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# Deliverable 3.4: Guide for implementation of Integrated Solid Waste management Systems

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## 1. CONTEXT

This guide is meant to help decision-makers implement integrated solid waste management systems. It will give a better understating of solid waste management and show the various problems encountered in the implementation of solid waste management systems.

In order to manage an integrated solid waste management systems, the stakeholder must have a good understanding of the current waste management system and the major constraints, have clear management objectives and understand the regulatory and institutional system in place, adequate technologies and funding mechanisms.

## 2. DEFINITIONS & BASIC CONCEPTS

Solid waste can be regarded as a material which has no value for its generator at a certain space and is discarded. While it is waste for some, it may have a value for the others. The main generators of solid waste can be households, business, markets, institutions, industries and healthcare facilities. In this order solid waste can include hazardous waste (e.g. from industries) or medical waste e.g. from hospitals (Rouse and Ali, 2002). Hazardous wastes were not discussed in this project, since they require special treatment. Furthermore all kind of liquid waste types (e.g. from mining, chemical industry, oil industry) as well as slurry (e.g. from waste water treatment) are not targeted by the IWWA project.

The category of waste in this study is referred as solid waste and is mainly focussed on metal and plastic, which is generated by households, business, markets, industries and healthcare facilities and carries a high value. But also organic waste, which demonstrates a huge waste fraction with more than the half from the household waste and the mushrooming multi media sector which results in WEEE also referred as e-waste.

The concept of integrated solid waste management has evolved over the last 20 years and is becoming widely accepted. It is focussing a holistic approach while considering the following stages such as waste generation, its collection, segregation, recycling, energy recovery and final disposal (van de Klundert and Anschütz, 2001). Ideally, systems needs to be simple, affordable, and sustainable (financially, environmentally and socially sound) and should aim to protect the environment, support economic productivity and provide a secure environment for workers. Factors affecting the planning and the implementation of solid waste management systems can be from cultural, social, economic and environmental character. Also the essential framework such as the legislation and infrastructure in the country has to be taken into account. Various stakeholders such as households and other generators, informal and private sector, NGOs, Municipalities and Governmental bodies were linked in the solid waste management processes. These include prevention, generation, segregation, collection, transport, and recycling, sweeping, disposal of waste as well as environmental education, planning, monitoring and evaluation of solid waste management systems (Rouse and Ali, 2008). This also requires active participation from the stakeholders, which has to be included in the planning process.

# 3. IMPLEMENTATION GUIDE

This Guide is meant for decision-makers and should help them find answers to the various issues related to the implementation of integrated solid management systems, i.e.:

What is the current situation in the sense of integrated solid waste management?

How to assess the current situation?

What are the organisational aspects of integrated solid waste management?

What are the institutional aspects of integrated solid waste management?

How to select appropriate and adapted integrated solid waste management?

How to establish a sustainable funding system for integrated solid waste management system?

How to identify capacity building gaps and needs?

## 3.1. Situation Analysis

What is the current situation in the sense of Integrated Solid Waste Management? This Chapter must help the authorities understand how solid wastes are currently managed and identify gaps and needs in order to adopt an integrated waste management system.

**Current situation of an organization and its environment**

When developing an ISWM scheme, analysis of the organization and its environment at the present moment and its development in the future, is important. The analysis has to be executed at an internal as well as the external level to identify all forces, weakness opportunities and threats of the new strategy.

### 3.1.1. Data collection

The Situation Analysis primarily aims to assess the contemporary situation. This analysis requires collection of accurate and updated data on the basis of which the assessment can be conducted. Data collection therefore forms a crucial step in the Situation Analysis process. It can either be conducted through dedicated data surveys or through the formulation of data formats. National statistics are some of the key data collected (Population size and spread statistical data on current waste management practices, available technologies, community participation etc.)

Situation analysis can be classified into two categories, namely Internal and External situation analysis situation analysis[1]

### 3.1.2. Internal Situation Analysis

This is an examination of the organization related MSW management. The strengths, weaknesses, opportunities and threats to the organization are assessed. This is refers to as SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats). Key parameters used in this analysis include:

**Organizational structure** (e.g., is the organization well-structured to ensure that all functions in the management of waste are adequately covered (waste minimization, waste collection, waste transportation, waste disposal site, recycling and planning). Are there frequent changes at the top and/or middle levels of the organization?).

**Staffing structure**

Staffing structure refers to the number of staff at the various operational levels, e.g., is there a shortage of skilled officers etc.

**Technical Capacity**

The technical capacity refers to the ability of organizations to perform technical functions or activities. Infrastructure resources and technical knowledge influences this ability to perform technical functions.[2]

**Technology and Infrastructure**

This refers to availability of required technology and infrastructure to ensure environmentally sound management of waste in the areas of collection and transportation, recovery and recycling of waste, treatment and disposal. For example, is the technology and infrastructure for sound management of solid waste available i.e. the right equipment and enabling environment, is there adequate electricity supply, motorable roads, are the laboratories where research related to SWM can be carried out well manned and well equipped?

**Financial mechanism and position**

This refers to sources of funding of solid waste management (levies, charges, subsidies and private sector participation) and availability of funds for carrying out the functions of the organization (e.g., is the organization unable to perform its job due to a lack funds?)

Institutions involved in SWM

**Institutional arrangements**

This refers to the all the relevant institutions that should be involved in SWM in a country (Do they have the necessary resources and jurisdiction to manage the various waste streams/ sources.

### 3.1.3. External Situation Analysis

External situation analysis can be done by reflecting on the environment surrounding solid waste management. This analysis includes all types of waste generated; municipal solid waste, e-waste, hazardous waste etc. This will include assessment of the characteristics and current management of MSW in the community and region.

**Characteristics of MSW**

**Quantity of Waste** - It is important to know how much MSW the system must deal with, now and in the future.

**Composition of Waste** - For integrated solid waste management, in which different materials are handled in different ways, a community must know the types of material in its waste stream. The composition of the waste stream varies.

**Waste Trends** - Seasonal and long-term changes in waste quantities and composition, such as those due to changing population or industrial activity, may be significant in some areas.

**Existing Management Methods, Costs and Resources** - The external situation analysis would also cut across all the aspects of waste management i.e. from generation to disposal. Analysis of existing management methods costs and resources can include an examination of collection systems for MSW and recyclables; waste reduction and recycling programs; markets for recyclable materials; mulching and composting programs; waste-to-energy and other combustion facilities;

landfill facilities; public education programs; solid waste management costs and funding sources; customers of the solid waste management system; and regulatory influences.[3]

**Policies**

This refers to the examination of current laws, regulations, economic tools for solid waste management and its enforcement. (Does it cover the various waste streams and sources?)

**Process and level of stakeholder participation:**

This examines the role of waste generators, the role of the private sector in SWM services and for recovery and recycling of waste. (Are all relevant stakeholders performing their roles in the management of wastes?)

Problems encountered in conducting solid waste management situation analysis:

- Outdate and insufficience data
- Difficulty to involve relevant stakeholders
- Lack of solid waste management scientific knowledge and expertise
- Academic language of present situation analysis
- Unclear share of solid waste management responsibilities between institutions
- Fragmentation and lack of communication between institutions.

In addressing these problems, it is important to initially do a detailed study of the current situation by carrying out an integrated strategic planning process, rather than rushing into investments in new and expensive equipment that are not suitable for most African countries. Also, it is essential to get the support and cooperation of all relevant stakeholders rather than consulting with an elitist group that is not representative of the stakeholders.

## 3.2. Planning, organisation and control

### 3.2.1. Strategic Plan development process

Strategic planning is a process, a methodological activity which consists of shaping the objectives and choosing the appropriate means to achieve them. Planning is part of prospective management.
Its success depends on the preparation and control of the process, hence the need to prepare properly and to have a qualified team on hand to conduct the exercise.
The initiative to begin any planning process should derive from a genuine desire and commitment from local and centralised authorities to support and participate in the exercise and to implement the proposals. It should be noted that the goal should not be to have a taxable reference document at the end, but rather to initiate a participatory and iterative process involving all stakeholders and to build consensus for integrated waste management.

For the preparation and launch of the process, the following are expected:

- **Government commitment to institutionalise the planning process**
- **The identification and mobilisation of** stakeholders in order to involve them in the process.
- **The establishment of steering and running committees.**
- **Preparation of a communication strategy** to accompany the strategic planning process
- **Organisation of a methodological workshop** involving members of the executive to allow:

    - ***clarification of the issues***
    - ***validation and approval of the work plan***

- the organisation of a launch workshop

- **Strategy Development**

After validation of the sector analyses and the identification of major issues, the exercise will continue by shaping the vision, strategy and action plans.

Envisioning “Where we want to go?” is one of the most inspiring exercises of a strategic planning process. By grounding the **visioning** process with information from the situation assessment, communities can dream the attainable. Then, the development of **objectives** represents a translation of the vision statement into substantial and specific goals able to guide practical decision-making.

After the formulation of a vision, the work process will use the following three steps:

- ***The identification, prioritisation and analysis of problems***
- ***Identification and evaluation of strategic options:*** solutions are proposed as strategies that show how to achieve a lasting resolution of the problem. For each strategic option, action sequences, tasks and actors will be identified.
- ***Development of an action plan*** that summarises the objectives, expected results, actors, timing, cost, indicators… etc for each action.

To facilitate the participation of communities, local community fora for example can be organises. These public consultations will be organised at neighbourhood level. Each public consultation will bring together community leaders and their objectives will be to discuss, comment, amend, strengthen and / or validate the details of the proposed Strategic Plan proposed for their area. The suggestions of the population will complete the guidance sought by the experts.

- **Validation**

- **Presentation and Validation of the Strategic Plan by the various bodies set up**
- **Organise local consultation with the participation** of all stakeholders to build consensus in how to support of the strategy;
- **The validation of the strategic plan by the legislative body of the structure in charge of waste management**

- **Implementation and monitoring-evaluation**

The strategic plan is a clearly essential phase of the strategic process. But it would be futile and ineffective if not accompanied by a mechanism of implementation and of effective and efficient monitoring and evaluation designed to involve all stakeholders, to be financed and for all the selected activities to be conducted. Thus, the triennial and repeated actions in the strategic plan will be implemented by the institutions in charge of the various components of the plan with regular evaluation of activities and readjustment.

- **The establishment of a mechanism for coordination, monitoring and evaluation:** the strategy and the organisation are inseparable, the implementation of strategic directions requires a suitable institutional and organisational framework. Thus, the institutional and organisational measures will be launched and a framework for coordination, monitoring and evaluation will be put in place.
- **The implementation of a strategic and operational communications plan.** Waste management, at the heart of urban management issues, involves innovative and multi-sector processes that engage a set of political, social and economic actors. Therefore, a strategic and operational plan for mobilising the target for ownership, for conducting a program of Information-Education-Communication on the management of waste and to spread the word on the achievements regarding the implementation of the waste management strategic plan will take place.
- **The implementation of the proposed three-year rolling plan**
- **Evaluation of activities followed by an update of strategic guidelines.**

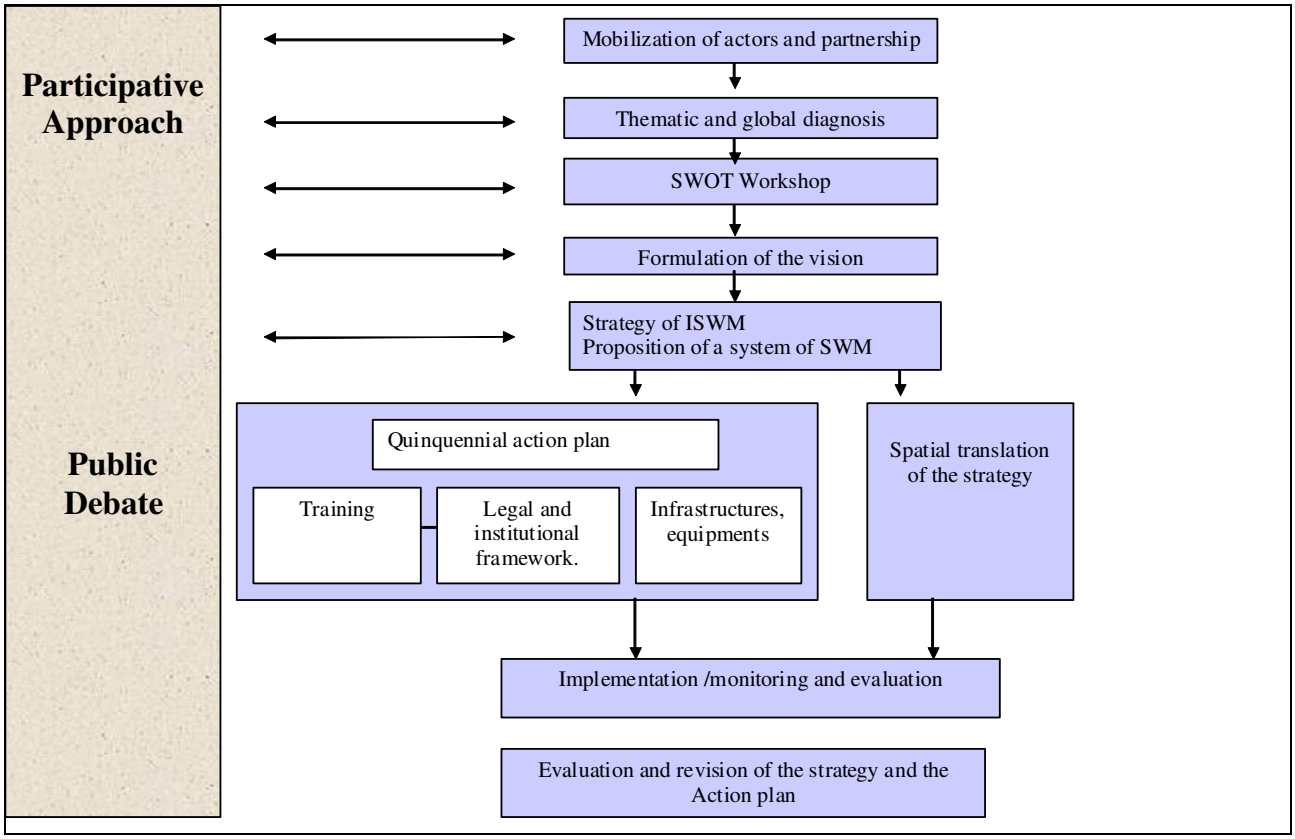


Figure 1: Schema of elaboration of a strategic plan (adopted from Comeliau and al., 2002)

### 3.3. Stakeholders roles and responsibilities

Solid waste management is a growing environmental, health, social and financial problem in developing countries including the four target countries who are immediate beneficiaries of the IWWA project. Despite significant efforts in the last decades, the majority of municipalities in the developing countries cannot manage the growing volume of waste produced in their cities. This inability to manage urban solid waste consists of failures in the following areas:

- Inadequate services
- Inadequate financing
- Inadequate environmental controls
- Poor institutional structure
- Inadequate understanding of complex systems
- Inadequate sanitation.

These inadequacies are receiving increasing attention, and are gaining in priority both in the countries themselves and in the international donor community. The attention to sustainable development also means that sustainable waste management systems – actually, sustainable material use systems - will increasingly come to be the goal of solid waste policy.

In addition to the above, several agencies at the national level are usually involved at least partially in solid waste management. However, there are often no clear roles/functions of the various national agencies defined in relation to solid waste management and also no single agency or committee designated to coordinate their projects and activities. The lack of coordination among the relevant agencies often results in different agencies becoming the national counterpart to different external support agencies for different solid waste management collaborative projects without being aware of what other national agencies are doing. This leads to duplication of efforts, wasting of resources, and unsustainability of overall solid waste management programmes.

### 3.3.1. Regulatory and Policy Environment

- **Laws and Regulations for Solid Waste Management**

The legal and regulatory framework governing solid waste management in the target countries are in the form of bye – laws, ordinances, policy documents, legislative instruments, laws, international treaties that concerns disposal, collection and transportation of solid waste as well as acts of parliament, which includes corresponding inspection and enforcement responsibilities and procedures at national and local levels. These policies, laws or legal regimes are fragmented with no committee to coordinate activities involved in sustainable solid waste management. The fragmented and uncoordinated laws and policies on solid waste management have also created different agencies or stakeholders who are in one way or the other involved in solid waste management.

For example, in Ghana, the Environmental Protection Agency (EPA) in the Ministry of Environment Science and Technology (MEST) is the principal ministry for implementing legislation which regulate the management of chemicals and generally control pollution, as well as other environmental problems, which *inter-alia*, result from mismanagement of chemicals and toxic waste in the country as well as industrial waste (e.g. solid wastes from mining operations, manufacturing, textiles, hotels, etc). However, with regard to solid waste management, it is the responsibility of the Ministry of Local Government and Rural Development (MLGRD) who has the oversight responsibility in dealing with municipal/metropolitan wastes from households, commercial areas, etc.

The Ministry of Employment and Social Affairs ensures that workers are guaranteed maximum protection from the potential hazards of chemicals. Within this Ministry, there are inspectors who ensure that the provisions of the laws pertaining to occupational safety and health are abided by.

The Ministry of Food and Agriculture is relevant in toxic waste management, as it has established a Department of Plant Protection and Regulatory Services (PPRSD) which provides training to farmers on the safe use of pesticides. Another important ministry in the regulation of toxic waste in Ghana is the Ministry of Mines and Energy. Through its Mines Department, this Ministry is responsible for the implementation of the laws enshrined in the Mining and Minerals Law, as they relate to health and safety in the mining environment, and also, monitors the use and storage of explosives which are utilised in this sector. The Ministry of Trade and Industry ensures that under the Imports and Export Regulations, it grants licenses prior to the importation of goods specified in the second schedule which includes a number of chemicals.

Compounded with the abovementioned laws and policies, ministries, departments and agencies are tasked with the provision of environmental sanitation infrastructure and services. While the Local Government Act, 1993 (Act 462) and Local Government Service Act, 2003 (Act 656) seek to effectively transfer the functions and offices of central ministries, departments and agencies to the

Assemblies, this has not happened and many still exist and function as central government dependencies. The Ministry of Health, as part of the Pesticides Technical Committee, is important in ensuring that the occupational health of workers who could be exposed to chemical hazards and their safety are guaranteed. It must also be borne in mind that narcotic drugs can only be imported and exported only by the Minister of Health who then grants the appropriate license in this regard. It may be suggested at this point that such substances be extended to cover a wide range of chemicals, which are toxic and must not be limited to narcotic drugs alone.

- **National Policies on solid waste management**

The goal of Ghana's National Sanitation Policy developed in 1999 and revised National Environmental Sanitation Policy 2010 hopes to achieve an effective, sustainable national system for integrated solid waste management (ISWM) that is founded on the development of its various prerequisites embodying proper polices, legislation, funding, institutions, human resources, technological infrastructure and supportive awareness.

The principal components of environmental sanitation include:
(a) Collection and sanitary disposal of wastes, including solid wastes, liquid wastes, excreta, industrial wastes, health care and other hazardous wastes;
(b) Storm water drainage;
(c) Cleansing of thoroughfares, markets and other public spaces;
(d) Control of pests and vectors of disease;
(e) Food hygiene;
(f) Environmental sanitation education;
(g) Inspection and enforcement of sanitary regulations;
(h) Disposal of the dead;
(i) Control of rearing and straying of animals;
(J) Monitoring the observance of environmental standards.

Based on the above-mentioned key policy directives, the framework for the overall action plan is based on the premise of completing the currently undertaken urgent initiative, of the removal of old accumulations of waste. This would be taken within the longer comprehensive perspective of establishing a sound, secure and cost- effective integrated national solid waste management (INSWM) system. This system can be reached through a gradual type of continuing reform and improving the existing system, while including them and optimizing their use in line with the nationally set polices. The specific out put to be achieved is that all solid wastes generated in urban areas are regularly collected and disposed of in adequately controlled landfills or by other environmentally acceptable means.

### 3.3.2. Institutional and legal Frameworks

- **Stakeholders Involved in Solid Waste Management**

Solid waste management is a complex task, which depends as much upon organization and cooperation between numerous public and private sector actors as it does upon appropriate technical solutions. Thus, a wide range of individuals, groups and organizations are concerned with SWM as service users, service providers, intermediaries and/or regulators such as:

***National central government*** is responsible for establishing the institutional and legal frameworks for SWM and ensuring that local governments have the necessary authority, powers and capabilities for effective SWM. To assist local government to execute their SWM duties, national government provides them with guidelines and/or capacity building measures in the field of administration, financial management, technical systems and environmental protection. In addition, national government intervention is often required to solve cross- jurisdictional issues between local government bodies, and to establish appropriate forms of association when – as in most metropolitan areas – effective waste management calls for the collaboration of several local bodies.

***Local (municipal) government*** authorities are generally responsible for the provision of solid waste collection and disposal services. They become the legal owners of waste once it is collected or put out for collection. Responsibility for waste management is usually specified in bylaws and regulations and may be derived, more generally, from policy goals regarding environmental health and protection. Besides their legal obligations, local governments are normally motivated by political interests. Besides SWM, municipal governments are also responsible for the provision of the entire range of the infrastructure and social services. To fulfil their SWM responsibilities, municipal governments normally establish special purpose technical agencies, and are also authorized to contract private enterprises to provide SWM services. In this case, local authorities remain responsible for regulating and controlling the activities and the performance of these enterprises.

***Private sector*** includes a wide range of enterprise types, varying from informal micro – enterprises to large business establishments. As potential service suppliers, private sector enterprises are primarily interested in earning a return on their investment by selling waste collection, transfer, treatment, recycling and/ or disposal services. Private sector collectors may be contracted directly by individual households, neighbourhood associations or business establishments. More often, they operate under contractual agreements with municipal authorities. The informal private sector comprises unregistered, unregulated activities carried out by individuals, families, groups or small enterprises.

***Non-Governmental/Community Based Organizations (NGOs/CBOs)*** operate between the private and governmental realms. Originating outside of the communities in which they work. The NGOs are helping in building the capacity of people or community groups to play an active role in local SWM by contributing in raising people's awareness of waste management problems, building organizational capacity and the formation of community- based organizations (CBOs), opening channels of communication between CBOs and government authorities, raising CBO's voice in municipal planning and implementation processes, etc.

***Residential households*** are mainly interested in receiving effective and dependable waste collection service at a reasonably low price. In low- income residential areas, where most services are unsatisfactory, residents normally give priority to water supply, electricity, roads, drains and sanitary services. Solid waste is commonly dumped onto nearby open sites, along main roads or railroad tracks or into drains and water-ways. Pressure to improve solid waste collection arises as other services become available and awareness mounts regarding the environmental and health impacts of poor waste collection service. Community groups have considerable potential for managing local collection services.

***Bilateral and multilateral external support agencies*** are engaged in supporting SWM, whose acquired considerable expertise, within a broader development program aims at improving urban management capacities and/ or urban environmental protection.

- **Institutional Structure for Solid Waste Management**

Solid waste management is a major responsibility of local governments. The role of local governments is to create the enabling institutional structures and arrangements as well as organizational procedures and build the capacities of responsible institutions to play active role in SWM. Elements of good institutional structure for solid waste management include:

- Distribution of functions, responsibilities and authority between local, regional and central government institutions (i.e. decentralization), and among local governments in a metropolitan area,
- Organizational structure of the institutions responsible for SWM, including the coordination between SWM and other sectors and/ or urban management functions,
- Procedures and methods employed for planning and management,
- Capacities of institutions responsible for SWM and the capabilities of their staff
- Private sector involvement and participation of communities and user groups.

The figure below presents the institutional roles and responsibilities for waste management from national to local levels.

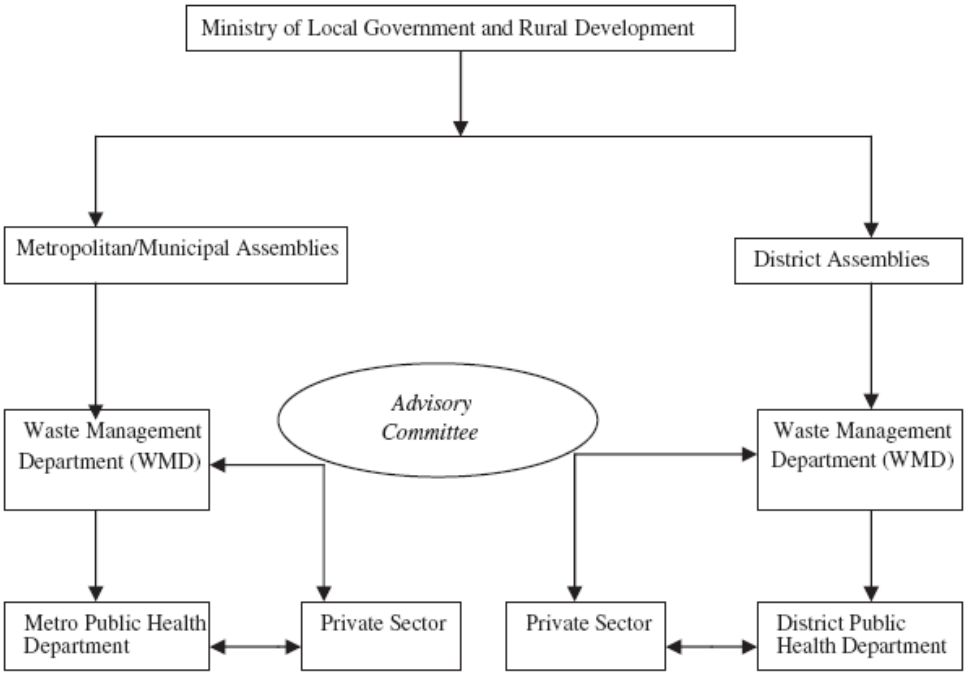


**Fig. 2: Typical Institutional arrangement for solid waste management**

However, according to Fobil et al., (2008) as a result of lack of clearly defined roles and responsibilities among the different stakeholders involved in solid waste management, it gives great latitude to public officials in applying the rules some of who do not take kindly to private sector participation in waste management as they see the lost of monopoly in the area including the right to employ staff as undermining their position. Hence affecting the abilities of developing

countries including the four target West African countries from managing their solid wastes in a sustainable manner (see fig. 2.0 below).

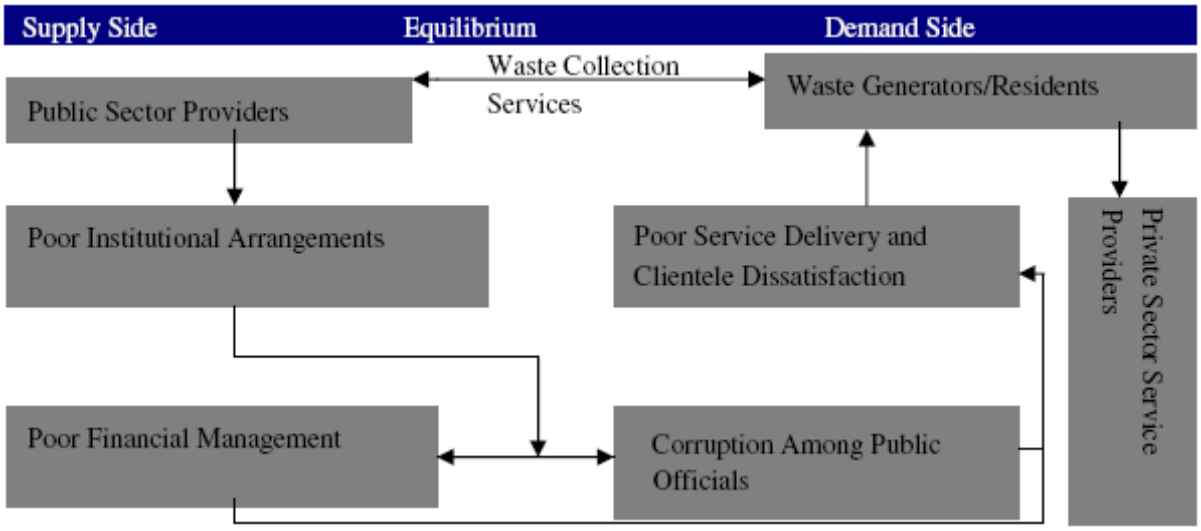


**Figure 3 Analysis institutional roles and responsibilities model in waste collection (adopted from Fobil et al (2008))**

**Current Institutional Issues affecting sustainable solid waste management**

There following are some of the institutional and legal constraints affecting implementation of sustainable solid waste management in the target countries:

- Inadequate Effective monitoring and supervision
- Limited logistics available to institutions
- Financial Constraints – Delay in payment to W.M companies make the institution responsible incapacitated to exercise its obligations.
- Corruption: Revenue collectors are engaged in corrupt practices which lead to loss of revenue to the government institutions.
- Lack of partnership engagement and inclusivity of stakeholders
- Lack of political will to implement principles such as polluter –pays.
- Duplication of functions resulting in conflict among institutions.
- Improper/unstructured decentralization policy.
- Luck of coordination and synergy.
- Lack of commitment on part of politicians to address waste management problems.
- Limited spatial planning.
- Most of the public are not aware of some existing laws on solid waste management.
- MMDAs do not have legal officers to act on their behalf.
- Some bye-laws are not gazzetted and cannot be used for prosecute.
- Longer time is spent to prosecute offenders
- Lack of specialized sanitation courts
- Judges have limited knowledge on waste management laws.
- Lack of sufficient deterrent penalties for offenders.

These institutional and legal constraints can be overcome by:

- Financial incentive for people to see the value of the waste.
- Create awareness.
- Law enforcement agencies should be more committed.
- Institutions should do more coordination/synergy.
- Training of judges to be more responsive to waste management laws.
- Review of existing laws that are obsolete to reflect the current situation.
- Inter-agencies waste management initiatives should be encouraged.

## 3.4. Selecting waste management technologies

The selection and implementation of a waste management technology bases on the overall concept of integrated solid waste management.and a thorough situation analysis which takes into account the boundary conditions and specific needs of a certain region. The proper and comprehensive situation analysis is key and an important step in planning because all subsequent steps will be based on its findings. Therefore, it is essential that at this level of planning all the functional elements of an integrated solid waste management system are considered.

The subsequent process in order to select and implement adequate waste management technologies is shown in Figure  and described below in detail.

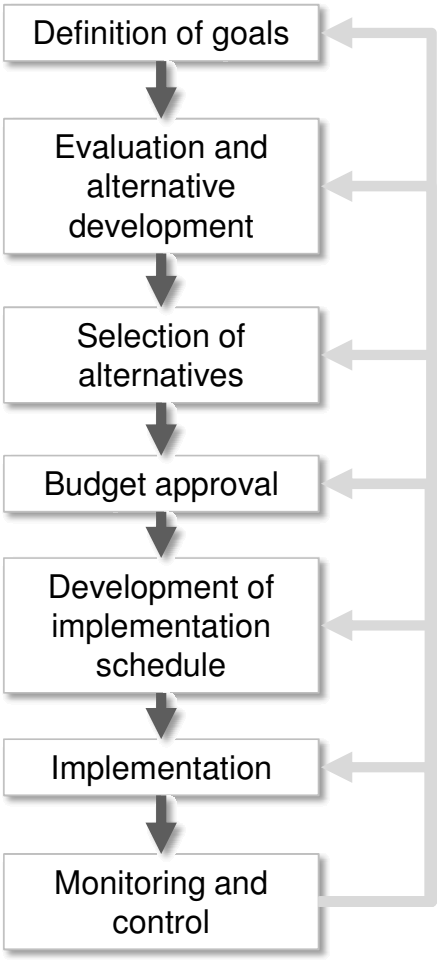


**Figure 4: Generic planning process how to select and implement a certain waste management technology**

### 3.4.1. Definition of goals

The situation analysis leads to the determination of services that should be provided, technological problems that should be solved and subsequently to the goals that each element of an integrated waste management system should fulfil. For each element of the integrated waste management system, detailed goals should be defined.

### 3.4.2. Alternative development

It is beneficial for decision-making purposes to develop alternatives composed of one or more different technological solution for a specific problem. An alternative can be as simple as characterising the differences of one-person versus two-person collection crews, or it may be as complex as specifying landfill disposal of all wastes versus processing wastes at transfer stations and recovering all recyclable materials. Every alternative must satisfy the solution of the problem defined in the situation analysis and in addition the requirement of measurability.

Documentation for each alternative, regardless its complexity, must encompass the following (Departments of the Army, the Navy and the Air Force 1990).

- **Performance**

The performance of a certain waste management technology describes how a specific service is provided or a specific technological problem is solved.

The details that must be identified include

- Level of service
- Required work force
- Required equipment
- Equipment reliability and flexibility
- Equipment and work force expandability
- Compatibility with other environmental programs and with future changes in solid waste technology

With these details established, it is possible to contrast performance functions of a recommended technology with performance functions of alternatives without additional studies.

- **Economic analysis**

Once the details of performance have been identified, it is important to analyse the economic impacts of each alternative. The analysis must include estimates of capital and operating costs. The cost of an alternative can be expressed on the level of annual costs, or, when divided by the annual quantity of wastes handled, as unit costs. Unit costs, such as Euros per ton, are often used to compare the cost effectiveness of alternatives. In addition it is needed to consider indirect cost effects of the different alternatives. An alternative may be cost-effective by itself but could cause additional costs in other parts of the waste management system, like for example a collection system might require specific containers for collection or a certain landfill technology will require additional aftercare costs. Therefore it is recommended that cost comparisons not only regard the individual technology costs but also system related costs. When cost estimates are completed, financing methods can be identified.

- **Environmental impact assessment**

Waste management technologies have direct impacts through changes in the existing environment caused by the building infrastructure and an indirect impact through the operation of the technology. Theses impacts associated with a new technology have to be carefully and thoroughly studied in advance in order to consider corrective and mitigating measures already in the planning stage. Thus, any activity that significantly affects the environment (e.g. landfill, incineration) requires an Environmental Impact Assessment. Such an assessment should not be carried out in an isolated manner but be seen as a chance to be done in a participative manner including different interest groups, both public and private and from civil society.

- **Organisational requirements**

The organisational requirements for the operation of a certain waste management technology should be studied carefully and skill level and expertise needed should be assessed. Particularly for complex technologies it is needed to compare different operating models, including fully public, fully private or mixed forms of ownership and operation keeping the goals of the services to be provided in mind. Each model may have its own justification but in all cases it will have positive and negative impacts which have to be evaluated against each other.

### 3.4.3. Selection of alternatives

All alternatives are reviewed and evaluated by the decision makers on technological, institutional, economic, social, environmental and financial level. The decision-making process should be based on commonly agreed and previously defined criteria, including e.g. the following (Ali et al 2010, Schluep et al. 2009):

- *Technological:* Quantity and quality of waste, availability of local knowledge and expertise, availability of spare parts and materials etc.
- *Institutional:* Existing roles and responsibilities of organization and management, relationships between organizations, legislation, policies and regulations etc.
- *Economic:* Land, labour and capital requirements, potential for local economic growth, structure of economy etc.
- *Social:* Job creation, skills of workers, training, convenience, benefits etc.
- *Environmental:* Emissions to air, land and water, odor emissions, use of electricity and fuel, use of freshwater, recovery rates etc; Health and safety impacts for workers and communities etc.
- *Financial:* Finance available; method of funding, ability and willingness to pay etc.

The most adequate waste management technologies or a set of adequate technologies for each element of the integrated waste management system are then selected based on the above mentioned criteria.

### 3.4.4. Budget approval

After the waste management technologies are selected, a detailed budget must be prepared and approved by the decision makers and financing must be secured.

### 3.4.5. Development of an implementation schedule

Once the waste management technologies including a detailed budget and the way of financing are defined and approved, organisation structures must be put in place and an implementation schedule must be set.

The organisational structure includes the selection of a project team, the assignment of one or several project leaders and the definition of roles and responsibilities of each team member by means of a visual organigrame. In addition, project communication protocol guidelines should be developed which comprise the setup of communication protocols, the documentation of communication procedures and the determination who will meet and how often during the implementation phase. All necessary forms should be created and all staff should know what they are for and how to use them (Hupston 2009a).

The implementation schedule should provide the following information in a clear, easy to read format:

- Project Phases
- Deliverables associated with each phase
- Major Activities for each deliverable
- Key milestones and deadlines

- Who is responsible for delivery of each major activity
- Interdependencies between project phases

### 3.4.6. Implementation

During the implementation phase, good project management is crucial for the success of a project. Regular controls, checks and balances help keeping the project on track.

Regular meetings should be held, as required by the project communication protocol guidelines. The meetings should be properly minuted and the minutes distributed to all concerned team members.

Other communication and reporting protocols as defined by the project communication protocol guidelines should be implemented. It is vital to follow predefined communication protocols during the implementation phase. If for instance some major activities are delayed, it needs to be addressed as quickly as possible to avoid impacting on the rest of the project (Hupston, 2009b).

### 3.4.7. Monitoring and control

The selection and implementation of waste management technologies should be strongly interlinked with a monitoring and control process. Results of the implementation phase must be monitored and controlled and, if they deviate from the original goals, corrected. The control process may influence all phases of the planning process (see Figure  and Figure ).

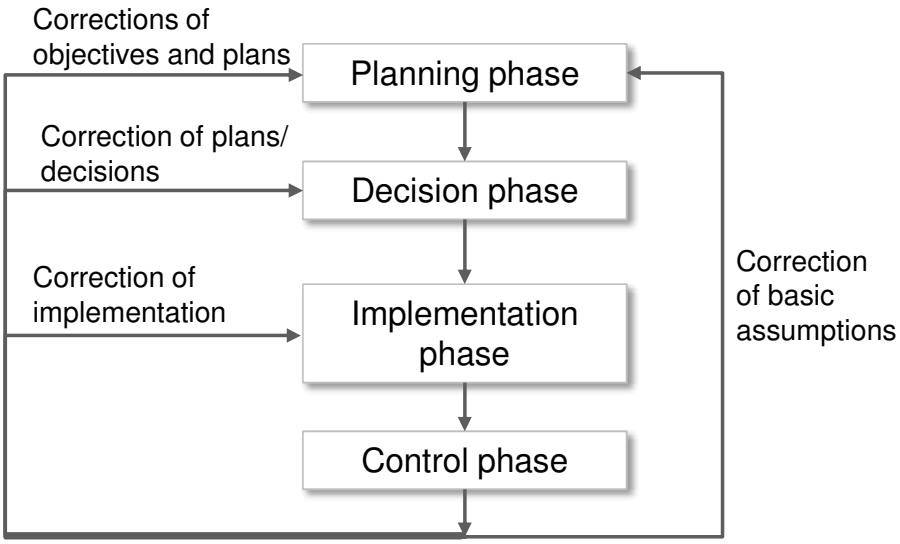


**Figure 5: Generic control process how to control and correct a planning process (Kropfberger date unknown)**

### 3.4.8. Typical problems and possible solutions

Problems and causes for deviations from the intended planning process can happen at each phase of the process and are often not predictable. Therefore it is important that planning, implementation and control are seen as iterative processes that may have to be adapted several times.

Typical problems and the corresponding solutions are listed in the table below.

**Table 1: Typical problems and the corresponding solution**

| Phase of planning process | Typical problem | Possible solution |
|---|---|---|
| *Situation Analysis* | Change of basic conditions or wrong basic assumptions | Integrate different scenarios considering changes in the most relevant basic conditions in the whole planning process |
| | Lack of data on i.e. waste generation, waste characteristics and waste generators | Include local research institutions, adapt existing knowledge from other comparable situations to local conditions |
| *Definition of goals* | Change of project environment | Integrate different scenarios considering changes in the most relevant basic conditions in the whole planning process |
| | Unbalanced goal setting, resistance of interest groups against planned activities | Use multi-stakeholder approach in planning process |
| *Alternative development* | Indirect cost effects are disregarded in the comparison of alternatives | Make cost assessment on technology and system level |
| | Organizational requirements do not match with availability of staff and know-how | Assess training needs and develop tailor-made training plan |
| *Selection of alternatives* | Selection of technology without consideration to its appropriateness in the overall solid waste management system | Clearly define overall concept, include all elements of integrated solid waste management |
| *Budget approval* | Budget exceeds financial capacity of organization | Evaluate access to finance and multinational funds of different models: Public, private or mixed and study cost effective alternatives |
| *Development of an implementation schedule* | High complexity and interdependency of technology set | Develop stepwise implementation schedule with clear milestones considering changes and adjustments in the course of implementation, including alternatives and exit strategies |
| *Implementation* | Lack of communication | Adjust or stick more strictly to communication protocol guidelines |
| | Unexpected incidence | Adjust implementation schedule, adjust goals, if necessary |
| | Lack of technical expertise in the course of the implementation | Assess training needs and develop tailor-made training plan |

| Phase of planning process | Typical problem | Possible solution |
|---|---|---|
| | Lack of commitment of interest group/stakeholder | Use multi-stakeholder approach during whole planning process |
| *Monitoring and Control* | Lax monitoring and control | Define strict monitoring and control processes |
| | Lack of enforcement of corrective measures | Define clear responsibilities and penalties |

## 3.5. Funding and cost recovery mechanisms

Waste management service delivery is capital intensive area which needs a careful planning before on how best service providers can meet the demand and at the same time considering reaping returns on their investment. The first thing a private sector will consider when providing waste management service delivery is the ability and commitment of government to have the financial means to honour its contractual agreements. Any financial provision should take into account recurrent cost such as salaries, spare parts, fuel, tyres, utilities, maintenance, etc.

In general the breakdown of cost of solid waste management in developing countries according to (Veenstra, 2000) is into:

1. Capital cost: 20-30% Sweeping, 30-40% collection, 50-55% Disposal
2. Labour cost: 50-70% Sweeping, 15-40% collection, 10-20% Disposal
3. Consumable and Maintenance cost: 10-20% Sweeping, 20-45% collection, 30-35% Disposal

### 3.5.1. Cost recovery

Full cost recovery as method proposed by many multinational financial organizations is where beneficiaries of waste service provision are made to pay all the cost of providing the service. The cost build-up or analysis of providing waste management services arises from many calculations of different cost components. Some of the cost components worth considering when proposing complete recovery mechanism are the following and could be a combination of these cost components:

a. **Fixed Cost**: This is a cost which will have to be born whether the business is active or not. It is sometimes called the cost to be in business.

b. **Capital Cost**: This is a one-time special variety of fixed cost for purchase of capital equipment of facility.

c. **Depreciation and Amortization**: This is a calculation of expected useful life of equipment or facility and spreading the replacement cost over the useful life, to create a reserve to pay for replacement.

d. **Financial Cost**: This is also referred to as capital cost. It is the basis of analysis of net present value; the value of money today that will not be spent until the next year.

e. **Variable Cost**: This is the cost which is related to the actual work done. If no work is done no variable cost is incurred.

f. **Marginal Cost**: This is the cost of adding one more element to a system. Marginal cost pricing makes it possible to increase profitability by adding more service units without raising price per unit.

g. **Average Cost**: This is the basis of cost analysis. It is the addition of fixed and variable cost in the system and spread it evenly over all the units in the system.

h. **Operating Cost**: This includes both variable and fixed cost. This cost is continuous repetitive cost of doing business.

i. **Indirect and Hidden Cost**: This involves operation using production factor for which no cost is calculated or recognized.

Apart from having the means to finance capital works, the private sector wants assurances that government will meet its regular payment obligation to cover recurrent cost. The private sector usually prefers a direct cost recovery system based on user charges, and also prefer that all of this income goes to a segregated account dedicated to the solid waste sector, since user chargers also provide revenues that can be reliably reserved for the solid waste sector. The private sector is **more willing to invest when there is a source of revenue that is not subject to political whim.**

Direct user charges lead to greater accountability to the customer since collection of fees may be more difficult if there is dissatisfaction with the service.

### 3.5.2. Funding options

There are a number of funding options available to government, private sector and both. This can be surcharges on waste collection bill, tipping fee, user fee, grant programmes, general funds.

- **General Obligation (G.O bonds)**

In order to finance many non revenue producing capital projects, local government have typically issued long term general obligation debt. While such debt could be repaid from project revenues, the bonds are secured by a pledge of the full faith and credit and taxing powers of the government sponsor. If project revenues fail to materialize, the debt service must be covered by tax revenues.

- **Project revenue bonds**

Project revenue bonds are the preferred form of financing when a project is capable of producing revenue sufficient to support the project and entirely repay the bonded debt.

Revenues included not only revenues from sale of materials but also revenues from other pledge funding sources such as tipping fees

- **Industrial Development Bonds (IDBs)**

IDBs are tax –exempt bonds issued by the public agency on behalf of a private party proposing a project with a public benefits, such as economic revitalization or increased employment opportunity.

The first thing that the private sector will investigate in when considering investment in solid waste management is whether government has the financial means to honor its contractual commitments.

- **Other bonds and grants programs**

Here, the government may provide opportunities for communities to finance their own project from government bonds or loan programs. This type of financing has the same characteristics like those discussed above just that this kind of bonds grants the community the opportunity to obtain outside finding source.

When the waste is out of sight, the government is the only possible payer of last resort. The government gets the responsibility because there are legal instrument that force generators to pay the cost of clean-up. Again, the local government may obtain finance to cover capital cost through

- Transfers from central government
- Grants from multilateral and bilateral organizations
- Loans from multilateral and bilateral organization, development banks, communal funds and commercial banks.
- Renewal Funds from user fees or other solid waste tariffs
- Municipal bonds
- Private sector participation.

- **Taxes**

Ideally, it would be efficient and effective to fully cover all solid waste costs through solid waste tariffs included within the property tax, designating on the tax bill, the solid waste portion to be set aside for the solid waste sector. However, in most developing countries, given the inadequate property cadastral and appraisal systems, poor tax collection efficiency, and the large number of illegal settlements, recovering some payment from all residents through property tax is typically not feasible. Although this may be a challenge, but most solid waste companies financed their activities through taxes paid to government.

- **Capital Equity**

The major source of capital funds for a privately owned solid waste facility would be private ***equity capital***. An equity capital financing can be through a private party and the issuance of tax-exempt, private activity bonds, or a total private equity for less intensive facilities. With a combination of private capital equity and private activity bonds, the equity capital contribution must be structured in order for the private party to be recognized by the government and Internal Revenue Services (IRS) as the facility owner, and thus be eligible for the tax benefit associated with ownership.

The major advantage of this is that, the equity capital contributed by the owner will reduce the amount of borrowed capital, which should result in cost savings to the overall project. This means that the equity capital is less costly to rate payers than debt capital.

- **Development Partners/Donors**

First and foremost, they may be willing to pay for capital equipment like trucks or treatment plants. Usually, in most instances they may pay for machines or supplies which are produced in their counties by their own companies.

Again, in most cases when the donor government decided to fund waste management systems, they only pay for identified projects and they pay under certain conditions.

Also, donor governments are sometimes willing to pay for planning for a waste management system or give kinds of consultation.

- **Fund from multinational Agencies**

Multinational Financial agencies provide, grants to support waste management activities such as feasibility study, long term loans and co-funding of projects. The loans either have low percentage interest repayment of flexible terms of payment.

- **Fees**

If there is money in waste management, it is a mostly money that is paid to get rid of the waste. Usually, generators pay for the removal of their waste and this is one of many ways that waste management companies fund their activities.

A fee is what someone actually has to pay for a service. A fee is a special case of price since many things go into a fee other than the cost of the service. It is calculated which includes cost and information, but may also incorporate policy goals or introduce cross- subsidy where certain service which can support higher fees actually raise money to support others which cannot pay their own.

- **Partnerships**

In developing countries, most solid waste management companies either partner with a private institution or the private sector may partner with the government to source for funds.

In most cases, the government may have share in that particular waste management institution and may go a step further to provide other logistics that could be needed for operations by the company. Some of the partnership could be:

*Contracts*

The government may arrange a partnership deal with the private sector where the government pays for the services rendered by the private company. This contract can even be management contract; for instance the government of Ghana pays Zoomlion, a private waste management company to manage a the youth in a sanitation module under the National Youth Employment Programme (NYEP).

*Divestiture*

Government owned enterprises and their related assets are partially or wholly sold to the private sector with the expectation that the basic function of the enterprises would continue.

*Public/Private partnership*

Government establishes a joint venture with the private sector to which each party contributes assets and resources and each party assumes certain risks and responsibility as defined in contractual agreement.

*Franchise*

Government may grants a private firm an exclusive monopoly to provide a specific type of solid waste within a specific zone. The firm collects its own revenues from generators within the zone or from the sale of solid waste by – products.

*Concession*

Government may grant a private sector to utilize a resource to for profit making purpose. Government may pay for part of the serves provided whiles the remaining becomes revenue to the private entity for cost defray. Example construction of a long-term facility to sort, treat, transfer and dispose waste. Government may pay service fee such as tipping the private company whiles the sale of products from the facility solely goes to the private company.

- **Subsidies**

Subsidies are a sum of money granted by the government or a public body to assist an industry or business so that the price of a commodity or service may remain low or competitive. Here the government may subsidize the cost/taxes on importation of logistics and equipment. Municipalities may offer private sector investors a range of financial incentives that could be viewed as hidden subsidies. These include:

- debt serving
- customs duties insurance
- vehicle registration
- social benefits
- Administrative overheads
- use of government land and/or facilities,
- tax exemption,
- customs duties exemption,
- accelerated depreciation periods for taxation,
- staffing support from government roles,
- facility in obtaining permits,
- improved regulatory enforcement to assure compliance with new systems,
- assured source segregation to obtain quality wastes for resource recovery purposes,
- revenue sharing of by-product sales revenues,
- special utility pricing,
- limited liability (as in the long-term post-closure liability of sanitary landfills)
- development rights to completed and/or reclaimed disposal sites, in partnership with government.
- Utilities charge

### 3.5.3. Novel finding mechanisms

- **Clean Development Mechanism**

Clean Development Mechanism (CDM) could be developed and calculated on a project to win carbon credit for protection of the environment under the Kyoto protocol. Focus on methane capturing from landfill or a recycling facility. This is a very bureaucratic mechanism but provides a steady income.

- **Cost Recovery Principles**

*Polluter Pays Principle*

The polluter has the responsibility to cater for all the cost of the waste generated.

*Extending producer responsibility*

Aims to transfer financial burden of end of the life products from municipality to the producer

## 3.6. Human Resource management and Contract

### 3.6.1. Human Resource Management

There are three essential phases:

- **The organisational analysis**

The organisational analysis allows us to assess the strategic capacity of the institution, on the one hand, to take advantage of opportunities and on the other, to overcome constraints in meeting its mission, which is to turn the authority's Vision and strategic plan into reality.

- Presentation of the institution

- Analysis of the strategic capacity of the institution
  - Identification and assessment of resources
  - Identification and assessment of available skills

From the analysis of the strategic capacity of the institution, we should also determine its strengths and weaknesses.

- **Reorganising the Management Structure**

In the light of guidelines set out by the strategic plan and the strengths and weaknesses of the institution, improvements will be suggested in relation to:

- The staff structure
- The staff and levels of qualification of the Human Resources
- Coordination mechanisms
- Management style.

- **Human Resource Management**

Human resource management consists of enabling the institution to have the required qualifications and skills needed, available when needed, to produce goods and services. From this point of view, its role is primarily to acquire and integrate the necessary staff, and then work to render the staff as efficient as possible with respect to the objective that is being worked towards and create a sense of loyalty, as defined in the following definition:

**HRM = HR Acquisition + HR Development + HR Stimulation**

- HR Acquisition
    a. Defining posts
    b. Recruitment and selection
- HR Stimulation and motivation in terms of remuneration and working conditions
- HR Development
    c. Evaluation: it allows us to understand each persons achievements
    d. Operation: the results of the evaluation will be used for career management and to identify training plans.

### 3.6.2. Monitoring System

This monitoring activity can be conducted daily, weekly, monthly or annually. It can be assessed against the objectives, standards or events relating to the context. In any case, the monitoring should not be carried out just to observe, but to also help in making decisions.

Various documents can be used to allow effective monitoring:

- A personal monitoring checklist
- Activity implementation reports for internal monitoring
- Activity reports for external monitoring

Healthy management does not exist unless the reviewing body has all information pertaining to the implementation of the strategic plan and related activities.

Therefore, the effectiveness of the monitoring system is based on:

- The establishment of an information system that allows traceability of all data,
- The establishment of a stratified monitoring team.

### 3.6.3. Process for awarding contracts

A contract is an agreement between two parties. Its object is to record the terms agreed and the responsibilities of each party (e.g. the scope of work, expectations, deliverables and payment).

Contracts are meant to be fair and to protect both parties. However, they may be one sided or vague, and hence open to abuse. A contract is a record which serves as a terms of reference. As it is legally binding, it must be carefully thought out, written and worded.

The Institution may assign all or part of its work to the private sector through contracts:

- Public Contracts
- Service delegation (lease, concession)
- Partnership Contracts (mixed management)

The process for awarding contracts is governed by the Public Procurement Code that defines the procedures for awarding contracts. In general, several steps are set out as follows:

- Tender preparation
    a. Identification of needs and funding
        i. determination of the needs to be met
        ii. definition of the supplies, services and works
        iii. contract funding - availability of credit and prior authorisations
    b. Identification of constitutive documents and content of bidding documents

- Procurement
    a. Preparation of tender documents
    b. Choice of procedure type:
        i. through tenders
            - open tender
            - tender with pre-qualification
            - open tender in two stages
            - restricted tender
        ii. through a direct agreement
        iii. through specific procedures
            - procedure for requesting information and price
            - specific provisions for intellectual service provision contracts
            - specific provisions for contracts for involvement in public service provision

    c. Process steps
        i. Notice
        ii. Advertising
        iii. Offer Preparation
        iv. Receipt of tenders
        v. Evaluation of tenders

    d. Completion of the procurement procedure
        i. Decide who to attribute the contract to
        ii. Signature, approval, notification and publication of the final attribution
        iii. Publish the attribution and inform candidates.

## 3.7. Capacity building

National and local authorities in the target countries are increasingly facing problems with the management of municipal and industrial SW due to rapid population increase, rural-urban migration, industrialization, poor planning, and economic growth. Data from the World Bank shows that less than 50 % of urban population have their solid waste collected in developing countries. While efforts are being made to implement ISWM within the target countries, there are still numerous gaps – technological, policy, institutional, financial, legal, and socio-cultural – that must be addressed in a sustainable manner.

In order to address the complexity of obstacles hindering ISWM systems in the target countries, there is the need to develop an action plan that recognises all aspects of capacity building. The lack of capacity in the target countries to undertake activities leading to the development of ISWM plan is a major problem. Highly experienced and motivated human resources are major requirements in the planning and implementation of ISWM systems. Every aspect of ISWM – development of well-defined policy, regulatory and institutional frameworks, setting up of standards – requires qualified human resources in all relevant institutions from waste generation to waste utilization and disposal. Roles and responsibilities of stakeholder institutions must be clearly defined.

Adequate training of personnel involved in SWM will lead to effective management of SW by:

- providing conceptual understanding of issues with regards to ISWM through awareness creation and information dissemination;
- building capacity on the entire chain of ISWM, including but not limited to: collection, quantification and sorting of SW from households, municipalities and industry; SWM system assessment and evaluation currently practised in the target countries; identification of challenges and bottlenecks; identification and adoption of technologies, policy and legal instruments, and standards for ISWM; and development of ISWM plans, methodologies and implementation strategies for rural and urban communities;
- building capacity in research methodologies that engender sustainable solutions to challenges facing implementation of ISWM in the target countries;
- building capacity in the use of ICT for data gathering, planning, and management of SW;
- equipping individuals with the understanding, skills and access to information, knowledge and training that enables them to perform effectively;
- making legal and regulatory changes to enable organizations, institutions and agencies at all levels and in all sectors to become more proficient; and
- information sharing from ISWM demonstration projects and from countries where international best approaches in ISWM are practised

To develop ISWM systems in the target countries, the following guidelines for developing qualified human workforce in every aspect of SWM are required:

- training of central and local authorities, and waste management companies in the development of an ISWM strategic plan that takes into consideration socio-cultural situations within the target countries. A strategic plan, which integrates functions of all stakeholders, will encourage simultaneous consideration of socio-cultural, technological, environmental, and economic factors that are all vital in implementing ISWM. Moreover, an

ISWM plan should highlight priorities based on the situation in the target countries, and the use of SWOT analysis would assist authorities to set realistic priorities. The main objective may be to increase waste collection, increase recycling, reduce waste generation, or increase cost efficiency. In order to realize the objectives, targets must be set and approaches for meeting the targets should be clearly outlined;

- training of authorities in the identification of stakeholders in the management of SW. Stakeholders fall in the following main groups: waste generators, waste regulators and law enforcement bodies, central and local authorities, traditional authorities, research institutions, NGOs and CBOs, waste scavengers, collectors and transporters, waste disposers, waste recycling and treatment companies, informal sector, and other service providers;
- training of central authorities in defining clear-cut roles to be played by all relevant stakeholders within the SWM chain. This avoids duplication of duties and thus avoid negligence of stakeholders in the performance of their respective mandates;
- training in the development of standard schemes for long-term evaluation of ISWM systems practised in the target countries;
- training of authorities is required to addressing evolving processes with respect to laws, institutions, financial mechanisms, technology and infrastructure, and stakeholder involvement. Developing capacity in conducting situational analysis, monitoring and evaluation strategies will lead to identification of gaps and hindrances in the implementation of ISWM;
- special training and refresher courses should be developed for staff and administrative personnel of local authorities. With the support of institutions such as universities and research institutes, specialized short and medium term courses should be designed to meet the needs of different levels of staff including sanitation workers and supervisory staff of local authorities, and waste collection and disposal companies;
- special courses on every aspect of ISWM should be developed by higher educational institutions working in the field of environmental management in corporation with national and local authorities and the private sector;
- training of waste companies involved in waste collection, transportation, disposal, storage, recycling, reuse, and treatment, as well as central and local authorities in data collection and management. Data should include:
  - waste generation and collection: quantities and categories of waste fractions including organic materials, plastics, electric and electronic waste equipment, paper, glass, metallic scraps, hazardous waste, among others;
  - quantity of waste that are recycled, reused, disposed in landfills, dumped in poorly engineered and unapproved sites, incinerated, used in other activities such as composting, energy generation, etc.;
  - options for waste transportation to centres where waste is used, temporally stored, or permanently disposed;
  - predictions on current trends in SW generation and composition;
- training is needed in standard procedures for conducting surveys, administering questionnaire, data collection and analysis and interpretation of data;
- training is needed to clearly define waste streams such as waste emanating from households, industry, commercial sources, laboratories, health institutions, and construction. Also waste generated would have to be categorized into hazardous and non-hazardous waste. Moreover, a waste stream may have to be sub-categorized; for example, plastic waste may be classified into thermoplastics and thermosetts;

- local authorities need training to cluster industries within their areas of jurisdiction based an internationally accepted method of classifying industries with regards to the type of waste generated;
- training of local authorities is needed to identify, manage, and control hazardous waste generated by different sectors such as industries, health institutions, laboratories, construction companies, and in agriculture;
- ANational bodies and or district authorities should be trained to manage data on demographics, study and respond appropriately to changing socio-economic and behavioural lifestyles, and to predict population growth and migration within different parts of communities;
- training of central and local authorities, and personnel from relevant institutions such as NGOs, CBOs, universities and other higher educational institutions, in the development of supportive SWM policy and legal frameworks that addresses identified bottlenecks;
- training of central and local authorities, and companies involved in SWM in appropriate financial instruments and mechanisms, how to raise additional funds to finance SWM and be able to determine the initial and long term cost associated with the implementing ISWM systems;
- training of central and local authorities, and relevant stakeholders, in enforcement of waste bye-laws;
- training of personal from all stakeholders in the use of environmentally sound technologies such as composting, waste-to-energy, etc. , and on appropriate disposal of different waste streams;
- training of authorities in good record keeping;
- training of local authorities to effectively communicate with all stakeholders including the informal sector in the target countries.
- Training of technical experts in selecting the most appropriate technology for a particular geographical area. These include; waste collection equipment, disposal sites, recycling and resource recovery systems.

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