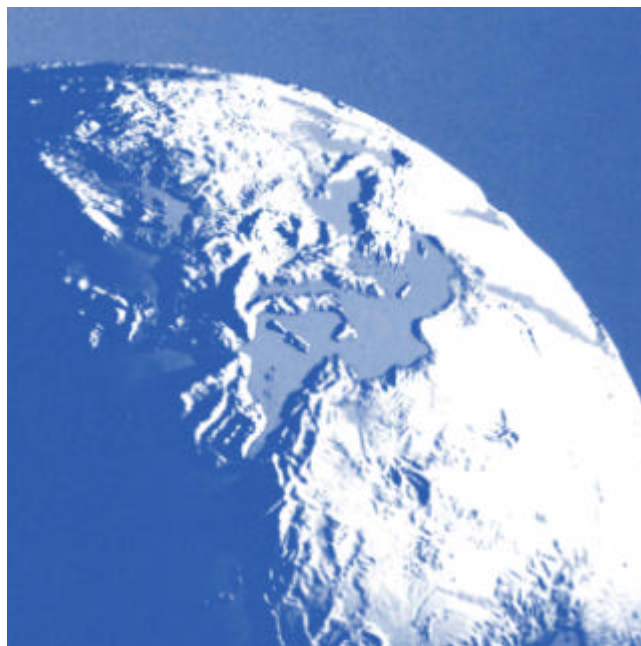




POLICY AND INSTITUTIONAL ASSESSMENT OF SOLID WASTE MANAGEMENT IN FIVE COUNTRIES

Cyprus, Egypt, Lebanon, Syria, Tunisia



Cedare



**Blue Plan
Regional Activity
Centre**

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Regional Study on

**Policies and Institutional Assessment of Solid Waste
Management in Egypt**

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**The Study was coordinated by CEDARE and revised by The Dutch NGO, WASTE-
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Introduction

Proper waste collection and sanitary waste disposal have become very important issues for city management and represent a substantial work for municipalities. At the same time waste generation rates and composition are changing with changes in population as well as composition patterns. Leading to the fact that creating a proper waste management system or improving the existing one needs extensive field studies with multi-disciplinary approach (socio-economic and technical approaches).

In Egypt, the problem of solid waste management (SWM) has been aggravating everywhere. Its negative manifestations as well as its direct and indirect harmful, even serious, consequences on public health, environment and national economy (particularly as related to manpower and tourism) are becoming quite apparent and acute. Recently, the problem has taken a newly favorable dimension with the rising public awareness and State attention within the general progressive national movement. In effect, the problem has been given high priority that culminated political commitment at the highest levels of the government. A decisive confrontation towards a complete eradication of this pervasive problem, based on a well founded scientifically planned approach, serious involvement of all stakeholders and allocation of the needed resources, financial and otherwise is required.

SWM is a major responsibility of local governments. It is a complex task, which depends as much upon the organization and co-operation between numerous public and private sector actors, as much as, upon appropriate technical solutions. SWM is also considered an important entry point for integrated urban management support.

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

Management is a cyclic, goal-oriented process of setting objectives, establishing long- term plans, programming, budgeting, implementing operations and maintenance, monitoring and evaluating, cost controlling, revising of objectives and plans, and so forth. Management of urban infrastructure services is a basic responsibility of the municipal government. It is usually advantageous to execute service provision tasks in partnership with the private enterprises (privatization) and/or with the users of services (participation), but the final responsibility remains that of the government.

SWM encompasses the functions of collection, transfer, treatment, recycling, resource recovery and disposal of municipal solid waste. Its first goal is to protect the health of the population, particularly that of low- income groups. Other goals include promotion of environmental quality and sustainability, support of economic productivity and employment generation. Achievement of SWM goals requires sustainable SWM systems, which are adapted to and carried by the municipality and its local communities.

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

- households, community- based organizations (CBOs) and other service users,

- local and national government authorities,
- non- governmental organizations (NGOs),
- formal and informal private sector enterprises, and
- external support agencies (ESAs).

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

Political aspects concern the formulation of goals and priorities, determination of roles and jurisdiction, and the legal and regulatory framework. Institutional aspects concern the distribution of functions and responsibilities and correspond to organizational structures, procedures, methods, institutional capacities and private sector involvement. Social aspects of SWM include the patterns of waste generation and handling of households and other users, community- based waste management and the social conditions of workers. Financial aspects of SWM concern budgeting and cost accounting, capital investment, cost recovery and cost reduction. Economic aspects of SWM are connected with the impact of services on economic activities, cost- effectiveness of SWM systems, macro- economic dimensions of resource use and conservation, and income generation. Technical aspects of SWM are connected with the planning and implementation and maintenance of collection and transfer systems, waste recovery, final disposal and hazardous waste management.

This study aims at assessing the policy and institutional frameworks for solid waste management in Egypt. Appropriate strategies and solutions for improvement shall be identified, based on the country's needs and the broader political and social changes going on in Egypt.

1. Basic Background Information

1.1 Physical geographical conditions:

Egypt forms the Northeast corner of Africa and spreads over into Asia, and embraces a total area of almost on million Km². The natural divisions of Egypt are: Upper Egypt, the Delta, the Canal cities, the Mediterranean coast, the Western and Eastern Deserts, the Sinai, and the Red Sea coast. The inhabited part of Egypt is the 1,000 km valley from Aswan to Alexandria, flanked by desert.

Egypt has a hot and dry weather in summer and a warm winter with little rain. The average temperatures in Egypt rang: between 18 to 35 degree centigrade in summer and, between 7 – 28 degree centigrade in winter. The average rainfall is about 50 mm/year. Egypt is not a windy country, wind speed ranges between 6 to 20 meter /second, and humidity is between 40 to 70 % depending on the location (i.e. close to or far from the coastal areas).

1.2 Demographic development:

Egypt has an estimated population of about 65 million, and is projected to reach about 80 million in 2017. The average annual rate of population growth was 2.5% between 1980 – 1990 and has slowed down to 2.2% since 1993 and is projected to be about 1.3% in 2017. The population doubling time has, therefore, been about 27 years. Life expectancy, at birth, increased from 46 years in 1960 to 66 years in 1996. The total fertility rate was 3.7 in 1996, and in the same year about 35% of the population were under 15 years of age, and 49% of the total population were women. The under 5 years' mortality rate dropped from 258/1000 live births in 1960 to 51 in 1995. The illiteracy rate is still high in Egypt, about 39% in 1996. It should be noted, however, that these national averages conceal wide differences between Governorates, and between urban and rural areas within the Governorates.

About 98% of the population of Egypt live in 21 Governorates in the narrow Nile Valley, the Delta and the adjoining territories, which have together an area of only 4% of the total area of the country. In contrast, the remaining 2% of the population live in the five desert (frontier) Governorates that occupy 96% of the total area. The population density is about 1400 persons/ Km² of the inhabited land. In Cairo Governorate the population density reaches an outstanding 31,000 persons/ Km², in Alexandria Governorate it is 10,452 and in Port Said Governorate, 6,819 persons/ Km². In Lower Egypt Governorates, the population density is higher in urban than in rural areas (1,141 and 785 persons/ Km², respectively). The difference in population density between urban and rural areas is most striking in the Upper Egypt Governorates (19,382 persons/ Km² in urban areas and only 1,141 in rural areas).

1.3 Economic conditions:

The Egyptian labour force numbered about 18 million in 1996. From those employed, about 32% were in agriculture, 22% in industry and 46% worked in the service sector. Female participation in the work force was about 22%. Egypt's economy is estimated to have grown by 4.9% in 1998, up from 3.9% in 1994. The structural adjustment and economic reform undertaken since 1991 are beginning to yield some of the anticipated results. The reform program aims to transform a centrally planned economy with a relatively small private sector to a decentralized, market-based, and outward-oriented economy in which the private sector plays the leading role in the country's economic development and growth.

The most important industries are textiles, food processing and building materials. New industries have appeared in the last two to three decades, including; chemical industry, pharmaceuticals, leather production, soap, fertilizers and plastics.

Egypt's GDP in 1995 was US\$ 56 billion, of which 17% came from agriculture, 19% from industry, 8% from the petroleum sector and 56% from services. The per capita income in that year was \$790, ranking Egypt as a middle-income country according to the World Bank's classification. Households living below the poverty line increased from 29% in 1981 to 35% in 1990 and to about 40% in 1995. On average, the largest concentration of poor households is in Upper Egypt (45% of the total poor). Ismailia Governorate has the lowest poverty rate (8%), followed by Port Said and Damietta (21% and 22%, respectively).

1.4 Socio-cultural setting:

Egypt enjoys having different cultural areas:

1. It has the civilians, those who live in urban areas and big cities (the second and third generations). They are more cultured, less conservative and educated.
2. Rural residents, especially those who live in Delta (Lower Egypt). They are more conservative, less cultured and less educated.
3. Upper Egyptians who live northern Giza. They are the most conservative, least in culture and education.
4. Bedouins who live in the desert. They are very little in numbers and share with the other similar tribes, the same traditions and customs. The Bedouins live in three main areas in Egypt: The West Desert, the East Desert, and Sinai. The Bedouins can move to other neighbouring countries across joint borders (e.g. Sudan, Libya).
5. There are the Nubians who live between Egypt and Sudan and they are different from the Bedouins. They have had a long history with Egyptians since about 4000 years ago. They have their own language, which is not performed in writing.
6. And last, there are those who live on the coastal areas such as the Suez Canal and Alexandria. As they are in strong contact with the foreigners, those who come through the incoming ships and as tourists, their cultural understanding, and economic activities are different than those who live in the other parts of Egypt.

Egypt has majority of Muslims (over 80%) and considerable weight of Christians (about 20%). Very few Jews are still living in Egypt now.

1.5 Political structure:

Egypt has three main authorities: the Legislative, the Juridical and the Executive, which are headed by the President (who is now Mr. Mubarak). The chairman of the legislative authority is the head of the parliament. Laws are proposed by the Cabinet of Ministers or the President and get the approval of the Parliament and the Senate Council before they are signed finally by the President to be in action.

The President appoints the Prime Minister and chairs the Executive authority. The Prime Minister appoints the members of his cabinet. The National Council heads the juridical authority. The number of the Parliament members is 444 and they are elected every 5 years on a geographical base. There are local popular councils at the village, city and governorate levels. The Governors in Egypt report administratively to the Ministry of Local Administration and politically to the Prime Minister. There are 26 governorates in Egypt and one special city (Luxor). The three authorities are independent. The Egyptian person becomes qualified for voting when he/she is 18 years old, and qualifies for election when he/she is above 35 years old.

There is considerable concern about the state of Egypt's environment, a concern that is justifiable since environmental degradation is not only well advanced already, but also is getting progressively worse as the country's population, urbanization and industrialization increase, and as its economy develops generally. This concern has led to a growing recognition that economic development and the health and well-being of the country's population are closely linked with improved environmental management and protection.

2. Regulatory and Policy Environment

2.1 Laws and Regulations for Solid Waste Management

The legal and regulatory framework for solid waste management is elaborated in the form of by-laws, ordinances and regulations concerning SWM, which includes corresponding inspection and enforcement responsibilities and procedures at national and local levels. Besides regulations, economic incentives and non-economic motivations are important instruments of SWM.

The main legislation relating to SWM is Law 38 for 1967 as amended by Law 31 for 1976. The law regulates the collection and disposal of solid waste from residential areas, commercial and industrial establishments, and public places. It imposes a cleanliness tax on all housing units equivalent to 2% of the rental value. Article 6 of the Law # 38 for 1967, requires that the local council issue a license for all workers employed as waste collectors. Law # 31 for 1976 defines "garbage and solid wastes" as including domestic and industrial waste. It also specifies garbage containers, means of transportation, and the periodicity of solid waste collection.

Ministry of Housing Decree # 134 for 1968 implements Law # 38 for 1967. It declares specifications and locations of dumping places, and methods of treatment (e.g. dumping, composting and incineration).

Other relevant laws are:

- Law # 106 for 1976 regarding the organization of construction works and construction /demolition waste.
- Law # 66 for 1977 regarding traffic and auto motives deals with transporting litter and similar materials.

- Law # 3 for 1982 regarding urban planning and the importance of having enough space for public services and utilities through environmental consultants.
- Law # 43 for 1979 regarding the local governing body which deals with the responsibilities of the local officials in public services and their authorities in levying dividends and gate fees.
- Law # 137 for 1981 deals with occupational safety. It only has peripheral relevance here, but includes Article 117 which requires that an employer should inform his workers of the hazards associated with his non-compliance with safety measures and that personal safety equipment, together with training on its use, should be provided to the worker.

Presidential Decree # 284 for 1983 established the Cairo and Giza Beautification and Cleansing Authorities. The mandates of these authorities include the collection of garbage and solid wastes and their disposal in special areas.

By 1990, the Cairo and Giza Governorates have forbidden waste transportation by the use of donkey carts and formalized the subcontracting of door-to-door waste collection. As a result, many *zabbaleen*, (traditional, informal private small-scale waste collection and recycling enterprises) formed co-operatives to be able to buy pick-up trucks to continue their waste collection services.

Law # 4 for 1994 (the Environmental Protection Law) has influenced solid waste management. The Prime Ministerial Decree # 338 for 1995 promulgates the Executive Regulations of Law # 4, and the Executive Regulations cover many areas of environmental protection.

Law # 4 for 1994 requires environmental impact assessments of new developments, including industrial projects. It established the Environmental Protection Fund to fund various relevant environmental projects. The Fund is supported financially by the government, donors, and the proceeds from fines paid by those contravening environmental regulations. It also advocates setting up a system of incentives to be offered to organizations, individuals, and others, to carry out projects for environmental protection; and covers the protection from pollution of the land, water and air environments.

In terms of SWM, the most specific stipulations of Law # 4 for 1994, deal with the handling and circulation of hazardous materials, including wastes, and the prohibition of the installation of facilities for treating hazardous waste without a license. The location and conditions of any such license to be determined by the Ministry of Housing after consultation with the Ministries of Health and Industry and the Egyptian Environmental Affairs Agency EEAA.

In particular, the law stipulates the following:

- Article 29. Forbids the handling of hazardous substances and wastes, without a license from the competent administrative authority.
- Article 30. Management of hazardous wastes shall be subject to the procedures and regulations stated in the Executive Regulations of this Law. The Executive Regulations shall designate the competent authority, which, after consulting EEAA, will issue the tables of dangerous wastes to which the provisions of this Law shall apply.
- Article 31. It is forbidden to construct any establishment for treating dangerous wastes without a permit from the competent administrative authority and before consulting EEAA. Disposal of dangerous wastes shall be according to the norms and conditions that will be stated in the Executive Regulations of this Law. The Minister of Housing, Utilities and New Communities shall assign, after consulting with the Ministries of Health, Industry and EEAA, the disposal sites and the required conditions to authorize the disposal of dangerous wastes.

- Article 32. It is forbidden to import dangerous waste or to allow its entrance into or passage through Egyptian territories. It is forbidden without a permit from the competent authority to allow the passage of ships carrying hazardous wastes through territorial seas or the exclusive economic zone of the Arab Republic of Egypt ARE.
 - Article 33. Makes it mandatory for all those who produce or handle dangerous materials, either in gas, liquid or solid form, to take precautions to ensure that no environmental damage shall occur. The owner of an establishment whose activities may result in hazardous wastes shall, according to the provisions of this Law, maintain a register of these wastes and the method of disposing thereof, as well as contracting concerned agencies for receipt of these wastes. The Executive Regulations shall state the data to be recorded in that register and EEAA shall be responsible for following up the register to ensure its conformity with the truth.
 - Article 37. Prohibits the burning, disposal or treatment of solid waste except in designated areas far away from housing or industrial or agricultural areas as well as from waterways. Article 38 of the Executive Regulations of the Law permits the incineration of infectious waste generated from medical care in hospitals and health centres, with certain provisions.
 - Certain Articles of the Prime Minister's Decree # 338 for 1995 promulgating the Executive Regulations or the Law for the Environment are also of particular reference.
 - Article 39. States that collectors of garbage and solid waste shall maintain their garbage bins and vehicles in a clean state. Garbage bins shall be covered tightly so that no offensive odours shall emit, and also to avoid becoming a source for attracting and growing flies and other similar insects, or a focus for attracting stray animals. The garbage contents shall be collected and transported at suitable intervals according to the conditions of each area. The quantity of garbage shall not exceed the capacity of any of these bins at any time.
- At present, there are no landfill regulations or standards that provide a basis for compliance and monitoring, but national guidelines for these standards are being prepared by the EEAA.

2.2 Plans and Strategies for Solid Waste Management:

2.2.1 National Policies regarding Solid Waste Management:

The present economic policies of the Egyptian government have a rather more capitalist economic approach than socialist economic approach. The Prime Minister, Dr. Atef Ebeid, has announced many times that the government would no longer keep any economic business for its own, but it would privatize it. The role of the government then would be the planning, and arranging for the enabling environment for businessmen to work safely.

The goal of the Minister of the Environment is 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 policies, legislation, funding, institutions, human resources, technological infrastructure and supportive awareness.

The key policy directives, being committed by the Government of Egypt, are:

- The central government will assume the supportive “enabling” role, whereas local government agencies will be assigned the full operational responsibilities,
- Public cleansing services and SWM will be gradually delegated to the private sector. The role of governmental agencies will then be focused on the planning, follow-up and control functions within a set of clearly cut licensing and contracting conditions in accordance to

the prevailing legislative and regulatory framework, as well as a well grounded “public-private partnership” approach,

- The “polluter pays principle” shall prevail. Procedures will be fully responsible for their products throughout their whole life cycle, particularly with regards to packaging materials. Full cost recovery will be pursued as a necessary tool for improving service, enhancing private sector participation, and safeguarding sustainability,
- The concept of attaching an economic value to wastes, as being recoverable resources, will be fully stressed as a necessary means for reducing their disposal costs and negative environmental effects. Such policy will require adherence to the plausible “reduce, reuse, recycle, and recover” type of hierarchy,
- Complete involvement of public organs and the served community at large to ensure proper execution.

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 policies.

The following is a draft proposed framework of the National Strategy of Management for Municipal Solid waste, issued in September 1999:

The Government of Egypt identifies solid Waste Management as one of the most important environmental issues. It is related to the social, economic and technical factors, which affect the quantity of waste generated and its management. However, due to many financial, managerial, technical and institutional reasons, this system has been unable to adequately address the problem of solid waste management and thus contributed to different environmental problems. The appropriate strategy to face this problem must take into consideration and make use of comprehensive planning which is based on principles with clearly defined objectives to treat and dispose of the daily-generated waste together with the existing accumulated waste in urban and rural areas.

The following is the outline of the proposed strategy for the proper management of solid waste. Different strategic and technical options are presented and the Governorates have to choose the appropriate scenario sensitive to each local setting and then develop an action plan.

The main principles in developing this strategy are related to regional orientation, flexibility and sustainability as follows:

Main principles:

1. Decentralization in planning and implementation (regionally oriented)
2. Sustainability (effective financial and organizational structure)
3. Comprehensive system to deal with the existing accumulations and the daily generated waste
4. Making use of the existing local experience and the previous efforts and available resources
5. Increasing the level of awareness
6. Improving and developing the local composting plants
7. Application of sanitary landfills in the regions where appropriate sites are available
8. Improving workers' situation.

General objective:

The general overall objective is to develop a national strategy for municipal solid waste management. This should enable local Governorates to provide and implement an effective suitable

management system of solid waste management in urban and rural areas of Egypt, to protect the environment from pollution and hence, raise the level of public health.

Specific Objectives:

Each Governorate has to undergo a number of specific objectives to reach the overall objective. These are:

1. Coverage with a comprehensive system within a defined time schedule.
2. Solving the problem of existing accumulated wastes and rehabilitation of the dumpsites.
3. Gradual development of recycling activities of the different constituents, using environmentally safe methods.
4. Gradual development of sorting at source and waste minimization.
5. Gradual development of the utilization of environmentally friendly materials in different applications, including packaging materials.

Strategic Options:

Each Governorate has to define its strategies regarding the different related issues, such as:

1. Financing SWM system (governmental, private, customer-service fees, and others)
2. Contribution and participation of private sector in operation and maintenance
3. Scope of the system (covers an administrative zone, urban and rural neighbourhoods and other areas)
4. Participation of NGOs (in public awareness, recycling and some other related services)
5. Organizational set-up (establishing an agency, a regulatory set-up within the Governorate, others)
6. Technical specifications (on the national or local level)
7. Action towards those who do not comply with regulations: (Legal action (penalties), Incentives, Raising awareness).

Some technical options related to:

1. Disposal of the existing accumulations (transfer partially or totally to dumpsites which can be later transferred into parks or gardens)
2. Waste collection (door to door, outside containers)
3. Waste storage (intermediate storage with or without sorting, compaction)
4. Waste treatment (composting, digestion, incineration)
5. Final disposal (sanitary landfill, regulated dumping)
6. Protection of water streams (covering dumping, use of special containers)
7. Rural areas (sorting at homes, reception stations, recycling activities)
8. Awareness (use of mass media at schools and clubs).

Preparation of Action Plans at Governorate level:

Based on the strategic options, each Governorate has to develop its own action plan that includes objectives related to:

1. Coverage level of collection and transfer of the daily generated waste in urban and rural areas
2. Coverage level of treatment (urban and rural)
3. Coverage level of final disposal (urban and rural)
4. Minimization of the amount of waste to be treated and disposed of
5. Increasing rates of re-use and recycling
6. Institutional set-up
7. Participation of private sector
8. Participation of NGOs
9. Removal of the existing accumulations

The National Solid Waste Management strategy has been drafted many times since 1992, till now. Every time there is a change in the management of the Ministry of State for the Environmental

Affairs or EEAA, a proposal for a new SWM Strategy is drafted. This duplication of time, efforts and money costs Egypt a lot of funds in order to do the same thing again. For the time being, there are a number of persons representing more than one institution working on different new drafts. For example, Dr. Mokhtar M. El Halwagy, who is a former under secretary for the Ministry of Science and Technology, and a current freelance consultant, is drafting the strategy for EEAA with sponsorship of USAID. While Dr. Ahmed Hamza – the senior consultant to the Minister of State for the Environmental Affairs is doing the same job with sponsorship of UNDP. This interference causes a lot of administrative problems and degrades the creditability of both EEAA and the Ministry of the Environment. The real problem with that, is there is no dead time where we can say that the strategy design would be finished, and definitely, there is no time frame under which we can say when this strategy would be implemented, how, and who would be in charge of its implementation.

2.2.2 National Programmes and Projects:

In the 1990s the Government of Egypt had clearly opted for a policy of waste recovery, focusing mainly on composting. Compost is considered an attractive product because of its possible use as a soil conditioner for desert reclamation schemes. The national policy comprises the construction of two windrow composting plants in each Governorate of Egypt, preferably by using locally manufactured equipment.

Most recently, in 1999, the Government of Egypt has developed and partly implemented a plan to fully privatize solid waste management including waste collection, composting and disposal in nine Governorates. For the time being only Alexandria is working on this privatization project. The tender document has been made, the tender has been publicized, and the bidders have submitted their bids, which are now under evaluation. After that, the other Governorates will follow.

It is expected that the informal private collectors and recyclers will be important parts of any new system where no single company would be able to do the whole job by itself. At the same time, the informal private waste collectors are rather familiar with waste collection techniques than the other sectors, so as the informal waste recyclers, who may represent the instant market for the sorted recyclable materials.

A national management and information system for hazardous materials and wastes is currently under development within the auspices of the EEAA in collaboration with all stakeholders and involved government authorities. Parallel endeavours are also being undertaken by EEAA jointly with the Ministry of Health to cope with the alarming situation of medical wastes. Various management schemes and technology options are being assessed.

As for industrial hazardous waste, two systems for Greater Cairo (including Cairo, Giza, and Qaliobia) and Alexandria are being planned for implementation. Parallel efforts are being made in new industrial cities, particularly from the standpoint of establishing proper secure landfills for final disposal.

2.2.3 Projects Funded by International Donors:

There are a number of projects in the field of solid waste management that are funded by foreign donor agencies. One of these is a project called “Action Plan for Site Location and Development for the Design, Operation and Environmental Impact Assessment of Solid Waste Sanitary Landfills in Egypt Governorates”. This project is through the LIFE-Third Countries Program (Local Initiative Fund for Environment), which is sponsored by the European Community. This project is executed by EEAA and a Greek company (EPEM Ltd.), depending mainly on the use of Geographic Information Systems (GIS), where layer of geological, hydrological and land-use maps are put together in order to find the areas that are most suitable for sanitary landfills. The selected areas are

then subject to some other exclusionary factors, such as; closeness to main utilities, cultural, and security landmarks.

There is another project that is managed by EEAA in co-operation and sponsorship of the British Government. This project Called “Support for environmental Assessment and Management (SEAM). SEAM is a multi – disciplinary environmental project being implemented by EEAA through TCOE, Entec UK Ltd. and ERM, two UK engineering consultancies. The first phase of SEAM project (until 1999) focused on regional environmental management with the preparation of Governorate Environmental Action Plans (GEAPs) for the Governorates of Dakahlia in Lower Egypt and Sohag in Upper Egypt. The process involved extensive community participation, which proved invaluable in raising awareness and incorporating people’s views in a forward plan of action. Support has been provided to local communities taking environmental actions that address the priority issues of the GEAP. A total of 14 projects have been undertaken in different areas. The project is extending its services now to two other Governorates: the Governorate of Damietta in Lower Egypt and the Governorate of Qena in Upper Egypt.

3. Institutional and Financial Frameworks

3.1 Stakeholders Involved in Solid Waste Management:

Solid waste management is a complex task, which depends as much upon organization and co-operation 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.

- **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 Organizations (NGOs)** 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.
- **Numerous bilateral and multilateral external support agencies (ESAs)** 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.

3.2 Institutional Structure for Solid Waste Management:

Institutional aspects of SWM concern the institutional structures and arrangements of SWM as well as organizational procedures and the capacity of responsible institutions:

- 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 co-ordination 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.

Solid waste management is a major responsibility of local governments.

EEAA has seven Regional Branch Offices (RBO's) countrywide, some of which are still not operational. The reason behind establishing these RBO's is to tie up the Environmental Management Units (EMU's) at the Governorate level with the headquarters of EEAA. This policy will help in having a two-way communication link between EEAA and local governments. At the same time it will help in designing, operating and monitoring any project related to the environment in full co-operation and co-ordination with the target area, with full participation of the target group.

The future role of EEAA and of the Governorates is spelled out in the proposed national strategy for solid waste management (see 2.2 Plans and Strategies for Solid Waste Management) as follows:

The Role of EEAA:

- 1- Preparation of a strategic document concerned with municipal solid waste management.
- 2- Preparation of guidelines and codes of practice emphasizing different stages of the proposed system.
- 3- Coordination of efforts for establishing final waste disposal sites and facilities.
- 4- Provision of technical support for different Governorates emphasizing performance indicators.
- 5- Provision of financial support for the different Governorates within the available capacity as well as addressing the Governorates for applying for funding from donors.
- 6- Revision of EIAs prepared by specified administrative agencies.

The Role of Local Governorates:

- 1- Selection of strategic alternatives and preparation of appropriate scenarios according to the conditions of each Governorate
- 2- Preparation of workshops and programs that are required for the implementation of the proposed scenarios.
- 3- Preparation of EIAs for different program activities and sending them to the EEAA Headquarters.
- 4- Setting up the suitable measures and regulations for work performance, as well as evaluation and follow up (control and monitoring), implementation of the proposed activities.
- 5- Implementation of the proposed programs and activities.

3.3 *Staff and Management Involved in Solid Waste Management:*

The municipal employees who work in waste collection and street cleansing are not allowed to acquire the valuable recyclable materials that are found in the collected waste. With the privatization of waste collection from cities, or operating the public composting plants, the municipal workers are rather prohibited to benefit from this waste.

Training of workers is not widely practiced in Egypt. Training municipality employees is not available. Lack of funds to pay the overtime time and cleansing allowances are the most pressing points for both parties for the time being.

Two examples -Dakahlia and Sohag Governorate- will illustrate the above. In Dakahlia Governorate cleansing departments are understaffed due to the poor holding power of municipalities over part-time employees and the pull of the agricultural sector during harvesting times. Municipalities have to employ almost half their cleansing staff on temporary basis because of budgetary constraints and permanent staff restrictions.

The basic salary of the waste collection staff member ranges from LE 35-60/month (10–17\$US), thus working two shifts generates an income in the range of LE 90-130/month. The sale of recovered plastics adds another LE 70/month in supplemental income. This total (LE 160-200/month) still does not match the potential income from agricultural activity (around LE 10/day or LE 250/month). It also requires much longer working hours than agricultural labor. However the latter is seasonal with no job security, pension or health insurance. Surprisingly, workers and drivers employed by rural waste collection units receive salaries similar to urban areas, or around LE 120 and LE 150 per month respectively.

Some examples from rural local units around Mansoura City, In Mahalet Demma the local unit charges LE 1/month/household and LE2/month/shop. It employs 8 workers. In Bedway 6 workers are employed to operate the common dumpsite for all local units, which pay a fee to use it. In Shoha two workers are employed to sweep the main streets.

Employment in SWM in Sohag Governorate is shown in Table 1 below. It shows that 1588 workers and 125 supervisory staff are employed in SWM in Sohag Governorate in total.

Table 1. Employment in SWM in Sohag Governorate

Local Authority	Human Resources	
	Supervisors	Workers
El Maragha	14	105
Tahta	23	280
Saqlta	3	80
Akhmim	15	105
Dar El Salam	2	48
Tema	16	162
Gehena	3	38
El Monshah	N/A	N/A
El Baliana	3	167
Guirga	8	365
Sohag city:		
East District	17	108
West District	21	130
Total	125	1588

3.4 Conditions for Private Sector Involvement:

Private waste collectors (both traditional, i.e. the *zabbaleen* and non-traditional companies) are able to obtain waste collection licenses from the relevant authorities. The latter are the Cairo Cleansing and Beautification Authority–CCBA, and other city councils throughout the Egyptian Governorates.

Waste collection licenses give the private waste collection companies the right to collect waste from residential and commercial areas for a monthly fee-for-service. In return, the collection companies have to pay dividends to the relevant license provider i.e. the local municipality, in addition to a sum of money, as collateral for covering any penalties that may arise. Private companies pay gate fees to the local relevant authority.

The private waste collectors do not have the right to force people (residents) to pay for the service. In other words, residents' contribution in private waste collection services is not compulsory.

There are a few cases, which have been reported recently whereby private companies and the local authorities drew contractual agreements so that the companies can ensure that their fees will be directly collected from the local government. For example, street waste collection by some private companies in Cairo and Alexandria, such as: Care Services Co., Misr Service, Europe 2000 Co., etc. There are also some cases in Hurgada and Sharm El Sheikh, where the City Council collects the monthly fees from some hotels directly and contracts private waste collection companies to do the service for a monthly fee-for-service.

The majority of private sector companies are involved in the recycling field. They also manage some of the state owned composting plants.

The city council is the contracting authority for waste collection business. However, the council can not fine people or force them to participate in a private waste collection service, as people pay-by-law- the 2% cleansing tax and they are not obliged to pay two different fees to two different sides for having one service.

3.5 Financial Resources for Solid Waste Management:

Usually, all the taxes and fees that are collected by the government go directly to a central fund where all the financial requirements go as well. The government then decides which requirement gets what fund. However, the 2% cleansing tax goes to the cleansing fund directly. No cost analysis is made before fees are set. As a matter of fact, the cleansing tax was set a long time ago without any modification. It is subject to political bargaining. All the municipal budgets, on the other hand, show substantial deficit. The system cannot be easily changed, only the parliament has the right to add, delete or change any tax.

Most of the parties served by the private collection service pay their fees on a monthly basis. The monthly fees range between 1-2 LE/month in the pre-urban communities to 3-5 LE/month for the urban middle- income communities. Some people pay more that that give some sort of incentive to the waste collector in order to encourage him to come on time. Business establishments have different fee categories.

As an example, in Dakahlia Governorate funds for SWM come among others from the Cleansing Fund (2% of property rent). To pay for equipment, money is taken from the Development Fund, which is financed by donations and other similar sources. Since 1998, the Mansoura composting plant has charged companies a monthly fee to compost their waste.

In rural areas any repairs (usually of tractors) are sent to the private sector, as none of the rural waste collection units has a maintenance shop or garage. The money to pay for these repairs - and for the cleaning itself - comes in the form of gifts and donations from local residents. Still this is not enough. The constraints faced by municipalities in acquiring additional resources to improve services, or even just to cover basic budgets, have led to poor maintenance of street containers, fewer collection shifts, and vehicles falling into disrepair.

An interesting point was raised in Dakahlia regarding official attempts of charging residents collection fees. In many cases residents had complained to their elected assemblymen about the increases in municipality charge and, as a result, the assemblymen blocked the passage of new bills instituting collection charges. Curiously, many of these assemblymen were themselves members of the same municipalities, which complained bitterly about low budgets and financial constraints facing attempts to improve waste collection services. Thus it seems as though the political role and public image are stronger than the official role.

4. Private Sector Profile

4.1 Formal Private Sector:

4.1.1 General:

There is a humble role for the formal private waste collection companies in Egypt. For example, In the past few years some private waste collection and street cleaning companies were established such as Care Services Co., Europa 2000 co., El Baroudy waste collection co., Kalash co. Queen Service co., Misr Service co., ...etc. Some of these companies collect only street waste or only residential waste or both.

Other private waste contractors operate some of the public composting plants (e.g. Mansoura, Quattamia in Cairo, Ismailia, Benisuef ...etc). Those companies are pay annual, or monthly, fees for the relevant Governorate based on annual contracts. The contracting of private companies to operate the public composting plants is done through the governmental rules of renting public facilities to private entrepreneurs (i.e. through public bidding).

The third category of private sector participation in the current SWM system in Egypt is through waste processing and recycling, such as: waste sorting, secondary sorting of specific waste materials (eg. sorting waste plastics into its original polymers and colors), waste baling and washing, waste granulation/cutting and other size reduction processes, recycling of waste paper to produce hardboard, recycling of glass to produce new glass products, metal recycling, production of glue, production of charcoal from animal bones...etc. Thousands of micro, small and medium industries are using waste material as raw material in their industrial processes. 70% Of the total waste recycling activities are located in Cairo city, 20% is located in Alexandria, and the rest is distributed unevenly countrywide.

4.1.2 Income and Employment:

Tens of thousand of people who are working in other waste collection, handling, recycling and disposal in the formal private companies and the municipalities. There is no accurate figure in this regard. They carry out all of the possible activities included in the typical solid waste management system in Egypt (i.e. street sweeping, waste collection from residential, commercial and industrial institutions, waste transportation, waste sorting and treatment, waste recycling in different levels by different technologies, waste selling and buying, waste final disposal including dumping and incineration ...etc.).

Incomes of those who are working in waste collection and disposal activities range between LE 100/laborer/month up to thousands of pounds per month if they have a good waste recycling facility or a successful waste collection company. The big waste collection and industrial waste recycling firms are somehow more sustainable than small ones; especially those with a long experience in waste collection or recycling. On the other hand waste collection and recycling businesses are, like any other business, affected strongly by the market's supply and demand.

Examples of income and employment provided by the formal private sector (and community-based organizations) involvement in SWM in Alexandria, Sohag and Dakahlia Governorate are as follows:

In Alexandria Governorate the public sector collects about 80% of the total waste generated and private companies and community-based organizations (CBOs) collect 20%. Table 2 below, gives an overview of the private companies and CBOs that have contracts with the Alexandria Cleansing and Beautification Authority to collect waste in Alexandria city. In total they collect 605 tons/day, using tractor-trailers and trucks. They charge the households monthly fees for their service.

Table 2. Employment by private companies and CBOs in solid waste collection in Alexandria City

Name	District	Labour force
Society of local Community Development	Montazah	142
Society of Dar El Salaam	Montazah	51
Society of Hoda El Nabawiya	Shark	60
Society of Abna Banayoutr	Shark	45
Bianki Corporate	Shark	30
Young Graduates project	Shark	165
Omar bin El Khattab	Shark	180
El Watania for Garbage Collection	Wassat + Sidi Gaber	100
Total		733

In Sohag Governorate only a few households in Tahta and the East district of Sohag City deal with private collectors who collect garbage door-to-door. The residents pay a monthly fee for this service of LE 3/month/household.

In Dakahlia Governorate private companies are also involved in waste collection, on a somewhat larger scale than in Sohag. They require legal licensing from the municipality, although none have it. The reason for this is that municipalities perceive private collection companies as offering ad hoc solutions to waste problems and prefer not to constrain them by formalizing their situation vis-à-vis the municipality. The private companies hire their own staff, charge their own rates and have used the municipal dumpsites for a long time at no cost. Since 1998 gate fees for the composting facility in Mansoura City have been introduced.

In the villages around Mansoura City 4 private companies and 1 community-based organisation collect fees for door-to-door waste collection. These fees range from LE 1 to LE 2/month/household (see Table 3).

Table 3. Private waste collection companies and CBOs in rural local units near Mansoura

Local Unit	Population (x1,000)	Labour Force	Operator and Fee Rates
Kom El- Darby	35	6	A Cleaning company collects household waste for LE2/month for every unit.
Mit Ali	20	4	A private cleaning company charges LE 2/month per household.
Tanah	75	4	The Community Development Association charges LE 2/month per household to collect waste
Naqita	73	6	A private cleaning company charges LE 2/month per household.
Salamoon	35	4	A private cleaning company charges LE 1/month per household and LE 2/month per shop.

Source: Eng. A. Shoman Municipal Solid Waste in Dakahleya Governorate, February 1999.

4.1.3 Involvement of international companies:

So far, there has been no international investment in SWM in Egypt. This situation shall change however, once the privatization of SWM is implemented. It is obvious that the only foreign financial contribution to SWM today is in pilot developmental projects and the like.

There might be some investments in waste recycling, in a form of industry. At the same time there are some proposals from some Egyptian businessmen to buy waste recycling equipment from European or American companies awaiting for either sponsorships for feasibility studies or for facilitation for financial assistance.

Concerning waste management technologies, composting of organic waste, incineration of hazardous waste, conversion of waste to energy technologies, are among the environmental technologies that have been marketed in Egypt for the last few years. USA, Denmark, UL, France, Italy and Germany are the most technology marketers in Egypt.

There are some examples for the operating facilities: The health care waste incinerators in Cairo University Hospitals are Danish – through a program with DANIDA, several waste recycling

equipment, mainly for plastic recycling industry are operating by the Egyptian entrepreneurs who bought these equipment.

4.2 *Informal Private Sector:*

4.2.1 **General:**

In rural areas traditional practices continue to be followed today, but the nature of village waste has changed and peddlers (*sarriiha*) now collect waste (principally plastics and worn shoes) on an informal basis throughout Egypt wherever the quantities available offer sufficient (if often very little) profit.

As the country moved towards further urbanization and industrialization, new types of discarded materials started being reused in low-income urban areas. For example, scrap corrugated iron appeared as a roofing material, fences were built from discarded plumbing fixtures, tires and vehicle exhaust pipes, and cardboard, tin and canvas were used to construct additional rooms on rooftops.

Of Egypt's cities, Cairo has potentially the greatest waste disposal problems. As the city grew, traditional waste disposal practices continued, but became informally organized resulting in what is probably the most developed private sector of waste collection and reclamation.

The current system in Cairo evolved through interactive relationships between the *waahi* and the *zabbaleen*. The *waahi*'s are the initial collectors of waste who are also involved in the sale of recyclable paper, while the more general waste collectors were from the Nile Valley who became the *zabbaleen*. With no more land available for farming, the *zabbaleen* resorted to raising animals in the city, where the only source of fodder available was waste. To feed their animals (mostly pigs and goats), the *zabbaleen*'s waste collection activity expanded to include not just paper, but also organic waste from high-income areas for use as pig-feed. By 1983 there were four *zabbaleen* "garbage villages" around Cairo.

Since then, the *zabbaleen* have expanded their activities. Currently, they take the waste they collect back to their "garbage villages" where it is sorted into recyclable components: paper, plastics, rags, glass, metal and organic waste. The organic waste is fed to their pigs and the other items are sold to recycling centres.

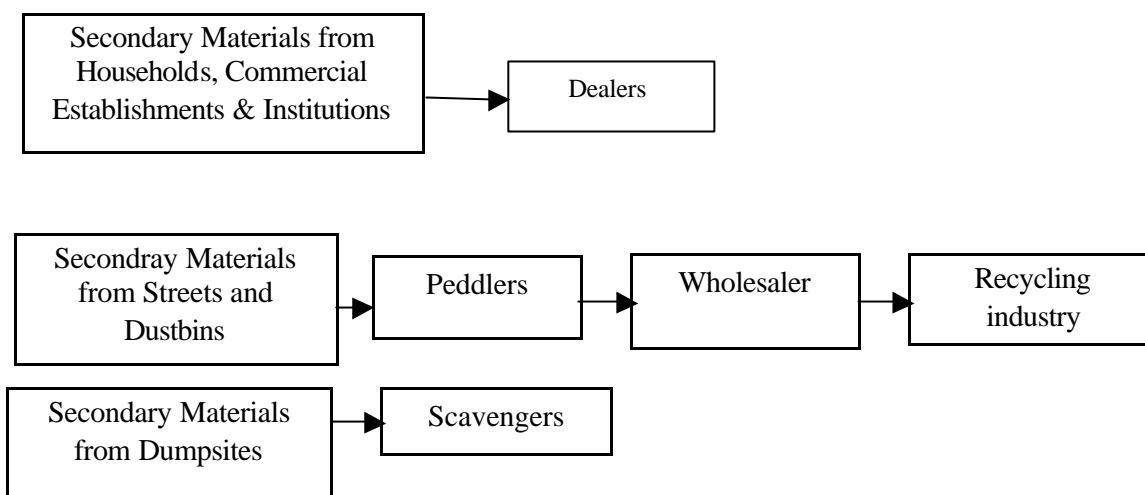
In 1986 a micro-enterprise scheme was initiated in the garbage village in Mokattam through a local NGO. The scheme involved introducing locally made plastic crushers and cloth "grinders". This tended gradually to change the *zabbaleen*'s role; they had previously acted more as sorters than recyclers. The scheme eventually involved the development of techniques to reclaim plastics, cloth, paper, aluminum and tin. As a result, many of the original pig breeders found a new role in the micro-enterprise sector and sold their pigs to become recyclers.

By 1990 the Cairo and Giza Governorates forbade the use of donkey carts in waste collection and formalized the subcontracting of door-to-door waste collection. As a result, many *zabbaleen* formed co-operatives to be able to buy pick-up trucks to continue their waste collection services.

Moreover, the pigs' waste attracted the attention of a group of supportive scientists, who developed a simple composting plant, which now produces what is reported to be one of the highest-grade composts in Egypt.

Waste segregation and separation practices are evident throughout Egypt. A simple illustration of a typical provincial urban system in Ismailia is shown in Figure 2.

Figure 1. Flow of Secondary Materials in a Typical City



Source: EQI, Solid Waste Management in the City of Ismailia, Egypt, 1994.

The example from Dakahlia Governorate shows that the informal sector is involved in the recovery of much of the non-organic content of solid household waste. It recovers plastic and some metals; the staff of private collection companies do the same, but different working practices sometimes allow them to sort in local transfer stations owned by the private collection companies. Informal street peddlers recover plastic from residents and scrap metal from industrial and commercial enterprises. However, collection-crews tend to have first access to plastic waste from the homes of the more affluent residents, hence, the informal peddlers recover mostly from middle-to-low-income-houses.

4.2.2 Income and employment:

There are about 70,000 persons involved in waste collection, sorting, treatment and primary recycling from the informal private waste contractors in the Greater Cairo Urban Region (that includes: Cairo city, Giza city and Shoubra El-Khema city from Qualiobia Governorate).

Typical market prices for recyclable materials are given in Table 4 below.

Table 4. Typical market prices for recyclable materials in Egypt

Commodity	Unit Value (L.E./ tonne)
Paper and cardboard	100
Metal	150
Textile and bags	50
Glass	60
Plastics	600

Source: Government of Alexandria MSWM Implementation Plan, USAID, Nov. 1998.

4.2.3 Organizations Representing the Zabbaleen:

There are several organizations representing the waste collectors and/or recyclers in Egypt. However, the most important organizations are:

- The Association of Waste Collectors for Community Development, which hosts most of the informal garbage collectors inside and outside the *zabbaleen* community in Manshiet Nasser;
- the Rabta of the *zabbaleen* in Bab-El Bahr, Mosky district, downtown, which hosts the “*mo'alems*” or the “*waahi's*” who were the sole waste collectors fifty years ago and still administer some of the *zabbaleen*;
- the Association for Protection of the Environment EPA. Although it is not managed by the waste collectors, it is working closely with the *zabbaleen* and their families, and has successful projects with them.
- There are other organizations in other cities or in other *zabbaleen* settlements but they are not as active as the previously mentioned ones.

Most of the time these organizations are in competition with each other rather than in co-operation. However, when it comes to a serious problem they act together. In general, the organizations that work in SWM and other environmental issues have one umbrella to represent them all in front of the government.

5. Current Solid Waste Management Practices

5.1 Practices at the National Level:

5.1.1 Waste Generation at the National Level:

It is important to note the big differences in Egypt between solid waste generation and the amounts reaching final disposal sites. In developed countries, the two figures are usually much the same since most waste generated must be disposed of formally (although there are trends towards the segregation of some components of waste at the source in a number of countries). In developing countries, including Egypt, scavengers recover much of the waste arising before it reaches the point of final disposal. Indeed, many materials that are deemed worthless in developed countries are justifiably recovered from waste and then reused in developing countries.

For any figures related to the quantification of waste to have any meaning they must be interpreted with the foregoing in mind. Also, estimating the amount of waste produced by households which is then finally disposed of, is notoriously difficult-even in countries with well-organized collection and disposal systems thus, statistics can be unreliable. The situation is made worse in Egypt as there are no weighing facilities at disposal sites and no practice of waste sampling and analysis, except at composting plants. Furthermore, the types and quantities of wastes arising and which are reclaimed, vary with the locality and, to some extent, with the seasons and areas, with more traditional lifestyles tending to generate relatively small quantities of waste, and segregation and reclamation practices are more widespread.

Throughout this report the best available data has been used, but since the data is sparse and there are some conflicting readings, they have sometimes been interpreted in light of the consultants' own local findings and experience.

According to the National Environmental Action Plan (1992), 10 million tons of municipal solid waste arises annually in Egypt, of which 60% arises in urban areas. Industry generates 3-5 million tons/annum of solid waste, of which around 50,000 tons are classified as hazardous waste.

As the population grows and affluence increases, the quantity of solid waste also increases. This is a logical relationship and is in accordance with international experience. In any country the amount of solid waste generated varies with the standard of living of its people. For Egypt it is estimated that the rate of waste generation ranges from 0.03 kg per capita per day in truly rural areas to 0.8 kg per capita per day in Cairo, but it can be as high as 1.5 kg capita per day for hotels and tourist resorts. This range is low but is typical of many developing countries. The amount of waste generated by different sources (e.g. households and commercial establishments) is necessary to define the number and capacity of waste storage and collection facilities required.

Tables 5 and 6 show an estimated breakdown of waste generation rates for urban and rural areas in Egypt. Table 6 also shows the important differences between the amount of waste generated and the lesser amount that needs to be collected, particularly in rural areas. This reduction is due to the reclamation of reusable constituents in the waste. Interestingly, it shows that in urban areas there is no great difference between the amount generated and the amount that needs collection. It is demonstrated elsewhere in this report that reclamation in one form or another is important in all areas to the country and it is surprising and anomalous that this is not reflected more in this table.

Table 5. Urban Waste Generation (1990)

Area	Criteria (inhabitants 10 ³)	Inhabitants (M)	Waste Generation (kg/cap.d)	Waste (t/d)
Large Cities (e.g. Cairo, Alexandria and Urban Giza)	>500	11.77	0.8	9.416
Medium Cities (Most Capitals of Remaining Governorates)	>150-500	3.15	0.7	2.205
Small Cities	>150	6.03	0.6	3.617
(Remaining Cities Adjustment)		3.80	0.7	2.660
Total (Cities)		24.75		17.898

Source: Arab Republic of Egypt, National Environmental Action Plan, Cairo, 1992
(An adjustment was made to reflect January 1995 population figures).

Table 6. Urban and Non-Urban Solid Waste Generation (1990)

Location	Population (million)	Waste Generation		Reduction (%)	Need for Collection			
		Kg/capita Per day	x10 ³ tons/day		x10 ³ tons/year	Kg/capita Per day	x10 ³ tons/day	x10 ³ tons/year
Urban	23.25	0.6-0.8	16.9 2	6,18 0	90	6-0.8	15.23	5,560
Peri-Urban	10.30	0.4	4.12	1,50 0	70	0.28	2.88	1,050
Rural	22.00	0.3	6.60	2,41 0	20	0.06	1.32	480
Total	55.65			10,0 90			19.43	7,090

Source: Project in Development and the Government. Comparing Environmental Health Risks in Cairo, V2c. 1994.

5.1.2 Waste Characteristics at National Level:

Some of the principal constituents of municipal solid waste and estimates of their individual contributions to the total mixed waste arising are shown in Table 7. The data are from two different sources but are not mutually conflicting. The following table shows that about two-thirds of municipal waste arises from household sources.

Table 7. Sources of Municipal Solid Waste (Estimated as a Percent of Total Waste)

Source	Source 1*	Source 2**
Household	68	64.3
Street Sweepings and Green Refuse	12	12.3
Commercial	11	14.9
Industrial	5	2.3
Institutions (including Hospitals)	4	
Educational		0.9
Hotels		0.7
Hospitals		0.09
Other		4.15

Source1: Arab Republic of Egypt, National Environmental Action Plan, Cairo, 1992

Source2: Project in Development and the Environment Comparing Health Risks in Cairo, V.2:C. 1994.

The National Environmental Action Plan defines five broad sectors generating solid waste: municipal waste from urban, peri-urban and rural areas; hazardous waste from hospitals; industrial non-hazardous waste; and agricultural waste.

There are other sub-categories of solid waste that may sometimes be considered separately for reasons of local conditions and/or constraints. In the Egyptian context these include sewage screenings and dried sewage sludge (which are often dumped with municipal solid waste), market wastes (which can be of a significant quantity in some urban areas), and dredging from irrigation and drainage canals. Construction wastes are also of significance. Animal carcasses also appear throughout the waste collection and disposal sequence.

Traditional rural practices demonstrate a high degree of waste reuse; waste food from households is fed to animals, animal and post-harvest waste is converted into fuel, and the excess is home-composted and used to condition the soil. (Bio-gas is recovered for use as a beneficial resource in a few pilot projects in Egypt). The composition of waste generated in rural areas is particularly suited to such practices as it is mainly organic in nature.

These traditional practices have been influenced by the developing prevalence of plastics, which began to appear in village solid waste when villagers gained more mobility and started shopping in neighbouring urban centres. In particular, plastic bags and worn plastic shoes started to appear as waste.

Urbanized communities produce more non-organic waste and raise animals on a lesser scale than rural ones. Waste from animals is disposed of through street collection/transfer points or directly into the streets themselves. The waste from animals used for transport is usually, and inevitably, deposited directly into the streets where it arises. Thus, two items, which do not appear in rural

waste start appearing in waste generated in urban areas: food from households which no longer raise animals and animal waste from households that continue to raise animals and from street traffic (horse carts).

Waste characteristics vary according to the extent of urbanization, the income level of the area, and the degree of its industrialization and commercialization. The density of solid waste generated varies according to point of measurement (at source, during transportation, at disposal) but averages about 3000 kg/m³ in Egypt. This is significantly higher than solid waste densities found in developed countries, but is comparable to those found in other developing countries (see Table 8). Waste density is another important measure used to define the number and capacity of waste storage and collection facilities required. Based on waste density and the capacity of trucks, the amount of waste collected can be measured in tons (weight). The relatively high density measured in Egypt reduces the effectiveness of compaction vehicles for waste transportation.

Table 8. Solid Waste Densities around the World

Country	Density of Solid Waste (kg/m ³)
<i>Developed Countries</i>	
United States	100
United Kingdom	150
<i>Developing Countries</i>	
Tunisia	175
Nigeria	250
Thailand	250
Indonesia	250
Egypt	300
Pakistan	500
India	500

Source: Arab Republic of Egypt, National Environmental Action Plan, Cairo, 1992.

The composition of municipal waste depends to a large extent on the affluence of the population contributing to the waste stream. It is essential to know the composition of waste, both at the source and at disposal, to assess the most suitable option for disposal and recovery. For example, the feasibility of composting is determined by a combination of the quantities of waste generated and the proportion of organic waste, amongst other factors. An example of a typical composition of solid waste in Egyptian cities is shown in Table (9) below. Typical data from the United States and Britain are shown in Table 10 for comparison.

Table 9. Typical Composition of Solid Waste in Egyptian Cities

Waste Composition	(%)
Organic Waste	60
Paper	10
Plastic	12
Glass	3
Metals	2
Textiles	2
Other	11

Source: EEAA. Action Plan for Sanitary Landfills in Egypt, 1998.

Table 10. Solid Waste Constituents as a Percent of Weight

	USA	Britain
Food	7	20
Yard Waste	18	4
Plastics	8	7
Glass	7	10
Metals	8	10
Miscellaneous	12	8
Other	-	8

Source (USA): Thomas J. Cichonski and Karen Hill, Ed. Recycling Sourcebook, 1993.

Source (UK): Newel, J. Recycling Britain. New Scientific, September 1990:46.

It is clear from the preceding tables that Egypt's urban (municipal) solid waste differs considerably from that of cities in developed countries, which is to be expected. One reason for this is that there is a wide range from poverty to affluence in Egypt's urban population; another is that much of the waste is reclaimed for recycling at various stages from arising to final disposal.

Tables 9 and 10 are of general relevance and interest; and they emphasize the importance of understanding the exact point in the sequence from arising to final disposal to which data refer. In developing countries the characteristics of waste change significantly during the arising-to-disposal sequence. Data reported for Egypt does not always make clear the point of sampling and is often, consequently, easily open to misinterpretation.

The quantities and organic content of solid waste are much less in rural areas where many waste materials are used traditionally and beneficially (e.g. for feeding animals, as soil conditioner, and as fuel for ovens). While rural areas comprise about 60 percent of the total population in Egypt, they only dispose of around 30 percent of the total amount of solid waste.

Some peri-rural (suburban) areas follow much the same practices as truly rural areas. Other peri-rural areas have adopted more urban life-styles. Animals are commonly kept even in these areas; but there may not be the historical outlets for the animal waste locally, so co-disposal with normal municipal waste is often practiced.

5.1.3 Waste Collection and Transfer at National Level:

It is reported in the National Environmental Action Plan (1992) that some 68 percent of municipal waste is collected on average in Cairo; of this about half is collected by *Zabbaleen* ("garbage collectors"). In effect, waste collection efficiency ranges from zero percent in low-income rural areas to 90 percent in high-income areas of large cities. In poorer areas, Often the only means of solid waste disposal is informal scavenging by people and animals, natural biodegradation and dispersion, burning at the primary point of disposal, and local self-help for disposal in informal dumping sites.

The responsibility of municipal solid waste management rests basically on the municipality. In Cairo, traditionally the *zabbaleen* (groups of people living from waste recycling, see Section 2) collect waste from households in middle to high-income areas and the municipality, on the other hand, is in charge of street sweeping.

Public waste collection, whenever it is carried out on its own, is usually not efficient; it operates at a loss and equipment is heavily subsidized. In addition, there are legal problems in terms of raising additional income from user fees. Because of this, we find many cases of subcontracting a substantial part of waste collection and street sweeping services to private companies, which have a higher efficiency. Subcontracting to private companies has mainly occurred with services in commercial areas, airports, hotels, and in tourist towns. For these kinds of services, as well as for the *zabbaleen*, fees are billed directly to the clients.

5.1.4 Treatment and Disposal at National Level:

Treatment and disposal technologies such as sanitary land filling, composting and incineration are rather recent in Egypt, having been introduced over the past two decades. Crude open dumping is the most common practice, about 95% of the wastes collected by the municipalities are disposed of in open dumps. Dumpsites are commonly set alight to reduce the volume of accumulating waste, hence adding to the air pollution caused by the uncovered dumped waste itself.

However, over the past few years there has been a trend towards applying proper treatment or disposal methods. Options that are currently considered viable under Egyptian conditions include sanitary land filling, windrow composting and incineration; the application of each of which would depend on the specific location and waste conditions.

Sanitary land filling is usually the lowest cost option as long as the required landfill area is available. The case is valid, for example, for cities in relatively close vicinity to desert or abandoned quarries and mining areas. The practice of sanitary land filling is still in its infancy in Egypt. The first properly designed “controlled landfill” with a daily capacity of 1000 tons was established in Cairo in 1996, but was not operated because of military security reasons. Three “semi-landfills” or “controlled-tipping” type of dumps, have been established and operated in Cairo, Giza and Alexandria. However, these are not considered typical of sanitary landfills, which secure sealing of the surroundings of the fill. Meanwhile, the GTZ is currently establishing a prototype landfill in Aswan for demonstration purposes. Two other small landfills have been established in Upper Egypt.

At present, there are no landfill regulations or standards that provide a basis for compliance and monitoring, but national guidelines for these standards are being prepared by the EEAA.

Since the 1990s the Government of Egypt has clearly opted for policy of waste recovery, focusing mainly on composting. Compost is considered an attractive product because of its possible use as a soil conditioner for desert reclamation schemes. The national policy comprises the construction of two windrow composting plants in each Governorate. The windrow composting of intermediate level technology and with recycling of recoverable materials was considered to be technically and environmentally appropriate, based on the performance of the first 5 imported plants (varying in capacity between 6 – 10 tons/hour MSW).

Eighteen plants of about 150 tons/ day are now in operation in Egypt, while another 15 are under construction within a 5 years’ plan of establishing about 15 - 20 plants annually. It is estimated that by the end of the year 2000, 56 plants will be in operation, processing around 22% of the total MSW in Egypt (at full capacity).

However, in-depth field assessment is needed for the purpose of improving the present practices and increasing the prospects of success, as most of the composting plants that have already been established do not operate efficiently nor at full capacity. Sales revenues usually hardly cover operating expenses, let alone depreciation costs. This is partly due to the expensive imported equipment used in the first five composting plants established in the 1980s.

In the 1990s national research led to the local manufacturing of all equipment. The first composting plant using locally manufactured equipment was in Zagazig in Sharqiya Governorate, which began operations in 1995. Even with this plant, operational and marketing problems remain to be solved.

Composting seems especially promising in the Delta where there is a lack of land for land filling, where the waste quantities generated are relatively large and where the proportion of dust in the waste is rather low.

Although the separation of waste at source is highly needed for the success of many treatment and recycling systems, especially of composting, there have only been a few pilot projects in this area.

Incineration, because of technical and cost consideration, would be largely limited to hospitals and other hazardous wastes. By law (Law No. 4/1994), incineration has become the mandatory treatment for hospital and certain other hazardous wastes. However, the range of proper hazardous waste treatment and disposal facilities available in Egypt is extremely limited.

Another option, “landfill composting”, combining the merits of composting as regards to resource recovery and recycling, as well as the relatively low cost of land filling. While this option needs much less land requirement and has a much larger site life span, was proposed for some time and has been recently investigated on demonstration scale in Behaira Governorate.

5.1.5 Recovery and Recycling at National Level:

In rural areas of Egypt, traditional re-use and recovery practices continue to be followed today. But the nature of village waste has changed and peddlers (*sarriiha*) now collect “new” waste (principally plastics and worn shoes) on an informal basis throughout Egypt wherever the quantities available offer sufficient (if often very little) profit.

As the country moved towards further urbanization and industrialization, new types of discarded material started to be reclaimed in low-income urban areas. For example, scrap corrugated iron appeared as a roofing material, fences were built from discarded plumbing fixtures, tires and vehicle exhaust pipes, and cardboard, tin and canvas were used to construct additional rooms on rooftops.

Of Egypt’s cities, Cairo has the most developed private sector of waste collection and reclamation. Much of the recycling and recovery in Cairo is done by *zabbaleen* (traditional garbage collectors and recyclers originally from Upper Egypt – see 4.2 Informal Private Sector). Wastes collected by the *zabbaleen* system are transferred to one of the seven *zabbaleen* settlements, where it is subjected to intensive sorting and recycling. The waste the *zabbaleen* collect is hand-sorted into recyclable components: paper, plastics, rubber, rags, glass, metals and food. The food waste is fed to pigs and goats and the other items are sold to special dealers and recycling centres. The most characteristic feature of the *zabbaleen* system is the involvement of the whole family in waste collection, treatment and trade. Also the hand sorting of waste by mostly *Zabbaleen* women takes place under unacceptable aesthetic and hygienic circumstances.

In 1986 a micro-enterprise scheme was initiated in Mokattam (the “garbage village”) through a local NGO. The scheme involved the development of techniques to reclaim plastics, cloth, paper, aluminium and tin.

As an aside, the pig waste attracted the attention of a group of supportive scientists, who developed a simple composting plant, which now produces what is reported to be one of the highest-grade composts in Egypt from the manure of goats and pigs with some food waste.

5.1.6 Hazardous Waste Management at National Level:

Proper functional and safe hazardous waste management (HWM) is not fully practiced in Egypt. Much effort has been recently extended to install proper systems nation-wide; and in conformity with the Environmental Protection Law # 4 for 1994, and with internationally accepted sound practices, taking into account the Egyptian conditions and limitations. In general, the field of hazardous wastes is being given top priority matching with its high risk mandates, particularly under the poor prevailing conditions.

A national management and information system for hazardous materials and wastes is currently under development within the auspices of the EEAA in collaboration with all stakeholders and involves government authorities. Parallel endeavours are also being undertaken by EEAA jointly with the Ministry of Health to cope with the alarming situation of medical wastes. Various management schemes and technological options are being assessed. Recently, it is estimated that hospitals, nation-wide, generate about 200 tons/day of various wastes, of which about 75 tons/day is considered hazardous (infectious, sharps, chemicals, ..etc.).

Regarding industrial hazardous wastes, two systems for Greater Cairo (including Cairo, Giza, and Qaliobia) and Alexandria are being planned for implementation. Parallel efforts are made in new industrial cities, particularly from the standpoint of establishing proper secure landfills for final disposal. In a recent study, industrial hazardous wastes in Greater Cairo Metropolitan (harbouring about 55% of all industrial activities, nation-wide) were estimated to amount 77,000 – 84,000 tons/year. Thus, the estimated amount of hazardous industrial wastes ranges between 150,000 – 175,000 tons/ year.

5.2 Current Solid Waste Management Practices in Cairo Governorate:

Cairo Governorate is a totally urban Governorate and has no rural areas. It has a population of 6,955,000 inhabitants (CAPMAS, 1998). The rate of annual increase of the population is about 1.06%. The total days of tourism season were 15,432,753 in 1995. Cairo Governorate is strongly connected to two other cities; Giza and Shoubra El Khaima, the capitals of Giza and Qaliobia Governorates respectively. Cairo Governorate hosts the cabinet, all the ministries, 6 universities, as well as a great number of commercial, institutional and industrial establishments, in addition to a great number of hotels of various ranks.

5.2.1 Waste Generation in Cairo Governorate:

The average rate of waste generation in Cairo Governorate is 1.3 kg/ person/ day. This is a total of about 9000 tons of waste/ day, with an average density of 350kg/ m³.

Cairo Governorate generates construction and demolition waste (CDW) of about 760 tons/year, in addition to 1500 tons/ year of dry sludge coming from the wastewater treatment plants.

5.2.2 Waste Characteristics in Cairo Governorate:

The average composition of waste generated in Cairo Governorate is shown in the following table:

Table 11. Average Waste Composition in Cairo Governorate

Material	Organic waste	Paper	Glass	Metals	Plastic	Textile	Others
%	56.0	19.5	3.0	7.2	3.8	1.1	9.4

Quoted from "SWM in Cairo Governorate- questionnaire LIFE Project, EEAA; December 1999".

There are no available figures on the agricultural or industrial wastes generated in Cairo Governorates.

5.2.3 Waste Collection and Transfer in Cairo Governorate:

According to the estimates of Cairo Cleaning and Beautification Authority (CCBA), the efficiency of waste collection in Cairo Governorate is about 80%. CCBA's district branches collect about 40% of the total daily-generated waste. The traditional waste collectors (*zabbaleen*), who are located in four settlements; Ezbet El Nakhl, Mokattam, Tora and Helwan, and the formal private waste collectors collect another 40% of the total daily-generated waste. The rest of daily-generated waste, about 20%, is currently left on the streets for casual collection, due to lack of mechanical and human resources. Most of the accumulated waste is located in squatter areas and slums around Cairo Governorate.

To summarize waste collected in Cairo Governorate is as follows:

- waste collected by the CCBA 3600 tons/ year,
- waste collected by private collectors 3600 tons/ year,
- waste remaining for casual collection 1800 tons/ year.

There are no stationary transfer stations in Cairo Governorate. However, some big trucks and compactors are used as mobile transfer stations. Construction and demolition waste is currently being collected, according to the law, by specific contractors. While the dry portion of the sewage sludge is sold for land reclamation and for farmers in new/old agricultural lands as compost.

5.2.4 Treatment and Disposal in Cairo Governorate:

There are four operating composting plants in Cairo Governorate: Cairo Governorate (municipality) owns 3, and one is owned by an NGO -Association for Protection of the Environment (APE). Private contractors, through concession contracts, operate all the composting plants. The capacity of each of the Governorate-owned plants is 10 tons/ hour, and that owned by the NGO (APE) is about 5 tons/ hour. Two other composting plants are currently under construction, and soon will join the composting activities.

About 90 tons/ year of health care waste are currently incinerated in a number of university and public hospitals.

The rest of waste (amounts to 3,700 tons/ day), that is not sorted by the *zabbaleen* or by the composting plants or that is not incinerated, is transferred to the open dumps that are owned and operated by Cairo Governorate (municipality). The following table illustrates some important information about the existing open dump sites in Cairo Governorate:

Table 12. Disposal Sites in Cairo Governorate

Open dump sites	Waste Inflow (tons/day)	Life Expectancy (in years)	Starting Date
Quatamia	1000	10	1989
Nasr City	800	15	1991
Es-Salam	700	3	1993
Al- Nahda	700	3	1993
Al Wafa wa Al Amal	500	10	1993
Total	3700		

5.2.5 Recovery and Recycling in Cairo Governorate:

About 80% (2,880 tons/day) of the total waste collected by the private waste collectors and the traditional waste collectors (*Zabbaleen*) is manually sorted and recycled. Only about 3% of the total waste, currently transported to the composting plants, is sorted out as recyclable (this amounts to about 4,320 tons/ year).

Some recyclable materials (about 2000 tons/ year) are imported, by Cairo waste dealers, from other Governorates such as Alexandria, Qaliobia, Giza, Sharqeya, Red Sea, Sinai,.etc. On the other hand, some waste materials (about 1000 tons/ year) are exported from Cairo to the same Governorate for further processing and recycling.

5.2.6 Hazardous Waste Management in Cairo Governorate:

Health care waste in Cairo Governorate is about 1,695 tons/ year. This is generated only from public and private hospitals, regardless of the other sources such as clinics, pharmacies and dispensaries, or laboratories.

5.3 Current Solid Waste Management Practices in Alexandria Governorate:

Alexandria Governorate is comprised of 3 cities and 6 districts hosting over 3.4 million inhabitants in winter and over a million visitors in summer. The University of Alexandria houses about 71,000 students enrolled in 22 Faculties and 3 institutions. There are 96 hospitals in Alexandria with 1035 beds, and 54 hotels with 4041 beds. The most prominent industries in Alexandria are in textiles, boats, and iron / steel, chemicals, food production and other production. Alexandria also generates about 46,203tons/year-sewage sludge.

5.3.1 Waste Generation in Alexandria Governorate:

Alexandria generates about 2,800 tons / day of municipal waste (about 0.82 kg / person / day) and 100 t/day of construction and demolition waste. This amount increases in summer to over 3400 t/day that is to say an increase of about 600 t/d.

5.3.2 Waste Characteristics in Alexandria Governorate:

Table 13 below, shows the composition of municipal waste in Alexandria.

Table 13. Average Waste Composition in Alexandria Governorate

Item	Organic matter	Paper	Glass	Plastics	Metals	Textiles	Dust/inorganic matter	Others
%	65.5	13.1	3.4	8.1	1	2.5	5	1.4
Amount t/d	1834	366.8	95.5	226.2	28	70	140	39.2

5.3.3 Waste Collection and Transfer in Alexandria Governorate:

The public fleet collects about 80% of the total waste generated in Alexandria and private companies and Community-Based Organizations (CBOs) collect 20%.

Table 14. Number and Type of Street Containers in Alexandria Governorate

District	1m ³	2 m ³	15 m ³	Total
Montazah	350	150	22	519
El Gomrok	250	60	4	316
Wassat	1.440	0	24	1.458
Shark	700	200	25	922
Gharb	160	250	19	429
Ameriya	300	200	8	508
Total	1.000	860	102	4157

At the same time the waste generated in old town of Burg El Arab, a small suburb with a population of about 30,000 residents, is collected by the city council. Waste there is collected using an old trailer tractor. Residents depend on their own efforts to get rid of their waste by running a mini-truck to take their waste to an abandoned area or to the surrounding desert. Also, the new Burg El-Arab City with a population of 7000 has its own solid waste collection system that is independent from Alexandria Governorate. The following tables show the mechanical resources for waste storage and collection in Alexandria per district.

Table 15. Inventory of Trucks “Serving all Districts” in Alexandria Governorate (March 1999)

District	Total no. of trucks	Total capacity (m ³)
Montazah	20	77.8
Shark	21	80
Wassat	45	201.7
Gomrok	11	34.5
Gharb	17	54.6
Ameryia	14	57.9
Central	10	16.5
Total	138	523

In addition to that there are two Mechanical sweeping trucks. As shown below, there are six main garages in Alexandria related directly to solid waste activities and another one for small cars. A central workshop also exists for heavy machinery as well as motor cycle’s repairs.

1. Ameriya Garage: Total area is about 10.000 m³
2. Ras El-Soda Garage: Total area is about 7200 m² for Montazah district 7.200 m² for
3. Moharram Bey Garage: Total area is about 42,000m² for Conglomeration Gharb, Wassat and El Gomrok district as well as the central department. This garage comprises four garages.
4. Smouha Garage: Total area is about 20.000 m² and serves the El Shark district.
5. El-Hadara Garage: Total area is about 27.000 m². It houses the central workshops.
6. Old Burg El – Arab Garage: Total area is about 5.000 m² for Burg El-Arab town.
7. El-Raml Garage: This is a small garage that is used to park small cars for supervisors, managers and officials.

On the other hand Table 16 shows the human and mechanical resources of the private companies and CBOs that collect waste from some residential areas in Alexandria based on door to door waste

collection services. This table also shows, the waste collection capacity for each company/CBO in town/day.

Table16. Human and Mechanical Resources of Private Enterprises and Community-Based Organisations in Alexandria Governorate

Name	District	Labour force	Machinery	Waste collected T/d
Society of local Community Development	Montazah	142	18 tractors	80
Society of Dar El Salaam	Montazah	51	5 tractors 1 truck	30
Society of Hoda El Nabawiya	Shark	60	No Record	15
Society of Abna Banayoutr	Shark	45	No Record	15
Bianki Corporate	Shark	30	No Record	5
Young Graduates project	Shark	165	55 trucks	220
Omar bin El Khattab	Shark	180	6 trucks 10 tractors	120
El Watania for Garbage Collection	Wassat + Sidi Gaber	100	20 trucks	120
Total		733		605

5.3.4 Treatment and Disposal of Waste in Alexandria Governorate:

Waste in Alexandria goes to either the open municipal dumpsites or to the public operated composting plants. Part of the waste goes to some informal random dumpsites in the surrounding desert. Table 15 shows the current municipal landfills (dumpsites), surface areas, capacity, lifetime and other relevant data.

Table 17. Current Disposal Areas in Alexandria Governorate

Disposal Site	District Served	Starting Year	Site Area (m ²)	Landfill Capacity (m ³)	Daily Reception (m ³)	Life Span (year)
Abbis	Shark, Wassat, Gomrok, & Gharb	1983	160,000	1,600,000	2,000	6
El-Montazah	El-Montazah	1995	63,000	650,000	1,700	7
El Ameriia	El-Ameriya	1986	126,000	1,260,000	660	15-20
Borg El-Arab	Borg El-Arab	1991	420,000	420,000	25	
Total			391,000	3,930,000	6,385	

Table 18 below shows the current operating composting plants in Alexandria and their nominal capacities (Design Capacities). This table shows that the percentage of waste composted is very little compared to the waste that goes to the dumpsites.

Table 18. Current Composting Plants in Alexandria

Composting Plant	Construction Date	Design Capacity (m3)
Abbis 1 *	Jan 1985	160
Abbis 2 **	Jan 1998	150
Montazah ***	March 1998	120
Total		430

* Egyptian share and loan from the World Bank payable in 50 years with no rate of interest.

** Gift from Japan International Co-operation Agency (JICA)

*** Designed by the (National Academy of science & Technology and manufactured by Military Factories at Abou Kir / Alexandria.

The revenue of the three composting plants in Alexandria was assessed in 1998. The revenue of the first plant (Abbis 1) was LE 446,890 in 1998, with LE 27,255 net profit. The second plant (Abbis 2) generated LE 476,526 with LE 223,260 net profit, while the third plant (Montazah) generated LE 175,185 in 1998 with net profit equals to LE 4,884. The first plant was made in England (Mother Well co.), the second plant was a grant from Japan, while the third plant is made locally by the Military Factories and technical consultation of the National Research Centre (NRC).

5.3.5 Recovery and Recycling in Alexandria Governorate:

The scavengers of streets and dumpsites sort other waste manually and informally. Recyclable waste materials sold to waste dealers and/or waste treatment and recycling workshops in Alexandria. Some of the recyclable materials are sold to waste processors and/or recyclers in Cairo.

5.3.6 Hazardous Waste Management in Alexandria Governorate:

The USAID study (1999) estimated the quantity of infectious medical waste in Alexandria to be about 5tons/day. Also, the study estimated the cost of establishing an environmentally sound incinerator that could deal with such an amount (5tons/ day) of about 500,000 L.E. The operating costs would be around 500 L.E./ton, including personnel, fuel, maintenance and disposal of ash; and an additional 10% depreciation cost per year should be accounted for. Table 19 shows the medical waste incinerators that are available now in some hospitals in Alexandria.

Table 19: Medical Waste Incinerators in Alexandria

Organization	No. of Hospitals	Efficiency of incinerators
Ministry of Health Hospitals	5	100%
	2	50%
Medical Care Associations Hospitals	1	50%
Health Insurance Hospitals	2	Stopped *
University Hospitals	1	100%
	1	50%
	3	not working
Private Hospitals	1	Frequently out of order
Military Hospitals	2	100%
Total	18	

* Because of complaints from the community, this incinerator was discontinued due to the fact that the chimney was too short.

5.4 Current Solid Waste Management Practices in Sohag Governorate:

There are no definitive data relating to urban waste characteristics or quantities arising or disposed of within the Governorate. Furthermore, the available data is not accurate. (For example, in earlier SEAM Project Reports the author reported, inter alia, that “the available literature shows a clear

inaccuracy of information and looseness of the system itself” and Prof. Dr. Olfat Anwar El-Sebai reported “some bias” in some results and found it necessary to “overcome this discrepancy.

Both the sources referred to in the preceding paragraph are authoritative and the authors have taken every reasonable step to develop meaningful interpretations of the data made available to and/or generated by them. But their findings are often anomalous and inadequate upon which to base those judgements that rely on a full understanding of waste characteristics. This is, perhaps, is not too surprising since it is notoriously difficult to establish reliable data related to waste characteristics, even in countries where the resources and facilities needed for such exercises are adequate and readily available.

In the following sub-Sections selective and interpretative use is made of the data that do exist and judgements are drawn that have sufficient reliability and validity for most of the requirements of this study.

5.4.1 Waste Generation in Sohag Governorate:

5.4.1.1. Urban Waste:

Bushra and El-Sebai (1995) presented figures for waste generated in urban areas of the Governorate. The former data are reported as emanating from the Environmental Management Unit for the Governorate.

It is indicated that waste for disposal from large cities (e.g. Cairo) averages 0.8 kg per capita per day while that from medium (most) cities averages 0.7 kg per capita per day and that from small cities a 0.6 kg per capita per day. Other reported data measure waste generated ranging up to a maximum of 0.8 kg per capita per day for urban areas, and waste available for collection ranging from 0.06 – 0.8 kg per capita per day depending on the area.

Estimates made by Prof. Dr. El-Sebai (Solid Waste Management Study Sohag, SEAM Project) show waste generation ranging from 0.128 – 0.892 kg per capita per day, with the lowest generation rate coming from the city of Sohag. This range could be interpreted as indicating an average waste generation in Sohag Governorate cities of 0.54 kg per capita per day.

Table 20: Estimated Amount of Waste Generated in Urban Areas in Sohag

Markaz (center)	Population	Waste Generation (kg/capita/day)	Amount of Waste (tons/day)
Dar El Salam	20,273	0.672	13.6
El Baliana	42,685	0.156	6.6
Guirga	90,588	0.700	63.4
El Monshah	47,987	0.455	21.8
Sohag	169,989	0.128	21.8
Akhmim	90,338	0.892	80.6
Saqlta	17,544	0.523	9.2
El Maragha	30,382	0.600	18.2
Gehena	43,635	0.528	23.0
Tahta	47,713	0.755	56.4
Tema	60,005	0.427	25.6
Total	688,139		340.3

Source : Prof. Dr. Olfat Anwar El-Sebai. Solid Waste Management Study Sohag, SEAM Project, 1995.

The figure of 0.54 kg per capita per day compares well with that of 0.6 kg per capita per day given for medium cities in the National Environmental Action Plan. But –and of critical importance – the cities of the Governorate are not typical of the country as a whole due to their rural nature and traditional practices. In addition, the quantities of waste generated and the quantities put out for disposal in Sohag are strongly influenced by the socio-economic status of the Governorate and its rural and traditional way of life. For example, mud ovens are still commonly used and fuelled with waste paper, cardboard, rags and animal manure, whilst goats and sheep are herded into towns to feed on discarded waste.

These factors result in a lower usage of consumer packaging (e.g. glass and plastics), a greater degree of reclamation and re-use (for example, plastics, scrap metal and glass are commonly segregated at the source and sold or bartered) and, consequentially, much lower volumes of waste arise.

By using the information provided and relating it to population figures, it may be estimated that the average quantity of waste generated in urban areas of the Governorate, is of the order of 0.4 kg per capita per day. Bearing in mind the difficulty of obtaining accurate data and the nature of the urban lifestyle in the Governorate, this figure is assumed to be typical for cities in the Governorate of Sohag. However, much of the waste arising does not reach final disposal sites.

By assuming that a conservative figure of 75% of the reclaimable components of the waste generated are actually reclaimed prior to disposal, then the waste arriving at final disposal sites would amount to an absolute maximum of some 0.25 kg per capita per day. This is a lower figure than that assumed to reflect an average situation nationally, but is entirely reasonable and fully accords with visual site inspections made by the consultants in the Governorate.

In the absence of more definitive estimates, it is assumed that the quantity of waste collected and disposed of at final dumpsites for cities in the Governorate amounts to a maximum of 0.25 kg per capita per day.

5.4.1.2 Rural Waste:

The Governorate of Sohag has income levels much below those of comparable populations in the Delta area, and travelling from villages to the nearest town is often difficult. As a result, purchasing power is low and life-styles are conservative. In rural areas, even more than in the urban areas of Sohag Governorate, organic household waste is segregated at the source. Food and farm wastes are fed to animals. Animal waste, paper, cardboards and rags are burned in traditional ovens. On the other hand, there is very little glass waste (the rural population buys few goods packed in glass containers and soft drinks come in returnable bottles) and plastic and scrap metal waste is sold to peddlers. These Peddlers visit every rural area and are the only waste collection system available or, indeed, truly needed in these areas.

There are no reliable data on the characteristics of rural waste, but investigations have shown that very little is discarded as waste in rural areas, and whatever might be discarded is picked up by animals and scavengers. The remaining waste consists largely of inorganic materials for which there is no perceived use or value.

A national figure for the quantity of waste for disposal in rural areas is 0.3 kg per capita per day. (An evaluation by the consultants of rural waste for disposal in the Governorate of Dakahlia gave the same figure). In the Governorate of Sohag there is much less waste for disposal from rural areas than in Dakahlia (or nationally). Indeed, the amounts of waste disposed of in the rural areas of Sohag are of minimal quantity. Thus, the quantities of waste for final disposal from rural areas in the Governorate are essentially negligible.

5.4.2 Waste Characteristics in Sohag Governorate:

A summary of the quantities and characteristics of waste arising in cities in the Governorate as provided by the Environmental Management Unit, Governorate of Sohag is given below.

Table 21. Characteristics of Waste Arising in Cities of Sohag Governorate

City	(% total by weight)						
	Paper	Plastics	Metals	Glass	Animal Waste	“Dust”	Other
El Maragha	25	-	-	-	-	44	31
Tahta	20	5	5	5	-	-	65
Saqlta	25	2.5	12.5	2.5	20	37.5	-
Akhmim	-	-	-	-	-	most	-
Dar El Salam	12.25	2.5	12.50	0.5	1.5	41.5	30.0
Tema	57	7	7	7	7	-	15
Gehena							
El Monshah	N/A						
El Baliana	12.5	12.5	18.75	-	-		50
Guirga	10	7	3	-	-	80	-
East Sohag	33	0.7	3.3	3.3	3.3	45.4	-
West Sohag	36.6	2.8	5.6	8.5	8.5	39.5	2.8

Dust = mostly dust from food and animal husbandry.

(Source : Eng. Mounir Bushra. Preliminary Report on Solid and Hazardous Wastes, Sohag Governorate, SEAM Project, 1995).

The data shows the widely varying nature of the solid wastes arising in urban areas of the Governorate and the unusually high proportion of “dust” (fine inorganic particulate matter).

A subjective assessment of the data has been undertaken. It has neither mathematical nor statistical validity and is based solely on an experienced interpretative approach to what are essentially unsubstantiated figures. On the basis of this assessment it is judged that waste arising in the cities of the Governorate may show the above average characteristics related to key specified constituents.

There are other data giving estimated characteristics of waste generated in cities in the Governorate. For example, the figures for generation rates given by Prof. Dr. El Sebai (Solid Waste Management study Sohag, SEAM Project) may crudely be interpreted as demonstrating that the organic content of solid waste arising in the cities of the Governorate ranges from less than 0.1 percent (in Dar El Salam) to over 83.7 percent (in Gehena).

It is clear that such a wide range could never be met in practice and it is for this reason that Prof. Dr. El Sebai understandably felt the need to rely upon interpretative mechanisms. However, and unfortunately, whilst these mechanisms result in the generation of figures that “agree with the rate suggested by the World Bank for the urban areas in the region” they do not necessarily reflect variations that probably occur throughout the Governorate. Nor are they likely necessarily to reflect an average picture of the cities in the Governorate as a whole.

The waste generated has been shown probably to contain some 20 percent of compostable materials, animal waste and “food”. It may be assumed that some of the animal waste is separated for use as fuel and that, perhaps, goats and sheep consume 50 percent of the “food”. It may also be assumed that many of the other constituents are reclaimed by scavenging and similar activities. Based on these assumptions it could be speculated that an absolute maximum of half the waste for final disposal is compostable. If this is so, then composting is a viable process for the Governorate. However, it is a very unlikely scenario and the consultant’s observations locally do not support this speculation. For example, no evidence was seen at the final disposal sites that anything approaching half the waste is of an organic and compostable nature.

Although this is necessarily based on a considerable degree of speculation it has been possible to draw sensible conclusions by using the available data as a basis for informed extrapolation. These conclusions are adequate enough on which to base a reliable solid waste management strategy for the Governorate.

- **Other sources of solid waste:**

The preceding sub-sections have necessarily been restricted to the discussion of urban waste in general; however, some specific waste is produced in the urban areas of the Governorate and is usually mixed with household waste. A brief comment on the most significant categories of these wastes is given as follows in table 22. The Table gives a distribution of the amount of waste produced by different sources for Sohag West District.

Table 22. Generation of Solid Waste from Different Sources in Sohag West District

Source	(%)
Households	33.4
Streets	20.0
Educational establishments	6.7
Health Institutions	3.3
Industrial establishments	3.3
Handicraft workshops	6.7
Commercial establishments	20.0
Hotels	3.3
Market	3.3
Total	100.0

Source : Administration Sohag West District, 1997.

- **Market Waste:**

All cities have markets, which generate significant quantities of solid waste. In the context of the agricultural ethos of the Governorate, it seems likely that much of this waste is used as animal feed. This would be an area worthy of further study, however, since the organic nature of much of this waste could be used to improve the nature of any urban waste destined for a composting plant.

- **Commercial Waste:**

In view of the traditional practice in the Governorate to use paper and cardboard as a fuel, it is believed that most commercial waste is used for this purpose and does not find its way to final disposal sites. Any paper or cardboard that does reach a final disposal site is most likely taken by scavengers.

- **Institutional Waste:**

Information has been made available to the consultants regarding educational establishments and hotels. It is unlikely, however, that the wastes generated from these institutions have any significant influence on the general quantities or characteristics of the waste generated in the Governorate.

5.4.3 Waste Collection and Transfer in Sohag Governorate:

- *Collection:*

As elsewhere in Egypt, some residents in Sohag throw their waste from windows and balconies, and directly or randomly dump it in the streets or on vacant land. However, most urban waste is deposited by residents in containers at street collection/transfer points. However, in Tema, Tahta, Guirga and Dar El Salam, most households dump their waste directly onto the streets, either with or more frequently without bags.

The most common type of waste collection container is a drum similar to an oil drum (some are, in fact, old oil drums) on two bars for easy dumping. El Monshah uses square metal containers with a capacity of 0.2 m³ and fabricated in the district workshop; rectangular metal containers are also used in Sohag City and some other cities. The drums are lifted manually and emptied into the collection vehicle while the rectangular ones are often chained or welded to supports set in the ground and must be emptied manually. The other types of containers in use in the Governorate are:

- Large (5m³) metal rectangular containers with wide openings at the top and side openings for emptying (The openings are designed to be covered by moveable plates, but the latter are usually missing) These containers are placed in middle and low-income areas. They are commonly not emptied frequently enough and thus overflow.
- Three-wheeled containers designed for use by waste collectors. Most of these have been irreparably damaged.
- In Dar El Salam, El Maragha and Gehena wheelbarrows or handcarts are used to collect waste from the streets into piles, which are then loaded into leather (or soft) baskets.

The waste containers are closely spaced on streets in high-income areas, but their frequency and condition fall in line with area income levels (i.e. there are far fewer containers in low-income and market areas than in high-income areas). There is very little door-to-door (or private) collection practiced in the Governorate, but cities in some districts have improved their urban collection services to high-income areas by placing containers (again drum-type) at the entrances to each residential block. A few households in Tahta and the East district of Sohag City deal with private collectors who collect garbage door-to-door; the residents pay a monthly fee for this service.

- *Transfer:*

There is an unusually wide range of waste collection vehicles in use throughout the urban areas of the Governorate (waste is not collected formally in rural areas). And, although Sohag is mainly agricultural in nature, there are very few tractor-trailers in use for waste collection. They were widely used until a few years ago and are commonly used for waste collection elsewhere in Egypt.

The waste collection vehicles in use in the Governorate have been haphazardly supplied under aid schemes from various donor-sources and, as a result range from American and Japanese models to locally-assembled Indian vehicles. Some of the vehicles have compaction bodies, but they are not very satisfactory, mostly due to the high proportion of abrasive construction debris ("dust") in the waste, which tends to damage the hydraulic compacting systems and slides.

In spite of the large number of vehicle types, many heads of maintenance departments say that one of their main problems is a lack of equipment. In reality there is probably more than enough vehicles; however, a large number of vehicles are out of order due to the lack of spare-parts and the marked shortage of suitably trained maintenance staff. Of course, the many different makes, and models of vehicles only serve to exacerbate these problems. Transport resources for the cities of the Governorate are shown in table 23.

Table 23. Equipment for Waste Collection and Disposal in Sohag Governorate

Local Authority	Mechanical Resources		
	Make/Type	Units	Capacity
El Maragha	Tractor & Trailer	7	3m ³
	Tipper Truck (Daihatsu)	7	3m ³
	Press truck	7	3m ³ and 6m ³
	Tipper Truck (Suzuki)	7	2m ³
Tahta	Suzuki	12	1m ³
	Daihatsu	12	1.5m ³
	HENO High Tipper	12	6m ³
	Chevrolet	12	3m ³
	Tractor & Trailer	12	
	KIA	12	3m ³
Saqlta	KIA High Tipper	5	3m ³
	Daihatsu High Tipper	5	4m ³
	Paper Press	5	4m ³
	Loader	5	4m ³
Akhmim	Isuzu	13	4m ³
	Daihatsu High Tipper	13	4m ³
	Tractor with Trailer/Paper Press	13	6m ³
	KIA High Tipper	13	4m ³
	Paper Press	13	
	Watering Machines	13	
Dar El Salam	Toyota High Tipper	8	3m ³
	HENO High Tipper	8	6m ³
	Daihatsu	8	3m ³
	KIA High Tipper	8	3m ³
	Watering Machine	8	
	Loader	8	
Tema	Daihatsu	11	It & 3m ³
	Ford	11	0.5t
	KIA	11	It
	High Tipper	11	4t & 3m ³
	Loader	11	
	Paper Presser	11	6m ³
	TATA	11	2m ³
Gehena	Tipper Truck	5	3t
	Tractor with Trailer	5	3t
El Monshah	KIA Tipper Truck	5	4m ³
	International Tipper Truck	5	6m ³
	Paper Presser	5	4m ³
	Suzuki Tipper Truck	5	4m ³
El Baliana	KIA High Tipper	9	4m ³
	Tractor & Trailer	9	3m ³ & 6m ³
	Daihatsu High Tipper	9	4m ³
	International High Tipper	9	6m ³

Guirga	KIA High Tipper	16	4m ³
	Tractor & Trailer	16	3m ³
	Mitsubishi	16	3m ³
	Daihatsu	16	3m ³
	Chevrolet High Tipper	16	4m ³
	International High Tipper	16	6m ³
	HENO High Tipper	16	6m ³
	Vehicle with Paper Press	16	6m ³
	Tractor	16	
Sohag City	High Tippers	12	4m ³
East District	Suzuki Trucks	12	1.5m ³
	Tractor with Trailer	12	6m ³
	Bedford Truck with Loader	12	6m ³
Sohag City	Tractor with Trailer	21	3m ³
West District	Trucks	21	4m ³
	Suzuki Trucks	21	1.5m ³
	Loader	21	

- **Maintenance of equipment:**

A study of a number of maintenance workshops showed that some are operating efficiently within the constraints of limited spare parts and equipment whilst many others are in disarray and badly in need of re-organization. As there is clearly a marked shortage of well-trained staff (e.g. mechanics, engineers, electricians and other technicians) and tools across-the-board, much of the complicated work is usually sent to the private sector. There is general agreement that mechanical expertise exists in the private sector, but not in the municipal workshops. This situation most likely stems from the lack of training given to workshop staff, which was a frequently heard complaint during the study.

In addition, many of the workshops suffer from inadequate space and funding. In some workshops there is little or no space for greasing or washing vehicles - one workshop lacks enough room to store all the waste collection vehicles at one time. In terms of funding, most of the workshop heads said that there is no annual fixed budget for maintenance and that the Governorate sends money on an infrequent and irregular basis. As a result, one workshop (in El Maragha) generates its own income by offering services (e.g. tiling floors, painting and welding) to the public; this shop claims to have earned LE 90,000 in revenue in 1995 from these extra-curricular activities.

The workshop in the East district of Sohag City could well serve as a model for others in the Governorate. The workshop has a number of departments - washing and greasing, fitting, electricity, turnery, painting, and mechanics. In addition, the department has most of the equipment and tools needed to function, thus only very complicated work is given out to the private sector. (The one problem expressed by staff there is the inadequate number of professional workers). As a result, the city's fleet of thirteen vehicles - which represent a variety of makes and models - are all in operation.

5.4.4 Treatment and Disposal of Waste in Sohag Governorate:

The dumpsites for five of the selected cities in the Governorate (Tema, Tahta, Sohag City, El Maragha, and Geziret Shandaweel) are located in unused irrigation canals. (Tahta has a second dump located in the west of the city near houses and agricultural land). El Baliana dumpsite is located near an irrigation canal that is still being used. Four other cities (Akhmim, Dar El Salam, El Monshah and Gehena) dump their waste in the desert.

Guirga's dumpsite is located on a large area of land and ponds created by the diversion of the River Nile - a natural event happening about once every 100 years. The furthest distance of travel to any dumpsite is 17 km from the centre of town.

It is noteworthy that some of the sites (e.g. Guirga, Dar El Salam, Tema) are operated in a semi-controlled way in that every few days the waste is levelled and covered with sand. This sort of good practice is unusual in Egypt.

The designation of dumpsites for the construction of low-income housing, playgrounds, parks, schools and mosques when they have reached the end of their life span is common practice in the Governorate. When the old dumpsite in Sohag City - again, an unused irrigation canal - became full the site was remedied and developed as a playground with a football pitch, and a 4,000 m² public garden (a school is currently being built on the rest of the site). Another example is Tema, where part of the site has been levelled and turned into a garden and youth centre.

There are many unused irrigation and drainage canals in the Governorate, but most are either in use for purposes incompatible with waste disposal or have been appropriated (or are being appropriated) for a particular purpose, usually development. The majority is not available for the final disposal of waste.

It should be noted, however, that unused canals are not wasteland, but rather very fertile pieces of land cultivated by poor, land-less peasants. And when an unused canal is designated as a dumpsite, the squatter farmer is evicted and left to seek a living elsewhere. The Irrigation Department considers these squatter farmers the best possible users of this land and are less destructive than a dumpsite. There is a general perception that redundant canals should not be used as dumpsites, even when using controlled land filling techniques. It is believed that the proximity of desert land to the narrow agricultural strip of the Governorate offers the best means of final waste disposal.

Composting plants have become a popular option for waste treatment within the Governorate. However, it has to be kept in mind that composting plants generate reject materials that must be disposed of by land filling. This, in turn, requires that a landfill site be reasonably accessible to the composting plant. Therefore composting plants only provide partial solutions for waste disposal/treatment.

5.4.5 Recovery and Recycling in Sohag Governorate:

The principal components of the waste that is reclaimed and recycled in the Governorate are plastics, scrap metal and bones. There is very little paper, cardboard, rags or glass worth scavenging. Most plastics are sold for eventual re-manufacture while bones are sold for use as a whitening agent in sugar refining, or for use in fertilizers or paint manufacture. There is a thriving scrap metal trade in some areas (e.g. the cities of Guirga, Tahta and Tema), but nowhere is there evidence of the reclamation of "tin" cans. Old vehicle batteries are collected and exported from the Governorate for reclamation while used vehicle tires are sent to Alexandria and Cairo for re-trading. Tires are also used locally to some extent - they are heated on building sites and the resultant melted rubber is used as a damp proof membrane (which is yet another bad practice).

The waste collection/transfer points in urban areas tend to be a focus for goat-herders – and to a lesser extent shepherders – and scavenging children. The animal-herders enter the towns before dawn and again in late afternoon. There, they tip over the free-standing containers and manually empty the restrained ones to give their animals access to the waste. Children separately scavenge what they can from the containers and from the streets. This type of activity results in much of the contained waste being strewn about the streets. The waste collection operators themselves do not scavenge as do operators in some other areas of the country (e.g. parts of the Governorate of Dakahlia).

5.4.6 Hazardous Waste Management in Sohag Governorate:

- *Healthcare waste:*

The hazardous waste of greatest concern is that generated by health-care establishments, particularly clinical wastes. Table 24 gives Sohag City and the other *marakaz* in the Governorate as well as the quantities of waste produced per day.

The total amount of waste generated in hospitals in Sohag City is 1.2 tons per day. The amount of waste produced per day in the different hospitals varies from 26 kg in the Psychiatric Hospital to 299 kg in the General Hospital. The average amount of waste produced per bed is 0.70 kg/day in Sohag City and it ranges from 0.50 kg in the University Hospital to 0.90 kg in the General Hospital.

Table 24. Public Hospitals and Health Units in Sohag Governorate and Estimated Quantities of waste Produced

Center / Markaz	Hospitals	Health Units and Groups	Beds	Est. Waste per Bed per Day (kg)	Est. Total Waste per Day (kg)
Sohag	7	19	1,690	0.7	1,183
Akhmim	2	12	178	0.5	89
Baliana	2	24	321	0.5	161
Maragha	2	20	211	0.5	106
Monshah	2	25	252	0.5	126
Dar El Salam	1	25	189	0.5	95
Guirga	3	22	625	0.6	375
Gehena	1	12	120	0.5	60
Saqulta	2	13	181	0.5	91
Tema	2	22	310	0.5	155
Tahta	3	20	424	0.6	254
Total	27	215	4,510		2,695

Source : Health Directorate in Sohag Governorate and Management Hospitals, 1998.

Sohag has the highest number of beds in public hospitals and health units, followed by Guirga and Tahta, which also are relatively wealthy *marakaz*. That is why the amount of waste generated per day is estimated to be higher in these *marakaz* than in the others.

The total amount of waste generated in public hospitals and health units for Sohag Governorate is thus estimated at approximately 2.7 tons per day. There are a total of 616 private clinics in the whole Governorate. It is unknown how much waste they produce, but it adds to the total amount of medical waste generated in Sohag.

Table 25 shows the number of incinerators per *markaz* for the whole Governorate. In general, the number of incinerators seems to be limited and insufficient to cope with all the hazardous healthcare waste generated. Only four hospitals in Sohag City have incinerators; three of the four incinerators are in working condition.

Most hospitals do not have an incinerator or any system of segregating hazardous from non-hazardous waste. It is reported that many of them dump their waste in the street, put it in ordinary bins and containers, or burn it on their premises in the open air or in old incinerators. These practices pose a significant health risk to waste collectors, scavengers and the public at

large. One of the few municipalities that pay attention to hospital waste handling is Dar El Salam. There, hospital waste is collected separately and buried in a special pit at the dumpsite.

Table 25. Hospital Incinerators in Sohag Governorate

Markaz	Type of Hospital	Type of Incinerator	Capacity Per day	Status	Beds
Dar El Salam	N/A	N/A	N/A	N/A	N/A
El Baliana	Central	American for	50 kg	Working	210
Guirga	Central	syringes 1 French Dupex	100 kg	Working	250
El Monshah	N/A	1 American for	N/A	N/A	
Sohag	General	syringes	N/A	Working	299
	Chest	N/A	4m ³	Working	118
	Fever	Imported	4m ³	Working	96
	Education	French	N/A	Not	291
Akhmim	al	Local	4m ³	Working	81
Saqlta	Central	N/A	4m ³	Not	65
El Maragha	Central	Local	4m ³	Working	70
	Central	Local	100 kg	Working	
Gehena		1 Local	4m ³	Working	80
Tahta	Central	1 French Electric	4m ³	Working	204
	Central	Local	4m ³	Not	24
Tema	Fever	Local	100 kg	Working	200
	Central	Local		Working	
		American		Working	
				Working	

Source: Statistics Department, Sohag Governorate, 1998.

• **Industrial and Slaughterhouse Waste:**

Both the author and Prof. Dr. El Sebai have reported the number and type of industrial establishments. Although there is very little information on industrial solid waste quantities and most waste from industrial sources is generated in relatively small quantities, the importance of and the potential risks associated with industrial solid wastes should not be underestimated. It should also be noted that the numbers of sources and the quantities of industrial solid waste would increase with time. New industrial estates like El Kawther close to Sohag City will add to the amounts of waste generated.

Whilst the foregoing is a fair judgement regarding the likely future situation, it seems probable that the wastes generated by existing industries in the Governorate generally create few serious problems. There are, however, discrete areas with problems. For example, an onion dehydration plant in Sohag City audited by the SEAM Project in 1995 was found to produce 400 – 500 tons/annum of solid waste that is creating problems. However, this type of highly organic, non-toxic solid waste would be a useful supplementary organic material at a composting plant; although the affordability of such an arrangement would depend on the proximity of the factory to the composting plant.

The local slaughterhouses also generate significant quantities of waste, although most of their solid waste (skin horns and bones) is sold for re-use in their industries; even animal manure is reused –as fuel for ovens in which to bake bread. The remaining waste (e.g. blood and innards) is usually collected by the municipality, mixed with other waste and taken to the local dumpsite.

Another problem related to these establishments is the fact that many are unsuitable for slaughtering animals – many of the buildings are too small and lack proper fencing and thus find it difficult to contain their waste.

5.5 *Current Solid Waste Management Practices in Dakahlia Governorate:*

5.5.1 **Waste Generation in Dakahlia Governorate:**

- *Urban Waste:*

The sources and reported quantities of solid waste generated in urban centers and hospitals in the Governorate are shown in Table 26.

Table 26. Sources and Quantities of Solid Waste Collected in Urban Centres of Dakahleya Governorate

District Center	Population	(tons/day)
Mansoura	408,188	275
Mit Ghamr	123,636	30
Sinbillawayn	75,892	36
Dikirnis	59,139	50
Talkha	73,869	30
Aga	35,178	12
Manzala	61,486	60
Minyat An-Nasr	50,000	35
Bilqas	67,121	50
Timayy Al lmdid	16,000	12
Shirbin	49,251	100
Gamaliya	58,664	18
Matariya	109,952	75
Bani lbayd	70,000	18
Mit Salsil	60,000	30
Nabaruh	35,700	20
Gamasa	5,000	4
Total	135,9076	855

Source Eng. A. Shoman. Municipal Solid Waste in Dakahleya Governorate, February 1999

It is noted that there are some inconsistencies in the available data, particularly when compared with the generalized national data. In addition, data is not always complete. As a result, it cannot be used as the only basis upon which to estimate urban waste quantities in Dakahleya (either arising or for final disposal).

Reliable data for the quantity of waste delivered to the controlled landfill site in Mansoura is available since the consultants measured waste quantities over a four-week period (during the training of local staff at the landfill). As a result, it may be reliably estimated that the amount of solid waste arriving at the Mansoura landfill site for final disposal is 247-tons/day. As the landfill accepts waste from Mansoura, Talkha and Aga (which have a combined population of 517,235), this represents a quantity for disposal of 0.67 kg/ capita per day. Allowing for a collection rate (efficiency) of 90 percent and recovery of recyclable materials, this figure compares well with that of 0.7 kg/capita per day for other cities in the Governorate, and is believed to be a realistic figure for waste for disposal from Mansoura and Talkha.

As for other cities in Dakahleya, the data available suggests that there is less waste for final disposal than from Mansoura and Talkha. In these instances a reasonable figure is judged as being 0.60

kg/capita per day; this is the figure quoted for cities other than capitals of Governorates. Waste for disposal in urban areas may be assumed to amount to 0.70 kg/capita per day for Mansoura and Talkha and 0.60 kg/capita per day for the other cities in Dakahleya.

- **Rural Waste:**

The composition of solid waste generated in rural areas differs markedly from that arising in urban centers. Behavioral patterns still reflect traditional habits of at-source separation, recovery and re-use; in particular, most organic materials are re-used. This results in low waste generation rates and very low quantities of waste for final disposal; and the waste for final disposal has a high plastics content.

Table 27. Sources and Quantities of Solid Waste Collected in Rural Areas of Dakahleya

Area	Population	(tons/day)
Mansoura	495,000	56
Mit Ghamr	427,956	101
Sinbillawayn	313,983	7.5
Dikirnis	267,335	20
Talkha	369,256	49
Aga	391,063	13
Manzala	158,970	15
Minyat An-Nasr	150,000	40
Bilqas	272,670	13
Timayy Al lmidid	155,000	3.6
Shirbin	300,000	25
Matariya	21,434	6
Nabaruh	-	-
Gamaliya	9,022	3
Bani lbayd	87,000	4
Mit Salsil	60,000	10
Gamasa	-	-
Total	3,478,689	366.1

Source Eng. A. Shoman. Municipal Solid Waste in Dakahleya Governorate, February 1999.

The sources and quantities of waste reported as being generated in rural areas, which mostly gives a figure of 0.1 kg/capita per day. But this has no bearing on the quantities of waste for disposal due to the extensive re-use and reclamation practiced in these areas. The most realistic figure available for the quantity of waste for final disposal in rural areas is that quoted in Table 5.2 (0.06 kg/capita per day). This figure, whilst almost certainly being realistic for truly rural areas, might be a little too low for the larger towns ("villages") in rural areas. However, since these towns have very rural characteristics and practices, the figure of 0.3 kg/capita per day is considered sufficiently accurate to use for all rural areas of Dakahleya.

5.5.2 Waste Characteristics in Dakahlia Governorate:

Data relating to the characteristics of urban and rural waste is shown in Table 28 below.

Table 28. Composition of Solid Waste in Urban and Rural Areas of Dakahleya Governorate

Item	Urban Areas (%)	Rural Areas (%)
Organic Material	60-70	50
Paper	0.5	0.2
Carton	0.8	0.4
Plastic	0.2	0.08
Glass	0.72	0.3
Metals	0.4	0.02
Bone	0.02	0.02
Rags	0.3	0.1
Dust	7-5	25
Other	15.20	22

Source: Eng. A. Shoman. Municipal Solid Waste in Dakahleya Governorate, February 1999

5.5.3 Waste Collection and Transfer in Dakahlia Governorate:

- *Urban Waste Collection*

Routine waste collection does not take place throughout every urban area of Dakahleya. In many non-central areas of the cities (i.e. virtually all areas except the higher-income peri-urban areas) there is nothing more than an ad hoc removal of accumulated waste when it becomes intolerable, and scavenging. In areas where there is waste collection, practices vary. The following is a generalized yet representative description.

Two groups undertake formal collection: the municipality and private collection companies. The latter require legal licensing from the municipality, although none have it. The private companies hire their own staff, charge their own rates and previously used municipal dumpsites at no cost. Since 1998, the Mansoura composting plant has charged companies a monthly fee to compost their waste.

To collect waste, containers are commonly used as collection / transfer points. However, they pose operational problems. The ones that are designed with a wide, open top allow easy disposal by residents, yet are difficult to empty because they must be emptied from the top. And those that have smaller openings at the top but still allow for the easy drop-off of rubbish bags do not have large enough openings at the bottom for emptying by cleansing crews. This, however, is a problem that can be overcome by developing a practicable and locally relevant design.

Table 29. Solid Storage Facilities in Urban Areas of Dakahleya

Urban Area	Boxes	Collection Bins
Mansoura	280	60
Talkha	100	-
Shirbin	177	-
Bilqas	125	-
Aga	30	-
Mit Ghamr	-	-
Sinbillawayn	50	25
Timayy Al Imdid	25	60
Dikirnis	35	-
Minyat An-Nasr	-	-
Gamaliya	-	-
Manzala	110	-
Matariya	200	-
Nabaruh	35	-
Gamasa	50	490
Bani Ibayd	20	50
Mit Salsil	-	-

Source: Abdel Salam, Hamdi-Al. Municipal Solid Waste in Dakahleya Governorate, April 1995.

Both types of containers are often deliberately set on fire when they become full (i.e. when they have not been emptied as regularly as necessary or are too small). This situation occurs particularly when cleansing departments are understaffed due to the poor holding power of municipalities over part-time employees and the pull of the agricultural sector during harvesting times.

The collection of waste can take place up to three times per day. The frequency depends on the size of the population, the volume of waste generated, the affluence of residents and the financial resources of the municipality, commercial and market wastes may be collected once or twice daily. In smaller towns (in rural areas) waste collection is usually on an ad hoc (i.e. urgent need only) basis.

The constraints faced by municipalities in acquiring additional resources to improve services - or even just to cover basic budgets - have led to poor maintenance of street containers, fewer collection shifts, and vehicles falling into disrepair.

- **Rural Waste Collection:**

The methods used for the collection of waste in rural areas vary a lot. In larger towns, waste collection is commonly performed on an ad hoc basis (i.e. only if urgently needed). In small villages and other less populated areas - particularly if there is no local cleaning company - waste collection is virtually non-existent.

As none of the waste collection units has a maintenance shop or garage, any repairs (usually of tractors) are sent to the private sector. The money to pay for these repairs - and for the cleaning itself - comes in the form of gifts and donations from local residents.

More information on the cleaning sector in the *marakaz* and local units of Mansoura is provided in Table 30.

Table 30. Solid Waste Management in the Rural Local Units around Mansoura

Local	Population (x1,000)	Waste Tons/Day	Tractor/Trailers	Shifts Per Day	Labour Force	Waste Management System
Bedway	45	6	-	-	6*	Has a common dumpsite for all local units, which pay a fee to use it.
Kom El-Darby	35	4	2	1	6	A Cleaning company collects household waste for LE2/month for every unit
Shoha	35	8	1	1	2	The local unit cleans the main streets.
Mit Ali	20	2	1	1	4	A private cleaning company charges LE 2/month per household.
Tanah Barq El-Ezz	75 36	4 6	1 2	1 2	4 8	The Community Development Association charges Le 2/month per household to collect waste
Oweash El-Hagar Naqita	41	2	4	1	6	
Baramoon	73 50	5 4	2 2	2 1	6 6	A private cleaning company charges LE 2/month per household.
Salamoon	35	3	1	1	4	A private cleaning company charges LE 1/month per household and LE 2/ month per shop.
Mahalet Demma	50	12	2	1	8	The local unit charges LE 1/month per household and LE 2/month per shop
Total	495	56	18	-	60	

* Supervised dumpsite

Source: Eng. A. Shoman Municipal Solid Waste in Dakahleya Governorate, February 1999.

- *Transfer*

The equipment used in most cities in Dakahleya has been developed from homegrown technology - tractors and trailers are the predominant technology used. In Mansoura City Twenty-two compactor trucks with a capacity of 4-6 m³ have recently been purchased. Although each district owns one or two compactor vehicles that came from grant-aid some twenty years ago, tractor-trailers are the most common form of transport used for waste collection, reflecting the agricultural flavor of the Governorate.

Most of the equipment does not function efficiently as it was designed for agricultural use on farms not for the municipal collection of waste. Furthermore, the streets do not always accommodate them. Also, the commonly used tractor-trailer combination is difficult to load amongst others because of the high loading height, and collected waste either falls from or blows off the trailer during travel.

The vehicles working in solid waste management in the urban areas of Dakahleya are shown in Table 31, whilst details of the capacity of the transportation system in Mansoura are given in Table 32. The quantities of solid waste transported to the composting plant in Mansoura are given in Table 33.

Table 31. Transportation Vehicles Working in Solid Waste Management in Urban Areas of Dakahleya

District Center/City	Tractors	Trucks
Mansoura	38	22
Mit Ghamr	12	5
Sinbillawayn	17	3
Dikirnis	22	2
Talkha	13	4
Aga	6	3
Manzala	17	1
Minyat An-Nasr	18	1
Bilqas	10	6
Timayy Al Imdid	4	-
Shirbin	20	3
Gamaliya	10	1
Matariya	19	2
Bani Ibayd	5	-
Mit Salsil	8	1
Nabaruh	9	-
Gamasa	4	2
Total	232	

Source : Eng. A. Shoman Municipal Solid Waste in Dakahleya Governorate, February 1999.

Table 32: Capacity of Solid Waste Transportation System in Mansoura

	Tractors	Trucks	Loads (from 10am – 6pm)	Loads (during night shift)	Total Loads per Day
East District	22	9	50	5	55
West District	16	13	47	4	51
Total	38	22	97	9	106

Source : Eng. A. Shoman, Municipal Solid Waste in Dakahleya Governrate, February 1999.

Table 33: Amount of Solid Waste Transported to the Mansoura Composting Plan

Source of Waste	(tons per day)
City of Talkha	30
University Campus	8
Central security Camps	2.5
Military Camps	2.5
Oil Factory (Sandoub)	4
City of Aga	12
Fertilizers & Chemical Company	2.5
East District	115
West District	160
Total	336.5

Source: Eng. A. Shoman Municipal Solid Waste in Dakahleya Governorate, February 1999.

Each district has a maintenance and repair department supervised by the chief engineer who is responsible for all vehicles district-wide. The work is generally undertaken on the basis of crisis management and there is little, if any, preventive maintenance. The vehicles and equipment are often out of use due to breakdown, and parts are often obtained by cannibalizing other municipal vehicles.

5.5.4 Treatment and Disposal in Dakahlia Governorate:

The dumping of waste also varies, but is generally based on convenience. The local units in the vicinity of Mansoura City and most of the local units use open areas. Actually, the existing final disposal sites for solid waste in Dakahleya are all uncontrolled dumpsites - with the exception of the controlled landfill site at Mansoura.

The dumpsites create environmental and health problems, including:

- Smell nuisance
- Air pollution, particularly, due to the burning of dumped waste.
- Blowing of dumped waste
- Free access to scavengers, children and, indeed, any person or animal, due to the absence of security fencing.
- Risks of hazards to the health of nearby people caused by disease vectors.
- Damage to nearby farmland.

In addition, most of the dumpsites are located at relatively short distances from city and town centers. There are also many informal (and often illegal) disposal practices: even municipalities are knowingly disposing of waste illegally because they see no other solution to their problems (e.g. Bilqas dumps waste on the banks of the River Nile). There is also a tendency to resort to dumping household waste of every sort into both irrigation and drainage canals. This misuse of an important resource creates particular problems in the summer months when the scarcity of water forces farmers to irrigate their crops from polluted canals.

5.5.5 Recovery and Recycling in Dakahlia Governorate:

Informal collection covers the recovery of much of the non-organic content of solid household waste. It recovers plastic and some metals; the staff of private collection companies do the same, but different working practices sometimes allow them to sort in local transfer stations owned by the private collection companies. Informal street peddlers recover plastic from residents and scrap metal from industrial and commercial enterprises. However, collection-crews tend to have first access to plastic waste in the homes of the more affluent, hence, the informal peddlers recover mostly from middle-to-low-income-houses.

The scavengers commonly collect directly from street collection/transfer points. In towns like Shirbin and Aga, where income levels are relatively low and populations are less urbanized, residents separate recyclable components of their waste for sale or barter to peddlers which makes scavenging street collection/transfer points less profitable.

Dumpsite scavenging is the last point at which recovery is practiced by the informal sector. As for the formal sector, composting plants were established in Mansoura and Matariya in 1998 with picking belts to segregate waste, thus promoting recovery.

5.6 Current Solid Waste Management Practices in Fayoum Governorate:

5.6.1 Waste Generation in Fayoum Governorate:

The following is a summary of a three-day experiment carried out in March 1997 in order to estimate the rate of waste generation in one city and one village of each Markaz in the Governorate of Fayoum.

The generation rates measured by kg/person/day ranged between 0.3 in Senouris to 1.58 in Itsa, while the generation rates in villages ranged between 0.39 in Senouris and 1.75 in Itsa again. This shows that Senouris City and Markaz have the lowest waste generation rates while Itsa City and Markaz have the highest generation rates. Fayoum, Ibshaway and Tamia fall in the middle of these figures regarding waste generation rates.

However, the figures shown regarding the amounts of waste generated in each city do not represent the total amount of waste generated in these cities. They only represent about 90% to 97% of the total urban waste generated in these places, as there are other sources of waste generation such as hospitals, offices and institutions, markets, commercial establishments and so on.

Waste generation rates from the other sources were checked and estimated by the number of loads collected from them per day as one trailer load is equivalent to 1.5 tons when the waste density is between 0.2 to 0.3 T/m³.

5.6.2 Waste Characteristics in Fayoum Governorate:

The composition of waste was as normal as the typical waste of a pre-urban area (rural Governorates). For example, the organic matter ranged between 71.2% in Senouris to 82.7% in Itsa. This means that using simple equipment (e.g. a loader and a serving drum) could make a composting industry there.

5.6.3 Waste Collection and Transfer in Fayoum Governorate:

The Governorate of Fayoum is typical of other Egyptian Governorates in terms of problems with residential waste collection and disposal. For this reason, this study was conducted in order to investigate the magnitude of the problem and the potential solutions. This technical study will address the current solid waste collection system and their inherent problems and proposal with different scenarios for the potential solutions.

In fact waste storage, collection and transportation are tied to each other. The inadequacy of waste storage will lead to an inadequacy of waste collection and transportation processes. Both the time and mechanism used for waste collection reduces the efficiency between 60-70% of the total waste found in the dust bins, where most of side roads are not cleaned on a regular basis and almost all the streets of the villages. Table 34 shows the current mechanical facilities used for waste collection in Fayoum Governorate.

Table 34. Waste collection facilities available in the cities of Fayoum Governorate

<i>Fayoum Directorates (Markaz)</i>	No. of Equipment	No. of Operating Equipment	No. of Equipment out of order	Remarks
<i>Fayoum</i>	69	40	29	13 out of the 40 are 50% efficient or less
<i>Senouris</i>	24	18	6	8 of the 18 are less than 60% efficient
<i>Ibshaway</i>	14	14	-	6 tractors & 8 trucks. Only 1 truck is 60% efficient
<i>Itsa</i>	17	17	-	6 of them are 60% efficient
<i>Tamia</i>	12	12	-	

Waste is collected from the rural areas in Fayoum Villages by trailers drawn by tractors. Each village is serviced on average by two trailers.

5.6.4 Treatment and Disposal in Fayoum Governorate:

Some of waste is burned in open fires, either naturally (by self-ignition) as a result of some biochemical reaction, or induced by the dumpsite guard who may want to reduce the amount of waste.

The waste is first either stored in temporary dumpsite inside the city and/or on the banks of a canal or drain side. The stored waste is collected on either regular or irregular basis to be sent to open dumpsites outside the city borders. Some of the cities do not have a specific dumpsite and some have open areas where the city waste collection trucks dump openly. Table 35 shows the status of the waste disposal sites in Fayoum Governorate.

Table 35. Status of Waste Final Disposal Sites of in Fayoum

Directorates (Markaz)	Site Location	Size	Remarks
Fayoum	El Hawara	10 feddans	Open, incineration, informal sorting
Senouris	On Cairo / Fayoum road	3 feddans	Open, incineration, informal sorting
Ibshaway	Abo-Gonsho Village	2 feddans	Open, incineration, informal sorting
Itsa	El Gharak Village	2 feddans	Open, incineration, informal sorting
Tamia	Around the city	-	Open, incineration, informal sorting

Solid waste collection and disposal has become a serious problem in residential areas, especially in urban poor settlements. The problem of waste collection and disposal is caused by different factors such as the increase of waste generated by the growth in population, on the one hand and from the increase of consumption habits on the other.

5.6.5 Waste Recovery and Recycling in Fayoum Governorate:

Waste in Fayoum is either reused or recycled on the household level. For example:

- Reuse of some plastic and/or glass bottles containing water. Some of the big tin cans are used for storage purposes in households.
- Recycle: families recycle the organic matter and use it as animal fodder. Peri-urban areas and almost all villages use their food waste to feed their poultry and/or animals.

Some waste peddlers go around Fayoum cities and collect recyclable wastes such as broken plastic objects and non-ferrous/ ferrous objects, plastic and glass bottles. These materials are sold to waste dealers (by weight and/or by piece). Similarly, some scavengers go around the city streets, to the temporary and final dumpsites to sort out part of these recyclable materials. Again, these are sold to waste dealers by weight or by piece.

There are two types of waste dealers in Fayoum; micro/small dealers who buy the waste materials from the street scavengers directly. The latter get up to 0.25 ton of some waste (e.g. plastic) per day. They sell their waste either from the micro/small dealers or from the waste peddlers. The small/medium dealers can have 1-2 tons of some waste material (e.g. plastic).

Table 36 shows the amounts of waste used under different waste disposal practices e.g. feeding animals, sorting/recycling, incineration and final disposal. These figures were calculated based on the experience of waste disposal in Cairo as well as the personal interviews with some of the waste

peddlers, scavengers and dealers in Fayoum. There is a good potential for further recycling of both organic matter (as compost for example) and the other secondary materials.

Table 36. Estimated Amount of Waste Used per Each Disposal Practice

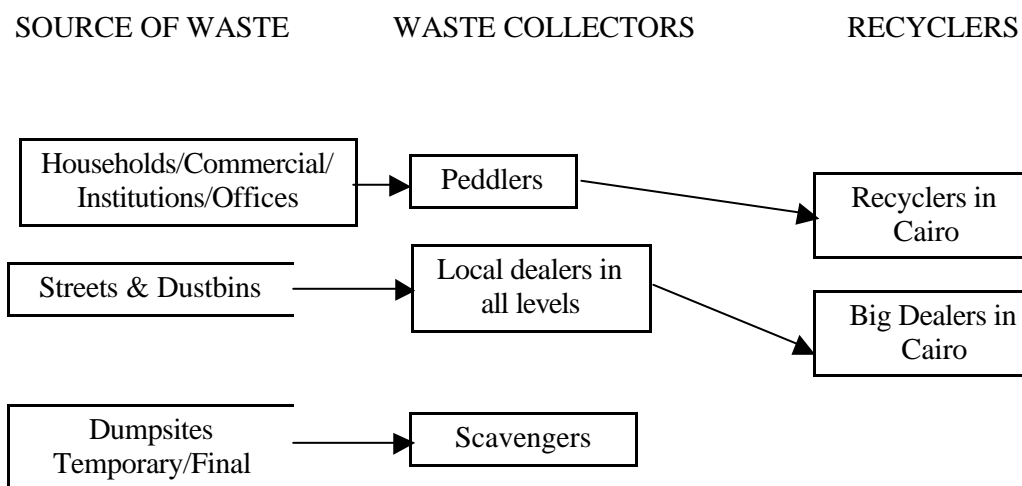
Directorates (Markaz)	Animal Fodder (tons/day)*	Sorted for Recycling (ton/day)*	Incinerated (tons/day)*	Remains in the Dumpsite (tons/day)
Fayoum	32	16	16	60.5 + 93 (153.5)
Senouris	4	2	2	12 + 5 (17)
Ibshaway	8	4	4	24 + 5 (29)
Itsa	12	6	6	36 + 6.5 (42.5)
Tamia	10	5	5	28 + 7 (35)
Total	66	33	33	277.0

*These figures were calculated based on the following statistics which resulted from the Shoubra & Damietta Composting Plants and the researches conducted in the Zabbaleen Community:

- 71% of the total amount of waste is sorted as recyclable material or 33% of the total average recyclable material.
- 14-15% of the total amount of waste is used for animal feeding or 23% of the total organic matter.
- 10% of the total organic matter or 7% of the total waste is incinerated by the end of the day.

Figure 2 shows the flow of the secondary materials (recyclable materials in Fayoum).

Figure 2. Flow Chart of the Recyclable Materials in Fayoum



The following is the market prices of some of the waste materials in different levels:

Table 37. Market Price of Some Waste Materials in Fayoum

Material	from Scavenger/ Peddler to Micro/Small Dealer (LE/kg)	From Micro/Small Dealer to Small/Medium Dealer (LE/kg)	From Small/Medium Dealer to Cairo Dealers (LE/kg)
Plastic*	0.25	0.35	0.5
Ferrous**	0.20 – 0.25	0.35	0.45-0.5
Non-Ferrous*** (Aluminum/Copper)	3-4	4-5	5-6

* About 3-5 tons of waste plastics go to Cairo from Fayoum/day

** 1-2 tons of ferrous metals go the Cairo form Fayoum/week.

*** Few tons of kilograms of non-ferrous wastes go with the ferrous wastes to Cairo/week.

5.6.6 Hazardous Waste Management in Fayoum Governorate:

The hospital waste generated in Fayoum Governorate is either burned openly in a very primitive way (in a barrel) – except in Fayoum Central Hospital that has an incinerator-, or hazardous waste is collected with the other municipal wastes, transported, and dumped openly in the public dumpsites. Industrial waste is not classified into hazardous/non hazardous. It is collected with other municipal wastes, transported and dumped openly in the public dumpsites.

6. Performance Assessment and Analysis

6.1 Introduction:

This chapter will discuss and assess the policies, regulatory and institutional framework of SWM in Egypt. To get a thorough assessment, a number of factors have to be examined which are interrelated and which should be seen from two points of view:

1. The Current SWM system in Egypt
2. The Proposed Strategy

6.2 Regulations and Environmental Policies:

The Current SWM System in Egypt:

A number of laws govern SWM system in Egypt. Although the Egyptian Laws cover many aspects of SWM, they still need to address many other components, in order to fully cover all the dimensions involved. There is a lack of legal possibilities to force residents to pay, thereby securing operational expenses, to say the least, for private waste collection companies. This legal restriction also prevents new companies from working in this field.

The present laws lack many articles and /or amendments, which require for example:

- The participation of people in waste collection services whenever they are available (i.e. residents contribution has to be compulsory not optional).
- An increase in the 2% cleansing tax to cover waste collection and disposal expenses.
- The facilitation of waste collection businesses in terms of licensing, taxes and disposal expenses.
- The facilitation of waste recycling businesses in terms of licensing, taxes and other services.

- The separation of waste at source in some public/private, commercial/industrial institutions.
- The allocation of waste disposal sites in the Governorates, which do not have desert extensions.

The Proposed Strategy:

The legal dimension is not discussed in the main objectives of the proposed National Strategy, although it is mentioned under the Strategic Options as “Actions towards those who do not comply with requirements”. However, the legal dimensions are implied in most of the Main Principles and the Strategic Options, for example, improving the workers’ conditions would require a decree or an amendment or a new law to be passed.

6.3 Institutional Sustainability:

Four conditions for institutional sustainability will be considered:

- Able Local Governments with Capable Staff
- Salary and Incentive Structure of Local Authorities
- Public Awareness of the Environmental Impacts of Solid Waste Management
- Public Participation

6.3.1 Able Local Governments with Capable Staff:

- ***Current SWM System in Egypt:***

This point in particular is very interrelated and attached directly to cost recovery. The lack of staff for waste collection and disposal and/or their lack of skills, the inefficiency of their performance are all due to a lack of funds, which in turn is a direct result of the shortage of cost recovery.

Labor – related problems in waste management in Egypt under the current public institutions are due to the following constraints:

1. lack of non-skilled and skilled staff
2. shortage of training
3. inefficient work due to lack of incentives and appropriate tools and equipment.

In many instances, the local government depends on temporary staff more than on permanent staff because of financial constraints, which impacts negatively on the overall system. On the other hand, the traditional waste collectors, the Zabbaleen and the private non-Zabbaleen companies do not have such problems. This is because they provide relatively higher salaries and provide monthly incentives based on the overall performance.

- ***The proposed strategy:***

This point is partially covered under the sustainability principle, which was defined as (effective financial and organizational structure).

6.3.2 Salary and Incentive Structure of Local Authorities:

- ***Current SWM System in Egypt:***

Realistically speaking, local authorities in Egypt do not have an incentive structure. Whereas, those who work in waste water for example, and other public services and utilities receive a “job risk allowance”, laborers of waste collection and disposal do not receive any form of compensation, be

it incentives or allowance for the nature of work. Therefore, it is only private companies that may offer such a financial structure.

- ***The Proposed Structure:***

Under the main principles of the proposed strategy, improving the workers situation is listed as far down as number 8. However, this point may also include offering other benefits such as training, salary increases, appropriate protection gears for staff, tools and equipment etc.

6.3.3 Public Awareness of The Environmental Impacts of Solid Waste Management:

- ***The Current SWM System in Egypt:***

The general sequence of SWM is the following:

1. Providing waste collection/disposal services
2. Conducting public awareness campaigns
3. Applying and enforcing relevant laws

It is generally understood that it would be waste money and efforts to create awareness among those people who do not have a service. It will also be unfair to enforce the law on them. Therefore, providing people with the service is an action that has to be applied prior to conducting any public awareness campaigns. For the time being, some of the local NGOs who are interested and concerned with environmental issues, in general, and solid waste management in particular, are engaged in public awareness campaign programs. However, their target groups may suffer from the lack of waste collection services all together or the inadequate waste collection and disposal service.

Similarly, the National Program for Public Awareness regarding the environmental impact of SWM is still in its infancy. It lacks many aspects which, if present, would contribute to the successful implementation of the program. For example, collaboration and coordination with the local authorities and relevant institutions, networking on a nationwide scale, funding and other factors.

- ***The Proposed Strategy:***

The proposed National Strategy stipulates public awareness as part of its main objectives and mentions this clearly in the “Strategic Options”, the “Participation of NGOs” and under the “Actions towards those who do not comply with the requirements. The strategy mentions public awareness again under the “Main principles”, under the “ Technical Options” and under the “Preparation of the action plans”.

6.3.4 Public Participation in SWM:

- ***The Current SWM System in Egypt:***

The only comprehensible participation of the public in SWM is through either of the following:

1. participating in the private waste collection services
2. dumping waste into the nearest dustbins or waste boxes/containers in streets

However, this is not applicable in all cases because:

1. Some people do not participate in the available private waste collection service, as the law does not oblige them. Therefore, they dump their waste in streets and/or open areas.
2. Some people neither have the private service of waste collection from their homes nor do they have dustbins or waste containers near their homes, so they are forced to behave in the way they do, i.e. by dumping waste onto streets.

Moreover, waste collection services provided by the local municipalities do not include waste collection from people based on a door-to-door system. At the same time, the Zabbaleen and non-Zabbaleen private companies collect waste from high and middle income residential and commercial areas where people can afford to pay a monthly fee-for-service and the composition of waste is appealing to waste collectors. Especially the Zabbaleen who sort the collected waste into different fractions, sell the recyclable materials and raise animals on the organic fraction.

Other poor areas are not served at all but through the random distribution of the poorly designed waste boxes which have neither sufficient capacities to receive incoming waste, nor adequate capacity for the use of people and or waste collection trucks. In some case, the local NGOs, PVOs and CDAs conduct public campaigns for street cleansing and transporting or collecting wastes from people on a regular basis.

- ***The Proposed Strategy:***

Both the general objective and the main objectives of the strategy, in addition to the “Main principles”, “Strategic Options” and the “Preparation of the Action Plans” focus on enabling the local Governorates to provide and implement an effective sustainable management system of municipal solid waste in urban and rural areas in Egypt. This will never be realized unless there is a complete public participation in the system.

6.4 *Private Sector Performance:*

6.4.1 *The Private Formal Sector:*

Points of strength:

- It is registered, formal and has technical and administrative capabilities for proper waste collection and disposal. It is reliable in any local, regional, and national plan.
- It introduces the modern and sanitary waste collection and transportation equipment, tools and sanitary protective gears to do its business.

Points of Weaknesses:

- It does not recover any portion of the waste it collects. This shortens the lifetime of the available dumpsites.
- It may be slightly more expensive than the informal private waste collectors as its income depends only on the monthly fees that are collected form the service recipients.

6.4.2 *The Private Informal Sector:*

Points of Strength:

- It uses cheap well-trained laborers
- It recovers up to 80% of the total waste that is collected, through sorting and recycling activities.

Points of Weaknesses:

- It can cause a lot of health and environmental problems during waste collection, sorting and recycling, as these activities are done with bare hands and very primitive techniques.

6.5 Financial Sustainability:

Financial sustainability will be dealt with from three points of view:

- Cost recovery
- Local taxes
- Funding

6.5.1 Cost Recovery:

- *The Current SWM System in Egypt:*

The current financial system of SWM in Egypt does not cover the costs of waste collection and disposal services carried out by the government, as represented by the local municipalities. The costs of waste collection and disposal of one area, in the majority of cases, exceed the revenues collected from the residents of that area. This explains the shortage of waste collection coverage to many places in urban and rural areas in the Egyptian Governorates. It also explains the lack of waste disposal sites, the availability of human and mechanical resources, the appropriateness of the waste collection and disposal facilities, which is also why the current system is not self-sustainable. However, the private waste collection system in high and middle-income areas in the main cities in Egypt, is financially sustainable. This system relies on either the traditional waste collectors- the Zabbaleen- who reside mainly in Cairo, Giza, Shoubra El Kheima, Alexandria and some other cities in the region, or on those private non-Zaballeen companies which operate in many cities in north and south Egypt.

The Zabbaleen recover a good part of the costs of waste collection and disposal from raising animals-mainly pigs- and selling sorted and or processed recyclable materials such as; plastics, glass, metals, bones, paper, textiles.etc. This allows the Zaballeen to ask for a minimal charge (i.e. a monthly fee-for-service) from the residential areas they service. On the other hand, the non-Zabbaleen private waste collection companies recover their costs from the residential units only. In such a case, they either obtain their fees from people directly or from the government through a service contract.

The Proposed Strategy:

As was mentioned earlier in Chapter 3, one of the main principles in developing a strategy is sustainability, which was described as (effective, financially sustainable and with a good organizational structure).

6.5.2 Local Tax System:

- *Current SWM System in Egypt:*

The current tax system related to waste collection and disposal is only 2% of the nominal rents paid to the government by occupants. This tax was issued many years ago when both labor costs and equipment were markedly low compared with the rental values of the residential units. At the same time, public policies, has since the 1960s prevented increases in the rents of apartments whereas the costs of equipment and labor have increased several folds. Hence the cleansing tax is very inappropriate and covers a very little segment of the overall costs of waste collection and disposal on the governmental level. That is to say that the 2% tax which used to be the main source of funding for the waste management system, does not and cannot cover the costs of the local SWM system, until the rents of residential units are raised.

6.5.3 Funding of Solid Waste Management:

- ***Current SWM System in Egypt:***

There are two sources of funding SWM in local governments in Egypt. These are:

1. General funding allocations from the Central government
2. Funds raised by charges levied in the Governorate for example the cleansing fund, which is generated by the cleansing tax (2%), fines charged for violation and gate fees and the local development fund, which is obtained by the fees imposed on drivers; licenses, buildings and school fees.

In principle, the local development fund can be used for any purpose; for example, part of it is used to fill any financial gaps in SWM expenditure.

- ***The Proposed Strategy:***

The proposed national strategy for the municipal solid waste management was discussed under the strategic options of financing the SWM system. It is mentioned that private financing of the service-through contracting private waste collection companies would be responsible for buying equipment and hiring staff. This would entail that the residents would pay all the costs of some of the services, including waste collection. Other options for financing the system could be proposed and introduced such as joint ventures between the public and the private sector.

6.6 Technical Performance:

The following three indicators were used to assess the technical performance of solid waste management in Egypt:

- Collection efficiency
- Recovery rate
- Proportion of waste treated in sanitary landfill

6.6.1 Collection efficiency:

It is reported in the National Environmental Action Plan (1992) that some 68 percent of municipal waste is collected on average in Cairo; of this about half is collected by Zabbaleen (“garbage collectors”). In effect, waste collection efficiency range from zero percent in low-income rural areas to 90 percent in high-income areas of large cities. The proportion of waste collected is much less in many other areas of the country, particularly in poorer areas, where the only means of solid waste disposal is often informal scavenging by people and animals, natural biodegradation and dispersion, burning at the primary point of disposal, and local self-help for disposal to informal (technically illegal) dumping sites.

According to the estimates of Cairo Cleaning and Beautification Authority (CCBA), the efficiency of waste collection in Cairo Governorate ranked about 80%. CCBA’s district branches collect about 40% of the total daily-generated waste. The private waste collectors and the traditional waste collectors (*zabbaleen*), who are located in four settlements; Ezbet El Nakhl, Mokattam, Tora and Helwan, are collecting another 40% of the total daily-generated waste. The rest of daily-generated waste, about 20%, is currently left in the streets for casual collection, due to lack of mechanical and human resources.

In Fayoum Governorate the waste collection efficiency is 60-70% of the total waste found in dustbins, where most of side roads are not cleaned on a regular basis and almost all the streets of the villages.

6.6.2 Recovery rate:

In Cairo it is estimated that over 30% of the municipal solid waste is recycled by the *zabbaleen* (about 3000 tons/ day).

About 80% (2,880 tons/day) of the total waste collected by the private waste collectors and the traditional waste collectors (*Zabbaleen*) is manually sorted and recycled. Only about 3% of the total waste, currently transported to the composting plants, is sorted out.

6.6.3 Proportion of waste treated in sanitary landfill:

About 95% of the waste collected by the municipalities are disposed of in open dumps. Three “semi-landfills” or “controlled- tipping” type of dumps, have been established and operated in Cairo, Giza and Alexandria. These are not considered typical of sanitary landfills, which secure sealing of the surroundings of the fill. Meanwhile, the GTZ is currently establishing a prototype landfill in Aswan for demonstration purposes. Two other small landfills have been established in Upper Egypt.

6.7 The Current SWM System in Egypt:

The financial deficit in the current SWM system in Egypt, in addition to some other factors, have induced the following technical problems:

Waste storage: They are mainly waste tanks, barrels and baskets.

- The inappropriateness of the current waste storage facilities as used by people (i.e. over-filling the storage containers with waste).
- The inappropriateness of the current waste storage facilities for the current waste collection and disposal equipment (i.e. emptying barrels from waste)

Waste collection: They are mainly trucks, tipper trucks and trailers drawn by tractors.

- The inappropriateness of the waste collection facilities for waste storage facilities.
- The inappropriateness of the waste collection facilities for waste treatment purposes (for example, using compactors and crushers which destroys and mixes waste and consequently hampers waste sorting, recycling and composting).

Waste treatment: They are mainly composting plants and incinerators.

- The inappropriateness of waste collection facilities for waste treatment facilities.
- The storage capacity of waste treatment facilities i.e. limited storage capacity.
- Rudimentary technology used for waste sorting, treatment and recycling.

Waste Disposal: They are mainly open dumpsites on vacant plots of land, cultivable land, canal banks and old drains.

- The inappropriateness of the waste disposal sites and locations to the nature and amount of waste.
- The open dumping of waste in open areas, canal banks and old drains which is detrimental to health and environment.

6.8 The Proposed Strategy:

The proposed technology used for waste management has been mentioned several times in the proposed national strategy and can be summed up as follows:

- Point no.3 in the “Main Objectives” regarding the gradual development of recycling activities

- Point no. 6 in the “Strategic Options: Technical Specifications”
- Point no. 8 as “Some Technical Options” under the Main Principles
- The first four points under the “Preparation of the Action Plan”
- Points numbers 2,3 and 4 of the “Role of the EEAA”

7. Major Policy and Institutional Constraints that Hamper Progress of SWM

7.1 Introduction:

There are many reasons for the constraints that hinder progress in SWM in Egypt. Some of these reasons are due to the current policies and some of them are due to legal, financial and institutional aspects.

The constraints that hinder the progress in SWM can be attributed to a deficiency in the enabling environment that should encourage the private and non-governmental sectors to participate fully in the local, regional and or/national solid waste management system. This can cause a lack of sustainability on the part of the system and make it dependent on direct governmental and other external support. The indirect cost of such a deficiency goes beyond the direct numerical costs of inadequate waste collection and disposal services. It may expand to create unpredictable socio-economic and institutional disturbances on various levels of the public services.

7.2 Constraints Due to Policies:

There are many constraints that fall within the national regional and local policies of SWM and other relevant issues such as:

- The ultimate (general) objective of waste collection and disposal is not yet clear. In other words, it is not clear whether the main objective is to maximize waste reduction, reuse and recycling approaches or just to get rid of the waste. The first option requires planning and implementation of a series of national, regional and local socio-economic and institutional programs.
- Laws are not adequately enforced, for all violators from both sides (waste service providers and waste service recipients). This is because of many factors such as: lack of human resources needed to enforce the law, lack of fund to assist those who should enforce the law (e.g. supply them with cars, and contamination analysis equipment and so on). Furthermore, the political inability to enforce the law on some people for a reason or another.
- When the strategy is confirmed first, we can look for the feasibility of reaching goals/targets defined in SWM strategy.
- The main obstacle in attaining the objectives of SWM strategies/plans is the inability to agree on a national strategy that is accepted by all key stakeholders and parties in Egypt. When there is only one identity that is responsible for SWM in this country not ten, when there is some fund that is allocated for such strategy, when the law is enforced on everyone whoever he/she is and in all similar cases. Then we can think of attaining SWM strategy objectives.

The current policy lacks many programs such as:

Technically:

- Preparing a series of transfer stations where waste could be sorted and baled.
- Encouraging sorting of waste at source, at least among high and middle-income neighborhoods.
- Encouraging the use of the multiple-use packaging materials such as glass bottled, textile bags, etc. Also, setting-up a series of drop-in stand points where people can return back plastic or glass bottles to the same manufacturing companies or to other recycling institutions.
- Encouraging the use of recyclable packaging materials at all levels for local use, export and import.
- Encouraging coding of plastic polymers by using the international codes that facilitate the sorting of plastic waste materials into their organic polymers.
- Reviewing the production standards so as to encourage the use of recyclable materials in the production process without any violation to the technical and environmental specifications.
- Establishing a technology transfer and data base network where people and entrepreneurs can use it for improving the levels of waste collection and recycling.

Financially:

Facilitate cost recovery of waste collection and disposal activities through different approaches such as:

- Increasing the cleansing tax (currently at 2%)
- Making public participation in the private waste collection service compulsory (not optional)
- Allocating enough budget for waste collection/disposal services from the national budget
- Encouraging waste minimization and recycling programs which not only reduces the amounts of waste but also recovers part of its costs
- Establishing waste recycling revolving fund
- Giving incentives to waste collectors and recyclers through minimization of customs, fees, taxes and allocation etc...
- Giving incentives to waste sorting at source programs
- Encouraging public donations for waste management related activities so that income taxes can be reduced.
- Supporting financially; pilot projects in this matter.
- Preparing feasibility studies for waste collection, recycling projects.

Legally:

- Facilitating the privatization of waste collection and disposal based on the cost recovery approach.
- Enforcing the cleansing laws, regulations and decrees that prohibit the open dumping and incineration of waste.
- Obtaining clear plans for new cities, resorts, public activities with estimations of amount and composition of waste and the proposed waste storage, collection, transportation and disposal facilities and approaches.
- Facilitating waste sorting at source, waste minimization and waste recycling through incentives and penalties (e.g. Taxes, customs, dividends)
- Creating so-called “Environmental Police” that can handle public/private cases of abuse of the environmental laws and regulations.

7.3 Institutional Constraints:

This part will discuss the organizational, administrative, as well as the institutional policies that hinder progress in SWM. On the local, regional and national levels, the current SWM system lacks the following points, which causes apparent weaknesses of any SWM system:

Administrative:

- Establishing Environmental Management Units (EMUs) in all Egyptian Governorates and cities, in order to take care of waste problems and help in drawing the local and regional plans regarding SWM in their areas.
- Linking between these EMUs and the Egyptian Environment Regional Branch offices (EERBOs) in order to combine between the national plans and the local/regional plans based on their needs and feedback.
- Preparing a national training program to acknowledge the EMU staff and other relevant offices (EERBOs) with any improvement in SWM system (as a policy or as a technique)
- Establishing local, regional and national data base on SWM regarding not only waste generation rates, composition and human/mechanical resources, but also waste collection/treatment/recycling techniques, market price and market of waste materials, recycled products and recycling machinery.
- Integrating waste management policies and plans with the local, regional and national policies and plans to incorporate waste policies and plans with other relevant issues such as industry, health, urban planning, agriculture/land reclamation (in case of composting)...etc.
- Planning a specific target or group of targets regarding the level of waste collection, waste recycling and the like. For example, an annual increase of waste collection services up to x% and y% for waste recycling in general or for specific materials such as paper, glass, metals and or plastics, in particular.
- Organizing periodical public campaigns for encouraging people to participate in waste collection services, minimize waste generation, separate waste at source, and recycle waste, etc.

Institutional:

- Encouraging all local, regional and national NGOs, Community Based Organizations (CBOs) and CDAs to participate in diagnosing waste management problems and plan their solutions.
- Organizing a series of tracking programs for building capacities of the current NGOs, CBOs and CDAs that work in the field of the environment in general and SWM in particular.
- Encouraging the establishment of the environmental groups at school level and in the large public and private institutions, for example plants and companies.
- Encouraging the local initiatives through the local NGOs concerning waste minimization, reuse, reduction and recycling.
- Attracting businessmen associations to participate in the current and proposed SWM systems and plans in order to expand the role of the private sector in these fields of work.
- Empowering the role of women in this field as they are the most influential segment of the society that can minimize waste, sort it at the source, reuse part of it, teach their children on appropriate behavior of waste handling.

- Encouraging all the efforts made by schools and other educational, social and cultural institutions that focus on the right way to handle waste, minimize it to recycle it through audio-visual and artistic graphics and illustrations.
- Encouraging the establishment of labor unions and commercial chambers for those who work in the waste collection/recycling business.

8. Strategic Directions and Opportunities

8.1 Introduction:

This chapter discusses the framework of the proposed National Policy regarding SWM in Egypt and represents the possible opportunities for every participating stakeholder or potential stakeholders. The proposed strategic directions will follow the same sequence as the previous chapter. In other words, it will briefly discuss the technical, financial, legal, administrative and institutional levels, respectively.

8.1.1 Strategic Directions:

Technically:

- The proposed strategy should confirm whether waste will be reused/recycled or will only be disposed of in dumpsites or sanitary landfills.
- A clear definition of dumpsite locations in the old as well as the new urban areas is essential through persistent coordination with relevant authorities, such as the urban planning authority.
- Matching waste storage tanks with waste collection facilities.
- Adopting waste separation at source, waste separation during collection, waste reuse, reduction, treatment and/or recycling policies and encouraging waste exchange approach.
- Introducing advanced waste recycling technologies for cost recovery purposes and for attracting private entrepreneurs.

Financially:

All the previous and current designers of the National SWM Strategy agree on the importance of cost effectiveness of waste collection and disposal services and the necessity of being financially sustainable, based on Polluters-Pay principle. The dilemma here is how to collect the funds that are required for establishing the very necessary waste disposal facilities such as the sanitary landfills and composting plants, considering that the private sector can take care of waste collection service. Especially when we know that waste disposal facilities are capital consuming and not for profit facilities. This will be the great challenge in front of the Government. In depth investigation of the different financing tools and pay back methods have to be discovered based on other similar conditions and international experience.

- Cost recovery is the golden rule for financial sustainability of any services including solid waste collection and disposal. This may imply increasing the 2% cleansing tax to suit the current costs of the service and adopting the “who pollutes pays” principle. The Governorate of Alexandria, for example, may add waste collection and disposal services costs to the electricity bill.
- Similarly, the privatization of waste collection and disposal and improving waste collection and recycling conditions will definitely decrease the costs of this service.

Legally:

- Legal interventions do not only touch upon waste collection fees or cleansing taxes but also help in implementing the principle of “who pollutes pays”, through a clear definition of waste collection and disposal laws and regulations. Adding the cost of waste collection and disposal to the electricity bill, for example, needs legal permission.
- To facilitate the involvement of private sector companies and NGOs in the field of SWM also requires legal permission. This may take the form of taxes and customs reduction, better contractual conditions with the government for waste collection or operation of landfills.
- Revising the standards of the Egyptian Codes of production to permit for more recycled products and to encourage the recycling industry, (e.g. use recycled paper in government offices).

Administratively:

- Allocate and train staff for EMUs and RBOs and create a network among them.
- Establish local, regional and national data base regarding SWM in every Governorate including, not only waste quantities, composition, waste collection/disposal, human and mechanical resources, but also waste dealers, market prices of waste materials, waste collection, treatment and recycling/disposal techniques etc.

Institutionally:

Any new SWM system would be in bad need to have, at least, the local NGO's with it. The Substantial role for both the central and local NGO's is vital as a catalyst between the government from one hand and people from the other hand. They are the best actors for community participation, public awareness, and gender involvement in such a case.

- Draw a clear role and program for existing NGOs that currently work and wish to work in this field. This may include capacity building and technical and /or financial support.
- Other non-traditional CBOs, such as school groups, businessmen associations, religious institutions, trade unions should also be approached.

8.2 Opportunities

This section discusses the expected opportunities for the proposed strategic directions, which were discussed in the first part of this chapter. Noteworthy is the fact that, numerous socio-economic opportunities can be created in the event that, some or all of the implementation of the previously mentioned proposed strategic directions.

Financial Opportunities:

Direct:

- The government can save the budget, which is currently allocated for waste collection and disposal (estimated at L.E. 20,000,000 per year for the city of Cairo only), as the private sector, will assume responsibility for it.
- The government will decrease the budget which is allocated for employment purposes, as one ton of waste can generate employment for about eight persons working in the collection of waste to its final disposal. The labor structure is usually comprised of the following: three employees for collection, one for transportation, one for sorting and three for secondary sorting, treatment, selling/buying recycled materials and final disposal.

Indirect:

- Reduction on imports of some raw materials that could be sorted and collected from waste recycling, such as plastics, metals, glass and paper. Exportation opportunities of such materials could be possible.
- Extension of the life spans of landfills and dumpsites.
- Possibility of reduction of energy and consumption due to waste recycling.
- Reduction of chemical fertilizers and irrigation water used in agriculture by using compost from aerobic and anaerobic fermentation of organic municipal waste.
- Financial sustainability of the SWM system.
- Better tourism industry.
- Reduction of costs on health expenditures, generally by improving the standards of cleanliness.

Socially:

- Improving the quality of life due to a better and clean environment.
- Assurance of social acceptability and sustainability of SWM projects.
- Introducing to the public slogans like “someone’s trash is someone’s treasure” and “waste of anything, including waste of human resources, is something which is not in its right place” so as to advocate for and create awareness to the importance of appropriate SWM systems. This will also help people to understand that some current problems can be the solutions to many other needs.
- Respect the environment and obey the law.

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