% in 1995 and up in 1996 to 63.7%. The trend, contrary to what is desired, shows significant increase in reliance on central government transfers.

Table 9 shows the main expenditure items of KMA from 1990 to 1996. Total expenditure have steadily increased from Cedis 676m in 1990 to Cedis 4.2 b in 1996, an increase of 625.6%. The steady growth has been a function of substantial increases in both capital (19.5% in average between 1990 and 1994) and recurrent expenditures (average growth 80.5% for the same period, dropping to 53.5% and 59.3% of the annual expenditure for 1995 and 1996).

Table 9: Main Expenditure Items for KMA, 1990 to 1996
(Nearest Million Cedis/Dollars)

Recurrent Expenditure	1990	1991	1992	1993	1994	1995	1996
GOG Salaries	129	158	186	240	249	460	784
Staff Costs	230	292	265	312	465	274	160
Travel and Transport	44	105	202	223	271	131	180
General Expenditure	39	44	56	126	141	130	156
Maintenance and Repairs	40	65	33	119	122	24	11
Waste Management Expenditure	0	0	0	0	0	438	1,026
Others	56	96	94	124	214	145	192
Total Recurrent Expenditure	**538**	**760**	**836**	**1,144**	**1,462**	**1,602**	**2,509**
Capital Expenditure	**138**	**165**	**183**	**349**	**317**	**1,391**	**1,720**
Total Expenditure	**696**	**925**	**1,019**	**1,493**	**1,779**	**2,993**	**4,229**
In US$	**2**	**2**	**2**	**2**	**2**	**2**	**2**

Until 1995 there was no separate data on waste management. This was effected as a result of the Urban Environmental and Sanitation Project, UESP (WB, GTZ and others) which resulted in the creation of the current Waste Management Department, the infusion of some funds and activities in the Department's budget (capital equipment, final disposal facility in the 5 major cities in the country, household budget survey for the establishment of fee levy base, etc.) and others. Other private-public activity was later undertaken in 1999 by Canadians who effected visible improvements in the waste collection. Capital expenditure had grown from Cedis 138 m in 1990 to 349 in 1993 and dampened in 1994 to sky-rocket to Cedis 1.7 b in 1996 (a phenomenal increase of 1,246% over the period).

The Financial Position of the KMA (1990 to 1996)

The Assembly hardly generated enough resources to cover its recurrent expenditures in the period 1990 to 1996. Table 10 below shows a surplus of Cedis 23 m after meeting its recurrent expenditures from locally generated revenues. This also increased in 1991 to Cedis 77 m but deteriorated from 1992 to 1994. It recorded an improvement in 1995 and plunged back into deficit in 1996. Over the period, revenue generation had not kept pace with expenditures and the rate of increase in expenditure far exceeded that of revenue. Local revenue increased by about 362%, while recurrent expenditure increased by about 466%. Government transfers remained to be the mainstay for the weak financial position of the KMA.

Table 10: KMA Income and Expenditure From 1990 to 1996
Nearest million Cedis

	1990	1991	1992	1993	1994	1995	1996
Local General Revenue	561	837	730	1,112	1,388	1,811	2,034
Less: Operating Costs	538	760	836	1,144	1,462	1,602	2,509
Contribution to Capital Expenditure	**23**	**77**	**(106)**	**(32)**	**(74)**	**209**	**(475)**
Add: Transfers/Subs.	132	169	226	268	711	1,868	1,157
Capital Income (Savings)	***155***	***246***	***120***	***236***	***637***	***2,077***	***682***
Less: Capital/Dev. Expenditure	138	165	183	349	317	1,391	1,720
Net Surplus/(Deficit)	**17**	**81**	**(63)**	**(113)**	**320**	**686**	**(1,038)**

Waste Management Operations (Revenue and Expenditure)

The WMD is expected to genrate enough revenue to cover its cost of operations and carry out other environemtal and sanitation "capital" programmes. Table 11 records revenues and expenditures of the WMD of KMA for 1995 and 1996. The following can be observed:

- KMA generated a higher proportion of revenues from liquid than from solid waste.
- Income from WM constitute 0.88% and 1.2% of total direct revenue for 1995 and 1996 respectively.
- Expenditure on WM activities far exceededincome from that source.
- Staff costs travelling and transport and vehicle running costs constitute a higher proportion of WM costs. Totaling 99% in 1995 and 93% in 1996. A condition typical to inefficient service delivery by the public sector.
- Expenditure on Wmrelated activities including personnel costs, vehicle running and equipment maintenance amounted to 27.3% and 40.8% of the total recurrent expenditure of the MA for 1995 and 1996 respectively.
- There is an imbalance between generation of income from WM and the cost of service delivery. Income increased from 16 m in 1995 to 25 m in 1996 –an increase of 56%, while expenditure increased from 437 m in 1995 to 1.02 b in 1996 – an increase of 134%.
- The above resulted in negative contributions to capital expenditures of 421 m and 1,000 m in 1995 and 1996 respectively.
- Cost recovery rates were very low. 4% and an even lower 2% in 1995 and 1996 respectively.

Table 11: KMA Wate Management Department Revenue and Expenditure, 1995 and 1996
Nearest million Cedis

	1995	1996	1995 (%)	1996 (%)
A: Revenue				
Solid Waste Disposal	3	7	18	28
Liquid Waste Disposal	13	18	82	72
Total	16	25	100%	100%
Share of Assembly's Direct Revenue	0.88%	1.20%		
B.: Expenditures:				
Personal emoluments	128	210	29	21
Travel and Transport	189	334	43	33
General Expenditure	0	0	0	0
Maintenance, Repairs and Renovations	85	223	19	31
Miscellaneous Expenditures	0	2	0	0
Hire of Equipment	35	154	9	15
Total	437	1,025	100	100
Share of MAs WM Operations Exp.	27.3%	40.8%		
Contribution (A-B)	(421)	(1,000)		

Assuming that the KMA would implement its plan to build a partially controlled landfill with the following potfolio of capital and operation costs (million Cedis):

Cost of Construction	8,749
Annual Operating Costs	506

Its cost recovery potential can be depicted from the table below (million Cedis):

	1995	1996
Income	16	25
Costs	437	1,025
Cost Recovery Rate	**4%**	**2%**

Given that KMA was hardly able to generate enough revenues from its own resources to meet recurrent expenditures in 1990 to 1996 – see Table 10 above, from the above it become clear that KMA would not be able to meet the cost of construction and operating costs of a landfill site from its own resources.

N.B.

The above budget corresponds to the following physical output achievements:

Service Coverage:

Population: 30% of the MA population of 250,000.
Collection: 40% of total generated (using 0.5 kg p.c. generation).
Area Covered: Average for urban areas of 25%, covering commercial (60%), institutional (50%), residential (25%) and industrial (60%) zones.

Conclusion:

Given that similar results obtained in other cities in Ghana (Tama and Saema with cost recovery rates of 1.2% for 1995 and 4% for 1996; and 11.7% for 1995 and 10.3% for 1996 respectively) and that:

- WM has assumed more prominence in MA, hence procurement of more inputs,
- Cost of service delivery has increased,
- More revenue can be derived from waste management related activities as this appears relatively untapped, and
- More privatization and community participation would be involved in lucrative areas for the private sector,

more efficient service provision is expected from the Mas especially in areas requiring major capital investments – with some public private sector participation.

Ethiopia

Solid waste management costs in Addis Ababa are relate to the costs of collection, transportation, landfilling and street sweeping. The type of costs involved are capital costs and operation and maintenance (O & M)costs for Region 14 Health Bureau. While O & M costs are derived from the Region 14 Budget for 1988 E.C. capital costs are consultants estimates for the same period. The costs are underestimates as they represent only corrected acquisition costs and operational costs. This would be a misrepresentation as administration overheads are entirely dropped and these usually represent an important proportion of service costs (usually ranging between 60% and 95%). Only direct labour is included and not even field supervision has been considered.

1US$ = 6 Birr (arbitrary estimate)

Table 12: a Summary of Addis Ababa Solid Waste Management Costs 1988 EC

	Description	Capital and Operational Costs (Birr)	Operational Costs (Birr)
1	**Collection Container System: Volvo Lift Trucks**		
	Acquisition Cost (Base Cost)	2 922 548	1 088 836
	Total cost with 10% contingency (predicted cost)	3 214 803	1 197 720
	M^3 Collected	178 850	178 850
	Unit Cost	17.98	6.70
2	**House to House System (side loaders and rotating Kuka trucks)**		
	Base Cost	628 911	628 911
	Predicted Cost	691 803	691 803
	M^3 Collected	76 650	76 650
	Unit Cost	9.03	9.03
3	**Total Solid Waste Collection System (1+2)**		
	Base Cost	3 552 452	1 718 740
	Predicted Cost	3 907 698	1 890 614
	M^3 Collected	255 500	255 500
	Unit Cost	15.30	7.40
4	**Landfill Management**		
	Base Cost	553 891	154 984
	Predicted Cost	609 801	170 801
	M^3 Collected	255 500	255 500
5	**Street Sweeping**		
	Base Cost	795 845	795 845
	Predicted Cost	875 397	875 397
	M^3 Collected	23 587	23 587
	Unit Cost	37.12	37.12
6	**All Collection, Street Sweeping and Landfill Management Costs (3+4+5)**		
	Base Cost	4 902 188	2 669 569
	Predicted Cost	5 392 407	2 936 526
	M^3 Collected	255 500	255 500

	Unit Cost	21.11	11.50
7	**"3+4" Costs (Weighted Mean Costs)**		
	Base Costs	4 106 343	1 873 724
	Predicted Cost	4 516 978	2 061 097
	M^3 Collected	255 500	255 500
	Unit Cost	17.68	8.07

N.B.: Base Costs are made up of capital costs (annual loan repayments plus interest) and direct operational (labour and material) costs.

The overall budget of the Sanitation Division and an approximation for solid waste management costs are shown below in Tables 13 and 14.

Table 13: Sanitation Budget 1987/88 and 1988/89, Addis Ababa City

Particulars	1978/88		1988/89
	Estimates	Actual	Estimates
Head of Division Management	9 920	8 722	10 420
Collection Section			
Salary, Consumables	45 140	43 543	157 468
Machinery and Equipment	510 000	241 718	69 000
Collection Section Total *	555 140	285 261	226 468
Disposal Section			
Salary Consumables	50 336	47 852	49 628
Machinery and Equipment	50 000	-	50 000
Disposal Section Total	100 336	47 852	99 628
Zone Offices			
Zone 1	394 440	303 476	391 647
Zone 2	301 238	222 560	297 542
Zone 3	250 504	207 408	270 328
Zone 4	397 036	321 712	413 044
Zone 5	310 182	256 103	317 270
Total Zones	1 653 400	1 311 259	1 689 831

Grand Total	2 318 796	1 653 094	2 026 347

* Excludes capital projects, construction of public toilets and communal latrines.

The above figures have been corrected to reflecte the costs for the solid waste management as shown in the Table below:

Table 14: Equipment Services and Actual Expenditure – 1988

Item	Total Budget	S.W. %	Est, S.W. Budget	Total Actual Exp.	S.W. %	Est. S.W. Actual
Personnel						
Salaries	818 808	40	327 523	534 795	40	213 918
Allownaces	17 352	40	6 941	11 689	40	4 676
Sub-total	***836 160***		***334 464***	***546 484***		***218 594***
Expenses						
Transport	1 010	40	404	737	40	295
Spares	1 200 000	40	480 000	785 706	27	212 141
Fuel/Lubricants	1 400 000	50	700 000	1 202 560	50	601 280
Stationary	11 000	50	5 500	10 998	50	5 499
Office Cleaning	400	50	200	236	50	118
Fire Extinuisher	5 000	30	1 500	0	30	0
First Aid	1 000	50	500	672	50	336
Vehicle Tax	80 000	65	52 000	63 800	65	41 470
Vehicle Insurance	-	-	-	-	-	-
Vehicle Purchase	283 732	20	56 746	0	0	0
Sub-total	***2 982 142***		***1 296 850***	***2 070 709***		***861 138***
Total	**3 818 302**		**1 631 314**	**2 617 719**		**1 079 732**

It is not possible to make a direct comparison between the costs as shown in Table 12 and the revenues as shown in Table 14 because of the defficiency of data and lack of basis for such a comparison. Nontheless a general view, taking into account the weaknessses (lack

of correspondence of various expenditure and revenue elements, underestimation of costs, etc) of the presented data, it can be seen that costs far exceed the budgeted expenditures for the solid waste management department. This indicates deficinet implementation of the planned project or credit overburdening. The budget revenues are silent over the portion realised through service charges and fees. This is a typical case to illustrate the importance of cost accounting for proper management of the service, performance measurement and control.

Improvement in the service could not be precisely estimated, but Region 14 reported 37% collection in 1982 and a 55% collection rate for 1998. The City Council attributes the improvement to the investment undertaken and expects more improvement in collection and sanitary conditions if more investment is directed towards more training, containers and trucks as well as development of the landfill site.

Sanitation Fee

Efforts to supplement these budgeted revenues included the introduction of the sanitation fee. The system attempted to achieve cost recovery for the service provided which is based on cross subsidy by the various beneficiary groups. The result is a fixed charge based on the cost of the business licence fee. A rough estimate of the sanitation service charge from the operating receipts of the Council are shown below:

Table 15: Major Operation Receipts, Region 14

	1982-83 G		1987-88 G	
	Birr	%	Birr	%
Sanitation Service Charge	1 031 593	4.3	1 171 000	4.5
Operating Receipts	23 747 449	100.0	26 179 000	100.0

From the above, and as is the case elsewhere, it is not possible to determine the cost of service for the city. As a consequence the revenue has not been interlinked with the cost. Only by so doing we can determine that waste management is precisely a costly activity for municipal governments.

In the Ethiopian case, although much effort has been done to establish the sanitation fee and the modes of collection from the service receivers: businesses, government, industry and residents, little effort has been done on actual collection. Lack of awareness on the part of the implementing agencies themselves of the importance of cost recovery, losing strategies (=collect when only extremely necessary), and the attitude of the fofficials themselves may tend to frustrate the limited willingness to pay and suppress efforts to effect and implement collection systems. The low proceeds for covering the service costs

are likely to continue if a continuous and efficient system of collection is not seriously put into place.

Surveys made on the public on willingness and ability to pay showed that households are willing to pay for the service if properly and regularly provided. Attitudes, however, on the broader but poorer urban classes are different. They are not willing to be bothered about paying for a service they do not perceive as important to spend their pittance of incomes upon. However, they are not happy either with the piles of garbage around their homes and in culverts and storm water ditches. They are however, prepared to "participate" in providing the service for their localities and perhaps pay a small share of their income for a good service. The participation potential could be tapped using local ingenuity in thinking out modes of participation, or borrowing from experiences elsewhere like the "Dump-as-you-pay" in Ghana, the MSF ticket system for high density areas introduced in Maputo, Mozambique or some other local models which proved to be applicable and successful.

Next Step

1 Test your comprehension of the information by answering the questions below, discuss them with the group, and compare with the answers are suggested at the and of the pamphlet

Questions:

1. Can MSW service be covered by user charges alone?

2. How does private sector participation represent a method of financing?

3. What do recurrent costs typically include?

4. What parameters should be considered befor involving the private sector in MSWM activities?

5. What are the differences between user charges, service charges on the one hand and taxes on the other?

6. What is a cost recovery policy and what does it seek to establish?

Answers

1. Full service cost may be toodifficult to cover exclusively from service charges in the immediate time. In the medium and long term this may be met. Attempts may be made to cover recurrent costs: mostly O&M costs.

2. Private sector can directly provide funds when operators provide the service, charge for it and collect direclty from beneficiaries. Franchize or direct contracting can be used in this cases and the municipality may also generate icome from the franchize fees or from fees on making arrangements for the contract where applicable. They may also provide funds in the form of equity or loaned funds taken on their credit worthiness for larger operations.

3. They include:

   i. Direct operational expenditure, e.g. wages, fuel and maintenance.
   ii. Provisions (accrued expenses) for liabilities, e.g. employee pension obligations and insurance payments.
   iii. Regular recurrent cash outlays, e.g. debt repayment and debt service charges (capital and interest, and others).
   iv. Provision (depreciation) for recovering the value of the capital assets progressively used up in the delivery of service (observe the double effect on revenues of points iii. And iv.).
   v. Alternatively iii. And iv. Above can be replaced by an annual amortization charge designed to recover the value of capital assets over their useful lives).

   Devising a strategic revenue generation strategy is a key component of the planning process.

4. Several contextual issues may have to be addressed before deciding eventually whether to involve the private sector in municipal activity in SWM. These briefly include:

   i. *Cost Recovery:* Public goods are not free goods.
   ii. *Efficiency:* The private sector may be more efficient in providing some of the SWM services by means of direct comparison.

iii. *Public Accountability:* A municipality is accountable to the public at large, and measures of efficiency have to incorporateed to judge private performance.
iv. *The Management Context:* Private sector management may enjoy more flexibility (hire and fire, working time, overtime authorisation, supervision, etc) than the public hand.
v. *The Finance Context:* The private operators may be able to raise funds for profitable ventures.
vi. *Economies of Scale:* These have to be judged on technical/capital indivisibility basis on the services to be provided, e.g. collection in low- and high-income areas, transfer systems, sanitary landfills, composting, waste-to-energy, etc.
vii. *The Legislative Context:* The private sector will invest, e.g. in sanitary landfill, if they are aware that environmentally sound safe disposal is not only required by law, but also enforced
viii. *The Cost Context*: Cost comparison between public and private agencies has to be fair, comparable and comprehensive. All participating public agencies costs are to be taken into consideration.
ix. *Sustainability of Operations:* This is desireable for the public and private sector on economic and environmental sustainability basis.

5. The main difference between taxes and charges is that taxes are paid directly into cosolidated revenue accounts whereas charges allocated to their specified uses; taxes do not relate to the costs of providing specific services while charges are levied with a view on making a contribution to the costs of providing a service.

Service charges and user charges are different in that user charges change proportionately with the volume of service provided while service charges are based on a different basis than the volume of service provided, e.g. apportionment of the overall costs to different user groups on ability to pay basis.

From another standpoint we can roughly say that user charges are direct charges while service charges are indirect charges.

6. Cost recovery relates to measures needed to finance additional costs (marginal or operational) associated with improved services. Because the accounting systems used by municipalities do not clearly reveal total costs (relating historical and new capital costs and O&M costs) and also because of ruling under-funding of services (which enlarges the burden at attempts to calculate actual total costs) there is tendency to underestimate revenue requirements to establish appropriate cost recovery levels. Consolidated revenue sources called upon to meet costs are usually short. Such that cost recovery would depend on availability of such funds,

stated objectives of cost recovery and the cost recovery policy of the municipality for MSWM services.

A cost recovery policy should seek to establish two things:

- Total amount of recurrent funds needed yearly, and
- How these are to be raised.

Minimum amount of cost recovery is usually the sum of annual recurrent funds required to finance direct operating costs and debt service obligations incurred in providing the service and – strategically – a provision for capital replacement.

Movement from full service funding from municipal sources to full service funding from user charges should be gradual and over convenient periods of time – but precisely and expediently planned and committed to.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UP-DATED TRAINING MANUAL OF WASTE MANAGEMENT IN HIGH DENSITY AREAS OF THE AFRICA REGION

MODULE 5
PLANNING

Contents:

INTRODUCTION

The Procedure of planing is probably the most important part of the improvement of MSWM. A good and practical plan increases the efficiency of waste management, and also can help to keep the service in a sustainable level.
During the planing procedure there are several steps what we can not elude. Here is a list of them, with a figure of strategic planing and a few words about what we have to do in each steps.

Strategic Planning for MSWM

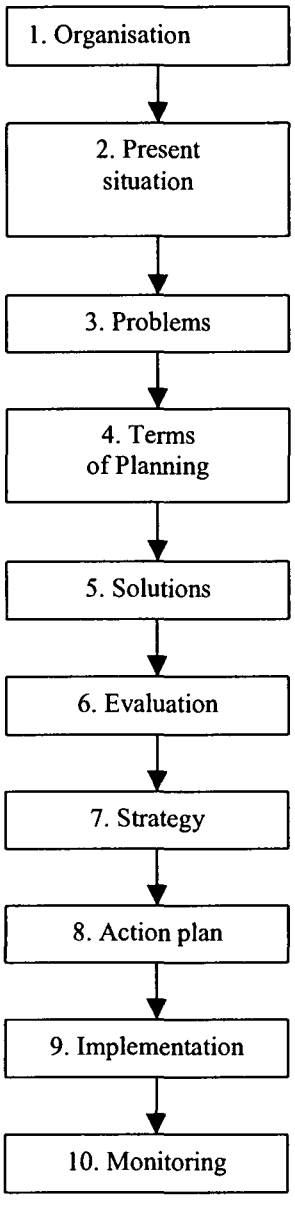

Figure 1 Steps in Strategic Planning for MSWM

Two further important points are illustrated in the schematic representation in Figure 1.

Planning for MSWM is not primarily a technical issue, but is much more regard with the organisation and management of the stakeholders'and all of the key actors' relationships to each other.
Figure 1 helps you to have an overall view of the logical process in strategic planning for MSWM. However, this representation of the process is purely schematic, and a simple, straight 'walk through' will be neither possible nor appropriate. Rather, lots of repetition and feedback between steps are profitable. We have to remind you that planning is not a once-off process, but rather an ongoing exercise which will need regular revision and update.

Summary of the ten steps in the overall strategic planning process

Step 1. Organisation: Step 1 is regard that how to get started with the strategic planning process. The main activities have been arranged into two groups:

- The political Mobilising Support. This includes establishing the need for the planning study, consulting and involving key stakeholders and establishing the Steering Committee to investigate the planning process. The most important effort of this part of the planning process is to establish political will and commitment.

- The more practical level is to organising the Work. That means establishing the Working Group to work out the planning study, defining the overall terms of reference, purchase resources and funding, contracting external consultants if required and dispose the detailed workplan.

The aim of Step 1 is the political framework within which the planning exercise can take place, and the team which has been mobilised and adjusted to begin work on the substance of the Strategic Plan.

Step 2 Present situation: The next step is to describe the present situation of MSWM at your municipality, to state future requirements, in terms of present shortages and both constraints and opportunities for improvement which needs to be addressed in the Strategic Plan. Three sub-tasks have been identified:

Task 2.1 Define the waste quantities and waste composition.
Task 2.2 Review of the waste management operations.
Task 2.3 Forecast of future capacity requirements.

Step 3 problems: Problem analysis and definition are the two main tasks of this step. Actually we have to use the information that we collected at the previous phase of planning process. For this we may need help.

Step 4 Terms of plnning: This step addresses a number of important issues, which need to be confirmed at the first part of the planning process. Four sub-tasks are emerging.

Task 4.1	Agreement of the planning area and planning period.
Task 4.2	Selection of the types of waste to be covered by the plan.
Task 4.3	Explanation of service levels, that is the quality and coverage of MSWM services which is being aimed for, but always keep affordability in mind.
Task 4.4	Setting of tasks and goals for the plan.

Step 5 Solutions: We can describe this step as the core of the planning process. In step 5, we are discuss the problematic areas, shortfalls, constraints and opportunities identified in Step 3, and using these to recognise practical options in terms of both the organisational and institutional aspects and the individual operating sub-systems which make up MSWM in the city. We must identify options for each aspect of the organisational framework and for each operating sub-system.

Step 6 Evaluation: In this step we must examine the opportunities for evaluation. We need to consider those options against a number of criteria covering all of the strategic aspects of MSWM. We have to shortlist alternatives or select the preferred option for each aspect of the organisational framework and for each operating sub-system. Step 6 is very important, because the evaluation of the options is the base of the decision. It is advantageous to choose only a few options for the further process, because fewer options make the decision much easier. It is said, that two or maximum three options in an area of waste management is enough.

Step 7 Strategy: In this step we take the results of Step 5 and 6, comprehend preferred solutions for some of the components and shortlists of alternative solutions for others, and integrate those in order to come up with the most suitable Strategy for developing the MSW system in your city or municipality over the long term (15 years). Methods are presented for the regular identification and evaluation of a small number of alternative strategies.

Step 8 Action Plan: Step 8 develops the Action Plan to turn into practical reality. What specific, detailed, actions need to be taken to achieve the individual components of the overall Strategy, who should take those actions and when? Two important considerations in Step 8 are the overall financial planning and estimation of the Action Plan and the identification and preceding of priority investment projects identified within it: these will generally require a detailed feasibility study as the next step.

The Strategy and Action Plan together embrace the overall Strategic Plan. Step 6 also addresses how to achieve the necessary permissions for the strategic plan and also introduces public awareness and education measures, without which the plan cannot be implemented successfully.

Step 9 Implementation: Strategic planning for MSWM is not an end in itself, the whole exercise is completely useless unless the resulting plan is implemented in practice and results in demonstrable improvements on the ground. Step 9 provides advice on:

- moving from planning to implementation;
- revising and updating the plan.

Step 10 Monitoring: Monitoring is needed to control the implementation of the action plan. There are two main tasks, which can arise in connection with our decision. The first is the appropriateness. We have to decide that, rather our system was appropriate enough to fit the requirements, or not? The second task is to find the problematic areas of the system and the solutions. To solve these tasks we have to do frequent reviews and updates on the ongoing system.

STUDY MATERIALS

The next section helps to get familiar with the overall options of planning for municipal solid waste management (MSWM). We show the framework of planing and we try to suggest some practical advice in connection with the problems that are emerging during the process. For this we will use the scheme what is in the introduction, and we examine the points step by step.

Step 1 Organisation

In this step we show, how to begin the planning process of the improvement. As we show it in the introduction there are two main options what we must solve in this phase of the planing process. The first is to mobilise the efforts and support on behalf the success of the improvement.

If we want to avoid the later conflicts we have to make a good balance between the politicians and the operators of the project. Political support and goodwill is very important to the final success of the improvement of the MSWM system.

First of all we have to establish the need for developing the MSWM system in all stages of the stakeholders firstly between those who handle the financial resources. These People are usually the officials of the local or upper government. If we convince them we will probably have better chance to get their help in many cases. The need can be assessed by consulting with the decision-makers on the unwanted environmental and health effects, related the inadequate waste management practices in the municipality. If the problems, what we have listed for the leaders are common, than we need the improvement is established.

We can work on the strategic planing successfully, if all the appropriate stakeholders are involved and consulted from the beginning of the work.

How to select the members of the Steering Committee

It is important, that the chosen stakeholders will form the Steering Committee. The members of the Steering Committee will assist the MSWM plan through a process of review and probably expert opinion that will help to establish consensus. By taking part on the Steering Committee participants will have a stake in the eventual success of the MSWM plan.

The Steering Committee needs to include the authorities and institutions involved in decision making for MSWM, together with a selection of other appropriate primary and secondary stakeholders. The ultimate composition must be carefully balanced and requires a commitment at the outset from all participating organisations to the formulation and implementation of the strategic MSWM plan.

Here is checklist of potential members of the MSWM plan Steering Committee:

- A senior political figure as chairperson
- Representatives of the various municipalities
- At least one member of the MSWM plan working group
- Selected local officials representing relevant departments
- Representative of the regulatory agencies
- Selected waste management operators, practitioners and planers
- Private sector representative
- Representatives of NGOs (Non-Governmental Organisations) CBOs (Community Based Organisations) and interest groups
- Women leaders in SWM
- Selected specialist experts
- Representatives of external support agency

This list is not a strict compulsory register it is just a suggestion. The final composition of the Steering Committee is the task of the organisers, but they have to keep the political and civil balance to the fore.

The second task of the first step is to **organise the work.**

We have to start it with the establishment of the Working Group, which will be responsible for the scheming of the action and strategic plan for waste management. The members of the Working Group are usually the employees of the office that is responsible for MSWM. It is important to ensure that the qualified personnel are take part on the Working Group.
The Working Group has to co-operate and work together with the Steering Committee. The Working Group will transform the requirements and ideas of the Steering Committee into practical measures of action, and inform the Steering Committee with technical and methodological options which could influence the plan.
It is important to define responsibility and tasks for each member of the working group. The number of the members is depending on the size of the mission, but we can say that a group from 5 to 10 could be satisfactory.

The **definition of the Terms of References** (ToR) for the MSWM plan

The main issues have to be carefully examined in terms of target areas, and financial resources. After we have done this task we can make the list of the ToR to make our work easier and clearer. The ToR must include all the work to be done and not just some parts, which may be contracted to other consultants. It is needed to clarify that ToR is a reference document, providing apparent declaration of need, extent and aims.

This is a possible list of the ToR:

Task 1: Review existing reports on municipal solid waste management. This will include information on population, income distribution, land use, municipal institutional organisation, municipal financial arrangements and revenue sources, commercial activity, industrial activity, land water resources, climate and geography.

Task 2: Data collection on refuse generation rates, waste composition and density. The sampling process must cover the households, institutions and commercial establishments in the sampling area.

Task 3: Examine the existing socio-economic baseline of the project area, to ascertain whether there are informal sectors of collection or recycling which influences the waste management service.

Task 4: Examine the existing collection and transfer service, the design of storage containers, pick-up frequency, supervision of workers, inspection of service areas, efficiency of collecting and transfer routing, and the citizen participation in the system.

Task 5: Examine existing disposal sites, the location, capacity, gas and leachate migration, fires, vectors and scavengers, influence on drinking water resources, and the need for reclamation.

Task 6: Assess of the resource recovery system, the types of methods, the level of mechanisation, the conditions of labour and capital costs, overall assessment of cost effectiveness of resource recovery system.

Task 7: Review of existing maintenance equipment and facilities, the skill level, length of service of mechanics, supplies and spare parts, and travel times.

Task 8: Provide recommendations for facilities and equipment for collection, transfer and disposal, covering the whole waste management system.

Task 9: Provide information on investment, operating and maintenance costs in the plan for upgrading refuse treatment. Make a program of investments with financial resources, and cost recovery opportunities.

Task 10: Supply information on basic management recommendations about the institutional and financial arrangements for waste management, with special attention on the decentralisation and privatisation of the service.

Task 11: Provide a summary for presentation to the local officials for waste management. The summary must include the basic data on the existing system and the guidelines of the improvement.

Task 12: Provide a report of the whole project, from the beginning until the end.

Purchase Resources

In most cases the local office which is responsible for MSWM does not have sufficient amount of money to finance the planing process, so the leaders of the project have the duty to procure the financial background for the development.
These sources usually are governmental or other external maybe international sources. The leader of the project or the person who is responsible for the financial sources have to make the formal and other requirement, suitable to the internal and external founds and other offices to get money for the project
Preparing workplan

This is the final stage of the first step. The workplan is usually based on the ToR, and made by the working group. The workplan must include:

- the task, which is required,
- the management responsibilities,
- the methodology to be applied,
- key project delivery points
- Key meeting points, and seminars.

Next step

Answer the questions seen below, and compare your answers with those suggested at the end of this pamphlet. Work in small groups if possible!

Questions:

1. What are the two principal options of step one?

2. How can we establish the need for the development of the MSWM system?

3. Who should be the members of the Steering Committee?

Step 2 Present situation:

In this part of the planning process we have to characterise the present situation of the MSWM system, and try to estimate the future service level requirements. The data are needed to make comprehensive plan for the improvement of MSWM. The information's that the working group has to find usually are in existence in some studies or other official registers. First you have to describe the information are needed and useful for the plan. You can build on the existing data, but probably you will need more updated information.
As we suggested in the introduction it is advantageous to divide this step into subtasks, which are the follows:

- Measurement of waste quantities and composition
- Survey of management operations
- Prediction of future capacity requirements

These steps can be undertaken simultaneously. By completing these tasks the Working Group will probably need help to collect data. The aim of this step of the planing process is to define the problem by collecting and analysing data. There are three questions about data collection:

- Why we need information?
- How to collect data?
- What data to be collected?

The tasks are the follows:

1. Make a report from the present situation of waste management in your municipality, covering every stages of the process, with special attention on the problematic factors.

    - The size of the managed area, the approximate number of households
    - The quantity and composition of arising waste, including hazardous wastes
    - The number and condition of collecting vehicles
    - The number of employees and their level of expertise
    - The framework of the department which is responsible for MSWM
    - The disposal facilities of your municipality
    - The legal background of waste management
    - The financial framework of MSWM

How to collect data for this report? Here are three general considerations for the process.

- Building on existing data

- Alternative methods for collecting data
- Focus on representative sample areas, if there are existing ones.

Probably there is a high proportion of the required data is already available, although maybe not in one source. It is very effective to build on previous studies, making maximum use of projects, in order to avoid unnecessary duplication of efforts. Existing regional or city development plans should be used.

The alternative data collection methods are include observation studies, consultation with other departments and authorities, and the use of questionnaires. The data we want to collect have to cover the following areas:

- Population
- Nature and quantities of wastes
- Refuse storage and collection
- Excreta collection and disposal
- Refuse treatment
- Refuse disposal
- Materials recovery
- Street cleansing
- Organisation and management
- Legislation
- Costs
- Revenue collection

The number and composition of **population** is the determining factors in the amounts and quality of waste. In case of different socio-economic groups the arising waste is also different in quality and quantity too.

Estimating the current and future **quantities and characteristics of** the solid **wastes** arising in an area is an essential task in preparing a comprehensive solid waste management plan.

The bases of analysing the solid waste arisings are:

- Sampling and analysing of household waste generated at source
- Monitoring waste, delivered to disposal sites
- Surveys of commercial, institutional and industrial establishments in the plan area

The sampling of household waste has two main objectives, the first is to find the quantity of household refuse generated per person per day, the other objective is to verify the composition and characteristics of household waste. You can solve this task with questionnaires or tables.

We have to pay attention on the socio-economic attribute and the type of dwelling during the selection of the sampling area.

By the collection of the samples it is important to inform the householders about the inspection, its dates and the method of it. It will be necessary to distribute plastic collecting bags. Wherever possible, use the same areas for collecting repeated samples.

Always determine the number of persons live in the household, their age and gender and the duration of refuse production. Ideally the collection of samples should extend over a period of one week, to take account of variations in domestic activities throughout the week.

During the sampling we have to get several information from the quality of the waste. The most important ones are the next:

- density
- proportion of recyclable constituents
- proportion of compostable constituents
- proportion of combustible constituents
- proportion of other constituents
- practical size
- moisture content

The monitoring process of the wastes that delivered to the disposal sites can give an adequately reliable indication of the amounts and types of waste generated, particularly non-domestic waste.

For the recording of the information printed record sheets should be used to include date time of arrivals, source of the waste, the weight of each load, if weight bridge is not available than the type and approximate size of the collecting vehicle.

Refuge collection and transport is important because in most cases this is the most expensive process during the whole waste management. You can collect information from a combination of interview, consultation, records and observation of the activities being carried out, to produce coherent consistent picture. The aspects, which need to be covered, include:

- types of containers in use, size, material
- estimates of numbers of containers of each type in use
- the frequency of service
- total manpower employed
- vehicles used, numbers, types, ages, capacities.

In case of **excreta collection and disposal** the collection of information could be difficult in establishing the existing level of provision of services. Where pit latrines are in use, a detailed

field survey may be necessary to establish the population covered by such facilities. Alternative methods of data collection which are appropriate in other circumstances, for example questionnaires, could led to misunderstanding in this case.

Information on the existing **refuse treatment** plant, and transfer stations, should be readily available. For each plant is important to know:

- its location
- age
- type (incinerator, compost plant, etc.)
- operating capacity
- current throughput
- remaining useful life
- manpower requirements
- percentages of recovered products, if any, and revenue received
- operating cost
- ownership

The importance of good information on waste arisings in an area is equalled only by the need to establish adequate facilities for their satisfactory disposal. The first step is to build up a sound understanding of the present situation of **disposal facilities.**

The important information about disposal sites are the follows:

- its location
- the daily/weekly amounts of waste deposited there
- the remaining capacity
- facilities available on site (water, electricity, sewer, telephone)
- its suitability (hydrogeologically, on amenity grounds etc.)
- ownership
- planned future use if it has any

The presentation of the first of these information won't be problematic, although there are some experiences where private contractors have been rather secretive about their sites. The amounts of wastes taken there, if no weighbridge is on site, will require estimation, based on the population of the district.

The examination of existing disposal sites in relation to the information on waste arisings will enable the adequacy of present facilities to handle future wastes. The extent of any shortfall can be identified.

Table 1 shows a potential landfill sites assessment summary. The strictly use of this table is not needed, this is just a suggestion, but it could be a base of the future data collection from the existing disposal sites.

Materials recovery is usually have a significant influence on the arrangements for refuse collection, treatment and disposal.

The first step is to establish the baseline position, current market prices for the various materials and the specification of quality required. This maybe obtained by consulting manufacturing federations, trade associations or direct approaches to known, preferably local, users of recycled products.

The reuse of waste in processed form, example as compost, requires a similar approach although the establishment of the acceptability of the product, size of market and possible sale price may prove more problematical.

The effort, put into seeking information on materials recovery options will depend on the other treatment or disposal alternatives available.

Table 1. Landfill site assessment summary

Location:		Map reference			code number			
		Visual estimate of:						
Nature:		Site area(m^2)			site capacity(m^2)			
Distance to nearby dwellings								
Distance from site to dwellings								
Current use if any:								
Access:								
Services available:	Water:		Sewer:		Electricity:		Telephone:	
Can top soil be stripped? If yes, to what depth? Where can it be stored?								
Ground conditions:								
Liable to flooding?				Ponds?				
Streams?		Gathering grounds for public water supply						
Culverting required?								
Fencing required?								

Ultimate use?
Finishing costs?
Comments?

In order to review the arrangements for **street cleansing**, measures of service, workload, resource usage and performance are required. The necessary information would be sought from records, discussions with managers and observations on the ground.

This includes:

- sweeping frequency in each part of the area
- method used – beat sweeping, gang sweeping, mechanical sweeping
- lengths of channels to be swept daily, weekly etc.
- personnel employed – orderlies, drivers, supervisors etc.
- inventory of vehicles and equipment used.

Subjective data on the general appearance of the area and the cleanliness of the channels will also be needed to enable a responsible assessment of the need and scope for improvement to be made.

The key elements in describing the existing **organisation and management** are usually best summarised in the form of an organisation chart. This shows the chain of command, functional and sectorial responsibilities. Such a chart may already exists in the area studied. However, it is not uncommon for actual practice to differ from the official structure.

The **legislation** takes place in local and national level also. Those of relevance could include:

- specific national laws on waste disposal practice
- sanctioned municipal responsibilities for providing basic services
- pollution control laws – air, water, land
- employment acts
- transport and traffic regulations

It is necessary to obtain copies of all relevant laws and statutes to ensure compliance in plan preparation.

The **costs** are usually the bottleneck of the existing waste management system, in most African countries. The data about the costs of waste management is important because the evaluation of alternative policies requires these information. It is usual to express all costs in terms of a base year, often the present year. The historic costs, perhaps 12 months old, need to be updated, using a local price index. Expressing capital and running costs on a comparable basis, interest rates, inflation rates and discount rates are important. By securing local unit costs for basic elements, for example manpower ($ per hour), electricity ($ per kWh) etc. and multiplying these units by the amounts of each resource experience elsewhere suggests are required, the costs of facilities of various capacities can be built up.

In summary, cost information must be comparable:

- all expressed in terms of the same year
- be based on local figures wherever possible
- local unit cost figures should be used to translate resource figures from elsewhere into financial costs for local use

Next step

Answer the questions seen below, and compare your answers with those suggested at the end of this pamphlet. Work in small groups if possible!

Questions:

1. What are the most important points of the waste management system, which must be covered by the report from the present situation?

2. Which information need to be collected in case of waste treatment?

3. How should we collect data, if we need reliable information?

Step 3 Problems:

Step 2 has presented the information, which is needed to make a diagnostic study from the situation of WM. system in your municipality. To achieve the diagnosis we must analyse the available information, and by this way we can define the problems, constraints and shortfalls in the current system. We have to find those areas which need immediate improvements, but also the inefficient situations which wasting both time and money.

The problem of solid waste in Africa is a direct result of a growing (urban) population, the changing patterns of production and consumption, the inherently more urbanised life-style and the consequent industrialisation. The increasing amounts of waste emanating from residential, commercial and industrial areas and the changing nature of waste over time (quantity, type, composition, etc.) have triggered the alarm on the short and long term consequences on the environment and human life. The health hazard, threat to natural resources by depletion or contamination and the aesthetic offensiveness have to be checked and controlled.

Problem definition, is probably the most important part of this step, because of the influence on the future. There are internal and external problems also, which need to be identified. Internal problems usually arise from the management. External problems need closer co-operation with related sectors of the problematic areas of MSWM system. Here we describes some of the topics of problem definition must cover.

- Service coverage, in terms of population, and area
- The level of waste collection, and other services, like street sweeping and other cleansing services
- quantity and composition of solid waste
- The efficiency of the WM. services
- Working conditions, especially safety, and workload
- Sanitary and environment conditions of the area, especially landfill conditions
- Recycling and materials recovery
- The involvement of the private sector, the lack of correct contracts, fair tenders
- Equipment management, the use, maintenance and shortfalls of equipment
- Public attitude, e.g. willingness to pay fees
- Decision makers attitude, accountability and awareness in connection to the waste management system
- The revenue and expenditure, how big is the difference between the collected fees and the expenditures
- Institution and organisation
- Legislation and enforcement, the laws and regulations in connection of MSWM, and the completion.

- Technical and financial support, internal and external supports and the requirements

Usually there is not only one problem, which arises during the investigation of the waste management system. Some of the problems are conspicuous but others are hard to find. We must keep the fore that the problems, which can be solve relatively easy, need urgent solution between the limits of the municipality.

The first task is to find the problems, and after it if we found all of the problematic areas we have to grade them in view of the limits of resources and the urgency of the problems.

The most common problems in connection of MSWM are ordinarily the next:

- Low labour productivity, which cause longer waste handling. The reasons are often the untrained employees, the lack efficient machinery and the low salaries.
- Financial resources are in most cases deficient in both kind of financing systems. One is where direct user charge is collected, and the other where the municipality finances it from taxes.
- Serious shortfalls in the supervising system. There are much fewer supervisors in low-income countries than in the industrialised ones, generally they have ten times bigger area to supervise than their western colleagues. The low work moral is also characterising the service.
- Maintenance problems, which means usually inexpert repair staff, and lack of spare parts. The vehicles are generally repaired, when they have broken down, instead of regular servicing and maintenance.
- Poor co-ordination between the neighbouring municipalities. It is sad because in this case the overview of the systems in each municipality could not be adequate because there is no other sample to compare with.
- The accounting systems for MSWM are commonly very poor, which can lead to underestimation in case of the costs.
- The absence of skilled and qualified personnel is typical in the waste management departments. The other problem is the relatively quick changes in the leadership, which can cause unreliability.

The problems can differ in each municipality, but there are two main principles what we have to keep the fore, when we are looking for the solution. The first is that limits of the resources will always determine the possibilities. The other is that we must initiate the relevant stakeholders to work on the solution of the problems.

Next step

Answer the questions seen below, and compare your answers with those suggested at the end of this pamphlet. Work in small groups if possible

Questions:

1. What are the main topics that problem definition must cover?

2. Write the most problematic area of MSWM in your municipality. In few words describe your opinion.

3. Why do you think problem analysis is very important?

Step 4 Terms of planning:

The task of this step is to make a clear and understandable survey for the planning process. We can separate this step into four organisational sub tasks, which could be the follows:

- The choice of the planning region and interval.
- The selection of the waste types which have to be in the plan
- Determine the level of the service
- Find the targets and objectives for the plan

For the choice of planning area and interval we have to consider several circumstances such as the geographical position, the demographic, economic and financial situation, and last but not least the institutional status of the area. We need to inspect the information here what we collected before as it is written in step 2 and 3. If the planing area is a city, we must declare how big agglomerated area must be covered by the plan. Unfortunately sometimes it is political question, rather than technical.

The interval of the plan is needed to emphasise on the long-term periods. This will allow for the development of investments, which have longer lifetime, and bigger investment necessity. Usually if we would make strategic plan we need to make plan for 15-25 years, while an action plan covers only around 5 years.

The selection of waste types is needed to make clear the responsibilities in the management, and help to shows the co-ordination areas, which have to be set up for adequate waste management. In principle the plan covers all solid waste types which arise in the planing area, but in general plans pay more attention on the so called priority wastes. These wastes are problematic in some aspect that is why they have special attention. The average waste types in view of their origin are the next:

- Household waste
- Institutional waste
- Commercial waste
- Construction and demolition debris
- Street sweeping
- Sanitation residues
- Industrial waste

All of these wastes can contain some hazardous wastes too. It is hard to separate them and there is usually very low separation capacity in the low-income countries, but from the other hand generally there is less hazardous waste in the waste stream than in the industrialised countries.

The service level determination is important mainly for the planing of the financial background of the future service. We must be informed about the limits of the financial resources to avoid unrealistic solutions.

Some circumstances that influence the choice between the different waste handling systems are the next:

- The categories of wastes, which are in the conventional responsibility of the local municipality
- The level of control that is needed in case of those waste categories, that are not in the responsibility of the local government
- The minimum collection frequency
- The type of the collection bins

We must strive to choose service level, that is sustainable and enough to work, on a desirable minimum level, but we have to keep the fore the health requirements. We need to make efforts to reduce the costs, and do not exceed the financial limits.

To find the targets and objectives for the plan is need to based on a discussion between all stakeholders, such as members of the community groups, public officials solid waste managers, technical staff, and representatives from the private sphere. Objectives should based on an assessment of the current municipal solid waste services, addressing operational and institutional aspects too. The basic purpose of the management is to keep the municipality clean and sanitary by collect and dispose waste in a cost-effective way.

We show you some objectives and targets, which could be profitable to consider:

- Clear definition of the roles and responsibilities of different groups for the MSWM service so accountability can be clarified, and incentives are put in place for service and efficiency improvements.
- Effective technical and financial appraisal of the WM. infrastructure, and avoidance of over emphasised and high-tech technology options
- Ensuring adequate funding for MSWM services trough adequate revenue generation mechanism, with application of the polluter pays principle.
- Improving the efficiency of MSWM services.

- Phasing out current uncontrolled dumping practices and provision of appropriate environmentally sustainable solutions.
- Improving public awareness of MSWM

Next step

Answer the questions seen below, and compare your answers with those suggested at the end of this pamphlet! Work in small groups if possible!

Questions:

1. Which are the so called average waste types?

2. What are the circumstances, which can influence the choice between different kind of waste management systems?

3. What are the subtasks in this step of the planning? Please describe them with a few words.

Step 5. Solutions

In this step we have to take into consideration the possible solutions for the municipality's waste management problems. Probably numerous practical options will be available for the problem, but we always have to keep the fore our limits, and choose the one which fits our possibilities. This is the core of the whole planning, because our decision has the biggest responsibility in this stage of planning for the future waste management system.

To make this step easier understandable we separate this step into two operational subsystems. The first is discussing the solutions for the Organisational and Institutional Framework of Waste Management, while the other discusses the Financial and Technical part of the planning process. The work in this step requires the accomplishment of the former steps of the planning process.

The main tasks of this step are the follows:

- Identify the different alternative options for the various aspects of the organisational framework and for the different operational subsystems.

- Compare the options for both organisational framework and operational systems. It is better if we divide the comparison into two steps. In the first step we make the so called screening, in which step the options are compared against several criteria which can give us information rather the option is fits the situation of the MSWM system, or not. In the second step those options that passed the screening period competing to each other, and finally the Working Group has a list of no more than 2 or 3 solutions for the problem or problems.

- The last task of this step is to recommend the chosen options to the Steering Committee. It is important that by the end the recommended options do not be longer than 2 or 3 options.

We also need to discuss this step in parts, because it could be too long to take it as a whole that is why we make subtasks to discuss the important parts separately. The subtasks are the next:

1. Development of the organisational framework
2. The financial background of the development
3. The technical options

The third subtask is accurately discussed in the pamphlet of Technical and Technological Know-how of this educational series.

Subtask 5.1. Development of the organisational framework

As we know effective organisation and management is needed to sustain a proper waste management system. First it is important that the institutional tasks and responsibilities have to be clarified and the appropriate resources have to be available for the actors of waste management.

The municipality needs to ensure the proper waste management services to the public. This is not means that the municipality has to physically operate the services (just think of the private sector in waste management). The role of the municipality can be different in different situations. In some cases, when the municipality engaged contractors to fulfil the role of "Operator". In other cases when contractors are involved to the services the municipality adopt the role of the "Client " responsible for to ensure the preparation of the service, but not for the delivery of the service.

The third role of the municipality is the role of the "Regulator". The regulator responsible for ensuring the legal requirements for proper MSWM services.

- The role of the Operator is to deliver the waste management services.
- The Client function is to ensure the proper level of the provided services.
- The role of the Regulator is to ensure the legal background for the MSWM service.

To clarify the tasks, roles and rights at governmental bodies and other organisations involved to waste management is very important, because overlapping in this area can cause arguments, controversies, and can lead to inefficient service and inaction which will weaken the political sustainability of MSWM systems. That is why a conceptual framework points to the need for comprehensive strategic plan for the MSWM sector to provide a basis for clarifying and mobilising the roles of the stakeholders involved to the MSWM services.

It is also important, that the municipality have to make its strategic plan in the framework of the National Strategy. It could be profitable because the municipality probably can achieve central resources easier if they follow the National principles instead of do everything in their own way. Another important issue is that the regulations must be transparent, understandable and accountable.

Here we show an average range of laws, at National level, which affecting the municipality's MSWM services:

Public health/Municipal waste collection legislation:

- Duty of municipalities to collect , remove and dispose of wastes and special wastes
- Fund rising of waste collection and disposal generally within the framework of the general legislation over municipal administration

Waste disposal legislation:

- Permitting (licensing) scheme for waste transfer, treatment and disposal facilities
- Responsibilities placed on the waste generator to ensure proper service
- Specific legislation for hazardous wastes, health care wastes and other special wastes.

Laws related to recycling:

- Producer's responsibility for the payment of the disposal costs, or to make their products recyclable

Planning laws:

- Any building, developments (including waste facilities) need authorisation, usually from a municipal or regional planning agency.
- Any significant developments (including waste treatment and disposal facilities) need environmental impact assessment.

Legal framework of privatisation:

- Some countries have a regulatory framework governing privatisation. If this is designed for state enterprises, these laws may hinder rather than encourage the private sector.
- Other countries have clear laws, which require the compulsory competitive tendering of many public sector services to facilitate private sector involvement.

If we make a strategic plan for strengthening the MSWM system, means generally a plan not only for a city, but a wider area, such as a city, and the agglomerated areas. That means not only one municipality will be involved to the project. In that case the inter-municipal co-operation is needed to succeed the aims of the strategic plan. This situation can led to difficulties, so in this cases the consultation between the stakeholders of the different levels of waste management is become very important. To find the solution which totally satisfy all the requirements of the stakeholders is probably impossible, but a convenient solution can be achieved due to compromises. In this cases a powerful, but equitable person is need to be the leader of the consultations to ensure the final consensus between the opposed parties.

Now we describe the possible available policy options to achieve MSWM goals. We can separate them into two main groups, economical and educational.

Economic and financial options	**Information and Educational options**
Waste taxes and disposal fees	Community right to know, waste reporting
Charge/rebate system	Support for research and development
Producer's responsibility	Formulation of targets and timetables with agreement from stakeholders
Raw material taxes	Waste exchange rates
Product charges	Public awareness programs
Subsidies for waste prevention and recycling	Voluntary agreements between government and industry groups
Tax preferences	Role of public, industry and trade associations
Liability instruments	Role of technical and academic institutes
Compliance/emissions trading	Training
Source: ERM	

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To ensure the correct partitioning of the responsibility in waste management we have to divide the MSW service into parts. These parts are usually:

- Waste collection, which should be the responsibility of the lowest appropriate level of municipal administration

- Waste treatment and disposal, which can be organised best at a unified basis, across the metropolitan area and the agglomerated areas as a whole.

- Waste transport and transfer is usually the responsibility of the same stakeholder as the treatment and disposal, but in some cases someone else is responsible for that part of the service which can lead to misunderstandings and argues.

It can be profitable if the responsibility is not divided into too many parts, for example if the collecting vehicles are in the maintenance of the municipality, but workers are the employees of an entrepreneur, the workers won't feel themselves responsible to take care of the collecting vehicles.

To **develop the institutional framework** of solid waste management we have to complete some tasks. These tasks are the follows:

- Establish the autonomy and authority of the different MSWM institutions. We can do this work best if we begin it from the base of the framework. Usually in low-income countries the fragmentation of the management is at a very low level. For example units which could be responsible for planning and monitoring simply do not exist, or the revenue collection is often centralised just as the financial framework. To reach the sustainable service a basic requirement is to share out the responsibilities between the different institutions of MSWM and to ensure the autonomy in terms of the basic organisational functions. Autonomy should mean that the manager, responsible for the MSWM institution is have the authority to control all of the necessary functions in his/her organisation.

- Improving the organisation of MSWM within the responsible municipality, is also a very important task to do. First we have to separate the different levels of the organisational system. The process begins with the separation of the unit within a larger department, for example to separate the unit of the street cleansing within the Department of Public Health and Environment. Second we should separate the department which usually called the Solid Waste Department. Then we should separate the agency which could be inter-municipal agencies operating relatively separately from the municipality. We have to measure the costs and service performances to assure the opportunities of the sustainable service and improvements.

- The separation of the functions by the MSWM agencies and offices is needed to obtain the more effective operation of the actors of MSWM. The three roles of the

MSWM system is need to be separated in a proper way. For example in the UK the system has a "client" department in each local authority which responsible for service provision, a direct service organisation acting as the "operator" in the system, competing and contracting the private sector, and a regulatory control organisation which is responsible for air and water pollution control, and for waste management regulation too.

- The gradual introduction of the improvements of the institutional framework of waste management is necessary to avoid any kind of shocks in MSWM, which could cause problems in the service.

Strengthening the management

It is well known that jobs in waste management are often has very low appreciation. To change that opinion well skilled senior managers need to be employed at this sector and the level of the wages, need to catch up those in other sectors. Other problems arise from the schedule of this job (fixed working hours) and from the low working morale which is a usual characterisation of this job. In many low income countries, the number of employees is very high in waste management, but instead of this the number of supervisors is low, and the lack of control can lead also to low working morale.

To solve these problems there are some options for the improvement of the human resources:

- Rationalisation of the working practices with more motivation in every level of the work.

- Field supervision and inspection, is improper in many low-income countries. The reason is sometimes very simple the supervisors do not have any vehicles to go with. If we increase the supervisor possibilities, they can work more efficiently.

- Training and human resource development is important to get trained staff at both managerial and operational level. The training can be carried out by education of the staff. The human resource development means to find the right man to the right place, but it needs cautious selection of human resources.

The participation of the private sector

The private sector participation can be profitable for the municipalities, because usually the private enterprises can deliver WM services cheaper than the municipality could do it. In this case this is worth considering to make discussions with the representatives of the private sector.

To decide which enterprise fits the best to accomplish the tasks that need solution from the private sector, the best option is the competitive tender. Competitive tender requires minimum two participants.

There are four well-known options for private sector participation in waste management, which are the follows:

- Contracting which can be won by competitive tender. The municipality awards a contract to a private firm to provide defined aspects of the overall waste management service for a fixed period. The contractor is paid by the municipality, who recovers the costs from the households. This option is well known and used in the EU.
- Concession contract means that the municipality awards a concession to a private enterprise due to competitive tendering to design, build and operate a facility for solid waste management. There are different kind of concession contracts depend on the ownership of the facility. There is one kind, when the enterprise is the owner (DBO), the other is when the municipality is the owner (BOO) and finally when ownership transfers to the municipality from the enterprise after a specified period (BOT). For this kind of contract the municipality have to guarantee a minimum quantity. This option is used in North America and Hong Kong.
- Franchise is the option when the municipality awards a limited monopoly via competitive tendering to a private company to deliver a particular waste service for a fixed period. Generally the private enterprise provides a performance bond and pays a fee for the municipality. The revenue is usually collected by the private company. This kind of private sector participation is revealing to the waste management system of the USA and the low-income countries.
- Open competition is the option where the municipality has the lowest responsibility, because the officials are only set up the roles of the solid waste management rules and then the private companies competing against each other for the households and commercial establishments. This option usually provides direct charge to customers. This kind of private sector participation is usual in the USA and in low-income countries too.

There are some criteria that we have to analyse before we contracting with a company from the private sector to ensure that the contractor delivers a quality service. These criteria are the follows:

- Well defined performance measures
- Enforceable sanctions in case of the lack of performance
- Aware monitoring
- Cost accountability

To ensure that the contractor works effectively and take the rules, we must consider the follows:

- Fluent inspection
- Pre-qualification of the contractor
- Contract documentation improvement
- Insist contractor to maintain staffed office in the contracted area

The informal private sector involvement in MSWM

In the low income countries there are usually informal sectors in the waste management system. These are usually single persons, families or micro enterprises. They are usually doing a special kind of recycling to collect recyclable materials from the waste stream. After they collect these items they sell them to enterprises and small companies which can recover or recycle these materials. Waste picking is the most widespread activity of this category.

Waste picking is usually unhealthy and ensures very low incomes to those people who do that work. Unfortunately this activity is likely to continue until both rural and urban poverty will not eliminated.

Instead of these we can help this groups with the followings:

- Improving working conditions and facilities for pickers
- Achieving more favourable marketing arrangements for picked secondary materials
- Introducing health protection, educational facilities and social security measures

Next step

Answer the questions seen below, and compare your answers with those suggested at the end of this pamphlet! Work in small groups if possible!

Questions:

1. What are the three different roles of the municipality in connection with WM service? Please describe them with a few words.

2. What are the average range of laws, at National level, which affecting the municipality's MSWM services?

3. Describes the possible available policy options to achieve MSWM goals.

4. Which are the four well known options for private sector participating in waste management?

5. How can we ensure that the contractor works effectively and take the rules, which are set up?

Subtask 5.2 Developing of the financial framework

In this step we take account of the financial options that arising during the planning process. In theory we can divide this subtask to three more parts, which are the follows:

- Establish the framework of the financial policy
- Economic assessment of the technology and alternative strategies
- Financial appraisal of the preferred MSWM strategic plan.

The establishment of the financial policy framework must begin with a comprehensive financial analysis of the existing system. It is important, that the economic and financial aspects are being addressed and on a timely basis. This process covers the following issues:

- Financial management and control
- The affordability to carry out the strategic plan
- The willingness to pay
- The revenue generation
- The cost recovery policy
- The sources of investments

Financial management and control

The financial management and control are necessary for the efficient operation of the solid waste management service, like any other services. Sound management is need to maintain cost effective and sustainable service. Usually these services are in poor condition in many countries. The reasons for it mainly:

- indigent organisational arrangements,
- poor budgetary systems,
- the lack of accountability
- inadequate revenue collection service
- the lack of skilled personnel

We can eliminate these problems with a well-built accountable financing framework. It needs very big efforts so it is important to keep the fore our limits.

Affordable cost effective services and appropriate levels of revenue generation are indispensable for the sustainability of comprehensive waste management facilities. This is the base of any improvement on waste management.

Here we enumerate some measures for Budgetary and Accounting system improvement:

- Adopt alike organisational structure with a similar budgetary system.
- Make separated cost and responsibility centres, each managed by a senior person
- Structure financial information systems along the cost stream
- Systematically collect data to estimate costs
- Make the municipality responsible for the revenue collection

If reorganisation is needed at the solid waste management departments these issues can be the first steps on this way. Usually the financial problems, which are facing the waste management are very similar to those that are concern the whole municipality.

Affordability

There are two aspects of affordability in connection with the MSWM Strategic Plan. The first is the affordability of the whole society and the second is the affordability of the individual person.

The affordability of the society relates to the costs of the proposed service relative to national income. The costs of wastes for the various components of a proposed solid waste management system can be estimated properly. After the proposed costs are estimated we can compare them with indicative costs considered for providing such services in a similar income country, but we have to make a conclusion whether the estimated costs are reasonable or need a certain over-thought.

The affordability of the individual persons is mainly depend on their social and economic situation. This relates to whether the user-charges, which are proposed in the strategy will be affordable to poorer members of the society, which means that the average household incomes are sufficient to pay it. The first is that those areas where the lower income member of the society live are the so-called "informal" or peri-urban areas with access difficulties, the lack of formal links through service provision or taxation. Strategies for this areas must usually planned and implemented separately from those for the "formal" areas in a completely different base.

The second option is concern with the structure and levels of proposed charges. If it is full cost recovery levels over time, or if the charge system contains a progressive element in which wealthy customers subsidise poorer ones. In that case wealthier users pay higher charges for the service, but they even get a higher level of service. It can depend on the area where the household is suited. The issue is normally addressed by first assuming that a full cost recovery policy is to be implemented regardless of income, but before implementing it, we always have to make an affordability analysis which shows the effects of such a policy, after it more progressive charging structures can be developed.

The third option is well known in developed countries, which is the polluter pays principle. This is an appropriate concept and could be a very god base of cost recovery policy.

Affordability studies that are important for the calculation of the charge levels are depend on the availability and appropriateness of the information on household income and expenditure. Average income statistics provide an indication of the overall affordability of the society. The relevant information are available usually from government agencies. These statistics are usually includes:

- Average income per capita for the whole society
- Average income per capita of the poorest group of the society
- The income difference between the richest and the poorest level of the society
- Changes in the distribution of income between survey periods

These data allow the affordability of proposed charges to different income groups to be assessed. This is useful calculating charges, which avoid unfair penalising the poor ones.

The proportion of household income is calculated for each income group and then compared with indicators of the proportion of household expenditure. From this we can decide, rather the projected service costs are reasonable to the average household or not, and the estimated charges are affordable for the poorest or not. If the service costs are too high for the average household the strategy may not be affordable and a lower cost alternative must be considered. If the service cost are not affordable for the poorer members of the society, then it should be taken into account at the calculation of the service costs.

If the income survey data are not available or too old , then to establish affordability we can generate them from customer data available from water and electricity companies. These data are also good to get information from the average bills, paid by the households.

The willingness to pay

The willingness to pay analysis is usually carried out as a social awareness survey and collect information about the paying intention of people. These surveys can help for the designers of the strategy to find the realisable solution. Willingness to pay should not be confused with affordability. Some people may see waste collection is the responsibility of the municipality, based on the existing taxes, others may not want the level of service being proposed, perhaps preferring a cheaper service. From the surveys we can get information to think carefully about service costs. The received data provide feedback on the types of services, people would prefer. It could be difficult to establish exactly what is that service level and type that is meet the expectation of most people relating to waste management. The ability of poor people to pay for a service is often reflects the judgement of others about the maximum percentage of income, a family should be required to pay. Under this circumstances it is understandable if the clean environment may not rank high among the priorities of an individual household. This could be the reason why NGOs and other organisations are fighting for integrated approaches towards community development. These may combine waste management, sanitation, community health, income generation activities and business development.

Revenue generation

There are two aspects of financing the waste management, what we have to consider during the planning period. The first is financing of the capital investments, the other is, financing of the recurrent costs.

Usually financing of the capital investments get more attention during the planning, even if the financing of the recurrent costs are probably more important, because the future sustainability is depends on this. The main elements of the recurrent cost financing are the revenues. In this case revenue generation and collection are the most important options to ensure the financial background of waste management.

The recurrent costs are:

- direct expenditures such as wages, fuel and maintenance
- provisions such as pensions or insurance payments
- regular recurrent cash outlays, for example debt repayment and service charges

The realistic revenue generation strategy is the key component of strategic planning process. Usually the major reason for service failures are the lack of proper budgeting procedures. Often waste management services are provided on a day to day cash basis, which is probably not

enough to ensure the long term viability of the service. The financing on a day to day basis can result a deterioration on the service quality and increase in costs. Within this circumstances the management becomes crisis management rather than service management.

Additional sources of revenues are also required because the common sources are fully utilised and competitive pressure exists for increases in the founds available to municipal services.

The common sources of revenues are:

1. Transfer founds assigned by the central or provincial government. This part is often contribute a significant proportion of total municipal recurrent founds. This funding source is outside of the control of the municipality.
2. Municipal revenue, which is comprising mainly of taxes and charges. These sources are usually paid directly into consolidated revenue. Local taxes are the most significant component of these sources. One part of municipal revenue is the property tax, which is an appropriate basis for founding local services. It relates to the value of the property and it is administratively simple to impose and collect. Other local government taxes are sometimes established in an occasional manner.
3. Specific charges levied by the municipality on the users of special service, such as water or electricity. These charges are intend to recover the costs of these services from the individual users. The agencies responsible for these services have a degree of operational and financial autonomy.

Possible options for additional revenue sources

1. Expanding the use of common sources. At this option we usually have little scope for action.
2. Realising funds from current sources with rationalising the expenditures and with establishing financial management if there were not existing one. For example, in many cities the collection is said to be good enough, but the disposal facilities are less than enough. With a rationalisation in the waste management framework we can deliberate relatively big financial sources, which can be useful in the other fields of waste management.
3. Maximising the revenues, which are available from taxes and charges is another possible solution for found generation. The option is to increase the mobilisation of the existing sources. For example following the inflation, or increase the efficiency of revenue

collection. The overall responsibility for revenue collection should rest with the Waste Management Agency.

The cost recovery policy

The cost recovery policy is needed to finance the additional costs which, are associated with the improved services. The municipalities have to be made aware of the costs of healthy and environmentally sound solid waste management services. To ensure the financing of these costs municipalities use the consolidated revenue. This often leads to under-funding of direct operating expenditures.

The cost recovery policy needs to establish the total amount of recurrent funds needed yearly and how these are to be provided.

The minimum account of recurrent founds required is to finance the direct operating expenditures and debt service obligations, but normally agency needs to make efforts to become self-sustaining and be able to be to recover capital expenditures and to provide a reinvestment into the service.

The user charges

Usually charges are levied to recover the costs of waste management services. The amount and way of levying is depend on the characteristics of the area concerned. There are two well known kind of user charges.

- The first is the direct user charge, when the charge is levied directly on the service user and reflect the level of use. This kind of charging is usually more popular by the industrial and commercial service users, because the users can pay only after the service they received. It is usually easier to estimate the amount of the generated waste in a weekly or monthly basis. The direct charging is conform with the polluter pays principle. The disadvantages of the system are the higher costs of the bureaucracy and the complexity of the maintaining separate user register.
- The other option is the indirect charging system, which usually relate to the level of demand for a service, which acts as a measure of demand for the waste management service. The indirect charging usually built in other bills like electricity or water, or in taxes such as the property tax. This kind of charging system is more preferred to use by the domestic users. The level of the charge can be differentiated depending on the service level and type. The advantages of the system are the administrative simplicity, the low collection costs, the high potential collection ratios, the availability for the punishment for non payment, possibility to follow the inflation index in the costs. The disadvantages are that the charges are related only indirectly

to the level of demand for the service, and the other problem is the dependence on another agency, which is responsible for the collection of fees.

The source of the investment founds

In this part we inform you about the possibilities and sources of financing the investment requirements of a MSWM Strategic Plan. There are several ways to establish the economic background for the capital investments here we describe the most used options:

- Internal savings are usually do not play big role in financing the investment costs of new strategies, because these sources often do not own the needed amount of money.
- Government contributions are usually the base of the investment financing. The problem with this kind of financing is, that these sources also in short supply and usually only to be made available on provisional manner, when urgently needed, that can made the planning system more difficult.

- Commercial loans are potential solutions, although rarely used, because the commercial rates and the short repayment periods made unsuitable this option for MSWM planning.

- Grants and loans from External Support Agencies are very important and good solutions for financing the capital investments if they are available. The grants are the best options, because neither interest nor capital has to be repaid. The problem is in that case, that generally there is no money allocated to spare parts and other maintenance costs. The loans allocated by External Support Agencies have usually lower interest rates and longer repayment period.

- The private sector involvement in the financing of the capital investment is a good option if the municipality do not have the sources establish any new waste management installation. It is very important to monitor the contractor before contracting, if he has the resources to manage the investment process. We also have to be careful with the selection of the contractor, considering his or her awareness of the costs. The contractors aim is to recover the investment cost and producing profit on charges and fees.

Next step

Answer the questions seen below, and compare your answers with those suggested at the end of this pamphlet! Work in small groups if possible!

Questions:

1. What are the three tasks of the developing of the financial framework?

2. What are the main fields of the financial analysis of the existing system?

3. What are the reasons of the poor financial management?

4. What are the main points of affordability studies?

5. What are the element of recurrent costs?

6. What are the sources of the investment founds?

Step 6 Evaluation

The evaluation of the technological options and the alternative strategies

This part of the planning process includes the methods to compare the possible options and solutions for the selection of the items of the final strategic plan, so this is the so-called economic evaluation process. The decisions are made at that stage of planning. The analysis is used to establish, what option is the most appropriate for a specific function. The economic and financial evaluation is often confused, although there is a big difference between the two tasks. The financial evaluation needs to establish the financial background of the investment, once decision has been made to invest. The economic evaluation decides rather the proposed investment is justifiable or not, and select between alternatives.

The tasks of the economic evaluation are:

- compare alternative strategies and technological options
- use economic prices during the process
- decide whether the proposed investment should be undertaken or not
- concern the efforts with the overall welfare of and the benefit to the municipality involved

To establish the financial background of the investment is not the task during the economic evaluation. The analysis has to calculate with the full annual costs of the single unit of equipment or technology. During the strategic analysis we need to calculate the total annualised costs of a technology or a piece of equipment, which comes from the sum of the annualised capital cost and the annual operating costs. The annualised capital cost is calculated by amortising the capital cost over its estimated economic life at the appropriate rate. The annual operating cost includes the fuel, maintaining, labour, management, administration and overhead costs. What we get during these calculations is good only for comparing the possible options, because they are average costs, and do not use them as input values.

Deciding between waste management strategies

To make the decision on which strategy fits better to our requirements we have to use the techniques of discounted cash flow analysis. During the process we need to make clear price understanding of the physical characteristics and resources required for each alternative strategy, and we have to translate it into cash outlays over time. The different options have different timing in their cost streams, but we need a tool, which helps during the comparison of

these variable cash flow streams. The discounted cash flow analysis translates the future cash flow into their present values. For this we use the appropriate discount rate.

With discounting we can reach the present value of the future costs that makes clear differences between the options and make easier to decide which is the more cost effective alternative.

For estimating the unit cost (currency/tonnes) of the different possible services, we best can use the average incremental cost analysis, which shows the average tariff need to collect for full cost recovery. We can get information from it for the future operating costs of the analysed strategy. We get the value of the unit cost by dividing the present value of a project cash flow by the present value of its associated waste throughput stream providing an estimate of the average cost per tonne of waste treated. It helps to compare strategies in the base of their unit cost.

The process of the overall economical analysis begins with the identification of the alternative strategies, which means we need to define clearly the options and find the ways meeting those objectives have been identified. The economic analyst needs to be a key member of the steering committee and the working group. Then we have to determine the discount rate, which is a essential tool to compare the different strategies on a common basis. the discount rate reflects the time value of money. Dealing with the interest rates is important, because they are mostly positive, usually in developing countries interest rates are between 8-15 % yearly in real terms. The discount rate is always expressed in real terms. The discount factors, which are needed to calculate discount rates, can be found in tables.

The strategic plan can involve many inter-related elements including collection, transfer and landfilling, so it is important to determine the characteristics and resource requirements of the strategies. The tools which are used for the identification of the resource requirements are:

- a schematic diagram which shows the component parts of each alternative strategy and
- a table setting out the resource requirements

To establish capital and operating costs we need to know, how these costs are built up.

The capital costs include usually the land, site development, infrastructure, plant and equipment and the licence costs if there are any. The operating costs include labour, fuel, maintenance, materials, utilities and insurance costs. Here we have to notice that usually under-estimation of the costs and over-estimation of the revenues characterise the planning process.

The aim of the economic evaluation is to choose the system which is the cheapest, but fits the a satisfactory level of service requirements. The evaluation is usually made on market prices. There are three factors, which have special influence on the result of economic evaluation, if we would like to use foreign technologies. The first is the actual exchange rate, the second is the import duties and the third is the tax levied on import duties. We also must consider the prices of the work force, the wages, because in many cases the vehicle demands can be substituted with human force.

It is better if we analyse the different strategies divided into operating subsystems such as collection, transfer or disposal, because in this way we can compare the relative unit costs of the various components. In this way we will be able to build a special strategy from different components, which fits best our requirement.

To be sure that we have chosen the best available solution, we have to make the sensitivity analysis. This analysis is based on the identification of the main risks affecting the strategies. The most important risks covered by the sensitivity analysis are the follows:

- Construction cost over-runs,
- components that taking longer than projected to implement
- waste volumes taking higher or lover than planned
- operating costs being higher than planned

This analysis involves calculating the effect that changing the values assigned to key parameters. The approach is usually to compare the effects of a percentage change, on the rank ordering of project options.

At the end of the economical evaluation , the alternative strategies can be ranked according to their average costs per tonne. The final decision can be made only when we took all the relevant factors.

The financial evaluation of the preferred waste management strategic plan

The financial analysis is undertaken after the economic evaluation has been completed. This evaluation usually takes care only with the preferred strategic plan. During this process we need to get information, what budgetary allocations the chosen system demands and how much money needs to be recovered from users to sustain it. The financial costs of a strategy can be influenced by government policies. The appraisal for the financing is therefore the basis for measuring municipal affordability and the limit of charges to be transferred to users. The financial evaluation is made on market prices, which must be adjusted for planned inflation to establish the actual amount of investment and recurrent cost s yearly

The financial evaluation has three aims:

- Demonstrate the financial viability of the chosen strategy,
- to prepare a financing plan to cover investment costs,
- ensure that the financial resources are available

It is important, that the preferred MSWM strategic plan should be financially sustainable in the long term. If there are any reason, which shows that the preferred strategy is not achievable, then it is unsustainable and another strategy should be considered. In this step we also need to take account the opportunity of contracting with the private sector. The private sector involvement to the strategy can result in a reduction in the total investment-funding requirement. Before we make any contract with the private sector, it is needed to examine the implications what these contracts can cause.

The investment financing plan need to include the total investment requirements, the proposed sources of investment finance, the loan and debt servicing schedules. This plan is usually a one-page table, and a critical part of the finance documentation. The total investment requirement is the total amount of money needed over the implementation period. It can be useful to prepare contract packages for different components of the strategy.
Cost items should be classified as foreign or local, with price adjustments, taking account the inflation and foreign exchange rates. When these price adjustments have been made we can calculate the total investment to be funded over the implementation period. After this it is necessary to identify the means, by which this can be funded.

The main sources of the investment are usually the local and foreign grants and loans. The preferred way of financing is grants, because grants do not have interest rates, and repayment obligations. Despite this an over dependence on grants should be avoided, because it can cause the non-affordability of the strategic plan, which means the strategy unable to afford the capital costs associated with the recurrent costs.

After we describe the sources of financing we need to arrange the investment financing plan, which shows the total financing requirements for the main strategy components and indicates how these are to be funded, and also establish the possible debt service schedules. The debt repayment is depend on the terms and conditions of the loan. Usually loans from international financing agencies will offer longer repayment periods, and lower interest rates than a commercial lender.

The next step is to establish the sources of the recurrent costs. The recurrent costs includes the operating expenditures, and the costs of the debt service such as interests and loan repayment, and usually these costs include the sources to sustain the service and for smaller developments in the service. To estimate the amount of revenue to be raised from user charges we can calculate the difference between the total recurrent funding requirements and the expected return from normal municipal sources. The other way we can get the needed amount of revenue is to estimate contributions from user charges according to realistic demands, and the different between them needed to form normal municipal sources.

Sources of funds from the municipality and from user charges are appear in the sources and uses of funds table, which shows all the relevant cash in and outflows. This table brings together the investment and recurrent funds as well as the capital and recurrent funding requirements. The difference between the total sources and requirements is shown as a surplus or a deficit. If there is a surplus it can be used for finance future liabilities. The deficit have to be financed from additional sources.

It can be useful to make an income statement and a balance sheet to make financial judgement easier. The financial statement shows the income and expenditures over a period of one year. The balance sheet provides an image of the assets and liabilities of an agency in a fixed point in time.

After considering all the necessary analyses a recommendation is made about the overall financial stability of the strategic plan. It is very important that the Action Plan is financially sound, and the longer-term strategy will be sustainable.

Next step

Answer the questions seen below, and compare your answers with those suggested at the end of this pamphlet! Work in small groups if possible!

Questions:

1. What is to be calculated during the economic evaluation?

2. What is the best way to estimate the unit cost (currency/tonne) of the proposed strategies?

3. What are the capital and operating costs? Please describe these explanations in a few words.

4. What is the main difference between the economical and financial evaluation?

5. What are the three aims of the financial evaluation?

6. What are the main sources of the financing of MSWM strategy? Please describe them.

Step 7 Strategy

At this step we take the results of the evaluation process and integrating those into the most appropriate strategy for developing the MSWM Strategy. The importance of detailed analysis of the possible solutions is get weight in this step, when we built up the final Strategic Plan for implementation. Usually the final strategy is composed of several operating subsystems from several possible solutions. The number of possible alternatives in this part of planning can not be more than ten, but it is usually much lower. It is important that the members of the working group have the responsibility to decide, what kind of strategy will be implemented, so they need to be able to apply their judgement as the most critical part of the planning process.

In this step of planning we take the options for each operating sub-systems and organisational aspects and integrating them into one Strategy for the long term. We need to keep the fore, that the strategy is made for the next fifteen years, so we need to be careful at each moments of decision making.

The building of the strategy is generally begins with the process of compatibility checking, between the selected options for each operational sub-system. This is a qualitative judgement to ensure, that selected options can be fitted together in an overall strategy. If there are any incompatibility between the options for different aspects, then it is needed to modify the options, or replace the incompatible ones with other options.
It is useful moreover to make a shortlist of alternative strategies integrating all the operational aspects. For Practical occasion the number of combinations should not exceed ten.

To evaluate the possible strategies it is needed to establish a list of selected criteria. The selected criteria are the basic standards against which the performance of alternative options and strategies need to be compared. The criteria are helping you to chose the right options and individual components from the possible solutions. The most appropriate way of evaluation of the alternative strategies is to compare them against a number of selection criteria.
We classify evaluation criteria into four strategic categories, such as:

- Technical,
- economic and financial,
- political and social,
- environmental criteria

We can divide these main groups of criteria into several sub-criteria. You must make your own lists of sub-criteria which are important in your local situation.

Here we describes some examples of sub-criteria:

Technological:

- flexibility to cope with local waste composition
- cost effective capacity
- safety and hygiene
- facility reliability and maintainability
- equipment and staff availability

Social and political:

- Legal and co-ordination difficulties
- difficulties with land purchase and land use as the MSWM site.

Environmental:

- vicinity of waste treatment and disposal facilities
- hydrological and hydrogeological acceptability of the selected area
- impacts of the waste management improvements on the natural and cultural environment

The evaluation process is to apprise of each alternative strategy against the criteria. This can be fulfilled by using a matrix or table which can be used to rank the options. We need to be careful, because this kind of evaluation is could be subjective. Do not forget that the most important element of the strategic building is the judgement by the working group which is based on the local knowledge and the understanding of waste management issues.

The next step is the comparative economic and financial evaluation of the proposed strategies. It means that the options are appraised against economical and financial criteria. The economical and financial analysis requires a quantitative approach. That part of the strategy building is very similar to the evaluation discussed in the former step, we even can not divide it.

To identify the resource requirements of the proposed strategies, there are two possibilities:

- make a table, setting out the resource requirements of each strategy
- make a schematic diagram, that shows the component parts of each strategy and the flows between them.

The table should reflect the functional activities, while the diagrams show the resource requirements of each component parts strategies. The table should include information at a very disaggregated level, to get a sophisticated image from the different strategies.

The table simplifies the evaluation process and reduces the opportunity to make errors in estimation. It can provides the further scheduling after the implementation, and it identifies the individual elements which operation and maintenance costs will be inquired.

The diagram can shows the various strategy elements and the relationship between them. It also provides a base for the construction of the economic model. In case of resource funding we have to keep the fore the increases in waste volumes over time. The correct estimation is can avoid negative surprises. This problem usually effects mainly the collecting vehicle capacity. To solve this problem in the future we can make financial reserves if possible.

The final comparative evaluation is usually made by an overall matrix, which is the summarisation of the evaluations of the different sub-systems of the strategies.

Here we show an example for this kind of matrix:

	Plan option				
Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Technical	B	B	A	A	C
Economical	A	C	A	D	A
Social/Political	C	A	B	B	C
Environmental	B	B	A	B	D
Overall Ranking:	2.	2.	1.	3.	4.

The letters show a ranking of the options Letter A mean very good letter D means poor.

It gives you an easy way to make a ranking between the alternative strategies. The winner of this kind of comparison is may the best available option, but there are several more objective and subjective criteria that influence the final choice.

After we decided which operational option will be implemented, we need to select the most appropriate organisational framework. The evaluation must cover:

- division of operational and administrative responsibility
- the mode of private sector involvement
- the services and operational areas to be privatised
- capital financing (loans, grants, leasing)
- manpower training
- public co-operation
- establishment of laws and regulations

The final step of strategy building is to integrate the preferred strategy and formal selection by the Steering Committee. During this process we need to integrate the organisational and operational aspects of the strategy, discuss the involvement of the stakeholders acting in the implementation and the preparation of the draft report to the Steering Committee for their comments and selection of the final strategy.

Next step

Answer the questions seen below, and compare your answers with those suggested at the end of this pamphlet! Work in small groups if possible!

Questions:

1. What is the compatibility checking? Please describe it.

2. Which are the main evaluation criteria of the strategy building?

3. What is the overall matrix and what it is good for?

Step 8 Action Plan

The action Plan turns the strategic vision into practical reality. it deals with specific actions, which are needed to be taken to implement the components of the overall strategy. The Action Plan determine that, who should take the appropriate actions and when. It is the part of the strategic plan. The Action Plan deals with the first period of life cycle of the MSWM development. The main task of the Action Plan is developing the immediate actions, which can be implemented over the next years, these are urgent and usually can be resolved without spending too much time and money. This can give credibility to the strategic plan, because the public and the different stakeholders can recognise that something is happening with the waste management system.

The action Plan needs to include the identification of priority investment projects, it should be worked up in detail for the first few (usually 5) years with more summary details being sufficient for the medium and longer periods. The Plan should also include separate items from each operational sub-systems of the strategy. The good and innovative ideas, which can be useful in the development process, should be tested in particular areas in pilot projects before possible introduction.

The contents of the Action Plan

We can divide the action plan into two separate parts, the first is the technical action programme and the second is the institutional strengthening action programme.

The technical part includes the service coverage, the collection, the waste treatment, the disposal techniques, the vehicle maintenance and the manpower requirements. Every sub-system of the proposed strategy must be defined in a detailed manner.

The institutional part must include the division of responsibility, the private sector involvement, the development of legislation and policy and the development of the training programs.

The key parts of the Action Plan depends on what we should develop, and what are the options we can realise, so these differ in every individual cases. The usual parts of an overall Action Plan are the follows:

- The development of institutional systems,
- financial planning and appraisal,
- development of the regional landfill, collection system, waste treatment, street sweeping etc. ,
- implement new waste treatment facilities such as composting sites, waste transfer sites, waste incinerator plant etc. ,

- description of new equipment,
- construction of new landfill and closure of the existing dump sites,
- the list of the urgent and medium term priority investment tasks with a detailed system description,
- the coordination plan of the implementation, and
- public awareness campaign, and public education.

There could be many other options which need to be considered in the Action Plan in different cases.

Probably the most important is the financial planning and appraisal, because usually the biggest shortfall is the money. From the former steps we have got detailed data, which are available to make a reliable financial appraisal for the Action Plan. The financial appraisal establish the revenue requirement of the MSWM Action Plan, which is necessary to cover operating costs and debt service, therefore establish the financial viability of the Action Plan.

If the funding of the investments are financed by an External Support Agency, then the detailed preparation of the financial appraisal of the project is generally a formal requirement. It would be necessary to identify the first priority projects for investment. Technically the appraisal would include the feasibility study, environmental impact assessment, the design and construction of the facilities covered by the Action Plan, the acquisition of the equipment and the establishment of the cost recovery system.

The key issues of the financial appraisal are the follows:

- Arrangements for financial management, which means the establishing of the financial objectives for the Action Plan. That is considered, the strategy must be self-sustaining in financial terms in the long run. The factors that influence the self-sustainability are the costs, must be recovered. The future investment arrangements and the municipal contributions to the service.

- Financing requirements for the capital and recurrent expenditures. We can calculate this due to the average incremental costs which is known from the step of evaluation of the plnning process

- The financing plan which summarise the total investment requirements, the proposed source of the investments and the loan and debt servicing schedules. It must be detailed and appropriate.

- The revenue sources. That means we need to describe the possible sources of the revenues. The most common sources are the municipal transfers, taxation and user charges.

The Feasibility Study focuses on providing sufficient detail to allow the lenders to agree the terms of the project loan. The study is based on public consultation and participation. During the work, establish the final data on waste quantities, and facility capacity. We have to choose the ultimate place for the future facilities. The feasibility study must include an environmental impact assessment. It needs to include detailed information about the site's characteristics such as the access, layout, investigations, transportation specifications etc. The study also has to include a affordability analysis, and information about the ownership construction.

The final step before introducing the Action Plan is the consultation with the stakeholders, because the plan must be accepted and supported by them. At the workshop the draft version of the Action Plan is discussed with a wider forum of stakeholders for a final input and approval. After the meeting the final version of the Action Plan is need to be prepared and published for the approvals. Usually several approvals are needed for the introduction of the Action Plan and for the implementation of the Strategy. these are usually:

- approval by the Mayor of the municipality,
- approval by the City Council.
- approval by the National Government and an
- approval by the lenders (ESA, Government)

Next step

Answer the questions seen below, and compare your answers with those suggested at the end of this pamphlet! Work in small groups if possible!

Questions:

1. What are the main tasks of the Action Plan?

2. What should the Action Plan include?

3. What is the final step before implementation of the Action Plan?

Step 9 Implementation

The implementation can be started only after all the needed approvals are available, and organisational, financial and operational background is ready for the process. It is useful, furthermore important, that the leader of the implementation process is have to be a strong and conscious member of the working group, with a sense of co-operation. The success of the implementation process is partly depend on the leader of the implementation.

The immediate Action Plan

Usually to get all the approvals to implement the overall strategy can take 6 or more months, the feasibility study which need to make for the lenders and other agencies is also can take a longer time. To keep the process in moving we can make an immediate Action Plan with the most urgent tasks, which do not need difficult approvals and significant financial background. A good idea for the immediate action plan is to make pilot projects testing some of the proposed strategies. The immediate action plan is important to provide credibility to the authorities, which they are seeking for.

The staff of the new institutional system

It could be useful to employ the members of the working group in the different agencies and institutions of waste management during the implementation period. Usually in the short term external technical assistance is required to strengthen the organisational and operational framework of the new systems in waste management. These experts can be local and international ones too. The international expert is usually characterise those waste management develop processes, which are funded by External Support agencies. In case of international expert a local staff member is needed to learn the tasks from the expert, and to substitute him in the long term. The aim is that the MSWM Institutions should be staffed by senior local staff with the responsibility and accountability to provide an efficient and sustainable waste management service into the future.

Public communication

The other main task of the implementation period is the communication with the public, which means education and public awareness. This is necessary to ensure that the implementation of the Strategic Plan is successful. The awareness and public education are tools used to increase the public support and participation. The main objectives of the public communication are to inform the stakeholders, to reach public support and to build image for SWM.

We need to inform the stakeholders about the operation of the used system, about the logistic system and about the measures that make stakeholders knowledgeable about the reason for proper waste management.

The main element to reach public support is of course to offer a sustainable and effective waste management service, but we also need to inform the public about the goals we would like to reach and about the success of the development. The best way for it is due to a Public awareness and education programme. The programme needs to address a wide variety of people with different background.

The image building is also the part of the communication programme, which has the task of increasing the appreciation of waste management. It is important, because that "dirty" image make difficulties for the waste management departments to find qualified and motivated workforce. To improve the image we can present waste management as a well organised system, and present waste as a resource not as the necessary evil.

The public awareness and educational programme should reach all representatives of the society. The more desirable target groups are the schoolchildren, for long term effects of education, the governmental departments, for the central support and the private sector with a view to possible participation and funding.

The programme usually carried out by the relevant department within the municipality, but in many cases they relegate this task to NGOs or professional agencies. There is one important thing what we should keep the fore during the implementation of the programme and this is that the information what we communicate is correct and component.

If we decided to make such a programme we need to make a plan which contains the list of the stakeholder to be reached, the extent of public involvement, the time plan the budget and the sources of the campaign.

Next step

Answer the questions seen below, and compare your answers with those suggested at the end of this pamphlet. Work in small groups if possible

Questions:

1. What is the immediate action plan?

2. Usually in which cases can we employ an international expert?

3. What is image building, and why it is important?

Step 10 Monitoring

During the planning process usually large amount of data are being collected and processed into useable information. It is known, that information is only valuable when it is focused and being used to a specific task. We need to use information in several areas of MSWM development. We need information for decision making, planning, problem solving, knowledge building and for monitoring too. Monitoring is the task of the operational period of the development process and it is based first of all on appropriate information. We need to monitor all the existing parts of waste management to get an overall picture from it to find the mistakes and sub-optimal functioning of the system.

Monitoring of the Strategic Plan

We must begin the monitoring process with the Strategic Plan. The Strategic Plan needs regular revising and updating to ensure that the targets of the plan are being met in terms of service delivery, financial performance etc. The Strategic Plan need to be flexible and need to adopt the changing circumstances, such as changes in waste stream etc. A regular review as a part of the monitoring can help to improve the municipality's knowledge about the MSWM system. It is important to consider when and how often the Plan should be reviewed. When it becomes obvious that changes are needed it may be necessary to repeat the main steps of the planning process.

Monitoring of the management services

The analysis of the performance of SWM with special attention on the parts which performed on an unsatisfactorily level, is need to be done in a detailed form. The performance monitoring has several goals:

- to observe the quality of the SWM service to maintain or improve the service quality
- to exploit the efficient use of available resources
- to improve service quality
- to compare services against the targets set out in the Strategic Plan
- to compare the quality of service provision in a municipality with a previous year or with another municipality's service

Performance review is a key element of the quality service. The main area which performance monitoring is deal with is the efficiency of the provided service. That means we need to know how can we use our resources, (money, workforce and equipment) to find the best possible way to serve the greatest amount of customers at the highest possible standards, and we also need to know the weak points of our system to take steps for the specific improvement.

To determine the performance of waste management system in general and its individual components, performance indicators and performance measures of MSWM are used. Performance indicators are quantitative data related to the waste management services. Performance measures are the results of performance indicators relating them to time or cost, and they are used to for assessing the performance of the system.

To get true performance measures we need reliable accurate and regular data collection and cost accounting. The weighing of waste and the availability of details on service operations are also important for the performance measures.

The two main areas of waste management are the waste collection and waste disposal. We divide the performance measures on this basis.

The performance measures specifically for waste collection:

Service provision

- Tonnes/week
- People served/week/operator
- Vehicle availability
- Frequency of collection, % of population receiving collection service

Financial provision

- Total collection cost/tonne or household
- Labour costs/tonne or households
- Vehicle costs/ tonne or household
- Revenue collected against cost of collection service
- Revenue collected from commerce and industry

These indicators can be used to compare performance on a time basis within the municipality or with other municipalities. The comparison must take into account local geographic and industrial conditions of service provided.

The performance measures specifically for disposal services

Service provision

- Tonnes of waste delivered
- Density of waste disposed

- Quantity and quality of leachate
- Frequency of daily cover use

Financial performance

- Total disposal cost/tonne
- Total operational cost
- Income from recovered materials
- Transfer costs

It is well known that higher operation costs are essential if the services and circumstances on the landfill were developed. The reliability of all performance measures depends on the quality of the information, that is why weighing of waste is important if we would get reliable information.

The Information Management System

The Information Management System is a system which information is collected, stored, organised, processed, utilised and disseminated. This system is requiring a regular stream of data to fed into it. We can get up-dated management information to calculate the outputs, the revenue requirements and the annual budget. The revenue collection can be improved through better resource mobilisation. It helps also during planning and decision making. It also able to give a guide for the future investment requirements.

It is need to know that the data collection and processing is a costly and time consuming exercise, but needed for the efficient and sustainable service provision. Data collection is begins with the consultation of the staff of waste management departments about their tasks in data collection and about the overall plan for Information Management System. An appropriate format and method has to be chosen, and the frequency of data collection has to be defined. It is important, that the data collection is need to be regular. All the collected data are need to stored and processed in a central place it is a kind of an information center. It is important that the municipal and private service performers also need to transfer all the information required by the information center.

For data storage and processing the use of personal computers is recommended, because of the large amount of data. A special database software should be used, and sufficient staff need to be used servicing the database.

Reports

There are different reports needed to summarise the results of data processing and performance measuring. For the general planning of the MSWM plan annual summary reports are sufficient, but for the leadership of waste management weekly or monthly reports are needed, and for the operating managers usually daily reports are required. The content of the reports are also differs from each other for example a daily report for the manager of waste collection is more detailed in its field than an annual overall report for the public. The costs of the system is depends on the sophistication of it, the software and hardware requirements.

Next step

Answer the questions seen below, and compare your answers with those suggested at the end of this pamphlet. Work in small groups if possible

Questions:

1. Why monitoring is important in waste management?

2. What are the goals of performance monitoring?

3. What are the financial performance measures specially for the waste collection?

4. Describes please the Information Management System.

ANSWERS

Step 1 Organisation

1. The first task of step one is to mobilise the efforts and support on behalf the success of the improvement. The second task is to organising the work of planning.

2. The need can be assessed by consulting with the decision-makers on the unwanted environmental and health effects, related the inadequate waste management practices in the municipality. If the problems, what we have listed for the leaders are common, than we need the improvement is established.

3. The members of the Steering Committee should be the follows:
   - A senior political figure as chairperson
   - Representatives of the various municipalities
   - At least one member of the MSWM plan working group
   - Selected local officials representing relevant departments
   - Representative of the regulatory agencies
   - Selected waste management operators, practitioners and planers
   - Private sector representative
   - Representatives of NGOs (Non-Governmental Organisations) CBOs (Community Based Organisations) and interest groups
   - Women leaders in SWM
   - Selected specialist experts
   - Representatives of external support agency

Step 2. The present situation

1. The data we need to collect have to cover the following areas:
   - Population
   - Nature and quantities of wastes
   - Refuse storage and collection
   - Excreta collection and disposal
   - Refuse treatment
   - Refuse disposal
   - Materials recovery

- Street cleansing
- Organisation and management
- Legislation
- Costs
- Revenue collection

2. The data which are needed in connection with waste treatment are the follows:
   - its location
   - age
   - type (incinerator, compost plant, etc.)
   - operating capacity
   - current throughput
   - remaining useful life
   - manpower requirements
   - percentages of recovered products, if any, and revenue received
   - operating cost
   - ownership

3. We should collect reliable and accurate the information in an up-dated base. We have to take care during collecting process to avoid mistakes. We need to describe the weight of data collection with those responsible for data collection in the different parts of waste management.

Step 3 Problems

1. Problem definition must cover several internal and external difficulties such as:
   - Service coverage,
   - The level of waste collection,
   - quantity and composition of solid waste
   - The efficiency of the WM. services
   - Working conditions, especially safety, and workload
   - Sanitary and environment conditions of the area, especially landfill conditions
   - Recycling and materials recovery
   - The involvement of the private sector, the lack of correct contracts, fair tenders
   - Equipment management, the use, maintenance and shortfalls of equipment
   - Public attitude, e.g. willingness to pay fees

- Decision makers attitude,
- Technical and financial support requirements

2. This answer is differ in each cases, because its regarding to the waste management problems in your Municipality.

3. Problem analysis is important, because we can only find the solution to our problems of waste management if we are know the problems clearly in a detailed manner.

Step 4 Terms of planning

1. The average waste types in view of their origin are the next:

- Household waste
- Institutional waste
- Commercial waste
- Construction and demolition debris
- Street sweeping
- Sanitation residues
- Industrial waste

2. The circumstances that influence the choice between the different waste handling systems are the next:
   - The categories of wastes, which are in the conventional responsibility of the local municipality
   - The level of control that is needed in case of those waste categories, that are not in the responsibility of the local government
   - The minimum collection frequency
   - The type of the collection bins

3. The subtasks are the follows:
   - The choice of the planning region and interval, which means that in case of the region we have to consider several circumstances such as the geographical position, the demographic, economic and financial situation, and last but not least the institutional status of the area. The interval of the plan is needed to emphasise on the long-term periods

- The selection of the waste types which have to be in the plan means that the selection of waste types is needed to make clear the responsibilities in the management, and help to shows the co-ordination areas, which have to be set up for adequate waste management
- Determine the level of the service, which is important mainly for the planing of the financial background of the future service.
- Find the targets and objectives for the plan, for decide what parts of the waste management is need to be developed.

Step 5 Solutions

Subtask 5.1.Development of the organisational framework

1. The roles of the municipality in connection SWM are:
   - The role of the Operator is to deliver the waste management services.
   - The Client function is to ensure the proper level of the provided services.
   - The role of the Regulator is to ensure the legal background for the MSWM service.

To clarify the tasks, roles and rights at governmental bodies and other organisations involved to waste management is very important, because overlapping in this area can cause arguments, controversies, and can lead to inefficient service and inaction which will weaken the political sustainability of MSWM systems

2. The average laws, at National level, which affecting the municipality's MSWM services are:

   - Public health/Municipal waste collection legislation
   - Waste disposal legislation
   - Laws related to recycling
   - Planning laws
   - Legal framework of privatisation:

3. The available policy options to achieve MSWM goals

Economic and financial options	**Information and Educational options**
Waste taxes and disposal fees	Community right to know, waste reporting
Charge/rebate system	Support for research and development

Producer's responsibility	Formulation of targets and timetables with agreement from stakeholders
Raw material taxes	Waste exchange rates
Product charges	Public awareness programs
Subsidies for waste prevention and recycling	Voluntary agreements between government and industry groups
Tax preferences	Role of public, industry and trade associations
Liability instruments	Role of technical and academic institutes
Compliance/emissions trading	Training

4. The four well known options for private sector participating in waste management are the follows:
   - Contracting which can be won by competitive tender.
   - Concession contract means that the municipality awards a concession to a private enterprise due to competitive tendering to design, build and operate a facility for solid waste management.
   - Franchise is the option when the municipality awards a limited monopoly via competitive tendering to a private company to deliver a particular waste service for a fixed period.
   - Open competition is the option where the municipality has the lowest responsibility, because the officials are only set up the roles of the solid waste management rules and then the private companies competing against each other for the households and commercial establishments.

5. To ensure that the contractor works effectively and take the rules, we must consider the follows:
   - Fluent inspection
   - Pre-qualification of the contractor
   - Contract documentation improvement
   - Insist contractor to maintain staffed office in the contracted area.

Subtask 5.2. Development of the financial framework

1. The three tasks of the developing of the financial framework are:
   - Establish the framework of the financial policy
   - Economic assessment of the technology and alternative strategies

- Financial appraisal of the preferred MSWM strategic plan.

2. The main fields of the financial analysis of the existing system are:
   - Financial management and control
   - The affordability to carry out the strategic plan
   - The willingness to pay
   - The revenue generation
   - The cost recovery policy
   - The sources of investments

3. The average reasons of the poor financial management are the next:

   - indigent organisational arrangements,
   - poor budgetary systems,
   - the lack of accountability
   - inadequate revenue collection service
   - the lack of skilled personnel

4. The main points of affordability studies are:

   - Average income per capita for the whole society
   - Average income per capita of the poorest group of the society
   - The income difference between the richest and the poorest level of the society
   - Changes in the distribution of income between survey periods

5. The element of recurrent costs are the next:

   - direct expenditures such as wages, fuel and maintenance
   - provisions such as pensions or insurance payments
   - regular recurrent cash outlays, for example debt repayment and service charges

6. The sources of the investment founds:

   - Internal savings
   - Government contributions

- Commercial loans
- Grants and loans from External Support
- The private sector involvement

Step 6 Evaluation

1. The analysis is used to establish, which of a number of possibilities is the most appropriate for a specific function. The analysis has to calculate with the full annual costs of the single unit of equipment or technology. During the strategic analysis we need to calculate the total annualised costs of a technology or a piece of equipment, which comes from the sum of the annualised capital cost and the annual operating costs.

2. The best way to estimate the unit cost (currency/tonne) of the proposed strategies is to use the average incremental cost analysis, which shows the average tariff need to be collected for full cost recovery. We get the average incremental cost by dividing the present value of a project cash flow by the present value of its associated waste throughput stream providing an estimate of the average cost per tonne of waste treated

3. The capital costs include usually the land, site development, infrastructure, plant and equipment and the licence costs if there are any. The operating costs include labour, fuel, maintenance, materials, utilities and insurance costs

4. The main difference between the economical and financial evaluation is that the economic evaluation decides rather the proposed investment is justifiable or not, and select between alternatives. The financial evaluation usually takes care only with the preferred strategic plan. During the financial evaluation we need to get information, what budgetary allocations the chosen system demands and how much money needs to be recovered from users to sustain it.

5. The three aims of the financial evaluation are, to
   - demonstrate the financial viability of the chosen strategy,
   - prepare a financing plan to cover investment costs,
   - ensure that the financial resources are available

6. The two main sources are the local and international grants and loans. The grants are more preferred option for financing than loans, because loans need to be repaid and interest rates also need to pay.

Step 7 Strategy

1. The compatibility checking is a qualitative judgement to ensure that the selected options can be fitted together in an overall strategy. If there are any incompatibility between the options for different aspects, then it is needed to modify the options, or replace the incompatible ones with other options.

2. The main evaluation criteria of the strategy building are:

   - Technical,
   - economic and financial,
   - political and social,
   - environmental criteria

3. The overall matrix is the summarisation of the evaluations of the different sub-systems of the strategies. The matrix helps us to rank the alternative strategies. It is easy to understand for all the relevant stakeholders.

Step 8 The Action Plan

1. The Action Plan enrols the specific actions, which are to implement the components of the overall strategy. The Action Plan determines that, who should take the appropriate actions and when. It deals with the short and medium terms of the implemented Strategy.

2. The Action Plan should include the following items:

   - The development of institutional systems,
   - financial plnning and appraisal,
   - development of the regional landfill, collection system, waste treatment, street sweeping etc. ,
   - implement new waste treatment facilities such as composting sites, waste transfer sites, waste incinerator plant etc. ,
   - description of new equipment,
   - closure of the existing dump sites,

- the list of the urgent and medium term priority investment tasks with a detailed system description,
- the coordination plan of the implementation, and
- public awareness campaign, and public education.

3. The final step before implementation of the Action Plan is the discussion with the relevant stakeholders.

Step 9 Implementation

1. The immediate Action Plan is needed to keep the waste management development process in moving. It usually involves the most urgent tasks, which do not need difficult approvals and big financial background.

2. We can employ international experts, when we have the financial background for it, and in cases, when the External Support Agency require the presence of such an expert.

3. Image building is part of the communication programme and it has the task of increasing the appreciation of waste management. It is important, because that "dirty" image make difficulties for the waste management departments to find qualified and motivated workforce.

Step 10 Monitoring

1. Monitoring is important in waste management, because we can get an overall picture from waste management to find the mistakes and sub-optimal functioning of the system. From the up-dated management information we can calculate the outputs, the revenue requirements and the annual budget. The revenue collection can be improved through better resource mobilisation. It helps also during planning and decision making. It also able to give a guide for the future investment requirements.

2. The goals of performance monitoring are the follows: to observe the quality of the SWM service to maintain or improve the service quality
   - to exploit the efficient use of available resources

- to improve service quality
- to compare services against the targets set out in the Strategic Plan
- to compare the quality of service provision in a municipality with a previous year or with another municipality's service

3. The financial performance measures of waste collection:
   - Total collection cost/tonne or household
   - Labour costs/tonne or households
   - Vehicle costs/ tonne or household
   - Revenue collected against cost of collection service
   - Revenue collected from commerce and industry

4. The Information Management System is a system which information is collected, stored, organised, processed, utilised and disseminated. This system is requiring a regular stream of data to fed into it. It helps for planning and operation tasks.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UP-DATED TRAINING MANUAL OF WASTE MANAGEMENT IN HIGH DENSITY AREAS OF THE AFRICA REGION

MODULE 6.
TECHNICAL AND TECHNOLOGICAL KNOW-HOW

Contents

1. INTRODUCTION

Solid waste problems are not the only environmental problems, and environmental problems are certainly not the only issues competing for attention and funds. The wise choice of a good technology or practice can sometimes resolve present problems adequately, at the same preserving funds for successfully resolving other environmental, social, or economic problems. Spending money on an ineffective technology, though, puts the burden of cleanup efforts on future generations. Therefore decisions made now regarding Municipal Solid Waste Management (MSWM) practices have a great effect on the future welfare of people living in the area.

It is pointless to try to design the "perfect" technical system or set of policies if they cannot be implemented. By considering resource constraints, planners can avoid the classic error of trying to determine what is necessary, instead of concentrating on what is possible.

The planning process can help to determine how to use a limited supply of resources, and can broaden a community's (or a whole country's) understanding of available resources. But in order to develop a well-integrated and cost-effective MSWM know-how, planners must evaluate how well each potential piece of the system fits in with other existing or proposed system components. The fit of a particular component can be measured in terms of its purpose, size, location, ownership, operation, system of financing, and relationship to administrative and regulatory agencies.

2. Objectives

The specific learning objectives of this unit are as follows:

- To get information of municipal solid waste, the sources, the types and the analytical procedures, the collection and transport of waste, and different types of waste management processes.

- To describe the main environmental problems that result from waste management and the opportunities to reduce them..

- To shows the practice of waste management which exist now in Africa and other parts of the world.

3. Key Learning Points

1 Solid wastes include all solid or semisolid materials that the possessor no longer considers valuable enough to keep. The management of these waste materials is the basic concern of all solid waste management activities. The waste analysis is important to get information from the waste, for the waste management plans.

2 There are a number of special, hazardous wastes that are generated in an urban area These wastes need separate handling. But for the most part in Africa, these services are not available for the toxic and infectious wastes, so they are collected along with the rest of the waste stream.

3 Waste collection and associated services adsorb most of the current costs of waste management in low income country cities, often 10-20% of the total municipal budget. Therefore improving the efficiency is very important for reducing costs. It is also important to choose the right or special equipment and collecting vehicles which are fit for the circumstances of the area.

4 Composting is a possible way to reduce the amount of waste .Composting could be promising because of the high organic content (up to 70%) of MSW, that characterise the low income countries. The two most important conditions are the cost efficiency and the expertise. Unfortunately composting does not have a significant impact on MSWM jet.

5 Incineration and waste to energy (WTE) installation are rarely used options for MSWM in Africa. The high capital and operating costs of these plants, the lack of expertise and the limited infrastructure shows that incineration technology for Africa needs a proper , elaborated planning before implementation.

6 The landfills are the main components of the MSWM system mainly because in many cases landfills are the only opportunities to dispose waste after collection. Landfills may cause serious environmental pollution especially on water bases if they are not planned, constructed and managed carefully. The environmental protection activities in MSWM should focus on improvement of landfills in African countries.

Suggested study procedure

1 Take the test in the review. Think about the raising questions, and your study requirements about this pamphlet.

2 Read trough the Study Materials, including the Reading Excerpts. Prepare answers for the questions at the end of each section. If possible work in small groups and discuss all the questions raised during the work. After you answered the question compare them with those suggested at the end of the pamphlet.

4. STUDY MATERIALS

The following sections are designed to help you become familiar with the technological options and know-how for Municipal Solid Waste Management in Africa. We try to show the framework of MSWM, how does it work and what are the special problems facing the African countries in the field of waste management.

4.1 Waste inventory (Quality, Quantity)

Municipal solid wastes are likely to include wastes from households, together with commercial, institutional and some industrial wastes, which have a similar character and composition to household waste. Industrial wastes are generally regarded as an industrial rather than municipal responsibility and are excluded from municipal solid wastes. The most frequently used categorisation to qualify wastes is the following:

- Paper
- Plastic
- Glass
- Metals
- Organics
- Textiles
- Potentially hazardous
- Construction and demolition debris
- Other

The composition is given in percentage of the total amount.
The quantity is generally calculated in the unit of [kg/capita/day], what is in Africa falls between 0.4-2 [kg/capita/day].

Special wastes which need special treatment, are rise from different activities.
We have to begin the management of special wastes of the asses of their impact on human health on the environment, and the level of their risks. In most African countries the treatment of hazardous wastes are not solved. In most of the cases they manage hazardous wastes together with the average waste stream. This is because of the lack of resources, mainly capital, but experimental ones also. This is one of the main environmental problems, that faces African countries. The most hazardous wastes are the follows:

- Medical wastes
- Sewage sludge and slaughterhouse wastes
- Household hazardous wastes
- Some of the industrial wastes
- Used oil
- Batteries

Solid waste quantities can be estimated by application of generation rates to a given population or other statistical data.
To know quantity of the raising waste is important at the planning of the waste management. The planning is important to divide the available resources.

Next Steps

1 Read the excerpt from "The rising wastes and the first step of waste management", included at the end of this pamphlet.

2 Test your comprehension of the information by answering the questions below, discuss them with the group, and compare with the answers are suggested at the and of the pamphlet

Questions:

1 Give a definition of municipal solid waste, and name the 8 categories of the waste classification.

2 What are the most important hazardous wastes, and how do we begin the effective management of these special wastes?

3 What does waste prevention means, and how could we reach it?

4 What are the main reasons of waste recovery and recycling in most of the African countries?

5 Encounter the strategies to promote waste reduction at the national and local level.

4.2 Waste collection and transport

The lack of waste collection is the most conspicuous part of MSWM. These services has the largest amount of expenditure in most municipal budgets in African countries. That is why it is important to improve the cost-efficiency of collection and transport.

The major cities in Africa have an existing collection system, but in the countryside it is not always solved, the level of collection is much lower than it would be expected. Collection rates in Africa are wide enough, from 20-80% with an average range of 40-50%. The greatest savings can be made by organising and planning waste collection and associated services.

The waste containers can be divided to two kinds, one is the owner's container, which used to store waste within a dwelling and brought out at a prearranged time for emptying , and the set-out containers which are large containers placed outside the dwelling and left at kerbside sites for collections. The containers should suit the following conditions:

- Made of local recycled or readily available materials
- Easy to identify
- Sturdy and easy to repair
- Appropriate to the terrain
- Made them from materials which do not attract theft

The waste collection vehicles in Africa are usually a mix of motorised, animal and hand drawn vehicles. About the vehicles it is very important, to choose the right ones, which are fit for the circumstances of the area. It is important to know, that in Africa a labour intensive collection system often can be more readily sustained under economic conditions, so it is important to get the correct balance between labour force and mechanisation. In many cases, improvements to MSW collection services in Africa can be best promoted through the development of local capability for manufacturing vehicles and equipment.
Probably the best solution to improve the efficiency of waste collection and transport is planning. A reasonable plan can reduce the costs, and increase the efficiency of waste collection and the joining services.

Next steps

1 Read the reading excerpts on "waste collection and transport in Africa" include at the end of this pamphlet .

2 Test your comprehension of the information by answering the question below and discuss them with the group.

Questions

1 What types of waste collection systems do you know, describe them with a few words.

2 What are the main options which make the collecting vehicle the right one for the task in developing countries?

3 What kind of collecting containers do you know which are used in African countries?

4 Make a list of the factors influencing the effectiveness of the collection process, and describe them.

5 How do you think planning can influence the collecting process?

4.3 Composting

As seen in the introduction, waste in African countries typically contains a large percentage of putrescible materials. This fraction of the waste has the potential to be composted at the local level. Composting can reduce the amount of waste , and also the costs of collecting. The other widely used solution to use the organic wastes is animal feeding.
This kind of recovery of organic waste works much better in local level than in centralised schemes. Composting in local level, however, is much less reliant on sophisticated technology and elaborate organisational and incentive systems.
Householders and communities set aside small areas of land for composting, set up their own system of waste segregation ,and use their own networks to distribute compost product.
Usually the level at which the composting system works best is too small scale for a municipality to be of productive assistance. Municipalities can, however , encourage local composting in educational and awareness programmes, which also reduces the quantities of waste.

Next steps

Read the reading excerpts on "Composting facilities in African countries" including at the end of this pamphlet.

2 Test your comprehension of the information by answering the question below and discuss them with the group.

Questions

1 How big is the proportion of organic content of MSW in African countries?

2 What are the two main level of composting, and usually which works better in practice?

3 What are the economic failures of composting? Describes them.

4 Make notes on the possible types of hazardous components that can contaminate the compost and their possible effect on product.

4.4 Incineration and energy recovery

Incineration technologies are strive to the destruction of MSW by controlled burning at high temperatures, it's main task to reduce the remaining residues to a safe non-combustible ash, which can be disposed safely.
This process is usually used in those countries where land of disposal is limited and scare.-. African countries usually have got enough place for disposals, but that is not the only reason why incineration is so little used option for waste management in Africa.
Waste incineration requires high technological level in the country which is supported by adequate equipment, infrastructure facility and trained personnel.

Next steps

1 Read the reading excerpts on " Incineration and energy recovery" included at the end of this pamphlet.

2 Test your comprehension of the information by answering the question below, and discuss them with the group.

Questions

1 What types of wastes are suitable for incineration in a cost –effective way?

2 What are the main options, why incineration is not the best option for waste management in most African countries?

3 In what cases could incineration be a reasonable solution for waste management?

4.5 Landfilling

Landfilling is the most used option for the final disposal of waste in Africa. Existing final disposal practices for MSWM in most African countries, consist of dumping of waste in vacant areas of land. Dump sites in most cases do not have any control to reduce their environmental impact. In many cases MSW is dumped in low-lying marshy land in the vicinity of inhabited area.

It makes a real risk of contamination of water resources from MSW dumping. Leachate (highly polluted liquid) is generated from decomposition and dissolution of MSW and can enter into surface-, and ground-waters. Due to their unplanned nature, dump sites often located close to community drinking water wells urban water supply intakes, or in sensitive ecological habitats. High levels of dust, odour and visual blight, often make the quality of the environment around the dump sites very poor.

The burning of wastes at the dump sites can cause air pollution, but other measures can turn the site to anaerobic decomposition, which increases the problems due to leachate and landfill gas. Landfill gas is a flammable and explosive gas, generated during the anaerobic decomposition of MSW. It can migrate to nearby residences and can cause fires and explosions.
If the dump site was not suitably built up from the beginning, it can slip, and cause several damages.

To brake this situation municipalities must demonstrate their commitment to higher environmental standards. The most effective method of achieving this is to concentrate on upgrading the standard of operations at existing disposal sites.
The uncontrolled dump sites also can cause significant health risks on those local communities living near to the dump sites. The vermin, insects and scavenging animals populations can get out of control, increasing the chances of illness and diseases. There is another health risk, which is caused by the lack of proper treatment of hazardous wastes.

The main duties are to phase out uncontrolled dumping sites and/or transform them into sanitary landfills, but it is expensive for the most African countries. To reduce environmental pollution, several measures must be taken step by step. These are the followings:

- Fencing
- Weighing
- Compaction and cover of the waste
- Leachate and storm-water control

- Separation of the recyclables
- Sequence of site filling (cellular filling)
- Control of vermin, scavenging dogs, and insect pests
- Special waste acceptance procedures
- Control of site access
- Monitoring and record keeping
- Health and safety issues, training of site staff
- Site rehabilitation upon completion of landfilling
- Landfill gas management

The landfill leachate can pollute the groundwater in a serious level, that is why we have to evaluate the risks of the leachate. To make priorities the effect of the landfill to be evaluated would address the following issues:

- Levels of pollutants in groundwater
- Quantity and nature of leachate being produced
- Depth and direction of flow of groundwater and hence time to reach an area of concern
- Mobility of contaminants in groundwater
- Possible impact of landfill leachates on surface waters
- Significance of landfill sourced pollution in relation to other sources of pollution such as septic tanks
- Risk posed by landfill gas

First of all we have to keep the fore that the measures which we would like to implement have to stay within the limits of the affordable resources .

Next steps

1 Read the reading excerpts on "Landfilling" included at the end of this pamphlet

2 Test your comprehension of the information by answering the question below, and discuss them with the group

Questions

1 What are the three different categories of landfills? Describe them with a few word.

2 What are the main criteria, of landfill siting, which the new site have to suit?

3 What are the main characterisation of an average landfill in Africa?

4 Name the main environmental impacts that a landfill can cause in the nearby area.

5 List those factors that must be taken into consideration in the operation of a municipal solid waste landfill.

5. REVIEW

Next step

Read the questions and choose the right answer, and sign it with a pick, or mark with a circle.

1 Solid waste is a composition of:

a) all solid and semisolid wastes that the processor no longer considers valuable enough to keep,
b) all types of wastes, including all kind of industrial wastes too,
c) only household wastes,
d) the commercial waste only.

2 What is usually the most hazardous one from these wastes:

a) construction and demolition debris,
b) tires,
c) medical waste,
d) paint thinners.

3 Which answer is not true for recovery and recycling entrepreneurs in Africa?

a) usually do not have the financial assistance, that large firms can receive easily,
b) frequently lack the technologies, to optimise recycling and disposal methods,
c) usually the workers work in quite good working conditions,
d) the sorting and picking workers are usually women.

4 How can we reduce the amount of waste significantly in the landfill sites?

a) put more collecting bins on the streets,
b) with better collecting vehicles,
c) with source reduction, which reduce wastes at the point of generation,
d) with the training of the employees of the landfill site.

5 How could municipalities in low income countries develop their waste collection and transport system most effectively

a) Choose transport and collecting vehicles made for developed countries, because these are reliable ones,
b) municipalities draw the whole waste collecting process under their only competence,
c) with raise of the communal collection points,
d) adapt a collection and transportation system or a combination of systems to fit the need of the community.

6 Why could a composting facility be uneconomic in African countries?

a) Because of the lack of putrescible wastes, which are needed for composting,
b) because in Africa the circumstances are not good enough to do any composting facilities,
c) because the farmers, and gardens are far from the composting site,
d) because of the high prices of land that is needed for a composting site.

7 What could be an accessible solution for hazardous waste disposal in African countries

a) To built incinerators with advanced filters in every African countries,
b) to put these wastes in a separate cell at the landfill, and cover with lime.
c) to deal these wastes together with the other wastes of the municipality,
d) to dispose hazardous wastes on a special landfill

8 why incineration is an inappropriate technology for Africa now and for the foreseeable future

a) Only because of the lack of expertise,
b) because of the opposition of the people live near to the future incinerator ,
c) because of the high costs, and the composition of the waste stream
d) because of the low percentage of high calorific value wastes in the waste stream.

9 Which one is the real advantage of a sanitary landfill from the following properties?

a) low initial costs
b) minimised environmental risks
c) easy access
d) materials recovery income

10 Which is <u>not</u> a key consideration in landfill planning ?

a) The former agricultural function of the area, where we plan the landfill,
b) the hydro-geology of the land
c) the costs of the site
d) The post closure land use of the landfill.

11 How can we effectively reduce the amount of waste and litter on the streets?

a) If we make pavements we can reduce the amount of litter,
b) if we increase the number of communal collecting points,
c) if we prohibit waste picking on the streets, because waste pickers decompose waste piles
d) if we make bigger landfills.

12 Waste recycling in African countries is one of the best ways to:

a) Reduce waste,
b) earn money,
c) make our production much cleaner, than it was before, when we used virgin materials,
d) get the highest official respect.

13 Which could be the most important characterisation of municipal waste collecting bins?

a) They have to be made of metal,
b) the bins have to be very attractive,
c) they have to be brightly coloured, which help the collectors to find them,
d) they have to be made only from plastics

14 Which is the most expensive process during waste management?

a) The collecting and transport system,
b) the salary of landfill workers,
c) to make plans,
d) landfill operation.

15 Why leachate control is so important?

a) Because leachate moisten extremely the soil under the landfill,
b) because we can recover energy from leachate,
c) because leachate is usually toxic polluted and has the potential risks of groundwater and surface water contamination from the landfill,
d) because we can use leachate for irrigation.

16 What could be a possible solution in African countries to reduce the impact of MSWM on environment?

a) To lay out more incinerators,
b) to establish more open dumps,
c) use less collecting vehicles, because they polluting the air,
d) to upgrade open dumps to controlled dumps, and finally to sanitary landfills, if it is possible ecologically and financially.

The correct answers are the follows: 1a; 2c; 3c; 4c; 5d; 6c; 7b; 8c; 9b; 10a; 11b; 12a; 13c; 14a; 15c; 16d;

6. READING EXCERPTS

6.1 THE RISING WASTES AND THE FIRST STEP OF WASTE MANAGEMENT

Solid wastes include all solid or semisolid materials that the possessor no longer considers valuable enough to keep. The management of these waste materials is the basic concern of all solid waste management activities The planning level of such activities can be local, regional or sub regional, or state and federal. For this reason, it is important for all people involved to know as much about municipal solid waste (MSW) as possible.

Source classifications can be developed in the following categories:

- paper
- plastic
- glass
- metal
- organics (putrescible)
- textiles
- potentially hazardous
- construction and demolition debris
- other

Types of solid wastes

It is important to be aware that the definitions and classifications of solid waste terms vary greatly in the profession literature. Because of this, the use of published data requires considerable care, judgement, and common sense. The following definitions are intended to serve as a guide and are not meant to be precise in a scientific sense.
Residential and commercial solid wastes, consist of organic (putrescible or combustible) and inorganic (non-combustible) solid wastes from residential areas and commercial establishments.

Waste characterisation

Waste characterisation data specific to African cities is not generally available, though some regional evaluations have been made.

As-delivered (wet basis) MSW from Accra, Ibadan, Dakar, Abidjan, and Lusaka shows a range of per-capita generation rates of 0.5-0.8 kg per day (compared to 1-2 kg per person per day in the OECD).

The main characteristics of the Municipal solid waste in Africa:

- putrescible organic content ranging from 35-80%;
- plastic, glass, and metals and textiles at less than 10%;
- paper content is between 10-20%;
- hazardous waste is around 1%
- density in Africa is in the range of 180 to 540 kilograms per cubic meter;
- calorific values are reported to be low.

Waste Analysis Procedures

Municipal solid waste consists of a wide variety of materials. Some materials, such as cardboard and vegetation will be present in relatively large proportions and be easy to measure from a small sampling of the waste stream. Other components which could be of interest, such as certain recyclable plastics, or special wastes, will be present in relatively small proportions. It would involve a much more intensive sampling and analysis effort to gain a reliable estimate of these types. Therefore it is important that waste analysis exercises have clear objectives and that the sampling effort is designed to provide the level of data needed.

The number of categories is determined by the purpose of the survey and the size of the sample needed to obtain a statistically meaningful result. Clearly, if there are more categories, or there is a smaller proportion of waste in each, greater effort is needed to obtain a precise estimate for the less common components of the waste.
The waste survey record sheet gives a recommended classification of 8 primary categories, each divided into several subcategories. These 8 main categories are sufficient to cover both bag collections and waste delivered directly to landfill. Other subcategories could be added, if necessary.

Important additional questions about MSW that must be answered include the following:

- What types and quantities of MSW will be received?
- What types and quantities of materials have already been removed for reuse and recycling?
- What properties does MSW have as it is received?
- How do the properties of MSW vary: daily, weekly, and seasonally?
- How do the properties of MSW change during processing?
- What are the properties of MSW that are of economic value?
- What hazardous objects must be removed?
- What contaminants should be removed?
- What tests and measurements to be performed to obtain answers to the above questions?
- What range of variations should be expected in the measured quantities and with what level of confidence?

6.2 The Environmental impact of the present municipal waste management

There are a number of special wastes that are generated in an urban area such as household hazardous waste (HHW - paints, solvents, oil, pesticides, fertilisers, medicines, consumer batteries, etc.), construction and demolition debris (CDD), medical and infectious waste (MIW), tires, sewage sludge, and chemical and pharmaceutical wastes.
These wastes are very different from each other, so they must be handled separately. But for the most part in Africa, services are not available for the separate handling of special toxic and infectious wastes. The general practice is to collect these items along with the rest of the waste stream and co-dispose of them at the same open dumps used for regular MSW which are subject to regular flooding.
Some special wastes can cause significant health and environmental damage when managed inadequately. Those who come into direct contact with the wastes, such as waste pickers; are at great health risk. Toxic components of these wastes can enter the environment, poisoning or infecting humans, animals, soil and water bodies. For example, spilled used oil, paints, solvents, pesticides can cause severe surface-, groundwater and soil pollution. Hazardous materials can also damage MSW equipment.
Some special waste materials with economic value are recycled either before or after entering the waste stream.

The types of special wastes that need special attention to prevent negative environmental impact:

- medical waste from hospitals, clinics, and laboratories
- hazardous waste in the household waste stream (e.g., oil based paints, paint thinners, wood preservatives, pesticides, household cleaners, used motor oil, antifreeze, batteries)
- used oil
- batteries
- construction and demolition debris
- sewage sludge, septage, and slaughterhouse wastes
- industrial waste

The effective management of special wastes begins with an assessment of their impact on human health and the environment specially on air, on water and on soil.
The environmental benefits of properly handling hazardous wastes can be very large, since in some cases small quantities of hazardous wastes can cause significant damage. However, even though all hazardous wastes present some risks, the quantities are not always high enough to induce separate collection and disposal. As points of reference, OECD guidelines and US regulations suggest minimum quantities of material that need special treatment as hazardous waste. Obviously, specific decisions regarding the management of special wastes can be assisted by environmental impact assessment (EIA).

A number of alternatives for the handling of special wastes have been or are in the process of being devised in response to the various needs of developing and industrialised countries.

The most frequently encountered special wastes

Medical waste

Medical waste is one of the most problematic types of wastes for a solid waste authority. When such wastes enter the MSW stream, pathogens in the wastes may pose a great hazard to those who come in contact with the wastes.
Waste generated within hospital premises has three main components:

a) municipal type" wastes, for example, administrative office waste and kitchen waste;

b) pathogenic or infectious wastes (these can also contain sharp items, e.g. needles, broken glass, etc.); and

c) hazardous chemical wastes (mainly those originating in laboratories and containing toxic substances).

The quantity of the first type of waste tends to be much larger than the second and third types.

Household hazardous waste

Households generate small quantities of hazardous wastes such as:
- oil-based paints,
- paint thinners,
- medical wastes,
- wood preservatives,
- pesticides,
- household cleaners,
- used motor oil,
- antifreeze,
- batteries and
- others.

Household hazardous waste in industrialised countries accounts for a total of 0.5%-1% of all waste generated at home. In developing countries, the percentage is even lower.

Proper management of special wastes is quite difficult in most developing countries, particularly in those where regular MSW is not managed adequately. Three issues are always relevant:

First, it is seldom clear who decides which wastes should be labelled special, hazardous waste.

Second, available resources to manage solid waste are limited and therefore priorities have to be set.

Third, the technology needed to manage special wastes is barely available.

How to prevent negative environmental impacts of the hazardous components:

- Priority waste streams must be separated according to the damage they cause, when released into the environment;
- Sufficient, clear, and frequent public education must take place regarding the need and the available opportunities for separation;
- Certain extremely dangerous substances are to be identified at the point of purchase (in the stores) as requiring special disposal practices;
- There should be heavy emphasis on point-of purchase take back systems for those items which can be collected in this manner, such as batteries, medicines, and used oil;
- There should be considerable emphasis at the policy and program level on redesigning consumer products to make them less dangerous (such as reducing or eliminating the mercury content in batteries);
- Personnel, handling household hazardous wastes must receive initial and subsequent training, but are not required to be licensed or trained chemical technicians.

6.3 TECHNOLOGICAL OPTIONS FOR MUNICIPAL SOLID WASTE MANAGEMENT

In supporting the existing technologies of waste management, urban managers and community organisations must not overlook the many problems of traditional waste collection, disposal, recovery and recycling systems.
Although recovery and recycling are basic principles of sustainable development, they impose significant health risks on those involved, especially when carried out "informally." This is particularly so in places where sanitary facilities are non-existent or deficient. Industries using recycled feedstock are in many cases more polluting than those using virgin materials. Such industries tend to be small-scale in developing countries, so they are often not subject to environmental regulation.

The Waste Management Hierarchy

Waste management possibilities can be arranged in a hierarchical manner to reflect their desirability. The first priority is waste avoidance, that is not producing waste in the first priority. If the waste is produced, then the quantities should be minimised. Once that has been achieved, the next priority is to maximise recovery, reuse and recycling of suitable waste materials (see table 1.) Taken together, these three steps are often called waste prevention, although strictly speaking only the first two are prevention because the third is already an end of pipe solution.
Once the possibilities for waste prevention have been exhausted, the next priority is to reduce the volume of residual wastes being passed on for final disposal, extracting resources in the form of products and/or energy in the process.

Item	Actions			
	Priority one	**Priority two**	**Priority three**	**Priority four and five**
Plan Implementation	Hold Solid Waste Management Workshop., to confirm plan, actions, timetable and budget	Establish steering committee to oversee the Plan	Appoint Solid Waste Officer	
Waste Minimisation				
Waste composition and quality	Multiple point waste characterisation			
Imported goods	Undertake waste characterisation survey, set waste reduction targets			
Packaging material	Cardboard, aluminium cans recycling	Consider setting regulations and tariffs to discourage excess packaging	Investigate tin can recycling feasibility	
Green waste	Put in place deposit scheme	composting		
		Prepare and distribute educational material on home composting	Trial composting of green waste with pig manure	
Refuse collection				
	Agree on roles with the service providers		Transfer stations for village areas	
Landfill disposal				
	Environmental impact analysis of existing sites, Confirm life of existing sites, fence and secure landfills	Prepare landfill management plan	New long term disposal site, introduce landfill charges	Record all past dump sites, rehabilitate existing dump areas
Special wastes				
	Storage area for special wastes	Battery recycling		

Table 1.Solid Waste Management Priorities

Waste reduction options

In African countries, the main motivations for waste reduction are frequently related to the high cost and scarcity of sites for landfills, and the environmental damage caused by toxic materials in the deposited wastes. The places that currently do not have significant disposal pressures can still benefit from encouraging waste reduction. Their solid waste departments, already overburdened, cannot afford to spend more money and effort on the greater quantities of wastes that will inevitably be produced as consumption levels rise and urban wastes change.

Solid waste managers in African countries tend to pay little attention to the topic of reducing non-organic wastes because the wastes they collect are between 50% to 80% organics. These municipal wastes are suitable for composting or digestion, *provided they contain very low levels of toxic or synthetic materials.* Solid waste departments thus have an interest in promoting diversion of synthetic recyclables from the waste stream.

Key methods in municipal waste reduction

Source reduction: any procedure to reduce wastes at the point of generation, in contrast to sorting out recyclable components after they have been mixed together for collection.

Source separation: keeping different categories of recyclables and organics separate "at source," i.e., at the point of generation, to encourage reuse, recycling, and composting.

Waste recovery, materials recovery, or waste diversion: obtaining materials/organics (by source separation or sorting out from mixed wastes) that can be reused or recycled.

Reuse: reusing a product for the same or a different purpose

Recycling: the process of transforming materials into secondary resources for manufacturing new products.

Redemption centre: waste trading enterprise that buys recyclable materials and sells to brokers. Sometimes also called "buy-back centre".

Producer responsibility: Producers of products or services accept a degree of responsibility for the wastes that result from the products/services they market, by reducing materials used in production, making repayable/recyclable goods, and/or reducing packaging.

Strategies to promote waste reduction and materials recovery at the national and local level

At the *national level*

- legislation on redesigning packaging and/or products;
- efficient use of raw materials;
- use of less toxic materials;
- promotion of "producer responsibility" for post-consumer wastes;
- promotion of consumer awareness.

At the *local level*

- diversion of materials from the waste stream through source separation and trading;
- recovery of materials from mixed waste;
- pressure on national or regional governments for legislation on redesigning packaging and/or products;
- support of composting, either centralised or small-scale.

Recycling / Reuse Options

The reasons for waste recovery and recycling in most of the African countries include:

- scarcity or expense of virgin materials,
- the occurrence of absolute poverty and therefore the availability of workers who will accept minimal wages,
- large markets for used goods and products made from recycled plastics and metals.
- Wastes which would be uneconomical to recycle or of no use in richer societies have value (e.g., coconut shells and dung used as fuel).

If one takes into account the use of compost from dumps sites as well as materials recovery, the majority of municipal wastes of all kinds are ultimately utilised.

In most African countries, materials recovery is widespread and occurs efficiently through traditional practices. Nevertheless, there are very serious problems that need to be addressed. Waste reduction that could be achieved by legislation and protocols (such as agreements to change packaging) is not, at present, a high priority in these countries, although some are now moving in this direction. Also, because so many people are engaged in the activities of materials recovery, processing, and recycling, and alternative work is scarce, governments and social welfare organisations are often more sensitive to employment needs than to environmental considerations in waste management. They are sometimes prepared to risk environmental and public health problems in order to generate employment possibilities. To avoid this type of risks education is important.

Issues for cities of developing countries

Diversion of organics from the waste stream has the highest potential for reducing waste.

Supporting maximum recycling / recovery of synthetic materials.
Solid waste management departments should encourage waste reduction and materials recovery by the private sector (formal and informal).
Municipalities should be cautious about adopting Western-style materials recovery programs and technology.

Materials recovery in developing countries

Solid waste management departments should carefully consider their main duties and managerial capabilities when making suggestions for adopting municipally managed source separation and materials recovery. In many cities of developing countries, the most valuable recyclables are already diverted from the municipal waste stream by waste generators, because an efficient private system of waste trading and recycling exists. Departments which are already overburdened with the duties of public cleansing and waste disposal are not advised to add the responsibility of collecting and selling source-separated recyclables. Also, if source-separated items were set out for collection, it is highly likely that these would be stolen before the municipality could claim them. This has already occurred in pilot schemes in both developing and industrialised countries.
Finally, given the widespread unemployment in most developing countries, it is often problematic to reduce the jobs provided by private waste recovery and waste trading by transferring these to the public sector. This is especially important where the public sector of waste management is inefficient.

Primary tools for municipalities in developing countries to use in promoting waste recycling/reuse operations

1. Promote educational campaigns for the public support of waste reduction and recycling and the reduction of the stigma attached to waste work.
2. Study waste streams (quantity and composition analyses), recovery/recycling systems, and markets for recyclables.
3. Support source separation, recovery, and trading networks.
4. Encourage small enterprises and public-private partnerships by regulations for co-operatives, loans to small-scale businesses, low-rent space for stockpiling depots, etc.
5. Assist waste pickers to move out of manual picking by retraining programs or subsidisation of sorting/redemption centres.
6. Advocate selective waste reduction legislation on packaging reduction, product redesign, and coding of plastics.
7. Export recyclables if there is high demand in neighbouring countries and non-toxicity is assured.
8. Promote innovation to create new uses for goods and materials that would otherwise be discarded after initial use.

6.4 Waste collection and transport in Africa

Most major cities in Africa have an established municipal waste collection system. Collection is carried out by human- and animal-drawn carts (wheelbarrows, pushcarts), open-back trucks, compactor trucks, and trailers. The collection vehicles are generally of the 6-7 cubic meter capacity and go directly from their point of last pickup to the disposal site. Collection rates across the continent range from 20-80% with a median range of 40-50%.
It has to be emphasised, that selection of waste, collection and transport methods should be based on appropriateness and cost-effectiveness.
In cities across West Africa, vehicle immobilisation rates can reach as high as 70%, reducing the rate of collection. Where collection is performed by non-mechanical means, the volume of material to be collected often exceeds the capacity of the collection system. Pre-collection is carried out by community groups in some areas not served directly by municipal vehicles. For example, in Cotonou, Benin, such a group is authorised to pre-collect the waste and deposit it in communal bins for later removal by the municipality.

In most cities, collection is provided by the municipality but private operators also provide service on a fee basis to households and commercial establishments. In Cairo, the Zabbaleen is a group that has traditionally specialised in MSW collection and now operates as a co-operative to perform this service with authorisation from the municipal authority. However, though such co-operatives might do much to improve municipal sanitation, they are not common in other African cities. Since the mid-1970s, international aid has promoted initiatives to improve the coverage of MSW collection services in Africa. These efforts have focused primarily on vehicular collections in the central city. In some West African cities, such as Dakar and Cotonou, local initiatives have focused on service to formerly neglected urban areas.
Transfer stations until now are not very common in MSWM in African cities. One such facility, operated by the City of Abidjan, Côte d'Ivoire, is no longer functional.
In almost all cases, the point of disposal of the MSW is located on the perimeter of the city, within easy reach of vehicles and collection crews.

Selection of containers

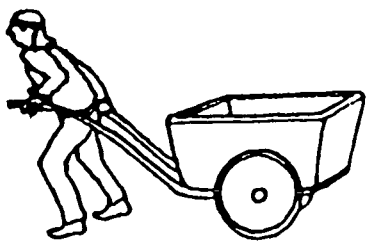
Most collection systems use some kind of container. In industrialised countries standardised, metal or plastic containers are used. In developing countries, this function can be performed by drums, bags, cane baskets, clay jars or any other kind of container available. In some places, waste is stored in a pit in front of the house until transport. In many places, the volume of the containers is not sufficient and waste is piled on the ground, awaiting collection.
Quicker collection can be achieved by using brightly coloured containers which help to find them. Containers should not be too attractive, though, or they may be stolen.
If recovering materials from the waste is preferred before collection, the container should be low to the ground, wide mouthed, and not too large. Where waste picking is discouraged, use taller containers

Figure 1 Simple collecting bins and muscle operated transporting vehicles

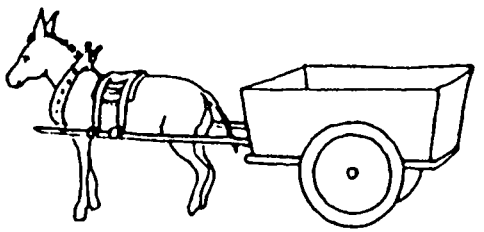
100-liter
half oil drum

30- to 80-liter
bin made from
truck tires

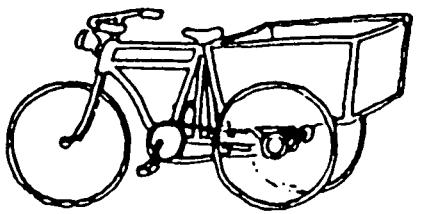
Sturdy set-out containers can be creatively made from a wide variety of materials. (credit: UNCHS (Habitat))



Human
hand-cart

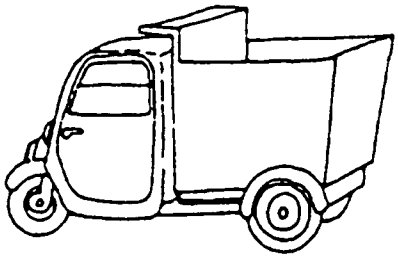


Animal
cart

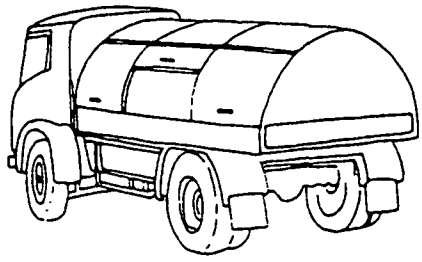


Human
pedal-cart

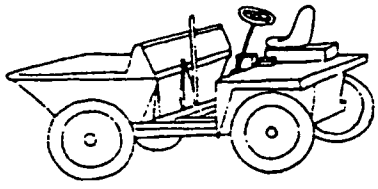
Figure 2 Varieties of engine operated transporting vehicles



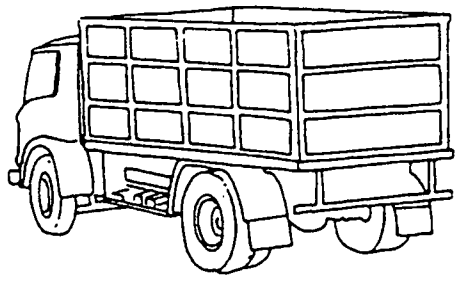
Three-wheeled autorickshaw



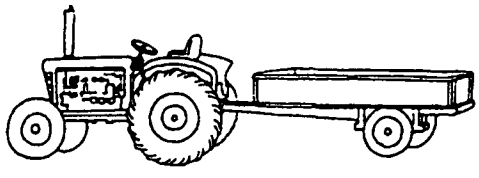
"Roll-top truck



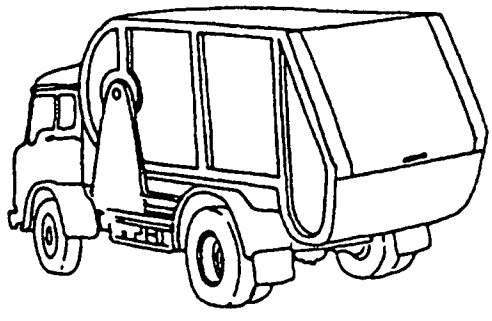
Dumper truck



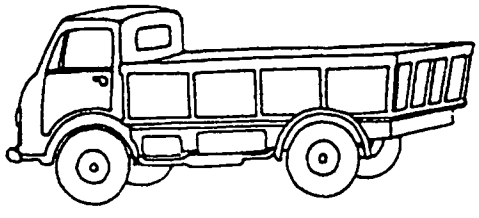
High-sided open top truck



Tractor and trailer



Fore-and-aft tipper truck



Conventional truck

A large variety of vehicles can be used in collection. The choice of vehicle depends on relative costs of labour and capital, the character of the waste, local availability of parts and repair expertise, size of streets, and distance waste must be hauled. (credit: UNCHS (Habitat))

Selection of collecting vehicles

The selected collection vehicle must be appropriate to the terrain, the type and density of the waste, and the roads and ways it must travel.
Muscle powered vehicles are important tools for collecting waste in many developing countries. Such vehicles are inexpensive and easy to build and to maintain compared to other vehicles.

The advantages and disadvantages of muscle powered vehicles

The advantages:

The vehicles work well:

- in densely populated areas,
- in narrow streets
- on hilly, wet or rough terrain,
- when used to collect small volumes of waste from densely settled houses.

The disadvantages:

- limited travelling range,
- slower than fuel powered vehicles,
- weather has greater effect on humans and animals.

The lack of a reliable collection service undoubtedly takes a toll on the public health and aesthetics of African cities. As the urban population grows on the continent, this problem is likely to increase. Collection is a key link in the chain of MSWM from the point of generation to ultimate disposal. In any initiative to upgrade a waste management service, sustainable, contextually appropriate collection should be a major focus of attention.
In most developing countries and cities, there are many areas that receive no collection at all. For example, collection may miss large areas of poor or squatter settlements; areas that are hilly; neighbourhoods with unpaved or impassable streets; or whole areas where houses are too close together for collection vehicles to get through. In these cases the collection should start with human hand-cart

Large numbers of people, particularly those living in poor or marginal areas, receive little or no collection service. Extending coverage to such areas should be the highest priority.

In developing countries, collection often involves face to face transaction between generator and collector. The level of service is low, and the generators often have to bring their wastes long distances and place them in containers that are sometimes difficult to use.
Many collection activities involve the informal sector: unregistered micro- or small businesses; poor individuals; squatters or recent arrivals from the country with no papers or who are outside of the social safety net.
The use of muscle-powered vehicles, including wagons, animal-drawn carts, or rickshaws, is common.

The practical aspects of collection - routing, set-out practices, vehicles, collection schedule - are highly variable, involve primarily manual labour, often of women and children, and depend on specific circumstances.
The boundary between collection of materials for disposal and collection for recovery in developing countries is not often clear, and recoverable materials may be separated during the collection process. The same people - waste collection crews, waste pickers, or independent buyers - may be involved in both the collection of waste and the separation and recovery of materials.

A common aspect of collection in developing countries is the chronic and acute lack of an adequate service, particularly in poor or marginal areas. This, combined with the relatively large volume of human and animal faecal matter, means that waste collection has a direct link to public health and sanitation in African countries: collection failure can lead directly to injury and disease.

Most collection is performed by public employees or firms under contract to the government/municipalities or to business and industrial waste producers. For efficiency reasons, collection tends to occur early in the morning, using closed compactor trucks. Collection efficiency is important, as is the invisibility of collection and its lack of impact on formal daily life. Recovery systems tend to be separate from waste collection systems, and to involve different sets of actors.

Communal collection points

In parts of many African countries and some industrialised countries, residents carry their waste to a container at a "communal collection point." "Collection point" is also used, particularly in industrialised countries, to mean a point, where recyclable materials can be brought to. Communal collection is very common in developing countries, particularly in areas that are difficult to serve, or in poor areas that municipal authorities are unwilling or unable to serve with door-to-door waste collection.

Summary of designing collection and transport systems

Selection of containers for developing countries can summarised in the following way:

- Select containers to fit the collection objective.
- Select containers made of local or recycled materials.
- Choose resistant, easily reparable containers.
- Containers should be easily identifiable.

Collecting vehicles for developing countries should be selected with the following points in mind:

- The selected vehicles must use minimum resources (capital, energy, labour) for the same duty.
- Select locally made vehicles of traditional design.
- Select vehicles that can be locally repaired and serviced.
- Select non-compactor trucks where population is dispersed.
- Consider using compactor trucks in industrialised urban areas.
- Use hybrid systems, to combine an old city centre with a modern commercial centre, wealthy outskirts, an industrial zone and poor neighbourhoods.

The best approach is to adapt a collection and transport system or a combination of systems to fit the need of the community.

6.5 Composting facilities in African countries

The organic content of MSW in the typical African city may exceed 70% (wet basis) but centralised composting, anaerobic digestion, and gas recovery are not significant components of African MSWM practice. Further investigation of their market potential prove this to be an overlooked opportunity.
Backyard composting is limited. Some NGOs promote the practice in Benin, Cameroon, Egypt, Ghana, Kenya, Nigeria, South Africa, and Zimbabwe but the practice does not have a significant impact on MSWM at the city level. This may be a large unutilised opportunity if the typical African waste stream is high in organic material with potentially high yields of compost.

Decentralised composting at the village and community scale

Composting is clearly a sound practice for the management of compostable waste streams at the village or community scale. Centralised composting of this type, whether privately or publicly developed, must come under the jurisdiction of the municipal or community authorities, who accept responsibility for its operation. These facilities will generally be in the range of 2 to 50 tons per day, depending on the size of the community and the proportion of compostable materials in the waste stream.
Siting is important, and sound practice requires that the compost operation follow the siting guidelines listed below for neighbourhood composting. At this scale, it may also be necessary for the site to accommodate more turning, processing, screening, and storage of the compost than at smaller scales.

Guidelines for sound composting practice

- The waste stream must be compostable;
- Manual pre-processing of mixed waste does work on a small to medium scale for the highly compostable waste streams;
- Economic factors related to landfills, markets, and materials recovery must support composting;
- Separation and composting techniques and scale must be appropriate for the input stream;
- The waste streams composted have a large effect on the quality and marketability of the compost. Support and enhancement of materials recovery of noncompostables is a necessary step in many countries.

Sound practice for siting facilities other than backyard bins includes:

- selection of a site with suitable access for the different types of transportation vehicles;
- availability of a buffer area between the site and nearby land users, to minimise the nuisance of waste and compost odours;
- appropriate soil for absorption or collection of leachate; and
- the possibility of placing the compost in a building, in cases where there is a need to control climate or a greater need to buffer the surrounding environment.

Decentralised neighbourhood-, block-, or business-scale composting

The next larger scale for composting is the neighbourhood-, block-, or business-scale composting site. Such facilities can provide a waste management opportunity to a small group of people at a relatively low cost.
Small-scale composting uses the wastes of a number of households, shops, or institutions. The composting is done on unused land, next to community gardens, or in parks. This may be called "multi-source" or "decentralised" composting, in contrast to backyard composting, where the wastes are from one source. These sites, which usually process less than five tons of waste per day, can be smaller than municipal sites and generally reduce the need for movement of compostable materials.

Sound practice for siting neighbourhood composting sites requires that they:

- be accessible to all who want to use them;
- be clearly designated with signs that all users and non-users can read or interpret;
- be sited with the agreement of the surrounding land users;
- have adequate fencing or control to prevent their becoming an open dump; and
- have appropriate soil to absorb leachate.

For neighbourhood compost piles to work, there must usually be a compost monitor or supervisor within the user community who takes responsibility for maintaining order and cleanliness. Sound practice generally requires backup from the municipal government in terms of technical and logistical support for removal of undesired items.

Identification of composting possibilities

Composting is a natural process of bacteria and other organisms eating what they like in a favourable environment. Composting has long been important and successful in some parts of the world, while in others it has been of little or no success. The problems most often cited for the failures of composting include: High transportation and operation costs, poor product quality, poor understanding of the composting process, and competition of chemical fertilisers.
Compost system can fail for many reasons. The main reasons are economic and technical ones. What these failures have in common is a failure to understand the role of composting as part of an overall waste management system.

Economic failure

Many compost plants have failed for economic reasons, related either to the ability to secure waste or to the need to market the compost that is produced.

Failure to secure waste

In many parts of Asia, where there is a long tradition of successful composting, the availability of inexpensive MSW disposal in dumps or landfills does not encourage composting. Composting takes place both informally and in an organised fashion.

In much of Africa, however, efforts to organise composting have failed to secure enough waste. When dumping or landfilling is inexpensive and not subject to effective environmental controls, composting is relatively expensive.

Marketing failure

The second economic failure is on the marketing end. Finished compost can become, but is not automatically, a valuable commodity: its value depends on demand for soil enhances, on perceptions of its value, on its quality, and on its accessibility to potential users in the immediate vicinity.

Compost marketing works when:

- the farmers or gardeners are located close to the source of the compost;
- the entity producing the compost is willing to transport it to the users;
- the compost is priced below the price of commercial fertilisers, or is given away.

Technical failure

Bio-waste composting facilities have generally relied on complex mechanical pre-processing to remove non-compostables. These systems have largely failed at their tasks. There are small scale Bio-waste composting facilities in both industrialised and developing countries that are successful because of the high degree of manual pre-processing. The larger facilities dependent on mechanical separation and generally cannot accommodate the diversity of the waste stream.

High organic content is essential. The biological composting process is so basic that it is very likely to succeed if there is an appropriate input stream (C/N ratio)and proper handling (temperature and moisture).
The high animal and vegetable waste content of the waste stream, combined with existing materials recovery systems can maintain the compostability of the waste stream and result in the production of good quality compost.

Failure of biological processes. Where there is a failure in the composting process itself, this relates to the failure to understand the nature of biological processes. Compost bacteria, insects, and micro-organisms require certain environmental conditions (temperature and moisture) to thrive. If these are absent or interrupted, they must be corrected.

Composting of sewage sludge, septage, and slaughterhouse wastes

Sewage sludge is generated in sewage treatment plants. Septage, on the other hand, is the material pumped from septic tanks. Both of these materials contain large quantities of pathogenic organisms and they often contain chemical contaminants, as well. They therefore require proper treatment and disposal.
Slaughterhouse wastes can be used to produce ingredients in the manufacture of fertiliser, animal feed, and glues. The traditional methods of sun-drying, breaking up bones manually, composting in pits (sometimes with the addition of household

organics), and steam digestion carry various health risks, and cannot be considered a good practice.
Small-scale aerobic composting of animal wastes, including manure, hide scrapings, tannery-, and slaughterhouse wastes can also produce fertilisers, but carries some risks in terms of spreading pathogens.

Proposed practices for reducing and handling sewage sludge and septage:

- ***preventing large volumes of sludge*** through separation of sewers and storm drainage systems;

- ***minimising reliance on centralised sewage systems*** through the installation of on-site treatment of human waste and household wash water,

- ***land application*** but only when very frequent sludge testing shows that toxic metal content is very low, and when the authority has the resources and commitment to maintain high standard for such testing. In practice, this will mean that in many situations the safety of land application is must be guaranteed;

- ***treatment such as drying, liming, composting***, or co-composting with yard waste or organics, followed by land use, which is designed to return the organic matter in sludge to the land. As above, however, contaminants of sludge can make this practice inadvisable for farmland.

- ***drying it and disposing of it in landfills.*** It is important to note that sludge should be dried before entering a landfill in order to avoid generating large volumes of leachate.

All of these activities generate leachate, are associated with bad odours, and are typically associated with poor working conditions and risks to workers' health, but may be profitable and provide subsistence income. Sound practice could involve introducing technical and health improvements, rather than eliminating the activities themselves.

6.6 0Incineration and energy recovery

Incineration and waste-to-energy (WTE) remain little-used options for MSWM in Africa. One energy recovery plant was recently constructed in Tanzania with foreign assistance. If successful in the long run, this experience would show how safe operations at such a facility can be sustained with local resources. Local capacity to sustain safe and efficient operations at such facilities is a key consideration in weighing the appropriateness of this technology for African cities. These considerations include local technical capacity to maintain and service the facility, the availability of basic spare parts, the scheduled replacement of pollution control equipment, and the effective implementation of a monitoring program to protect public health from plant emissions.

The Senegalese have conducted research into refuse-derived fuel (RDF). However, implementation of this system faces the same considerations listed above for incinerator technology in general. The high cost of pre-processing RDF poses an additional obstacle to its safe and cost-effective implementation in Africa.

There are **medical waste incinerators** in some countries. These are present in the major hospitals of South African cities. However, across most of Africa, many such facilities have no environmental controls.

The decision to use incinerators should be considered carefully because of high costs, limited infrastructure, and the composition of the waste stream.

High capital and operating costs make incineration and WTE inaccessible technologies for most African cities. Another limiting factor is the lack of infrastructure to support this technology. This includes human and mechanical resources as well as institutional controls. Furthermore, incineration in Africa would be unfeasible if the waste stream has indeed a 70% (wet basis) putrescible organic content. Under these conditions, incineration is likely to be an energy-consuming rather than energy-producing option.

Characterisation of the MSW stream would first be necessary to establish the feasibility of incineration and WTE from MSW.

In summary, incineration and WTE presently do not play significant role in MSWM in Africa. High costs relative to other MSWM options, a limited infrastructure of human, mechanical and institutional resources, and the composition of the waste stream itself, suggest that incineration is not the best technology for Africa now

6.7 Landfilling

Landfills are the main component of a well designed MSWM system. In many cases, the landfill is the only MSWM option available after the waste is collected. The landfills can be put into three general categories:

- open dumps,
- controlled dumps,
- sanitary landfills.

The types of landfills in Africa most often fall somewhere between open dumps and controlled dumps. These facilities are generally located at the perimeter of major urban centres in open lots, wetland areas, or next to surface water sources. Though many municipalities have legal requirements for the construction and maintenance of landfills, these are generally not enforced. In most instances, the landfills are owned and operated by the same public agency that is charged with enforcing the standards. Often a lack of financial and human resources, coupled with absent enabling policies, limit the extent to which landfills can be built, operated, and maintained at minimum standards for sanitary practice.

Thus, landfills are generally sited based on considerations of access to collection vehicles rather than hydrological or public health considerations. This practice ranges from cities in the more arid regions of the North such as Algeria, Libya, and Sudan to those in central countries with higher rainfall such as Cameroon and Zaire. The environmental and health consequences for water sources at risk are more significant for the later cities than the former.

Over the past years, many countries have considered policy changes to promote upgraded landfills for their major cities. These facilities would be classified according to the type of waste they receive, the type of construction, and their operating procedure.
Most disposal sites in Africa are open dumps, some of which are situated in ecologically sensitive areas. Recently, however, some countries have moved toward improved landfill practice.
Tunisia has shown leadership in developing a nation-wide sanitary landfill program. New guidelines for the construction and operation of landfills were issued in South Africa in 1995. The Environmental Council of Zambia also considers linking improved landfilling to upgraded MSW collection services in its 1995 solid waste plan.
The landfills are generally operated below the standards of sanitary practice. Waste pickers remove materials of economic value for recycling. Operation and maintenance costs are provided from municipal budget allocations and often do not cover the full amount needed. The result is substandard and unsafe facilities which pose public health risks and aesthetic burdens to the citizens they are meant to serve. The standards of modern sanitary landfills with leachate and gas recovery may be too expensive today.

Landfills are a vital component of any well-designed MSWM system. The safe and effective operation of landfills depends on the sound planning, administration, and

management of the entire MSWM system. This begins with an institutional and policy environment that views MSWM as an important component in the sustainable development plans of a city and country. It continues with MSWM regulations that are designed to protect human health and the environment.

Siting of new landfills

In case of the siting of a new landfill the new site have to be properly engineered to fit for the required capacity (usually for 20 years filling) and because of the of the sensitive circumstances
The location of a sanitary landfill should be based on a number of criteria. Health, environmental and economic factors must be considered:

- the impact of the operation on public health and the environment,
- the existence of ground water or nature protection zones in the area,
- the geological and hydro-geological conditions of the area,
- the risk of flooding, subsidence or landslides on the site,
- the protection of natural or cultural patrimony of the area,
- cost,
- distance and accessibility from the centre of waste generation.

Some approaches which could be important to consider in case of the siting of the a new landfill:

- If possible choose an area which was affected by quarrying or earthworks
- Propose long term lease for the period of filling if it is needed
- Include the need for disposal site in the education material for solid waste
- Choose reliable subcontractors

Future use of the site should also be considered.
Sanitary landfills should not be located in areas where there are sinkholes, disappearing streams, caves, etc. Ideally, sanitary landfills should be sited in areas with clay soils and where the slope of the natural terrain is greater than 3%.
Sanitary landfills should not be located within 3,000 m of an airport runway used or scheduled for use by turbojet aircraft, or within 1,500 m of an airport runway used or scheduled to be used by piston-engined aircraft.
Every effort should be made to avoid siting a sanitary landfill near politically or socially sensitive areas such as schools, hospitals, churches, etc. No residential development should be in place or allowed to be built within 500 m of the boundary of a disposal site. Furthermore, the fill should have a buffer of unused land.

Table 2 Main characteristics of the three landfill types

Type	Characteristics	Advantages	Disadvantages
Open dump	• poorly sited • unknown capacity • no cell planning • no site preparation • no leachate management • no gas management • only occasional cover • no waste compaction • no fence • no record keeping • waste picking and trade	• easy access • extended lifetime • low initial cost • aerobic decomposition • access to waste pickers • materials recovery, income	• environmental contamination • overuse, many noxious sites • needs remediation • ground- and surface water contamination • risk of explosion • shorter lifetime • indiscriminate use, no record of content
Controlled dump	• sited with respect to hydro-geology • planned capacity • no cell planning • drainage, at site preparation • partial leachate and gas management • regular cover • compaction in some cases • fence • basic record keeping • controlled waste picking	• less risk of environmental contamination • permits long term planning • low initial cost • easier rainfall runoff, less risk • moderate cost, reduced risk • extended lifetime • controlled access and use • valuable information • materials recovery • lower risk to pickers	• less accessible • environmental contamination • cost • slower decomposition • maintenance • loss of recyclable resources
Sanitary Landfill	• site selection based on environmental risk assessment • planned capacity • designed cell development • extensive site preparation • full leachate and	• minimised env. risk • long-term planning • reduced risk • vector control, aesthetics • extended lifetime • secure access • gate record • valuable information	• access • longer siting process • cost, longer preparation time • slower decomposition • cost, maintenance • cost equipment • displacement of pickers • loss of recyclable

	gas management • daily and final cover • compaction • fence and gate • no waste picking	• eliminate risk to pickers	resources

Planning of landfills

The principal factors to consider in planning a landfill are: the capacity of the facility, the NIMBY ("Not In My Back Yard") syndrome, the hydro-geology of the proposed site, the cost of the facility, and post-closure use of the land.
Capacity refers to the area and volume required for MSW disposal over the useful life of the facility. It depends on the projected rate of waste generation, the rate of population growth in the area served by the landfill, the density to which the waste is compacted at the landfill, and the maximum in-place elevation of MSW and cover material permitted at the site.

Key considerations in landfill planning

- *Required capacity*
- *NIMBY ("Not In My Back Yard") syndrome*
- *Hydro-geology*
- *Cost*
- *Post-closure land use*

NIMBY (**n**ot **i**n **m**y **b**ackyard) refers to community, opposition to the siting and operation of MSW facilities close to their neighbourhood. Residents express a variety of concerns about the presence of such facilities in their midst. These concerns include:

- the health and environmental risks posed by the facility;
- its negative impact on aesthetics in the area, particularly odours;
- its lowering of property values;
- the increased traffic, noise and dust associated with the facility; and
- the inequality of dumping everyone else's waste in their backyard.

Hydro-geology
In the present context lumps together hydrological, geological, and climatic factors. These include the height of the ground water level, the permeability of the soil, the characteristics of surface water, the presence of wetlands and floodplains, the annual precipitation, the presence of geological faults, and the degree of seismic activity in the area.
Ideally, the landfill should be sited in an area of low hydrological conductivity with a low water table - one that at its seasonal high point does not threaten to reach the bottom of a new landfill. Sound practice dictates that landfills should not be sited in wetlands, to avoid contamination of these ecologically sensitive areas. Similarly, landfills should not be sited in floodplains, to minimise the risk of washout of the buried waste during flooding. Such an event could pose significant dangers to public health. Similar safety and health considerations rule out the siting of landfills in seismically sensitive areas.

Costs are, of course, associated with all stages of the landfill from initial siting and design through operation and final closure. These costs may be broken into capital costs and operating costs. It is the capital costs which often determine the type of facility that can be constructed. Once built, there are a variety of mechanisms by which the operating costs of the facility may be recovered.

Post-closure period will have an impact on how the land is developed during use as a landfill. Thus, planned heavy building construction will require the use of high density compaction equipment and the placement of mooring on the site. If recreational uses are planned, such as golf courses or parks, then the site must be graded with this in mind and vegetation replanted on closed areas of the operating facility.

The design of a landfill will significantly affect its safety, cost, and effectiveness over the lifetime of the facility.
The facility should be designed to operate effectively given the mix of capital, labour, and expertise available to its owners. Thus, labour-intensive controlled dumps should be designed where capital is severely limited, labour is available at low cost, and there is a shortage of expertise and infrastructure to service a highly mechanised facility.

Items for consideration at the design stage:

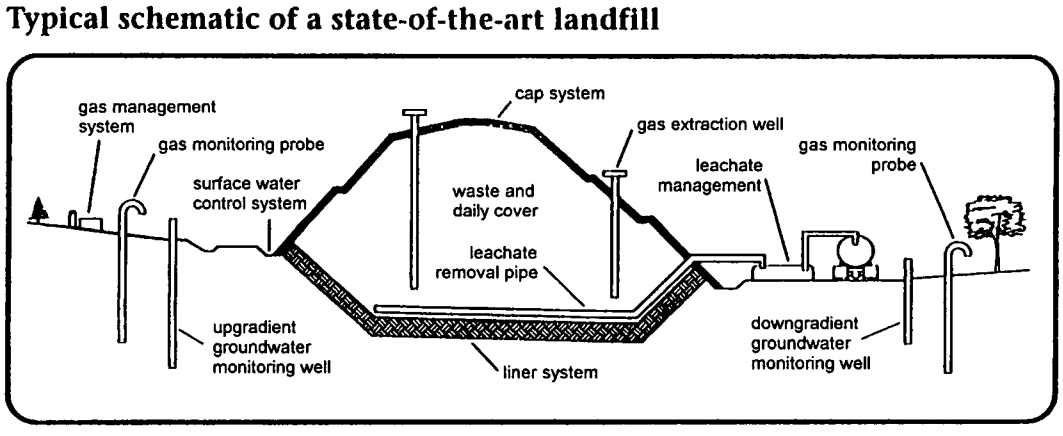
- capacity;
- public/private ownership/operation;
- cover system;
- bottom liner system;
- monitoring and control of leachate;
- monitoring and control of landfill gas;
- access and tipping area;
- pre-processing and waste picker policy;
- operations and safety manuals;
- closure and post-closure plans;
- community relations program.

These general guidelines apply equally to controlled dump and sanitary landfill facilities. In the case where an existing open dump is to be upgraded to a controlled dump or sanitary landfill, the siting decision has already been made. In this case the planner applies the above procedure to the areas for proposed expansion of the existing site.
In the case of a controlled dump, planned capacity may not be protected by zoning and land use restriction guarantees provided by municipal authorities. Therefore, the landfill planner must use the designated site strategically to minimise the risk of future area loss by municipal development and maximise the total area available for landfilling over the lifetime of the facility. Strategies may include acquisition of property surrounding the landfill site or working inward from the border that is thought most likely to be affected by urban growth.

For a sanitary landfill, capacity is often granted by regulatory permits on a stage by stage basis. Thus, rather than declaring the capacity of the entire site at the initial design stage, the planner develops it in two- to five year stages once the overall site meets the required zoning and land use requirements. This practice allows the landfill

owner to selectively develop the property with the flexibility to convert it to more profitable alternative land uses that may develop over time. This is particularly applicable to private landfill owners. In the case of municipal facility owners, stage by stage development may also be advisable for the same reasons. However, municipal planners must also ensure that appropriate sites with the required capacity are always available for future needs.

Figure 3 General arrangement of a sanitary landfill



Operation of a landfill

In most African countries, landfills are owned and operated by local governments or other public agencies. Often, substantial capital investment is required to construct such facilities. Where proven expertise is available in the private sector, municipal planners should explore the option of privatising landfill operations on a contractual basis. This option should be weighed carefully as it involves issues of cost recovery and the payment of fees for tipping privileges at the landfill. There are several references on the privatisation of municipal services in the literature. The municipal planner should read these paying close attention to their feasibility for the local situation.

Monitoring operations at sanitary landfills may involve computerised statistical sampling and automatic reporting of results at the regulatory agency. Such systems are costly and require skilled personnel to correctly use and maintain. The choice of system is dependent on the capital and human resources available to the landfill owner/operator and the requirements of local regulations.

Monitoring and control of leachate

Leachate management is a key factor in safe landfill design and operation. The natural decomposition of MSW, in combination with rain infiltration into the site, causes potentially toxic contaminants to flow to the bottom of the landfill.
The wetter the climate, the greater the potential risks of groundwater and surface water contamination from the landfill. As explained above, the geology of a site can increase or reduce the amount of leachate that enters the environment.

A variety of wastes can contribute contaminants to landfill leachate. Paint pigments and household batteries can release heavy metal contaminants. Household hazardous waste (e.g., paint products, garden pesticides, automotive products) and hazardous wastes from commercial and industrial generators can release organic chemical contaminants.

A sanitary landfill contains engineering features to prevent the release of hazardous substances to the environment. Natural or synthetic materials are often used to line the bottom and sides of landfills to prevent the migration of leachate into nearby groundwater and surface water. Many landfills use liners constructed from two feet or more of compacted clay. Other liners consist of thin sheets of plastic made from a variety of synthetic materials. Covering material is applied after each day over waste. When a landfill is closed, a final cover is applied. Leachate collection systems are installed and leachate are treated. Landfill gas recovery for energy is preferred.

Any type of liner, however, could fail to contain leachate. Natural and synthetic liners can crack, particularly if improperly installed, or can lose strength over time. In an effort to improve the containment of leachate, more than one liner or a mix of natural and synthetic liners, called a "composite" liner, is a recommended alternative.

Leachate collection and treatment.

Leachate retained by the liner will accumulate and possibly leak through the liner unless it is removed by a leachate collection system. Leachate collection systems are installed above the liner and usually consist of a perforated piping system which collects and carries the leachate to a storage tank. Periodically, leachate must be removed from the storage tank and treated or disposed of. The most common leachate management methods are: discharging to a wastewater treatment plant, on-site treatment followed by discharging to sewerage or surface water (depending on the quality of the treated leachate), and recirculation back into the landfill. All of these options generally require a pumping system. They require considerable maintenance due to the corrosive nature of the leachate.

Leachate recirculation.

Recirculating leachate over waste in landfills has been shown to increase the quantity and quality of methane gas for recovery as well as possibly reducing the concentration of contaminants in leachate and enhancing the settling of the waste. Landfill gas recovery for energy is feasible, and the cells can be excavated after five years and the space reused. The humus-like material that is excavated (about 65%) can be recycled as compost, and the remaining material can be used for the daily or final cover of the next cells.

As a substitute for a leachate treatment system, leachate reinjection may be particularly appropriate for areas with low rainfall, since leachate production in those areas is more dependent on the humidity of the waste than on the infiltration of rain. In some instances, this technology can be more cost-effective than other leachate treatment systems.

Leachate recirculation is a relatively new technique of leachate management. As a management technique, its goal is to stabilise the waste through accelerated and

controlled decomposition, accompanied by methane recovery. This is in contrast to standard landfill technology, which focuses more on isolation.

Inexpensive methods of leachate control.

The state-of-the-art liners and leachate collection systems described above are too expensive for many developing countries. There are three practices that are much cheaper and which may be practical in some situations.

a MSW in an area with **low rainfall** may be allowed to partially dry at transfer stations prior to landfilling. This will reduce the leachate produced at the landfill itself.

b For areas where pre-drying is impractical or where the soil conducts water very well, it may be necessary to site a **landfill in an area with a steeper grade** than would otherwise be chosen. In conjunction with a well-distributed leachate collection system, this can reduce the dangers of water table contamination. The use of steeper grading, along with the denser placement of leachate collection pipes, will add to the cost of a landfill. However, these changes may be far less expensive than importing, transporting, and applying clay or synthetic liners.

c To avoid the initial expense and ongoing maintenance requirements of pumping leachate, it can **be collected in a concrete-lined pond**, constructed downhill from the landfill. The best option in many cases is then to allow the leachate to evaporate as much as possible. In this circumstance, however, the leachate from an overflowing pond will be diluted by rainfall.

d In some locations, the co-treatment of leachate and other waste waters can have comparative advantages.

Monitoring and control of landfill gas

Landfill gas is primarily a mixture of methane and carbon dioxide produced by the decomposition of organic matter in the MSW. Landfill gas is highly flammable and poses a risk of explosion if not properly managed. Gas management is generally required at sanitary landfills. At controlled dumps, there should at least be monitoring to determine if dangerous amounts of gas are being released. A low-cost design to handle landfill gas may consist of buried vertical perforated pipes.

Necessary conditions for economic capturing of landfill gas.

- sufficient amounts of methane are generated;
- capital is available for processing the gas;
- there is local demand for natural gas or a means to transport it elsewhere; and
- the market price for natural gas is relatively high.

The technical feasibility of recovering economical quantities of methane gas depends on several factors. Perhaps the most important factor is the composition of the MSW. The production of methane gas depends on a relatively high percentage of organic

MSW as well as proper nutrients, bacteria, pH, and a high moisture content. The size of the landfill must be large enough and contain enough MSW to produce economically recoverable quantities of methane. Generally, landfills that have a capacity of at least one million tons should produce enough methane to support recovery operations. The age of the landfill is also important because it can take from several months to a few years after the disposal of MSW before sufficient methane is produced. Early methane production can be enhanced by using uncompacted waste as the first layer of a landfill, thus allowing it to compost more quickly.

The engineering components of a landfill may also increase the quantity of methane gas that can be recovered. Landfill liners help keep methane from escaping from the landfill and help maintain the anaerobic conditions necessary for methane production. Similarly, a daily cover that keeps methane from escaping and inhibits the introduction of air into the landfill can increase the rate of methane production. Other factors, such as the geology of the landfill site, also play an important role.

Access and tipping area

Because access control is important, a staffed gate should be the point of entry to the facility for vehicles and any waste pickers. Separate provisions must be made for access to emergency vehicles and equipment. Ideally, the gate should be equipped with scales for the weighing of vehicles as they enter and exit the facility. Weigh scales are an essential element of a sound municipal MSWM system, as they provide critical information, such as a record of the tonnage of materials entering the facility, that is needed for planning purposes and for the operational management of collection vehicles.

In the case of the controlled dump, the designer may forego mechanical scales when the total expected gate receipt of waste is less than 200 tons per day. Manual scales or calibrated tables of weight-to-volume for delivery vehicles may be used to provide estimated gate receipts in these cases.
Ideally, the tipping area should be at the working cell. This entails the design of access roads to these locations within the site. This may not be possible at controlled dumps and smaller sanitary landfills, either due to a lack of resources for road construction or the lack of maneuvering room for the delivery vehicles. In such cases, tipping may occur close to the gate area and the load transported to the working cell by smaller vehicles or muscle-powered carts.

Operations and safety manuals

Clear operating procedures and well-trained workers are vital to safe and effective landfill operations. Several handbooks and manuals on landfill operations are available and the planner should adapt these to the specific needs of the site. Such manuals should be prepared or acquired during the design phase of the landfill, because this permits their content to be specifically adapted to the processes for which the facility is designed.

Closure/post-closure plans

Closure and post-closure plans are required in the permitting process of most sanitary landfills. Their essential elements are:

- plans for the sealing and application of a final cover (including vegetation) to the site;
- plans for long-term leachate and gas management and monitoring;
- plans for long-term ground and surface water monitoring;
- financial assurance guarantees to the local or state government; and
- land use restrictions for the site.

In most developing countries, there are no closure and post-closure plans prepared in the case of controlled dumps and facilities are not required to make financial allowances for these activities. However, the provision of ongoing monitoring and control of the facility after its useful life is an unavoidable reality of landfill management. It is necessary to monitor these facilities to ensure their continued safety to the health of surrounding communities and the environment for periods that may exceed 30 years after their closure. Cost recovery programs may be instituted during the operation of the facility to provide funding for these activities. Alternatively, taxes or other revenue-raising options may be employed to secure the required funds.

Landfilling special wastes

Special wastes include medical waste, household hazardous wastes, tires, used oil, construction and demolition debris, human excreta, and sewage sludge. In all cases, the first option would be to redirect the waste to the appropriate facility. Some sanitary landfills are prohibited from accepting several of these components as a matter of regulatory policy. However, for many other landfills, particularly controlled dumps in developing countries, the facility is the final and only legitimate destination for these special wastes.

Medical waste: The first option would be to redirect medical waste to an appropriate incinerator or other treatment facility. If not possible, these wastes should be buried in a separate cell at the landfill and covered with lime. Special care should given to the management of leachate from these cells.

Household hazardous waste (HHW): Special handling of HHW is only required if it is delivered to the landfill as a separate load from regular MSW. In such cases, management at the landfill begins with documentation of the shipment's source, contents, and transporter. In other cases, HHW mixed with the regular MSW stream is processed according to routine operations. Ideally, the landfill should have a posted policy of not accepting special loads of HHW. However this may not always be possible.

Tires: Tires should not be disposed of with regular MSW. They do not remain compacted and negatively affect the structural stability of the completed cell. Open storage poses a fire hazard. It also poses a health hazard as a breeding ground for mosquitoes. If possible, the tires should be shredded to reduce their volume and used creatively around the site. Some such uses include terracing for erosion control and padding and bumpers on gates and heavy machinery. The unused material should be disposed of in a separate section of the landfill.

Used oil: Used oil should be rejected by the landfill operator. It is unsafe to keep for long- term storage and is highly polluting of ground and surface water if it leaks in the landfill.

Construction and demolition debris: This is largely inert material. Where possible, it should be handled at a separate cell in the landfill, both to facilitate possible future recovery and because such debris does not require the same leachate management efforts as other wastes. Where gravel and stone bits are present in sufficient quantity, they may also be used as cover material at the landfill. However, special processing to separate this material involves costly screening machinery which may be beyond the means of most controlled dumps.

Excreta and sewage sludge: Ideally these wastes should be dried before delivery to the landfill. They should be handled by specially trained and equipped workers. At the landfill, they are mixed and disposed of with the regular MSW. Where facilities are available, composting is a resource recovery option for these wastes.

ANSWERS

Waste inventory (Quality, Quantity)

1. Municipal solid waste include all solid or semisolid materials, that the possessor no longer consider valuable enough to keep. The categories are the follows: residential, commercial, institutional, construction and demolition debris, municipal services, treatment plant sites, industrial, and agricultural.

2. Medical wastes, tires, used oil, wet batteries, construction and demolition debris, sewage sludge, and industrial . The first step is to separate them from the waste stream.

3. Waste prevention has three steps. The first is waste avoidance, the second is waste quantity minimising, and the third is maximise waste recovery and recycling.

4. The reasons are the scarcity or expense of virgin materials, the occurrence of poverty, and therefore availability of cheap work force, and the large markets for used goods.

5. At the national level: legislation on packaging, raw material using, use of toxic materials, the promotion of producer's responsibility, and on consumers awareness. At local level: source separation, pressure on governments for legislation, and support of composting.

Waste collection and transport

1. In developed countries the collection and transport is usually a door to door service, which use fuel-powered vehicles. That means the collector vehicles collect waste directly from the houses, flats, shops, and transport it to landfills. In most African cities the waste collection and transport service is a hybrid one which use muscle and fuel-powered collecting vehicles and usually deal with communal collecting points (transfer stations), that means the collectors don't take the waste directly to landfills.

2. The vehicles must use minimum resources, for the same duty, select locally made vehicles of traditional design, and can be locally repaired, choose non-compactor trucks where population is dispersed, use hybrid system which is fits also for the modern commercial centre and for poor neighbourhoods too.

3. Bins could made from every materials what are available. There are drums used for waste bin, different kind of baskets, bags, bins made of truck tire etc...

4. The vehicle capacity, and loading heights, because if they are lack they determine the effectiveness of the collection. The condition of collecting vehicles, the reason is a bad machine can't work effectively. The awareness of the staff, because it is important to do their work conscientiously .

5. Planing can increase the effectiveness not only the collecting and transport services, but the whole waste management. For example with a good routing plan we can spare time and money also.

Composting

1. The organic content of MSW in the typical African city may exceed 70% (wet basis).

2. Centralised composting and backyard composting. Usually the backyard composting works better in African circumstances, because the centralised composting usually costs more, than its income.

3. The ability to secure waste or to the need to market the compost that is produced, usually that are the two main economic failures in connection with composting. In much of Africa, however, efforts to organise composting have failed to secure enough waste. When dumping or landfilling is inexpensive and not subject to effective environmental controls, composting is relatively expensive. Finished compost is not automatically, a valuable commodity, its value depends on external demand for soil enhances.

4. In sewage sludge and septage there are large quantities of pathogenic organisms and they often contain chemical contaminants. They therefore require proper treatment and disposal. Sewage sludge and septage generate leachate, which associated with bad odours, and it is typically associated with poor working conditions and risks to workers' health.

Incineration and energy recovery

1. The general characteristics, what is needed for incinerating cost effectively is the calorific value of the waste. If it is high, than incinerating is usually profitable. These materials are paper, plastic, and other combustible materials. If the waste is too moist it could influence the effectiveness of burning.

2. High costs relative to other MSWM options, a limited infrastructure of human, mechanical and institutional resources, and the composition of the waste stream itself, suggest that incineration is an inappropriate technology for Africa now and for the foreseeable future.

3. medical waste, and other hazardous wastes, which are combustible and can be burn safely to the environment in an incinerator. Incinerating is usually much more safe, than landfilling in the case of hazardous wastes

Landfilling

1. The three categories of landfill facilities are open dump, controlled dump, and sanitary landfill. Open dump are poorly sited, the capacity is unknown there is no site preparation, no fence ,waste picking and trade are average in this sites. Controlled dumps characterisations are: These sites are sited with respect to hydro-geology, they have planned capacity they are drained, there is usually partial leachate and gas management, they have regular cover, these sites re fenced, and waste picking is controlled. Sanitary landfills site selection based on environmental risk assessment designed cell development full leachate and gas management daily and final cover compaction no waste picking

2. There are environmental criteria which are the follows: the existence of ground water or nature protection zones in the area, the geological and hydro-geological conditions of the area, the risk of flooding, subsidence or landslides on the site, and the protection of natural or cultural patrimony of the area. The other criteria are: the costs and the distance and accessibility from the centre of waste generation.

3. The types of landfills in Africa most often fall somewhere between open dumps and controlled dumps. These facilities are generally located at the perimeter of major urban centres in open lots, wetland areas, or next to surface water sources. Often a lack of financial and human resources, coupled with absent enabling policies, limit the extent to which landfills can be built, operated, and maintained at minimum standards for sanitary practice.

4. There are several environmental risk, which a landfill can cause. Probably the most dangerous is the impact on the ground-, and surface water. The natural water contamination is caused by the leachate, which comes from the natural decomposition of MSW, in combination with rain infiltration into the site. Leachate is usually contain toxic components too which make it more dangerous. Air pollution is also risky impact on environment. The two main factors of air polluting are the dust and the smoke from the burning of the waste at the landfill. Soil pollution is also caused by the leachate. Household hazardous waste and hazardous wastes from commercial and industrial generators can release toxic chemical contaminants.

5. The operation of a landfill is a quite complex task for the operator of the landfill. We can separate operating tasks from the access of the waste till the final cover of the site. The subtasks are the follows:

- Access procedures: Weighing and estimation of the waste, billing or paper works, rejection of non-payers
- Tipping of the waste: Ensure internal roads for easier tipping, formation of cells, compaction of waste, covering of waste
- Monitoring operations: Leachate monitoring, landfill gas monitoring, ground water and surface water monitoring,
- Tasks with the leachate: Leachate collection, leachate treatment, leachate recirculation,
- Closure tasks: Further monitoring of the site after closure, Final cover denser than the daily cover, Recreation of the site after closure

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UP-DATED TRAINING MANUAL OF WASTE MANAGEMENT IN HIGH DENSITY AREAS OF THE AFRICA REGION

MODULE 7
CASE STUDIES

Contents:

INTRODUCTION

In this pamphlet we introduce the Municipal Solid Waste Management in practice, how it works in different countries, in different circumstances. We believe that, everybody who is concerned can learn from the others' experiences, and with this knowledge they can do their tasks better. We took examples from different countries from industrial countries in the European Union and the USA one from Hungary (country of economy in transition), one from emerging market in Africa (Ghana) and one from an LCD (low developed country, Burkina Faso).
In the pamphlet, proven technologies and both good and bad examples are shown to help in thinking about what examples to follow. We tried to choose case studies which have useable experiences for the reader which are hopefully can help their work in waste management.
It is always necessary to seriously consider the available options and the present conditions before introducing a local waste management system.
Read and think about these case studies carefully.

Objectives

The specific learning objectives of this pamphlet are as follows

- To show the different kind of waste management systems in the different countries making easier to learn from other's experiences.

- To drawn the conclusions from each of the case studies, and try to find the details which could be helpful in the future.

- To stimulate to compare the differences between situation of the case study and the situation of your country in the investigated subject.

STUDY MATERIALS

The following case studies review many of the important considerations that you should keep the fore when designing or developing waste management systems at your country or municipality.

CASE STUDY 1.

FINANCING OF REFUSE COLLECTION IN LOW INCOME, HIGH DENSITY AREAS IN ACCRA GHANA (CENTRAL COMMUNAL CONTAINERS) CASE STUDY ON "PAY AS YOU DUMP-SYSTEM"

Municipal solid waste (MSW) collection and management all over the world is capital intensive. In developing countries the situation is further compounded by rapid urbanisation and poor infrastructural facilities, like roads, housing, and reliable development schemes. This makes organisation and collection of wastes from a vast majority of urban dwellers very difficult and expensive. Most methods of management depend on communal collection system with its large overhead costs. Accra, the capital of Ghana is not an exception to this phenomenon. Over 60% of the waste generated in the city comes from the high density, low income areas which depend mostly on communal central containers. About 150 steel containers ($10m^3$ volume) were located in these areas where residents "travelled" a reasonable distance to dump their waste into. Collection for emptying of these containers by the Municipal authority for final disposal was daily, which made operational cost quite expensive. This system, unlike the Domiciliary (door to door) collection system, where the service was rendered directly to the houses in the mostly affluent residential suburbs of the city, was a drain on the finances of the municipal authority.

Where over 85% of the fees charged for service delivery in the door to door areas were collected monthly, zero returns were always recorded in the communal container areas. To reverse this trend and to ensure a better and sustainable delivery of service, several methods of financing were considered and tried without much success by the Municipal Authority, Accra.

The most tested one was the so-called "Sanitation or Refuse Levy" introduced in 1986. This was a fixed amount of ₵3,000 (three thousand cedis) charged per house per year and was attached to the property rate bill. Unfortunately most property owners refused to pay the levy on the grounds that they do not enjoy any direct waste collection services from the Municipality like those within the affluent areas.
Although they were aware some level of service was been rendered to the communities in the central container collection areas they did not appreciate it as a direct service to them, to warrant any payment.

Meanwhile, this was projected to generate over 135 million (one hundred and thirty-five million cedis) annually to support the Municipal Solid Waste Collection, but for most part of the period only an average of between 7 – 10 % collection rate was achieved, and this made the system, unworkable.

Over the years, the Department's operational cost kept mounting with the ever rising cost of fuel and spare-parts. The situation was really getting out of hand and therefore in the last quarter of the year 1993, a decision was taken to experiment with the collection of fees at the container sites within the communities on a pilot basis. This was code-named "PAY AS YOU DUMP SYSTEM".

Definition of the concept:

This was a system where residents were required to contribute a token fee of 20 (twenty cedis) per dumping at the container site. Payments were made direct to toll collectors or container attendants at the sites within the Sub-District Assemblies. The aim of the scheme was to:

- Create a revenue base to further support the waste collection system
- Create revenues for employment for the local youth
- Expand the revenue base for the Sub District
- Utilise local initiative and labour to control the predominantly negative sanitation habits of residents
- Establish a more effective system of revenue mobilisation to support and improve the standard of sanitation within the city.

Public awareness campaign:

Since it was a new programme to be introduced especially in the low income high density areas, there was the need for a thorough information flow and therefore, a vigorous educational campaign mass mounted in the communities.

Several rallies were held in almost every constituency of the District. These rallies were in the form of frame as talk shows, and open forums where the rationale for the introduction of the scheme was explained to the public, and questions from the public were also answered.

Effort s were made to involve the local authorities like the Assemblymen or Councillors as well as the opinion leaders within the communities. There was also an aggressive media coverage using both the print and electronic media. Adverts and posters were also employed to educate and mobilise residents towards the scheme. All these were undertaken within a period of three (3) months before implementation.

The Head Count survey:

Preparatory to actual implementation of the scheme there was the need to conduct a survey to establish several parameters for effective monitoring and control.

These were:

- The number of dumping per day
- The number of dumping required for the various sizes of containers to get full
- The standard and sizes of receptacles being used by residents
- The peak and lean periods of dumping
- Average revenue expectation from each public waste container.
- To come out with realistic target rates for toll collectors.

Methodology:

Fifty (50) container sites from all the six sub districts of the city were sampled for a period of five weeks. This formed about 33 % of total container location within the city (see Table 1.).

Table 1. Sample Size and Selection of Sites

NO	SUB DISTRICT	NO. OF CONTAINER SITES (APPROX)	NO. OF SELECTED SITES	PERCENTAGE (%)
1	ABLEKUMA	26	9	35
2	OKAIKOI	13	4	31
3	ASHIEDU KETEKE	9	3	33
4	AYAWASO	31	10	32
5	OSU KLOTTEY	4	2	50
6	KPESHIE-LA TESHIE/NUNGLA	9 16	3 5	33 31
7	PRIVATE CONTRACTOR AREAS(GEN)	42	14	33
	TOTAL	**150**	**50**	**33**

Notes:

- List of sites were provided by the District cleansing Officer in consultation with the Sub District Assemblymen/Councillors.
- Sites selected on those areas, where lifting of containers were regular.
- All container sizes were represented in the sample size.

A total of fifteen (15) National Service Personnel were involved in the project, with three co-ordinators from the Waste Management Department. Survey hours were from 4am to 9p.m. and was divided into two shifts.

1st shift: from 4.30 a.m. to 1.00 p.m.
2nd shift: from 1.00 p.m. .to 9.30 p.m.

Transport and incentive packages were provided for the survey team who in spite of the difficulties managed to conduct a good survey.

Results: At the end of the period the following observations came to the fore:

- Over 70% of the waste dumped were done in the day with the peak periods falling between 4.30 a.m. and 8.00 a.m.
- Most of the dumping was done by children, except in locations near the markets.
- Majority of residents paid willingly but not more than 20 (twenty cedis) per load/visit irrespective of the receptacle size used.
- Capacities of receptacles most frequently used by residents fell between 15-30 litres, 19% - 39% of the receptacles used were estimated to be of 40 litres and above.
- Most residents demanded an immediate improvement in waste management services to encourage residents to pay more.
- Need for further intensification of the educational drive.
- Minimum revenue set targets were achieved
- Over all public response was encouraging.

Implementation:

Since the Sub Districts were directly involved in the preparatory stages, implementation of the scheme was smooth. Its management was handled at the Sub District level which was charged to:

- organise and appoint toll collectors and cleaners
- receive daily payments from toll collectors
- pay toll collectors and cleaners
- resolve all conflicts at the local level.

Within a short time (about 2 weeks) toll collectors have been appointed to manage all the container sites. Targets were set for them based on local conditions, and in most cases, daily target ranged from 7000 (seven thousand cedis) to 16000 (sixteen thousand cedis) per container filled.

Since most of the receptacles used by residents were not of the standard type, there were few misunderstandings at the initial stages, ad to how much to pay, where the receptacle was a little bigger than normal. However, these problems were resolved with time. All revenue collected was paid to the Sub Districts account, from which tax reimbursed the Waste Management Department to cover cost of fuel supplied to the collecting vehicles, container repairs and cash payments.

Revenue performance:

The first four months of implementation yielded a total revenue of about 12 million cedis (c12,000,000.00) to the department. This was a great assistance ever to be realised from refuse collection in this sector. This positive trend continued to show improvement with each passing month, and by the end of the first quarter of 1994, the system vas gaining

grounds with higher monthly payments being made. By the end of 1994, a total of about forty-six million cedis (c46,000,000.00) has been realised from tolls payment to the department. This obviously proved more reliable than the earlier sanitation/refuse levy imposed on residents. Since this was a direct tax, it assisted the department to overcome some of its recurrent expenditures like fuel and minor spare parts, and within a remarkably short period of time, service delivery to the communities had improved tremendously. Most container sites were kept clean and tidy to the admiration of many residents, especially those who were close to these sites.

Apart from this revenue payment to the department, the Sub-Districts were enabled to pay allowances to toll collectors and cleaners from their share of earnings, which was an additional income to the Sub-Districts.

Difficulties with the system:

Although implementation was smooth, and revenue collection was very encouraging, it could not be said that there were no difficulties with the implementation of the new system.

In spite of the aggressive publicity campaign mounted before the exercise, there were many residents who were (ignorant and therefore) uncooperative. There were others who were also worried about accountability, since official receipts were not issued by the toll collectors for the monies being collected. There were also complaints that residents who had no money to pay or refused to pay, usually dumped their garbage into the drains and open spaces. Also children who misused monies, given to them by their parents to pay at the site, were also guilty of this offence. All these criticisms attracted wide media attention, which necessitated the suspension of the system in certain areas, to address the critical issues raised. Also the need to introduce appropriate bye-laws to facilitate implementation, as well as policy frame work to encourage full participation.

Conclusion:

Notwithstanding the set backs experienced with the system, it came out clearly that it could be a better and feasible option in the financing of waste collection in low-income areas of a fast growing city like Accra The "Pay as you Dump" system was seen as a direct or instant payment, which was preferred against the monthly fixed fee which was considered too high for the average family to meet: a daily breakdown was more and easily managed.
It is obvious that Central Government alone can not be able to finance wholly the operation of this service including the replacement cost of vehicles. Community supports the service, if good public health is to be achieved and sustained.

Next step

Answer the following questions, than discuss them with the group, and Compare them with the answers which are suggested at the end of this pamphlet.

Questions:

1. Why do you think that, time to time payment worked better, than monthly fees in the case of waste collecting in Accra.

2. Describe the main characterisations of the "pay as you dump system".

3. What were the main points at the implementation of the "pay as you dump system".?

4. What were the difficulties with the "pay as you dump system"?

CASE STUDY 2

CAPACITY OF THE COUNCIL TO COLLECT, TRANSPORT AND DISPOSE OF WASTE IN LUSAKA ZAMBIA

The City Council of Kitwe does not at present have the capacity to collect, transport, and dispose of all the solid waste generated daily.

The following statistics demonstrate, a steep and continuous decline over the years in both the amount of waste collected and in the levels of existing fleet.

The decline in capacity is in sharp contrast with the annual population growth rate of over 3.5%.

Year	No. Of Trucks	Loads of Waste Transported (t/a)
1980	17	5,531
1982	15	5,133
1983	13	5,020
1984	07	4,671
1985	04	3,543
1986	02	2,667
1990	02	1,588
1996	02	1,060

Difference between available fleet/plant and the optimum levels needed for acceptable operation.

ITEM	EXISTING	OPTIMUM REQUIREMENTS
7-tonne Truck	3 (1 Compaction loader + 2 open trucks)	25 x 7 tonne truck (complete with tipping facilities)
Tractors with trailers	Nil	25
Pay loaders	1 (Not specifically for waste disposal)	4
Skips	Nil	36
Refuse bins to residents	Council is unable to provide these	
Litter Bins	Very few are provided in public places	

Notice:There has been a steady decline in numbers of pickers and refuse collectors due to deaths, retirement and resignations. Replacements are rarely done.

Cost of performing exercise: Actual and budget

The required budgetary allocation for effective waste management in the district is somewhere in the region of K2,600,000,000.- for the Council's administrative areas.

Our 1995 budget is outlined herein below to give you an idea of the immensity of the shortfall. Note too that not all the budget amounts were actually released.

	ITEM	AMOUNT (K)
A.	Salaries, wages, other emoluments	88,082,000.-
B.	Premises (Maintenance, buildings, cleaning materials, furniture, etc.)	3,675,000.-
C.	Supplies and services (e.g. tools, protective clothing)	10,700,000.-
D.	Transport & Plant	25,000,000,.-
E.	Establishment (Post, telephone/insurance, etc.)	1,450,000.-
F.	Miscellaneous	2,000,000.-
	TOTAL*	130,907,000.-

* The figure for 1996 was K161,227,000.-
Exchange rate US$1=K800

Constraints:

I. Insufficient quantities of trucks, plant, equipment, etc.

II. Waste management in this country is "rate-borne" i.e. it is supposed to be financed from revenue collected from rates. The charges levied are unrealistic and any increases in rates require the approval of Council and the Minister of Local Government. Both approvals are very difficult to obtain.

III. In the presence of unrealistic charges other means e.g. grants, are required. No other means are available at present.

IV. Lack of appropriate technology

V. Lack of public co-operation

VI. Large scale littering and clandestine dumping

VII. Poor accessibility in unplanned settlement

VIII. High operational cost

IX. Lack of separate landfill for toxic waste disposal.

Future Plans

The Local authority has to consider the following option:

A. Contractor paid by Kitwe council – This entails the Council's calling for tenders for Waste Management by private contractors.

The work of the contractors, equipment used, areas served, etc. would be agreed with and controlled by Kitwe City Council who would pay the contractor an agreed price.

B. Private contractor charging prospective customers.

Municipal Waste Management in the city of Lusaka

In this section, we show the problems and the results in one of the African capitals.
To evaluate the waste management situation, a series of questions were open for discussion.

The questions asked were the following:

- Do you think the city and the compounds are clean?
- Do you think waste is collected and disposed of?
- Who collects waste?
- Which areas of the city are clean? (only answered by Kalingalinga respondents)
- Do you think waste is dumped at the right places?

All residents considered that both Lusaka and their neighbourhood are dirty. They also mentioned that no waste is collected or disposed of. In contradiction, when asked who collects waste, people from George-Matero recognised that PUSH workforce were involved in garbage collection in their compound. In Kalingalinga, the general answer was that no one collects waste, although they were quick to acknowledged that Lusaka City Council is responsible for waste collection. Kalingalinga residents mentioned that parts of the city such as Cairo road and some low-density residential areas and light industrial areas were clean. Finally, all people agreed that waste is not dumped at the right place.

Degree of Priority Given to the Problem of Waste Management

The residents were invited to list and compare between each of the problems they are facing in their particular locality and to decide which are the most important problems.

This was done by ranking the problems, from the most important to the least.

Of course, variations are found between the meetings in terms of the problems identified. Some respondents live closer to a clinic, some are nearer to a school, while others are well serviced with water supply. But in all meetings, poor waste management was identified to be a problem faced by the community. The ranking differed from one meeting to another. Poor waste management ranked first in two of the six meetings, and got as low priority as seventh in one of the meetings. On average, the relative ranking of poor waste management is fourth for Kalingalinga and third in George-Matero.

Personal Attitude Towards Improving Waste Management

In order to survey the attitude of people towards potential improvements of waste management, the following questions were asked:

What can be done about waste?
How much are you willing to pay for a good service?

All the respondents agreed that something can be done by the residents such as digging rubbish-pits and that they could mobilise the residents to collect garbage and dispose of it with help from the City Council in terms of transport and tools.

It was interesting to note that the respondents from Kalingalinga are willing to pay for a reliable service. The amount suggested is, on average, US$ 0.40 (K 500) per month. George-Matero residents have not quite committed themselves to any particular figure apart from one meeting which suggested an amount of US$ 0.24 (K 300). The others felt they don't have money to pay for such a service.

The following were some of the recommendations that came out of the George-Matero meetings:

There is a need for an intensive education campaign on waste management.
A penalty fee should be introduced for illegal dumping even in the compound.
A trophy should be introduced for the cleanest Zone in the compound.

Waste management problems are not only tied to financial and technical issues but to the attitude of the population towards waste, as well. In some ways, this seems to represent the reality of the situation surrounding waste management.

The results lead us to conclude that waste management is an important issue amongst the population. People feel that the city, especially markets and peri-urban areas, are not clean, and waste littering has negative effects on the soil.

On the other hand, some of these effects do not seem to be completely understood by the population. Nowhere in the answers was mentioned that waste what is thrown away clogs the drainage system in Lusaka, which has massive destruction effects on the road network during the rainy season.

Many of the respondents also did not identify the danger of ground water contamination created by improper waste disposal.
These two effects are less "visible" than visible nuisance or odours, for example, but actually threaten the community to a much greater degree in the long term.
In terms of the understanding of the situation in Lusaka, not all people recognised that there is a collection service in Lusaka, although it is deficient in many areas and only a third of the stakeholders were able to identify the Libala tipping site as a refuse disposal site.
From these results, one may think that as waste management services declined in recent years, the population has become more and more aware of the situation to a point that waste management is now viewed as an important issue. Markets and peri-urban areas are viewed as prime targets of intervention that could take the form of efforts to reorganise the service (such as privatising), to increase resources and to provide education to the population. The stakeholders can take advantage of the population's awareness to actually gain the support of the community in trying to improve waste management.

Roads Condition and Fluidity of Traffic

The condition of the road network in Lusaka is poor, especially for access roads to peri-urban areas. The main road to, and inside the Libala Tipping Site is also in bad shape. Such a situation has an effect on the efficiency and the cost of refuse collection, since the number of vehicle breakdowns and shorter life-spans as well as longer refuse transportation time contribute to the inefficiency of the system. In general, the major road axes provide good access to most urban areas.

Ecologically Sensitive Areas

Lusaka draws approximately 52% of its drinking water from the underground aquifer. Bore-holes are scattered all over the city. The south-eastern part of the city is located on the recharging zone of the aquifer. Although these areas were once officially declared as protected zones. The recent practice of waste management could jeopardise this precious resource. Besides there is a great number of illegal dumping sites and heaps of refuse scattered all over the city which may cause ground water contamination in the long run. The problem of leachate infiltration may have worsened by the quarrying activities. Similarly, it is feared that leachate from refuse at the Libala Site may have already reached the ground water table.

The authorities should carry out a thorough water quality investigation of the Lusaka bore-holes to identify the contaminated water wells. A hydro-geological assessment should be done around the Libala Tipping Site. The Municipality and other organisations should seriously consider groundwater protected zones as major ecological sensitive areas when undertaking waste management planning for Lusaka.

Refuse Storage Before Collection

Generally speaking, the population lacks proper storage containers for solid waste. In residential areas and in most cases, in commercial and industrial areas, waste is not stored in

containers because a greater part of it is buried in pits, burnt, or thrown in dumps on road sides and in illegal dumps.

Collective containers should be used in peri-urban areas and educational campaigns by community based organisations should promote the use of such containers. Also, services have to be improved.

Refuse Removal in Peri-Urban Residential Areas

This work has been subsidised largely by funding from international donors which does not make it sustainable. Collection and transportation work is difficult because many access roads to peri-urban areas are in a bad condition. It is also not feasible to access all houses by vehicle. This situation leads to the mushrooming of illegal dumping sites near or within the peri-urban areas, which can cause serious health risks. Unfortunately, peri-urban dwellers have very little capacity to finance a refuse removal service and some people are not willing to pay anything for a good service even. It is doubtful whether peri-urban communities, even when all possible education is provided, can afford a totally self-financed refuse removal service.

Waste Management in Low and Medium Density Residential Areas

Generally, people living in low and medium density areas could have a better capacity to pay for a waste removal service, compared to the residents of the high density, peri-urban areas. At present, there is no mechanism for fee collection from this high density area population.
Since the self-financing of the service by the community is more feasible in low and medium density areas than in peri-urban areas, the service in this case can effectively be carried out and self-financing mechanisms should be put in place.

Market Waste Management

The Lusaka City Council's (LCC) equipment for collecting and transporting waste from markets and commercial centres is hardly available. There is only one skip lift available to carry out the work, and it is often grounded for repairs.
The Council should provide skips at markets and commercial centres, as it is considered to be the most suitable container for such areas. In parallel to this service, it should purchase adequate skip lifts to handle the skip containers. The provisioning of such equipment should be accompanied by educational campaigns. The marketers, through their associations, should place an attendant to supervise the correct use of skips. Marketers could partially or entirely finance the operations of this system.

Commercial, Industrial and Institutional Waste Management

Many commercial, industrial establishments and institutions presently use private services, but the Council stretches its limited resources to provide a basic service to some of them, as well.

Commercial, industrial and institutional waste management should be privatised for those sectors which have the capacity to pay for the service.

Libala Tipping Site

Besides being located in an ecologically sensitive area, the Libala Tipping Site was initially chosen on a temporary basis. On the other hand, the site was intended to be used for dumping non-hazardous solid waste only. At the moment, the Libala Tipping Site is not operated as a sanitary landfill. For example, waste is not properly dumped and covered. There is poor control on entries since the site is not fenced and there are multiple access points.
There are no comprehensive records of the quantity of waste dumped at the site due to the absence of a weighing bridge. The operating problems are enhanced by the many scavengers present at the site.
At present, the Council should manage the site as a proper sanitary landfill. For instance, the Council should study the possibility of fencing off the site and having better control of accessing. All operations at the Tipping Site should be improved. In order to properly monitor quantities and types of wastes dumped at the site, the Council should install a weigh bridge and provide cellular filling. A proper system for recording and entering the data (quantities, customers, etc.) should be put in place.
As a long term measure, the Council needs to operate a new site, its location must be based on thorough environmental investigation. And as there is no suitable alternative site within the City boundaries, the Council must reach an agreement with neighbouring municipalities to open such a site.

Hazardous and Hospital Waste Management

The present legislation on solid waste management does not regulate the management of hazardous solid waste and in particular, there are no guidelines for hospital waste management. In addition, there is no comprehensive data on the quantities and composition of the hazardous waste produced.
In view of this, the Authorities should formulate specific legislation to address hazardous waste management. Considering that the Environmental Council of Zambia (ECZ) has already planned to develop regulations on hazardous waste management, steps should be taken in order to conduct a comprehensive survey of hazardous industrial waste generated in Lusaka. The ECZ and LCC should introduce guidelines on hospital waste management to help guide all medical practitioners and institutions.

Special Waste Management

The LCC does not have the capacity at the moment to collect special waste in a satisfactory manner. This problem is especially critical for building rubble and car shells.
The LCC should put in place a collection system for this kind of special waste. The service could be partially financed by the people requesting the service. Rubble can also be used as a covering material for landfilling.

Human Resources

The Public Health Service Department is responsible for waste management at the LCC. This Department is presently understaffed for its establishment requirements. The regular workers who form the majority of the department are not qualified and are not specialised in waste management.
The LCC should ensure that there is sufficient qualified personnel to handle solid waste management. Therefore the LCC should carry out an assessment on needs in terms of staff training. Regarding the contracting of casual workers, the recruiting policies at the LCC should ensure that those recruited at least meet a minimum level of education.

Waste Recycling

Some materials, such as aluminium cans or waste paper could be regarded as opportunities for recycling. But, looking at the relative composition of wastes as given in the characterisation study, it is important to note that recycling can not achieve a large reduction of solid waste quantities disposed off, as most of the waste disposed is difficult to recycle.
Stakeholders should co-ordinate studies on new economical possibilities of recycling and put in place appropriate programmes. Prime targets should be set. These would also have the advantage of carrying a strong message to the community towards conservation of resources and sensitising the population towards proper waste management.

Quantity Increase and Priority of Intervention

Approximately three quarters of the population of Lusaka lives in peri-urban areas, which are not serviced by the LCC in refuse removal. According to the characterisation study carried out, these people produce an estimated 169 000 tons of refuse per year. Adding up quantities of refuse generated by dwellers from low, medium and high density areas, the total quantity of domestic waste generated in Lusaka is estimated at 219,000 tons of refuse per year (of an estimated total of 243,000 tons per year of all types of refuse). In 15 years from now, and assuming that the generated quantities of waste per capita do not change, the domestic sector will produce 529,000 tons of solid waste, an increase of 140% from 1996. This increase is solely due to the projected population growth. If the economical situation does not change, the bulk of the refuse will still be produced by peri-urban dwellers. Refuse produced in peri-urban areas therefore does and will represent in the future the greatest part of waste generated.

Stakeholders in waste management must recognise that priority actions should be taken in peri-urban areas. In its waste management planning, the LCC must take into account the rate of increase of waste generated linked to the huge population growth.

Waste Minimisation

In the characterisation study, 65% of domestic waste collected in peri-urban areas falls under the category "other". This is composed mostly of sand, dust and ashes. In other words, a large portion of what people throw away is plain soil. Such a situation could probably be avoided. This example illustrates the potential of waste minimisation that can

be achieved in Lusaka. As a matter of fact, waste minimisation may be a more valuable option for quantity reduction at the moment than recycling, especially for peri-urban areas. The LCC and other stakeholders should study in details the various possibilities of waste minimisation. For example, a programme of waste minimisation could include education and sensitisation campaigns.

Financing of Operations

For 1995, the LCC spent a total of US$ 678,338 for waste management. This figure did not include any capitalisation in terms of vehicles. This represents US$ 22.60 per ton collected by the LCC. Local authorities can not carry out waste management adequately for a city the size of Lusaka with such an amount, especially, that work is not subcontracted. It is not possible to improve the quality of service of waste management with so little financial resources.

Billing Problems

The LCC dropped the collection of refuse removal charges as the service deteriorated. For 1995, revenues collected from such charges represented a meagre US$ 22,482, which represents less than 5% of the expenditures. The rest of the waste management expenditures are covered by general revenue sources of the LCC (rates, municipal house rents, etc.). Property rates bills by the LCC do not indicate any particular amount devoted to waste management, as municipal accounting is not organised in such a way. As shown in the social study, some people believe they are paying their fair share by contributing to the rates. If billing linked to waste management is reintroduced, it may face application problems.
The LCC should introduce an adequate billing system. Various options can be suggested. Accounting of refuse removal services can be separated from the rest of the LCC services and indicated as such in the billing of rates. Service charges can also be reintroduced. Any option suggested must take into account refusal of payment. To avoid such refusal, billing can be joined with an essential service (such as electricity or water) than can be cut on non-payment. The LCC would pay back a fee to cover the costs of administration. Education campaigns can also increase receptivity.

Attitude and Improvement of the Situation

According to the study on the attitude of the population towards waste management, as the situation of waste management worsened during the recent years, it appears that the population has become more aware of the issue. People do not consider Lusaka to be a clean city and mind about the problem but efforts to improve the situation can only be successful with the support of the population. A large portion (50%) of the stakeholders linked the situation to the attitude taken by the population. Also, education was found to be a major means of improving the situation.
The support of the population must be sought in order to implement improvements to waste management services. A complete Communication Plan has been drafted during the completion of this first phase of the project and can serve as a base for achieving this objective.

Next step

Answer the following questions, than discuss them with the group, and Compare them with the answers which are suggested at the end of this pamphlet.

Questions:

1. What do you think, what are the main shortfalls of the waste management system in Lusaka?

2. What were the questions that were asked from the residents?

3. What were the recommendations at the George-Matero meetings?

4. What are the possible options for the improvement of Libala Tipping Site

5. What are the main health risks which are caused by the shortfalls of waste handling?

6. What are the billing problems, and what should be the solution for them?

CASE STUDY 3

Examples of Waste Management in the European Union and in the USA

The European Community alone annually generates 50 million tonnes of packaging waste, 25 million tons from households, 15 million tons from services and 10 million tons from industry. Out of this, just 9 million tonnes or 18 percent is actually recycled.
But there are variations within the Community. Britain for instance produces 357 kg of household waste per head per year, compared with an EC average of 327 kg. Whereas the figures for France and Germany are 303 kg and 331 kg respectively, in the US it is a massive 864 kg.
Top of the list for recycling paper and cardboard is the Netherlands with 50.3 percent, closely followed by Germany at 41.2 percent with the UK coming in third at 27 percent. In the case of glass, again the Netherlands comes out on top with 62 percent, but at the bottom of the list is the Irish Republic at 8 percent followed by Britain at 13 percent.

Under EC Packaging Directive terms, within 10 years, 90 percent by weight of packaging materials must be recovered from the waste stream and 60 percent of this must by recycled.

So how is all this to be achieved?

A start has already been made with some waste collection authorities following North American practice and providing kerbside box collection of materials suitable for recycling. In some instances, these are of different colours to differentiate for example between glass, paper and plastics.

Milton Keynes Borough Council in central England, has gone from nil to 65 percent recycling in just under two years, with 1,500 t of paper, 650 t of glass, 270 t of steel, 23 t of aluminium and 120 t of plastic being recycled annually.

"The scheme is now borough-wide with door-to-door collection available to all 73,000 households and carried out on a voluntary basis by a further 50,000 households, representing 68 percent participation."

But only material for which there is an established market is collected in this manner.
Participating households receive a 45 litre capacity red box for newspapers and magazines and a similar blue one for cans, plastic containers, glass bottles and jars, without their lids.
Rubbish is rapidly becoming big business and although estimates of the market potential vary enormously, it is in the USA, which tops the league, with inhabitants throwing away 12 times more than for instance the Italians.
But there are potential problems, particularly with hazardous waste. Recently, the French government had to rush through emergency legislation when a consignment of hospital waste arrived from Germany and was described as plastic and household waste intended for recycling. Germany sends some 700,000 t a year of domestic waste to France!

In Germany itself there are tight regulations on the collection and recycling of packaging waste, but there are reports that much of the material, particularly plastic intended for recycling, is in fact just being dumped at a convenient location.
One organisation which is addressing the problems is World Action for Recycling Materials & Energy from Rubbish (WARMER). It produces its own bi-monthly bulletin. It has a database/library containing over 7,000 documents covering the recycling of materials and energy from consumer waste and is in constant contact with organisations in the waste management business world wide.
A recent example of WARMER's dedication to the recycling business is the inclusion in its August issue of an invitation by the Cyprus government for companies to pre-qualify to tender for recycling its solid waste.
In Cyprus at present waste generated, 1.1 kg per head per day, is collected twice weekly in compaction vehicles and disposed at sanitary landfill. The waste comprises 45-55 percent organic materials. 20-30 percent paper and 4 percent plastic, 1 percent cans and 2 percent each of iron, glass and rags.

Waste recycling in Duxbury

The study included an assessment of the amount of material recycled, composted and landfilled.
The investigation also included a survey of the residents of Duxbury to determine their perception of the status of their town's recycling program, and to seek ideas for improvements in the program.
Using this information, the Waste Recycling Committee designed and implemented changes to improve the recycling rate, improve the ease of use of the town transfer station and lower the MSW disposal costs.
Duxbury is a community of approximately 14,000 residents located some 50 kilometers south of Boston, Massachusetts, USA. It is primarily a bedroom community for the city of Boston and some of the larger towns surrounding it and has relatively little commercial or industrial activity. Like many communities of a similar size, Duxbury does not have a town-supported curb-side trash pickup and recycling program, but operates a transfer station whereby each resident is responsible for dropping off solid waste. Duxbury does not operate a landfill, but contracts with regional landfills and waste-to-energy incinerators for MSW disposal.
The town also operates a recycling and composting facility at its transfer station, for recyclable materials including, but not limited to, glass, aluminium, steel, newspaper, cardboard and some plastics. The town collects these materials at the facility and by private vendors are picked them up periodically.
The town composts leaves and grass clippings' and chips other yard waste, such as branches.

The Municipality of Massachusetts made an aggressive attempt to stimulate recycling some years ago and, in a master plan, introduced bans, in stages, on certain kinds of waste for landfills. It now bans, among other materials, leaves, yard waste, white goods and unshredded tires, aluminium materials, metal and glass, single polymer plastics and all grades of recyclable paper.

The state sought to divert 46 percent of MSW from landfills and combustion through recycling and composting programs that would yield a 72 percent capture rate of recyclables.

The enforcement of these waste bans is problematic because, while the landfill or incinerator operator has the right to reject any truck load of trash that contains "banned" material, he does not have to inspect any loads of trash that come from municipalities with Department Approved Recycling Programs (DARPs). When transporting a load of trash to a regional landfill or incinerator from a town like Duxbury (which has implemented a DARP) the operator need not inspect the load. The authorities assume that the load does not contain any banned waste. In addition, as many landfill and incinerator operators get paid by the ton of disposal, it is not in their interest to reject any loads of refuse, regardless of the recyclable content.
Duxbury had already started a recycling program when the state published the master plan. As a result of citizen interest, Duxbury started a program for the recycling of glass and newspaper in the late 1980s to reduce the overall costs of waste disposal and to show the community's willingness to support state-wide programs to help the environment.
Duxbury's recycling program relied on voluntary participation rather than enforcement through local bylaws. The city implemented user fees through the purchase of annual dump stickers to partially subsidise MSW collection and disposal costs.

The city viewed the fees as a means of making residents aware of the real cost of waste disposal, but more as a way of reducing the dependence of MSW collection and disposal on tax revenues.
The stickers were simply an annual fee and not part of a pay-as-you-go fee. One idea was that if residents could see how much waste disposal actually cost and how much recycling might reduce that cost, they would willingly participate in the recycling program. Residents received details of the voluntary recycling plan in a pamphlet distributed when they purchased their stickers.
Two factors now dictate Duxbury's recycling program: materials cost-effective to recycle and those materials, the city must recycle by law.
The city seldom recycles materials in the town if it can legally landfill or incinerate them at a lower cost. Duxbury does not have curb-side collection for household trash or for recyclable material. Instead, residents are responsible for taking their trash and any material they choose to recycle, to the town transfer station. Here the recyclable wastes are collected according to further use in the appropriate piles. The remaining solid wastes are put in a large compactor for temporary holding before shipment to the regional landfill or incinerator. Town employees inspect the material placed in the recycling bins as well as the yard waste and they are diligent in removing any contaminants. But transfer station employees have no way of inspecting all of the other municipal solid waste that goes into the compactor to ensure that residents discard potentially recyclable material properly. Since Duxbury has no way of determining the composition of the materials entering the compactor, it is difficult to know the overall composition of MSW and difficult to assess the rate of recycling.
The committee studied waste composition information from several sources. This was helpful, but no two places have exactly the same waste. The committee found a study from the US state of Rhode Island most helpful, but obvious differences appeared. The volume of

yard waste in Duxbury, for example, appeared 8 percent higher than that of Rhode Island, and the volume of glass containers in Duxbury is significantly lower because of a local law concerning the return of empty bottles.
Every household received a survey to evaluate the residents' recycling habits and opinions, and residents returned approximately 90 percent of the surveys. Because surveys were anonymous, the committee presumed an unbiased response. The survey results indicated that most of the households took advantage of some, if not all, of the recycling opportunities offered by their town.

Eighty-one percent of the households participate in newspaper recycling but only 31 percent compost yard waste at the transfer station. The participation rate for other materials fell between those percentages and the average participation rate for all of the material recycled at the transfer station stood at about 59 percent. This does not demonstrate the efficiency of recycling, but only showed how many people were at least willing to make an effort to recycle some or all of their household waste.

The city reorganised and expanded the recycling area. The city replaced signs at the transfer station with easy-to-read instructions and informative graphics.
The transfer station now accepts used paint too.
The committee has determined that additional work is necessary to educate the residents concerning the costs associated with municipal solid waste collection and disposal. The cost of disposing material in the large compactor (known as The Pit) varies, but is currently $ 70 per ton.
Recyclable material in all cases costs less than that and can provide income for the town. Any recycling lowers the overall waste cost. What is more difficult to accept is that supply and demand drives the recycling market, like most other markets, and that material which is cost-effective to recycle one day might not be so the next.
The markets for glass, steel, aluminium and newspaper are relatively stable but the price of mixed paper has fluctuated wildly.
Recycling mixed plastic material, though, is not cost effective for Duxbury.

Recovery of waste materials in Texas

Rising landfill costs and shrinking landfill space are threats to the budgets of small and medium-sized communities world-wide. A rural county in Texas, USA, faced this universal problem and came up with a solution that could be a model for other communities in similar circumstances.

Cass County has a population of about 30,000. There were seven landfills, one every 11 kilometers, until new regulations forced them to close.
The decision was made to construct a Material Recovery Facility (MRF), based on the concept that a landfill can recover nothing but an MRF can create revenue for the community.
An existing building was found in one of the small towns and its interior was razed.
Equipment for the MRF was purchased: a baler, a cuber, the inert separator, and a grinder.
The first operations were not successful; county officials blamed the poor performance of some vendors. A company called Rader Resource Recovery was selected to reorganise the

facility and make it work. Rader re-engineered the facility, supplied the remaining equipment, and performed the installation.
Incoming waste passes through a **bag opener,** in which plastic bags are torn open to free their contents. The waste then goes through a **two-stage bar screen**. At the first stage, the sorter separates fines, grit, food and waste. In the second stage, the remaining material is separated into two sizes. After screening, the waste goes through the **picking station** where large objects are removed. Plastic, aluminium, glass and rejects are removed manually, while ferrous metals are removed by **magnetic separators**. The remaining combustibles pass through a **shredder** for particle size reduction and go to an **air knife** where inert materials are extracted. The combustibles are densified in a **fuel cuber,** which produces fuel cubes from municipal solid waste. These are used as a fuel supplement by some local paper mills in their **biomass-fired boilers**.
Cass County has turned a common problem for small and medium-sized communities into a profit-making enterprise.

Waste management in the city of Newark

The US city of Newark, New Jersey was once synonymous with urban decay. It is certainly not well known as an example of sustainable development. This case study demonstrates how any municipality can be environmentally proactive and become a sustainable city.

Cities, even the poorest ones, have wealth. The goal of sustainable development, or self-reliance, is to put this wealth to work and to keep its benefits in the cities.
The sustainable city extracts the maximum value from its raw materials, its technologies, its buildings and its people. It emphasises production and efficient use of all resources over consumption. It relies primarily on locally owned small enterprises, rather than on a few large factories. Its development plans and policies are integrated to promote self-reliance.
The two components of sustainability that will be examined here are **source reduction** and **pollution prevention** that reduce or eliminate the creation of pollutants through increased efficiency in the use of raw materials, energy, water and other resources, or protection of natural resources through conservation.
Source reduction has been identified as the first element of any solid waste management strategy and includes activities which eliminate or decrease the weight or volume of materials, decrease toxic components contained within products and packaging and increase product longevity, reuse and repair.
Education plays a critical role in the success of Newark's source reduction programme because consumers are asked to consider lifestyle changes which may not be convenient (for example, using reusable cloth diapers instead of disposable diapers).

Using the motto "One person's trash is another person's gold," the city of Newark has published a guide designed to connect people who want to dispose of usable household items with local non-profit groups that need those items. In addition, "The Newark Guide to Source Reduction and Buying Recycled in the Workplace," is distributed through the local chamber of commerce to help local companies and institutions cut waste and stimulate demand for recyclables collected in the city. Seminars on source reduction have also been held for chamber members.

Newark publishes a quarterly "Earth News" newsletter that features articles on source reduction ideas for residents and success stories spotlighting people and businesses that have reduced their waste output. Annual magazine and newspaper supplements also feature instructional and inspirational stories on waste reduction and pollution prevention. Other educational efforts have included publicity campaigns through the media, direct mailings to citizens and a guide to safer alternatives to the use of hazardous household products to reduce the volume of hazardous waste.
Local legislative action includes a ground-breaking uniform packaging ordinance that bans the sale and use of polystyrene and polyvinyl chloride (PVC) food packaging within the city and a mandatory recycling ordinance.

Newark currently recycles 52 percent of its solid waste; since 1990, the recycling programme has saved taxpayers $ 15.44 million in disposal fees and collected nearly $ 167,000 in revenue from the sale of recyclables.

All paper products used by the city, from stationery to bathroom tissue, are made from recycled paper.
The city's motor pool recycles antifreeze and uses only recycled lubricating oils and retread tyres.
Since 1988, all proposals for the development of 50 or more single family housing units, 25 multi-family units or 100 ft^2 of commercial or industrial space must incorporate provisions for the separation, collection and disposal of recyclable materials. Another ordinance recognises the environmental merit of trees and requires builders to replace trees removed from construction sites. If the site cannot accommodate an equal replacement of trees, the developer must pay into a special planting and preservation fund that plants at least 2,000 trees in the city each year.

A significant consequence of the city's recycling programme is the savings of energy and resources. In 1993, 5,408 tons of recycled newspapers, magazines and office paper saved 91,936 trees, 20.8 million kilowatt hours of electricity and 36.8 million gallons of water. The use of 50 percent recycled glass in the manufacturing process reduces water pollution by 50 percent, mining wastes by 79 percent and air pollution by 14 percent. Recycling aluminium cans can reduce energy use by 95 percent.

Newark maintains a depot to which citizens may bring used motor oil to be recycled. This helps preserve water quality that is threatened when residents drain used oil onto the street or into storm drains.
To save water, Newark has also distributed free water conservation kits to many homeowners. The smallest drip from a leaky faucet can waste over 50 gallons of water a day. In six months, a leaky toilet wastes 4,500 gallons of water.
Hazardous material found in household products and thrown away in landfills frequently leak into the groundwater and pollute rivers and streams. In addition, most treatment plants that cleanse wastewater and release it back into waterways are not designed to remove all hazardous chemicals. To address this situation, the city of Newark recently mailed to each of the city's 80,000 homes a brochure designed to help residents avoid the environmental dangers posed by cleansers, batteries, moth balls, paint thinners and other common goods containing hazardous chemicals.

Additionally, household hazardous waste collection programmes are periodically held to help residents keep up to date on improved methods to reduce the use of hazardous waste as well as providing for proper recycling and disposal of household hazardous waste.
The sustainable city cannot exist independently of its extra-territorial environment. In order to ensure the sustainability of the city, three strategies should be pursued.
First the city's life support systems (air, water, soil) must be protected.
Second, social, cultural, economic and biotic diversity must be protected and enhanced by laws and regulations designed to further this strategy.
Third, resource management strategies must maintain or enhance the efficiency of the manmade infrastructure as well as the integrity of the ecosystem.
Application of these three strategies will make possible the reinvigoration of the central city, the improvement of the city's physical and social environment and enhancement of the residents' quality of life.

Next step

Answer the following questions, than discuss them with the group, and compare them with the answers, which are suggested at the end of this pamphlet.

Questions:

1. How much packaging waste generated in the European Union annually, and how many percent of it are recycled?

2. What is the amount and composition of the waste generated in Cyprus?

3. What are the banned wastes by the attempt of the municipality of Massachusetts?

4. What wastes have market for recycling at Duxbury?

5. What were the main equipment of Material Recovery Facility at Texas?

6. Describe the environmental communication of the local chamber of commerce in Newark.

7. What the Newark Municipality did to avoid the danger caused by the hazardous household chemicals?

CASE STUDY 4

COMPOSTING EXPERIENCES AT WOGODOGO IN BURKINA FASO

General Context

Wogodogo is one of the 30 administrative subdivisions (district No.10) of the capital city Ouagaduogou, Burkina Faso. It has approximately 25,000 inhabitants - mostly of the Mossi tribe (80%) and dominantly Moslem (60%). The monthly average income of the inhabitants of the district is estimated at 40,000 FCFA (US$70.-). The rate of illiteracy exceeds 80% and 1/3 of the population is unemployed, while 20% of the population is employed in the informal sector.
Families consist of 10-15 members which means, there are from 1,600 to 2,000 households in the district.

The Project

Before 1993 there was no organised collection system of solid waste. There was neither drainage of storm water nor management of used water and faecal matter. Disposal by other private sector operators involved merely burning and open dumping at the outskirts of the city. Excreta caused many health problems.

In 1991, CREPA launched a research action programme in order to find solutions to urban and environmental problems in African cities.
The result of this programme were 10 reports, articles, and publications. These covered 10 districts of Ouagadougou plus other three towns in Burkina Faso. The model applied at Wogodogo was very successful and has been copied by three other towns in Burkina Faso and several other neighbouring countries including Benin, Congo, Ivory Coast, Guinea, Togo, and Senegal. The project was a great source of inspiration in each of these countries.

Description of the Project

The project started in May, 1993 with curbside collection by a group of women and men in the district. One year after composting activity was launched, on a commercial basis. After 1995, a programme of providing latrines, digging wells and water pump stations was also started.
For collection, animal drawn carts, usually used for the transportation of goods, was chosen. Modifications were made by increasing the carrying capacity of the carts and providing cover against the wind.
In 1997, seven carts were used to collect waste once a week from approximately 1,000 subscribers and affiliated households. The carrying capacity of the first model of the carts (1.4 m^3) has been lowered to make it more compatible with the traction force of a donkey (i.e. < 1.4 m^3) and was also modified to allow for easy loading and unloading. The headquarters of the Association has been rearranged to serve as an office with an area to stock the materials and to keep the animals. The transfer station for storage, garbage treatment and recycling had approximately 1,250 m^2 area and is located at the centre of the

district. It has been fenced with a bamboo wall, 0.5 m high with a wooden door. This arrangement was not without problems as residents began to complain of littering caused by the wind and domestic animals which broke through the fence and scattered the waste. The wall was rebuilt of bricks, 1.5 m high, which better integrated into the surrounding environment. The site included a waste collection area, a composting area, shops and public latrines.

After one year the production of compost from waste has been started. The equipment, used by workers were gloves, boots, overalls, goggles, roll-tanks for transporting water (70 litres in capacity), rakes, metal sieves (10 mm), and 2 cutlasses. For the production of compost the Association used a simple installation, a basin and a fixed quantification of the organic material and water to maintain the humidity in the basin.

To limit evaporation, the basins are covered with objects recovered from the waste like sacks, tissues, etc. The temperature and humidity measurements are made by hand dipping in the mass and pressing the sample obtained from a depth of between 30-40 cm. Mixing to enhance aeration and to obtain uniform consistency is made every 15 days. After 2 months the compost is matured and then sieved and packed in sacks for sale. See Figures

Operation and Maintenance Strategy

Operation and maintenance (O & M) are essentially made to depend on local materials and expertise. The maintenance and repair of the carts and tyres as well as welding works were all done by local labour. Donkeys are treated by the district veterinary doctor and are fed by local cereals like maize, sorghum, and millet. Only the evacuation of the waste from the transfer station and its discharge are done by using the trucks of the municipality by municipality employees. At this end of the service chain the Association has been confronted by a lot of difficulties regarding collaboration with the municipality. The municipality services were certainly not sufficient and they had no intention of satisfying the needs and requests of the Association. They have had several disagreements with the management of the transfer station and this was the principal weak point of the project.

The total capital investment of the project is FCFA 3.5 million (US$ 6,100.-). The Association employed 20 persons directly plus voluntary labour for the construction of latrines and wells. This has been done in response to the demands of community members who eventually organised themselves and did the job themselves. Potable water stations were also constructed by citizen participation. The monthly salaries of personnel was FCFA 18,000 (US$29.-) for cart drivers, FCFA 9,000 (US$ 15-) for their helpers and FCFA 15,000 (US$26.-) for each of the two guards. In 1994 the Association had a revenue of FCFA 3.8 million of which FCFA 3.5 million were used to cover the expenses.

The distribution of the expenses were as follows:

Salaries	56%
Expenses on donkeys	30%
Rent	6%
Cleansing the area and disposal of waste	8%

Maintenance of the carts has been negligible (FCFA12,000/year).

The revenue was mainly made up of the contributions of the subscribers' regular payment of FCFA 850. The income from the latrines, and the potable water posts is achieved by employing a credit-saving system. The income would cover not only the O & M costs for such facilities but also help partially cover capital costs for additional wells and latrines elsewhere. For such additional latrines and wells the requesting group or individuals had to pay in advance 33% of the total cost which will then be topped up with funds from the Associations Treasury. The remaining 67% will have to be paid in monthly instalments over a 6-8 month period. Presently the compost is sold at a price of FCFA 15,000/ton (US$26) which was also a supplementary income. These initiatives have resulted in the Association being financially self-sufficient. The success of this project resulted from an organisational context enforced by mobilising the beneficiaries and the persistent support of CREPA.

The Association

At the start of the project the district had several women associations. Their activities were dedicated mostly towards household affairs rather than the management of the environment. Different meetings have resulted in the creation of a project team made up of men and women living in the district. The women who started as cart drivers and occupied minor posts in the project had demanded from the municipality/CREPA to be made the principal partners in the project – leaving some of the men aside. This would allow them to do the project as women on the one hand and illiterate on the other. The men have committed some kind of financial violation which obliged the authorities to consider the request of the women. The situation led CREPA and the Association to create intensive programmes and training cycles on health, communication and education as well as the administration of the project. These programmes were justified by the low levels of education of the new project team members. In 1993, approximately two women out of 9 have developed an ability to read, write and count. One year later, other associations in Ouagadougou had oriented their activities towards collection of district municipal waste. In 1996, these associations joined together and created a federation with a consultative structure for the exchange of experience to help the development of partnerships with the public sector and private enterprises working in the field of sanitation.

Local Authority

The district is administratively attached to the community of Baskuy – one of the communities of the Ougadougou Municipality. It is headed by an elected mayor. It is important to emphasise that the two mayors who were elected since 1993 were women.

The technical services of the community.

The technical services of the community are centralised at the Technical Services Department of the Ouagadougou Municipality which was in charge of waste management for the 30 districts of the city. But due to their limited resources it is essentially limiting its activity to the community of Baskuy which is in the centre, of which Wogodogo district is a part.

Conclusions

The project had to get the support of the local government, the religious community and had to meet the needs of the community.
Leaders did not have to be the most educated persons but they must have been reliable. For persons without enough education a training should be organised and, at least in the beginning, assistance in organisation, financial affairs and management should be provided.
Perhaps the presence of women responsible for the healthiness of their household could help the success of a hygiene enhancement project.
For the success of a project, a promotional and publicity campaign was necessary. In this campaign, local persons should play the leading role.
Small societies may be fruitful if local interests are in accordance with the project.

Next step

Answer the following questions, than discuss them with the group, and Compare them with the answers which are suggested at the end of this pamphlet.

Questions:

1. Why do you think it was a correct solution to start the project?

2. Why was this project relatively cheap?

3. What were the problems with the first fence and why?

4. What was the role of the women associations on the project?

CASE STUDY 5

STRATEGY OF THE MUNICIPAL SOLID WASTE MANAGEMENT IN HUNGARY

Estimates supported by technical calculations indicate that in Hungary about four million tonnes of municipal solid waste is produced annually by ten million inhabitants. The composition of the waste changed considerably due to the alterations in consumption habits and lifestyle, packaging and product range and also there is a steady, slow increase in the amount of the produced waste. Hazardous waste produced in the households. i.e. chemicals, medicines, exhausted batteries, etc., and the non-selective waste collection require special handling of the waste.

Because no detailed legal, technical, and financial regulations exist, the overall-government organised and monitored-system of municipal waste management has not been developed, the major obstacle of planning is the lack of an effective information system.

All these resulted the present situation, what is characterised by the National Environmental Programme as follows:

- Organised waste collection does not cover all areas, selective waste collection is still rare, the age of the used equipment is more than ten years;
- Only some 30 % of the 2700 municipal landfill sites meet the requirements, there are a considerable number of illegal dumping sites which are potential sources of environmental pollution and health risks;
- free waste depositing capacities are scarce, more up-to date methods than dumping are used in the capital city only.

In order to change this negative picture it is indispensable that all government, municipal, economic and social participants should take a co-ordinated action, to comply with international requirements, while also taking into consideration the special national character.

The objectives of municipal solid waste management

On the one hand, the determining elements of waste management strategy are the amended Directive of the European Community Council, on waste, the Directive of the European Parliament and Council on packaging and packaging waste, and the Resolution of the Council on waste management strategy. On the other hand, assuring the conditions for a sustainable development as declared by the Act on the general conditions for the protection of the environment, as an environmental goal to be achieved, and furthermore, the National Environmental Programme, approved by the Parliament in its Decision.

Accordingly, by creating better proportions in the use of the environment and by utilising better the natural resources, we have to be able to:

- prevent waste production as much as possible
- decrease the quantity and degree of hazard of the produced waste
- recover the produced waste to the largest possible extent
- dispose the non-recovered waste in an environmentally friendly way.

In order to achieve the objectives of comprehensive waste management, it is necessary to develop technologies and products, to give priority to the low energy consuming and low waste producing technologies, on the basis of the life cycle analysis are environmentally sound which can be recycled into the nature, to replace hard-to-manage and environmentally very risky products.
We have to make sure that the natural resources, processed materials, produced goods are utilized the best possible way in their function and material. The development and use of the necessary economic background have to be created and, also it should be encouraged a more extensive recovery of waste in the more traditional technologies.
On the area of disposal, use physical-chemical-biological methods in the widest possible circles.
In the case of otherwise unrecoverable waste, the incineration should be preferred instead of dumping and, only the solid waste remaining after this should be disposed by landfilling, using technical protection barrier (liners), and taking into account the landscape, the natural features and values.
The primary objective of municipal solid waste management in Hungary is to implement a low material and energy consuming system. Since the present day practice of waste management is rather far from this goal, significant development will be necessary both in the short and medium terms.
The basic precondition for obtaining these goals is to apply selective waste collection and pre-treatment methods taking into account the possibilities of optimal waste management. This have to be done parallel and in co-ordination with the development of waste processing capacities.
Besides managing the continuously produced waste, we have to reduce the damages caused earlier by incorrect waste disposal. We have to increase efforts to find, explore and eliminate the illegal dumping sites and polluted areas, to close the existing dumping sites which do not meet environmental requirements, to rehabilitate them by fitting them into the environment.

Means to carry out our objectives

Legal and economic means have to be used to put waste management principles into practices.

Legal means

The widest possible legal foundation for waste management is created within a comprehensive waste management law. Waste management authorisations, responsibilities and prohibitions, waste related general standards of behaviour, division of responsibility,

community, social and economic issues, etc. are regulated while the waste management law at the same time connect both horizontally and vertically to the already enacted other legislation and to the ones under preparation, especially to Act on the local municipalities, to the Act on the compulsory use of certain local public utility services, to the Act on the environmental product charge and to the act on environmental related fines. Lower level legal, economic and technical management rules determining the entire system of tools serving implementation are to be developed, taking the special aspects of certain professional fields into account.

Legislation have to be put into force gradually, providing time for preparation, while also guaranteeing predictability and consistency. Cost effectiveness, regional and target specific solutions can be used as principles.
EU legal documents will be adopted in several steps, each linked closely to the others.
Hungarian legislation – with the enacting of the waste management law – uses the EU definition of waste (75/442/EEC). This allows the joint management of non-hazardous industrial waste and household waste in the area of municipal waste management. A new requirement regarding management possibilities will be the limitation to deposit degradable organic material containing waste and the regulation of the conditions under which inert waste can be deposited.

In connection with EU standards, dealing with waste disposal, technical prevention will be introduced to meet the requirements regarding the closing of the landfill site when it is full, regarding the aftercare, the exhaust of bio-gases, monitoring and recultivation.

The return, recollection and utilization rates which Hungary has to meet at the given time as a result of the accession negotiations are be set out in 91/962/EEC, 94/62/EC. In order to be able to comply with the requirements, rules are to be established.

A basic requirement is to put responsibility in the owner and producer of the waste, thus the population is also required to collect waste at the site of its production, then handle it and hand it over to the utility service provider. A fee has to be paid to the utility company for the service provided (the "waste producer pays" principle).

The local municipalities are responsible for organising the environmentally sound management of waste, produced in the households, either they are to do it themselves in co-operation with other municipalities or via a municipal company. In the last few years, regions for the management of municipal waste started to develop without central initiative, based primarily on the geographical location of settlements and on the already existing infrastructure, making use of them. In the course of medium term developments, the local municipalities which are not yet part of the system, are involved, based on these regional centres, not necessarily taking into account the administrative regions.

The contractor, providing utility services, can do so only in possession of a license and he receives a fee for his services which is in proportion to the amount and quality of the waste and to the quality of the service provided.

The producer of the waste should be encouraged to follow waste management priority orders preferably by a differentiated tariff system, e.g. by lower tariff for selective collection, and sanctioning mixed waste.
Since the present day practice is rather far from the set targets, the extra costs of development of municipal waste collection and management can be built only gradually into the tariff . Thus right in the period of development it is necessary to allocate central financial resources for installing and operating the facilities and tools of selective collection, recovery or incineration, which require considerable investments.

The owner of the waste is required to take care of managing the waste produced by business activities (industrial production.) This can be done in a facility built for public utility services, if the composition of the industrial waste permits handling it together with municipal waste. A solution could be to transfer the responsibility of collection and management by sub-contracting it so, that the principle of efficiency and cost effectiveness prevail.
Since the construction of the necessary facilities require significant resources, and since the market for the products made from managing and utilising waste is to be created, the implementation of an environment friendly waste management will take a rather long time. During this period all the participants of these processes (the government, local municipalities, the population, the businesses) have to make considerable efforts.

In order to meet all these generally valid requirements - especially to set the necessary processes in motion - it is better to define and publish priorities. The facilities and measures realised along these priorities can promote an environment friendly transformation of the entire economy and a low material and energy consuming waste management.

Economic means

Waste management tasks can be fulfilled only with a large amount of investment. However, the economic and civil sectors responsible for carrying out these tasks, or the local municipalities on behalf of the population in most cases cannot afford to finance all the necessary investments. Central budget aims at making up for some of the financial problems by designated and dedicated grant systems via special environmental targets, development and economic target grants aimed at regional development and equalising.

Thanks to the product tariffs, the financial resources and possibilities to carry out operation related tasks increased as compared to the previous years.

Within the frameworks of a targeted grant system for setting up the municipal waste handling facilities, the local municipalities received a total of HUF 5.23 billion (21million US$) between 1991 and 2000 to build waste landfill sites for 107 settlements, this makes 45 % of the entire investment value. In 1997, 12 regional landfill sites received a grant of HUF 1.446 billion (5.8 million US$), receiving the waste of some 410 thousand inhabitants of 89 settlements. 10 regional landfill sites were launched in 1998. These will handle the waste of nearly 430 thousand people of 162 settlements. For 1999, HUF 1.5 billion (5.3 million US$), for 2000 HUF 288 million (1million US$), targeted grants have been applied for and received by the municipalities.

25 % of the annual budget of the Central Environmental Fund could be used to support waste management investments. Among the targets to be supported we can find the establishment of regional waste management systems, establishment of facilities to decrease, recover or dispose industrial wastes (including hazardous waste), establishment of infectious or potentially infectious waste (of human or animal health care origins), and collection and recover of waste produced by products after which a product tariff is to be paid (packaging, rubber tyres, lubricating oil, refrigerators and cooling agents, batteries.)

The costs of general economic development and investments needed to fulfil waste management tasks as per the EU directives have reached, according to calculations done so far, are HUF 415 billion (1.48 billion US$). About one quarter is made up by the upgrading of municipal waste management, which is the responsibility of the local municipalities, thus being indirectly a governmental task.

The intention is to use a considerable amount of international resources, PHARE, ISPA, COP99, in order to finance these investments.

The environmental targeted grants wish to support the following partial solutions to establish and operate complex regional municipal waste management systems:

Organizing selective waste collection in order to recycle waste

The aim is to reduce the amount of hazardous and reusable municipal solid waste, the former should be handled, the latter recycled. One of the ways to achieve this target is the selective waste collection. About 35-50 % of the produced waste can be handled if selective collection is realised, and after the suitable treatment they could be recovered or disposed.

Environmental and waste management aspects require that

- the hazardous parts of municipal solid waste should be separated by selective collection,
- the usable parts be separated by selective collection and subsequent selection for recycling.
- For selective waste collection, tools and equipment need to be purchased and facilities established, and the ones used at present to deposit mixed waste should be replaced.
- Implementation could be done
- by designating waste yards,
- by using mobile waste collection vehicles and by creating the necessary collection possibilities,
- by separate collection of municipal solid waste either at the place where the waste is produced. or nearby,
- by subsequent selection.

Since selective waste collection is not a general practice in Hungary (we have only recent experience in a very few communities), wide-spread use can be expected only if legal and economic conditions are introduced simultaneously.

However, if we want to achieve the necessary level of recollection rate and recovery on a nation-wide scale, we have to use selective collection methods which also help those participants who are inexperienced in this area. Therefore those methods of collection have to be chosen which suit best for the local conditions. Earlier experience shows the waste yard and drop off centres are the best, where the population deposits the waste and a trained staff help them in the selection. These yards are suitable to receive recyclable and hazardous waste, while the rest of the waste is collected near the homes -by door-to-door, or curbside collection,- which is disposed in up-to-date landfill sites or incinerators.

A special form of selective waste collection is required in handling green waste, containing decomposable organic matters. Since this type of waste represents quite a large proportion of the municipal solid waste, it is better to organise special collection and handling by the method of composting.

Wherever possible in inhabited areas, e.g.: in farms or family house zones the population should be supported in doing the composting themselves. In all those residential areas where local re-use is impossible - e.g.: in large housing estates - central collection and composting should be organised, just as in the handling of selectively collected waste. It would be advantageous to support agricultural use of the compost, produced this way. Should there be such a quantity of compost produced in an area that utilization is impossible, it should be reused by recultivating the regional landfills of the area.

In order to utilise some of the waste by selective waste collection, it is also necessary to achieve, by pre-treatment, a degree of quality (purity) of the waste collected selectively by the population as well as by businesses that is usable for the processing industry to produce highly usable products.

Therefore it is necessary to professionally prepare, select, wash, bale, etc. of the selectively collected waste in the sites created for this purpose. These pre-treatment sites shall receive the waste from the selective drop-off centres of the larger regions (of at least a county) and prepare them according to industrial requirements for processing.

In order to set the processes in motion, it is necessary to support these treatment sites from the central budget, however, they can only be organised on business bases. No subsidy can be given for operation, except for some very special cases, when they prepare unmarketable hazardous elements, yet pre-treatment is essential in order to prepare them for proper disposal. Shared responsibility must also prevail in such cases, and at least some of the costs have to be covered by the producer.

For setting up waste management systems by using incinerators

Huge masses (and volumes) of waste can be produced in small areas of relatively high population density. Incineration is generally a better solution for waste treatment compared to the landfills, because it produces energy and reduces the amount of waste. Landfills needs less investment and operation cost, but needs large area of land. Landfills do not decrease the amount of waste.

Only incinerators meeting air pollution emission limits (89/369/EEC) can be used and the produced heat should also be utilised.

In Hungary, there is only one single incinerator burning municipal waste, this operates in Budapest (the capital city) because at the time it was built, waste production in Budapest and surroundings justified the construction of an incinerator.

Recently consumption habits and the structure of the settlements started to change slowly in Hungary, thus larger quantities of waste are produced in certain regions than before. This tendency creates better conditions for the utilization of the energy created by incineration of the waste, which cannot be separated by selective collection.

A strategic objective is to build incinerators to destruct the waste produced by at least 500.000 people and to burn the non-recyclable parts of non-hazardous waste produced in the same region. These investments can be made only if all the provisions of environmental legislation in force are observed, the produced energy is utilised, and the solid combustion products are landfilled in an environment friendly way. Another precondition for such a development is that the population accept the planned construction.

Building regional waste landfills

Waste management aspects require the safe disposal of unusable communal solid waste.

Waste dumping often pollutes the environment, it requires a large area. Settlements often try to tackle this problem by themselves.

These problems can be decreased by building and operating regional, technically protected (lined) landfills.

Contemporary practice has to be replaced by the operation of regional landfills all over the country, which meet environmental requirements, are of regional type to serve several settlements. This way it is possible to utilise the capacity of these protected landfills of high technical quality, though built with higher costs, much better and it is also much easier to supervise them. Even after selective waste collection is wide-spread, landfills are needed to dispose the rest of the waste.

There are some 2700 dumping sites, which can be replaced by about 100-120 up-to-date, sanitary landfills on the medium run, and after these are depleted, on the long run only 10-15 landfill sites will need to operate. The precondition for meeting long term objectives is to gradually build all the necessary industrial processing, recovery and treating facilities in the meantime.

The number of people using landfills to be built in the medium run have to count at least 80.000, and at least 10 settlements have to join the project. Another requirement is that a new landfill site can be built only if there is not a waste disposal possibility (lined landfill site) in a 30 km radius which could meet proper environmental demands. Regarding the location of the planned landfill, the county or regional development concepts and plans have to indicate that the community of the region actually decided on the operation of such a facility on the given site. Projects creating more up-to-date conditions around vulnerable water bases enjoy priority.

Numerous explanatory and convincing information will be necessary until the needed capacities are built, in order to gain the co-operation of the local municipalities, the population and businesses. Certain measures to increase interest can also be used to support these efforts (e.g.: differentiated waste management fees, certain sanctions, etc.) Requirements are valid in case of investments to equip with a proper liner of the already existing landfills. When operating a landfill site, compactors are to be used to compress the waste, and the job must be done by specialised contractors.

Joining already operating regional landfill by setting up transfer stations

In places where the operating dumping site does not meet sanitary and environmental regulations, and where the building of a new, protected (lined) landfill is not economical, or if there is already a modern landfill operating in the region, two-stage waste transport should be organised. These transfer stations located in the settlements can help in the selective and mixed waste collection, then the waste is transported in compactor container to the licensed regional landfill site. The purchase of the equipment for the collection, compacting and transportation of the waste, the creation of the conditions for transfer station systems and their construction and operation shall require long term co-operation with the operator of the landfill site.

Transfer stations should be set up typically in small settlements and in the vicinity of larger towns.

Introduction of organised waste collection by using regional landfills

About one third of the settlements in Hungary have no organised waste collection, the population disposes the produced waste on their own, usually in a very unprofessional way, in dumping sites with unsatisfactory, or absolutely no technical protection. International standards at the end of the 20tn century require at least professional disposal, to which regional solutions are recommended.

The waste management act to be enacted in the near future will provide for compulsory municipal waste management.

In order to help the preparation of the usually small settlements with no organised waste collection, to make easier their future task, it would be appropriate to give them national

support for their developments if they wish to join an already operating waste management system, or if they want to build their own regional system.

Re-cultivation of the unlined municipal waste dumping sites

Most of the currently operating and filled up dumping sites are not protected against the landfill leachate (contaminated waste water) into the ground and ground water due to the absence of liner layers, thus they are to be considered as potentially environment polluting. These facilities have to be recultivated in order to decrease environmental risks and to reuse them. There is no general practice of recultivation of the municipal waste dumping sites in Hungary, costs of these activities are not well known. Even land ownership data are not always clear either, and often the local municipal leaders are not aware of the responsibility related to recultivation. Therefore recultivation work can be probably start only with central subsidies.

Recultivation plans have to be submitted for licensing, based on environmental legislation being in force. The application for license should be based on documented studies which explore the state of the environment on the site of the landfill and its vicinity, and propose certain solutions for the contents of recultivation. After the license is obtained, the necessary work can be carried out.

In order to establish the level of load on the area, the hydro-geological conditions are to be defined, furthermore, studies should indicate whether the landfill site pollutes the environment, and if yes, in which direction and to what extent.

The order of the necessary covering layers (the cap) have to be defined depending on the load level and on the pollution sensitivity of the area, after having estimated the amount and composition of the waste.

In the course of implementation of the project, the related legislation and limit values (e.g.: allowed limits for soil pollution) have to be taken into account and a detailed cost plan is to be made for the work to be done. The local municipality owing the area of the landfill site (or the operator) must assume responsibility, as per the provisions of the license, to operate a monitoring system on the long run.

Summary

In contemporary Hungary, according to statistics, more energy and materials are used and more waste is produced than justified by GDP or industrial production. Therefore to develop a more sparing and efficient management for our natural resources, is a priority. Also, in the area of municipal waste management a certain tendency is developing, which aims the prevention of waste production, the decrease in waste quantity and degree of hazard, and the recovery of the waste. This tendency could be reinforced by legal and financial regulations so that with a most efficient use of the domestic and international

financial resources, the targets set in the Strategy could be realised and considerable changes from the present situation could be achieved.

Next step

Answer the following questions, than discuss them with the group, and Compare them with the answers which are suggested at the end of this pamphlet.

Questions:

1. Describes the present situation of the Hungarian waste management system

2. How they try to utilise better the natural resources?

3. What is the idea of the regional landfill sites? Describe it!

4. What are the Hungarian experience on selective waste collection?

5. How many landfills are existing in Hungary today? What is the plan for the future on landfills?

6. What are the main advantages of the waste incinerators instead of landfills?

CASE STUDY 6

CASE STUDY ON WASTE RECYCLING IN AARHUS DENMARK

A summary description of Aarhus and key recycling data are presented in Table 6.1

Table 6.1 OVERVIEW OF THE AARHUS MUNICIPALITY

City Background	Details
Population	281 955 (1999)
Density	601/km^2
Type of area	Towns and villages: 68.5% of population. There are large expanses of agricultural land.
Type of housing	Flats: 58.8%; Detached houses: 24.6%; Terraced houses: 13.6%; Farmhouses: 3.9%.
Definition of MSW	Hazardous and non-hazardous waste covering households, industrial and commercial sectors.
Recycling target	• National: 64% recycling for all sectors (2004) • Aarhus: 69% recycling all sectors (2004); 70% (2012)
Recycling achievement	64% recycled in Aarhus 1999 (all sectors)
Principal recycling drivers	• national waste taxes; • volume based charging; • deposit refund; • good separate collection; • public awareness.

Currently 60 per cent of all waste produced in Denmark is recycled. However, Denmark has taken a different path from other European countries, exploiting much of the energy from waste through incineration.

National recycling targets in Denmark for the year 2004 include:

- 30% of domestic waste recycled (long term: 40-50%);
- 65% of industrial waste;
- 50% of institutional, trade and office material;
- 90% of residues from coal-fired power stations;
- 50% of wastewater sludge on farmland; and
- 7% of residues from waste incineration plants.

Denmark expect to recycle approximately 45% of all packaging waste by the year 2001. Specific targets established by material by 2001 are:

- paper and cardboard packaging: 55%;
- plastic and packaging: 15%;
- metal packaging: 25%;
- glass packaging: 65%;
- demolition waste: 90% (by 2004).

RECYCLING TRENDS IN AARHUS

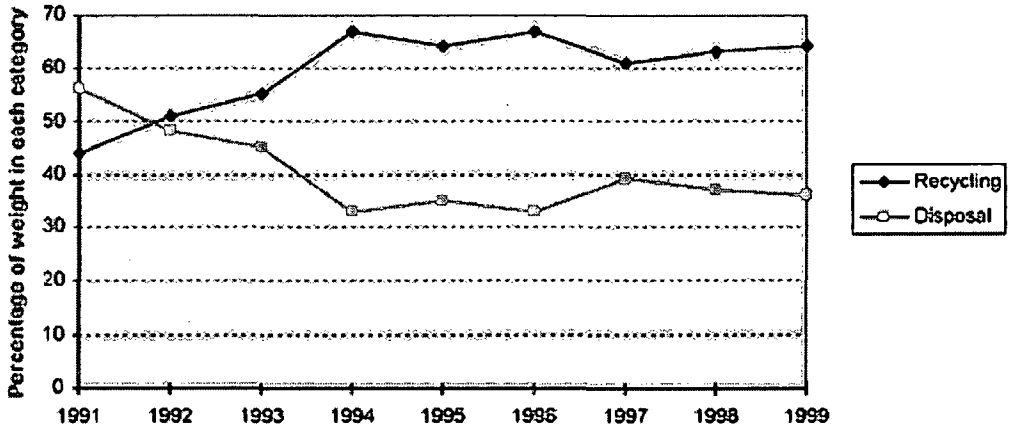


Figure 6.1 Waste management trends for MSW in Aarhus

In Aarhus, recycling has on the whole increased from 44 to 64 per cent, and the amount sent to landfill has decreased from 32 to 4 per cent over this period. Waste that is disposed is mostly incinerated for energy recovery.

It is noticeable that the amount of recycled material, although steadily increasing, but in some years, slightly decreased, for example, in 1997. These trends can be attributed to annual fluctuations in amounts of demolition waste. Construction and demolition waste accounts for 62 per cent of all waste recycled in Aarhus.

The potential for increasing recycling rates in Aarhus can be assessed by comparing the amount recycled by sector with the total generated in each sector. ***Table 6.2*** demonstrates that most potential exists for the household sector, where the current recycling rates are lowest.

Table 6.2 Potential to increase recycling in Aarhus

Sector	Percentage currently recycled
Household	27%
Household garden waste	c. 100%
Household bulky waste	11%
Industrial and commercial sector	56%
Construction and demolition waste	93%

We can further break down recycling rates by material. ***Figure 6.2*** shows that paper and card and metals are recycled in the largest quantities, followed by parks and garden waste.

Note: 83 per cent of paper and card from the domestic sector is collected from recycling containers located around the city. The rest is collected from civic amenity sites. Overall, recycling of household waste accounts for 17 per cent of total waste recycled.

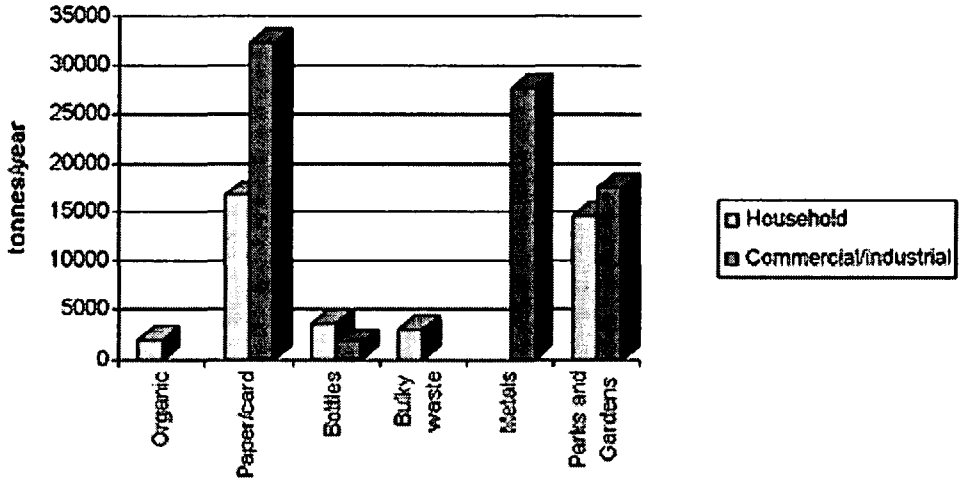
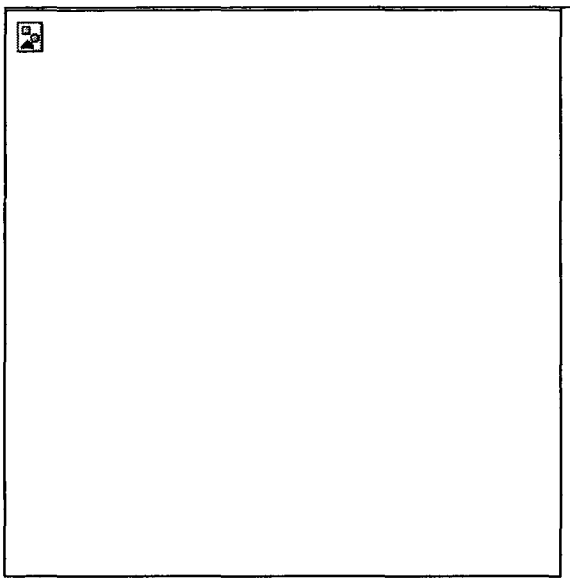


Figure 6.2 Recycling rates broken down by material and sector, 1999.



WASTE MANAGEMENT STRUCTURE

Both refuse collection and treatment of recyclables are contracted out. Originally, the contract for paper and glass collection was meant to last until 2014. Recently, the Aarhus Municipality have invited tenders for collection for certain areas of Aarhus for the next six years.

Aarhus Recycling is 50 per cent owned by the municipality and 50 per cent owned privately. The company is paid by the municipality to sort paper and glass. Sorted paper is sold to Danish industry. A company called 'Danish Fibres' purchases 50 per cent of the paper collected in Aarhus.

The municipality does not finance treatment of recyclable materials.

COLLECTION MECHANISMS AND ACCESSIBILITY

Kerbside collection of paper was proposed by the Danish government, but the public voted against this idea due the potential expense to households. Separate collection takes place through use of recycling containers.

Collection of recyclate occurs either twice a week for areas with less space and fewer recycling containers, or as little as once per month.

Detached houses, farmhouses and some terraced houses in Aarhus rent a 160 litre container for non-recyclable waste. Recycling containers for disposal of paper and glass are located around the city. There are 380 different street recycling sites within the city, with a density of around 430 people per container, although in some areas the density of recycling containers has been increased to 150 - 200 households per container. Trials in some areas have found that an increase in density of containers has not necessarily always had positive results. It is thought by the municipality that many farmers dispose of part of their paper waste though incineration in domestic ovens.

Most apartment residents have access to communal bins located in hallways, stairwells or gardens for combustible waste. These are collected weekly or fortnightly, depending on the availability of space, which determines the size and number of bins provided. In areas where kerbside collection is not possible, a set of recycling containers are provided for every 40 households.

In addition, no resident is more than seven kilometres away from one of the five civic amenity sites which are located throughout the municipality.

Trials for improving separate collection facilities have been conducted. Each is outlined in ***Box 6.1*** Each highlight different problems and successes. Results suggest that public information activities and the density of containers provided were the keys to success.

Box 6.1 Summary of trials for improved separate collection facilities

Method	Details
General Refuse Bins	Each household is provided with a 190 litre bin, which is collected every 1 or 2 weeks (households have to pay double for 2 bins). The small size of bins and limited collection provides an incentive especially for large households to recycle.
Street Containers glass and paper	All households in the towns and villages have access to the 600 - 700 recycling containers at 380 different sites for disposal of paper and non refundable bottles and glass. This gives a density of around 434 people per containers. Recycling containers were first provided in 1981.
Civic amenity sites	There are five civic amenity sites throughout the municipality, although access predominantly requires a car. Households can dispose of many materials including paper, cardboard, glass, demolition waste, plastics, bottles, plant clippings/soil, combustibles, asbestos, hazardous waste, electronic scrap, and some bulky waste.

Waste Islands	Four street bins are provided for every 40 households in areas where collectors have no access to backyards: two for refuse, collected up to twice a week, one for organic and one for paper. In more densely populated areas eight bins are provided.
Garden waste /Compost	A recent campaign has encouraged the sale of cheap compost bins. To date 17 000 have been sold, and the leaflets 'From Garden Refuse to Good Soil' has been distributed to households.
Hazardous (e.g. batteries, paints, solvents)	The 'Environmental Van' collects hazardous materials twice a year (outside of working hours). A timetable is given to households to inform of arrival times in their vicinity. In addition these materials can also be returned to the dealer, for example batteries placed in battery boxes e.g. in supermarkets, schools, photography shops, or the five civic amenity sites; car batteries to garages; paint remains to paint dealers and used medicine to chemists.
Bulky Waste	This can be delivered at the recycling centres or collected by the 'Aarhus Recycling Company' which owns a shop where bulky waste is repaired and then sold. The company can be telephoned and will collect material.
Tins	Very few tins are used in Denmark and these are incinerated.
Glass bottles	Dealers have their own deposit system for wine bottles. Production of new bottles is monitored through detailed sales reports provided by the companies to the government.
Plastic bottles (PET)	Central government are currently discussing plastic bottle collection due to EU legislation demanding ~15% collection. The Municipality originally thought that this could be achieved from industry collection, but now collection from households is under discussion.

Stream Trial

This was an organic waste separation trial held between Autumn 1990 and Spring 1992 involving 10 350 households. A bin was provided for kitchen organic waste that is less amenable to being composted outside. These wastes were collected and taken to a composting plant. The trial was relatively successful.

System 2000

This trial took place in 1999 and involved 175 000 households (6 000 detached, 2 000 terrace and the remainder flats). The trial attempted to provide better facilities for household disposal of paper, card and glass by providing houses with their own paper recycling bin. Flats were provided with kerbside bins for paper. In addition the density of glass street containers was increased in the trial areas with separate sections of each bin for coloured and clear glass. Glass separation was less successful.

The scheme also trialled the separation of household organic waste from refuse. Individual households were provided with frames for plastic bags to be used inside for kitchen separation. This has proved relatively successful.

Participation Rate

Actual participation is thought to be approximately 98 per cent, although refugees and migrants to the area are through to participate less in the recycling schemes.

Farmers who have further distances to reach towns and villages to dispose of recyclables tend to burn waste paper. No studies have been carried out to date to see how recycling in rural areas of the Municipality differs from the villages and towns.

COSTS AND REVENUES

The following table shows the total costs of collection for household waste, including collection of refuse. The municipality were unable to provide figures for costs and revenues from recycling.

Table 6.3 Costs and revenues for collection of household waste

Item	Costs (£)
Collection costs	
Household waste	5 091 344
Other household waste, eg. bulky	1 764 725
Total collection costs	6 856 070
Revenues	
Household charges	1 146 576
Income from sales of recycled materials	420 951
Total revenues	1 567 528

Shortfall	**5 288 542**

SUCCESS OF THE SCHEME

The principal driver for recycling has been the waste tax, which provides a strong incentive for the commercial and industrial sector to reduce waste. The tax is weight-based and explains recycling levels are exceptionally high for construction and demolition waste. The tax has kept residual waste from separate collection to a minimum.

The charging mechanism for households in Aarhus is based on the costs of waste management, which are inclusive of the waste taxes. Nearly all garden waste is composted and this can be attributed to the charging structure. In addition, waste is collected fortnightly and households are only provided with 190 litre bins. Households are charged double for additional bins. Households have tended to use only one bin, rather than pay for additional bins, indicating that volume-based charges are instrumental in waste minimisation by households.

There is evidence to show that mandatory standards requiring separate collection of materials are not in themselves a strong driver for increased recycling rates. The increase in collection of glass and paper has been moderate, so that only half the paper and glass waste potential is collected. This may be due in part because the waste tax forces households and companies to prioritise which waste they focus on sorting or recycling.

LEGAL/ REGULATORY REQUIREMENTS

The national Waste Management Plan, 'Waste 21', covers the period 1998 to 2004. All local Councils are under the obligation to survey waste amounts and to draw up waste management plans. Under Waste 21, Municipalities have to ensure collection of waste paper and glass if there are more than 2000 households in the area. This limit is soon to be reduced to 1000 persons. Households and the commercial sector are under an obligation to use the collection schemes.

Companies that produce approximately 100 kilograms waste per month, are required to recycle waste.

FISCAL INCENTIVES

There are 'green' taxes on products such as plastic bags and other packaging, disposable tableware and nickel-cadmium batteries.

Deposit refund systems have been established for a number of packaging types, for example, beer and carbonated soft drinks. The deposit refund is as follows:

- Glass (25 & 35 cl): DKK 1.25 (£0.10)

- Plastic 0.5 l: DKK 2.50 (£0.20)
- Id 1.5 1: DKK 4.50 (£0.36)

The return rate is around 99 per cent.

Producers are charged a fee of DKK 1.60 (£0.13) to produce or import a new bottle.

Waste Disposal Costs

A waste charge was introduced in Denmark in 1987. It was introduced to shift waste from disposal to recycling. In 1997, the tax rate was increased to encourage further recycling in the industrial sector. It is differentiated according to how the waste is managed, so that it is highest for landfill of waste, cheaper for incineration of waste, and a zero rate for waste recycled. Aarhus also charges local fees to finance their waste management.

Table 6.4 National and local waste treatment Fees.

Waste management method	National (£/tonne)	Local (£/tonne)	Total (£/tonne)
Recycling			
Garden waste	0	9	9
Bio Waste	0	44	44
Demolition Waste	0	1.32-11 (*1)	1.32-11 (*1)
Incineration (*2)			
Domestic waste	23	29	51
Industrial/ commercial waste	23	29-42 (*1)	51-65 (*1)
Landfill	30	7-36 (*1)	38-66 (*1)

(*1) Depends on type of material

(*2) Fees for CHP rather than just heat are reduced

Charging Systems for Waste Management

The charging systems for waste management vary between Danish Municipalities. In some waste is weighed and is collected and charged at DKK2 (£0.16 per kilo or £160 per tonne). Other households pay according to the bin size they require. Some pay around DKK250 (£20) per year for paper to be collected at their homes.

The Aarhus Municipality receives a yearly fee from citizens which pays for all Municipal services including waste disposal. The annual fee is based on a costs average for different waste management methods. (Table 6.).

Table 6.5 Waste Costs Included in Household Annual Payments (2000)

Service	Cost (£) per detached house	Cost (£) per terrace house	Cost (£) per flat
Communal facilities*	69	69	41
All collection facilities	52	33	22
All treatment facilities	33	28	21
Total	**157**	**130**	**88**

* For example, communal recycling containers and civic amenity sites.
Note: these charges are per bin (190 litres). Additional containers are charged accordingly.

Household charges for waste management cover the national and the local waste treatment fees levied on incineration and landfill. Because there is no waste charge associated with recycling, it is in the Municipality's interest to recycle as much material as is feasible. Each household is issued with a container of 190 litres. Any additional containers are, in theory, charged at double the rate, although most houses use only one container.

Commercial and industrial organisations pay contractors to collect and dispose of their waste, and this covers the national and local treatment fees paid by the contractor.

PUBLIC AWARENESS

Public awareness in the municipality of Aarhus is generally thought to be high. Information dissemination has been carried out through:

- written information, for example, the Municipality are currently preparing a 'waste booklet' with information for households on recycling of all types of materials. They hope to produce booklets on an annual basis;
- advertisements in the local papers;
- campaigns, for example, for home composting;
- information campaigns before recycling trials;
- an Energy Centre: employees visit schools and talk to children about energy saving and waste recycling.

It is still thought that there are areas within the Municipality where the recycling message is not getting through. Language barriers have been overcome though publication of information in other languages for example, Turkish and Urdu.

It is estimated that budget for public information is approximately DKK1.5 million (£121 000).

MARKETS FOR END PRODUCTS

Table 6.6 outlines some end uses for materials recycled in Aarhus.

Table 6.6 End Uses for Recycled Materials

Material	Use
Paper/ magazines	After ink is removed, the clean paper is transported to paper-mills in Denmark or overseas where it is used for making kitchen-roll, lavatory paper, egg cartons, wallpaper etc. There are plenty of markets internationally - the Far East, the German and the Swedish paper industry.
Glass	Around 50% of the glass is reused. The rest is recycled at Homegaard Glassworks.
Organic waste	Biogas and compost fertiliser in gardens
Demolition waste	Various uses e.g. harbour building

FUTURE DEVELOPMENTS

Future plans for developing recycling in the municipality are listed below

Future Recycling Plans

- ***Organic Waste.*** A new system will be introduced for both rural and urban residents in Aarhus over the next two years. Every household will have to separate its organic waste from its refuse waste through the use of black and green bags which are then collected in the same recycling containers outside the houses and flats. These bags will then be sorted at a Central Separation Plant and the organic waste sent to the biowaste plant.
- ***Bulky Materials.*** The municipality are also working on a better collection system for bulky material, to ensure that bags are not broken due to mixing of heavy bulky material with refuse and to avoid conveyor belt problems in the treatment place.
- ***Collection Systems.*** There are modernisation plans for the collection of paper and glass.
- ***Information.*** The municipality will continue to publicise the benefits and methods of collection.
- ***Bin Location.*** Research is in progress to improve the siting of recycling bins.

- ***Environmental Surroundings.*** The environs of street bins tend to become scrap yards. Plans are underway to make recycling points more aesthetic and pleasant.
- ***Container Provision.*** The Municipality intends to provide containers for areas of the municipality requesting more bins.
- ***Volume Charging.*** Refining the system of volume based charging is being discussed.

In Denmark, each local authority is required to be responsible for all wastes generated in its municipality. Nearly two thirds of the MSW recycled in Aarhus is construction and demolition waste. 93% of construction and demolition waste is recycled and nearly all of household garden waste is recycled as compost. The recycling rate for household waste generated currently stands at 27%.

Principal drivers of recycling

Waste management entities
Weight based waste tax
Households, commercial and industrial sectors
Weight-based waste tax Volume based charging for household waste collection Deposit refund system

The principal driver for recycling has been the waste tax, which provides a strong incentive for the commercial and industrial sector to reduce waste. The tax is weight-based and explains high recycling levels for construction and demolition waste. The tax has kept residual waste from separate collection to a minimum.

The charging mechanism for households in Aarhus is based on the costs of waste management, which are inclusive of the waste taxes. Composting levels for garden waste are reported to be 100 per cent for households and this can be attributed to the charging structure. In addition, waste is collected fortnightly and households are only provided with 190 litre bins. Households are charged double for additional bins. Households have tended to stick with the one bin, rather than pay for additional bins, indicating that volume-based charges are instrumental in waste minimisation by households. Municipalities are required to provide for separate collection of paper and glass. However, there is evidence to show that the provision of this infrastructure is not in itself a strong driver for increased recycling rates. The increase in collection of glass and paper has been moderate, so that only half the

potential paper and glass waste available is collected from all sectors. This may be due in part to the waste tax forcing households and companies to prioritise which waste they focus on sorting or recycling.

A deposit refund system exists for glass and plastic containers. The return rate is reported to be 99 per cent.

Next step

Answer the following questions, than discuss them with the group, and compare them with the answers, which are suggested at the end of this pamphlet.

Questions:

1. What were the Principal recycling drivers at Aarhus?

2. What is the recycling ownership structure in Aarhus?

3. What was the principle of waste charge introduced in Denmark?

4. What are the obligation local Councils concerning waste management?

5. What are the recycling rate of construction and demolition, and household garden waste in Aarhus?

6. What was the way to increase public awareness in Aarhus?

ANSWERS

CASE STUDY 1

1.
The so called "Sanitation or Refuse Levy", monthly fee, was attached to the property rate bill. The property owners refused to pay the levy, because they thought, that did not enjoy any direct waste collection services from the Municipality. In case of "pay as you dump" system there was a direct connection between the service and the payment.

2.
This was a system where residents were required to contribute a fee of 20 (twenty Cedis) per dumping at the container site. Payments were made direct to toll collectors or container attendants at the sites within the Sub-District Assemblies.

3.
Toll collectors were appointed at the Sub-district level and cleaners received daily payments from toll collectors. Payment was given to toll collectors and all conflicts were resolved at the local level.

4.
Official receipts were not issued by the toll collectors for the monies being collected. Residents who had no money to pay or refused to pay, usually dumped their garbage into the drains and open spaces.

CASE STUDY 2

1.
Insufficient quantities of trucks, plant, equipment.
Waste management is supposed to be financed from revenue collected from rates.
The charges are low and any increases in rates require the approval of Council and the Minister of Local Government. Both approvals are very difficult to obtain.
Lack of appropriate technology and public co-operation. Large scale littering and clandestine dumping.
Poor accessibility in unplanned settlement.
High operational cost.
Lack of separate landfill for toxic waste disposal.

2.
Do you think the city and the compounds are clean?
Do you think waste is collected and disposed of?
Who collects waste?
Which areas of the city are clean?
Do you think waste is dumped at the right places?

3.
There is a need for an intensive education campaign on waste management.
A penalty fee should be introduced for illegal dumping even in the compound.
A trophy should be introduced for the cleanest Zone in the compound.

4.
Fencing off the site and having better control of accessing. A weighing bridge should be installed and cellular filling must be provided. A proper system for recording and entering the data (quantities, customers, etc.) should be put in place.

5.
A great number of illegal dumping sites and heaps of refuse scattered all over the city may cause ground water and drinking water contamination in the long run.
The hazardous and hospital waste mismanagement may cause poisoning and infections to the citizens.

6.
For 1995, revenues collected from charges represents less than 5% of the expenditures. The rest of the waste management expenditures are covered by general revenue sources of the LCC (rates, municipal house rents, etc.). Property rates bills by the LCC do not indicate any particular amount devoted to waste management. As shown in the social study, some people believe they are paying their fair share by contributing to the rates.

CASE STUDY 3

1.
The European Community annually generates 50 million tonnes of packaging waste, industry, out of this, 9 million tonnes or 18 percent is recycled.

2.
In Cyprus at present waste generated, 1.1 kg per head per day. The waste comprises 45-55 percent organic materials. 20-30 percent paper and 4 percent plastic, 1 percent cans and 2 percent each of iron, glass and rags.

3.
The Municipality of Massachusetts to stimulate recycling, introduced bans, for landfills, on leaves, yard waste, white goods and unshredded tires, aluminium materials, metal and glass, single polymer plastics and all grades of recyclable paper.

4.
The markets for glass, steel, aluminium and newspaper are relatively stable but the price of mixed paper has fluctuated wildly.
Recycling mixed plastic material, though, is not cost effective for Duxbury.

5.
Started by a Bag opener, in which plastic bags are torn open to free their contents. The waste then goes through a two-stage bar screen. After screening, the waste goes through the picking station where large objects are removed. Plastic, aluminium, glass are removed manually, while ferrous metals are removed by magnetic separators. The remaining combustibles pass through a shredder for particle size reduction and go to an air knife where inert materials are extracted. The combustibles are densified in a fuel cuber, which produces fuel cubes from municipal solid waste. These are used as a fuel supplement by some local paper mills in their biomass-fired boilers.

6.
"The Newark Guide to Source Reduction and Buying Recycled in the Workplace," is distributed through the local chamber of commerce to help local companies and institutions cut waste and stimulate demand for recyclables, collected in the city. Seminars on source reduction have also been held for chamber members.

7.
The City Council of Newark recently mailed to each of the city's 80,000 homes a brochure designed to help residents avoid the environmental dangers posed by cleansers, batteries, moth balls, paint thinners and other common goods containing hazardous chemicals. Additionally, household hazardous waste collection programmes are periodically held to help residents keep up to date on improved methods to reduce the use of hazardous waste as well as providing for proper recycling and disposal of household hazardous waste

CASE STUDY 4

1.
The project resulted less waste, employment and fertiliser to the soil.

2.
Because for collection of waste and the production of compost they used a simple, low cost installation and it was possible to sell the compost on a reasonable price.

3.
The bamboo wall of 0.5 m high with a wooden door was too low to prevent littering, caused by the wind and domestic animals entering the composting area, through the low fence.

4.
The women associations in Ouagadougou had oriented their activities towards collection of district municipal waste. In 1996, they created a federation with a consultative structure for the exchange of experience to help the development of partnerships with the public sector and private enterprises working in the field of waste management and sanitation.

CASE STUDY 5

1.

- Organised waste collection does not cover all areas.
- Selective waste collection is still rare.
- The technical level and condition of the used equipment is bad.
- Only some 30 % of the 2700 municipal landfill sites meet the requirements.
- There are, many illegal dumping sites.

2.

- prevent waste production as possible
- decrease the quantity and degree of hazard of the produced waste
- recover the produced waste to the largest possible extent
- dispose the non-recovered waste in an environment friendly way

3.

The number of people using landfills to be built in the medium run have to count at least 80.000, and at least 10 settlements have to join the project.
Another requirement is that a new landfill site can be built only if there is not a waste disposal possibility (lined landfill site) in a 30 km radius which could meet proper environmental demands.

4.

Earlier experience shows, that the waste yards and drop off centres are the best, where the population deposits the waste and a trained staff help them in the selection. These yards are suitable to receive recyclable and hazardous waste, while the rest of the waste is collected near the homes -by door-to-door, or curbside collection,- which is disposed in up-to-date landfill sites or incinerators.

A special form of selective waste collection is required in handling green waste, containing decomposable organic matters. Since this type of waste represents quite a large proportion of the municipal solid waste, it is better to organise special collection and handling by composting.

5.

There are some 2700 dumping sites, which can be replaced by about 100-120 up-to-date, sanitary landfills on the medium run, and after these are depleted, on the long run only 10-15 landfill sites will need to operate. The precondition for meeting long term objectives is to gradually build all the necessary industrial processing, recovery, treating facilities and transfer stations in the meantime.

6.

Incineration is generally better solution for waste treatment compared to the landfills, because it produces energy and reduces the amount of waste. Landfill needs less investment and operation cost, but needs large area of land. Landfills do not decrease the amount of waste

CASE STUDY 6

1.

- national waste taxes;
- volume based charging;
- deposit refund;
- good separate collection;
- public awareness.

2.

Aarhus Recycling is 50 per cent owned by the municipality and 50 per cent owned privately. The company is paid by the municipality to sort paper and glass. Sorted paper is sold to Danish industry.

3.

It is differentiated according to how the waste is managed, so that it is highest for landfill of waste, cheaper for incineration of waste, and a zero rate for waste recycled.

4.

Municipalities have to ensure collection of waste paper and glass if there are more than 2000 households in the area. This limit is soon to be reduced to 1000 persons. Households and the commercial sector are under an obligation to use the collection schemes.

5.

Nearly two thirds of the MSW recycled in Aarhus is construction and demolition waste. 93% of construction and demolition waste is recycled and nearly all of household garden waste is recycled as compost.

6.

- written information, in the form of 'waste booklet' with information for households on recycling of all types of materials;
- advertisements in the local papers;
- campaigns, for example, for home composting;
- information campaigns before recycling trials;
- Energy Centre employees visit schools and talk to children about energy saving and waste recycling.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UP-DATED TRAINING MANUAL OF WASTE MANAGEMENT IN HIGH DENSITY AREAS OF THE AFRICA REGION

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