

## **2. CHAPTER 2 LITERATURE REVIEW**

### **2.1. SOLID WASTES DEFINITION**

Solid wastes are all the refused materials. [10] In other words Wastes can be considered, as those materials no longer required by an individual, institution or industry.

Waste has different types that are listed below:

### **2.2. CLASSIFICATION OF WASTES**

This classification is according to the source of each type as listed below:

#### **2.2.1. Municipal Solid Waste**

Municipal wastes as defined by the National Strategy for Municipal Solid Waste Management (NSFMSWM) are:

Those that are composed of wastes generated by households and wastes of similar character from shops, market and offices, open areas, and treatment plant sites as listed below:

- i. Households [residential solid waste] – multi-family and single-family dwellings,
- ii. Commercial enterprises [commercial solid waste] – shops, stores, retail outlets, office buildings, service organizations, tourist services, hotels,
- iii. Industrial enterprises [industrial solid waste] – small industrial activities such as assembly shops, fabrication operations, etc.; and offices, shipping, and non-process activities of larger industrial activities,
- iv. Administrative and Governmental bodies,
- v. Educational enterprises
- vi. Seaports/Airports – dunnage, shipping materials, office activities, food services,
- vii. Street markets [11],
- viii. Camping/Sporting activities – campgrounds, athletic fields and gymnasiums,

- ix. Street, Square and Park cleanings
- x. Green wastes from upkeep of public parks and grounds, and
- xi. Dust and Sand blowing into urban areas from the surrounding hills and desert areas.

### **2.2.2. Green and Agricultural Organic Waste**

The waste that is generated by gardening and forestry activities in public parks, gardens and other green areas; [11] Fruits and vegetables that are wasted, either because of defects, or because of surplus production.

### **2.2.3. Construction and Demolition Waste**

The materials generated in the normal course of construction and demolition processes. Generally, these materials are not water soluble and nonhazardous in nature and they can be classified into:

- i. Excavation, which produces materials that are composed mostly of rock and soil, usually not contaminated.
- ii. Construction, producing wastes consisting of concrete spoils, bricks debris, scrap metal, demolition timber, glass, plaster, and plaster board. Construction wastes may also contain hazardous constituents from equipment maintenance (e.g. oil filters) or materials needed for construction (e.g. paints, solvents, glues, contaminated cloth, etc.).
- iii. Demolition, which generates either internal finishing that are removed before demolition, or demolition debris consisting of concrete, gypsum and reinforcement steel. Demolition wastes may also contain asbestos or wastes contaminated with other hazardous materials, depending on the building materials used and former utilization of the building. [11]
- iv. Road refurbishment, generating wastes consisting of asphalt, bituminous materials, sand and gravel from road layers.

### **2.2.4. Industrial Waste**

Industrial waste is the waste generated from business activities. Industrial process wastes include a very wide range of materials and the actual composition of industrial wastes in a country will depend on the nature of the industrial base. Wastes may occur as relatively pure substances or as complex mixtures of varying composition and in varying physicochemical states. Examples of the materials which may be found under this heading are:

- i. General factory rubbish,
- ii. Organic wastes from food processing,
- iii. Acids/Alkalis,
- iv. Metallic sludges and
- v. Tarry and oily residues.

The most important feature of industrial wastes is that a significant proportion is regarded as hazardous or potentially toxic, thus requiring special handling, treatment and disposal. [6] The industrial waste management is not covered by the local government in the developed countries, while in the developing countries, with generally in an inappropriate system for the management of waste; industrial waste is often treated together with the municipal wastes.

### **2.2.5. Medical Waste**

Wastes made wholly or partly of animal or human tissue, blood or other fluids, excretion, drugs or other pharmaceutical products, swabs or dressing or syringes or needles or other sharp instruments, and any other infectious waste or chemical or radioactive waste arising from medical, nursing, dental, veterinary, pharmaceutical or other practices, investigation, research, teaching, or sample collection and storage. [6]

Accordingly, medical wastes would encompass the following types [11], each requiring special ways for handling and disposal:

- i. Infectious wastes,
- ii. Sharpens and syringes and
- iii. Expired medicines and pharmaceuticals.

#### **2.2.5.1. The legal framework**

The legal framework is comprised of several laws that are directly or indirectly regulating healthcare waste management. Those are:

- i. Law 4/1994 for the Protection of the Environment and its Executive Regulation number 338 of 1995,
- ii. Law 38 of 1967 on General Public Cleaning and its Executive Regulation No. 134 of 1968,
- iii. Law 48 of 1982 for the Protection of the River Nile and Waterways from Pollution,
- iv. Law 12 of 2003 Unified Labor law for the protection of workers from expected harmful exposure.

- v. Furthermore, the Ministry of Health and Population Decrees number 82, 343 and 413/1996 and 192/2001, are parts of the legal framework. [12]

#### **2.2.5.2. The institutional framework**

The institutional framework for medical waste management that defines roles and responsibilities of different authorities are summarized as follows:

- i. The Cabinet of Ministers, Ministry of Public Health (MHP) and Egyptian Environmental Affairs Agency (EEAA) are responsible for development and adoption of public policies.
- ii. MHP, EEAA and the Civil Defense Authority supervise the implementation of policies and monitoring of performance.
- iii. MHP and EEAA are responsible for issuing lists and codes of hazardous substances and waste.
- iv. MHP, EEAA, Ministry of Housing and Governorates are responsible for development of guidelines and standards of performance and preparation of various contracts and licenses. [12]
- v. The Cabinet of Ministers, the Finance and Planning Ministries, and MHP are responsible for allocation of credits of finance.
- vi. MHP, EEAA with the participation of scientific and technical experts, and the Ministry of Communication and Information Technology are responsible for capacity building programs and awareness campaigns.
- vii. The Governorates and local municipalities are responsible for the management of the medical waste system, either directly or by contracting private companies, contractors, or Non-Governmental Organizations (NGOs).
- viii. The responsibilities of health care facilities are: reducing the rate of waste generation; and creating an integrated hazardous medical waste management system including source separation, collection, transportation, storage, treatment and final disposal.

#### **2.2.6. Radioactive Waste**

Refer to sources of “ionizing radiation”, which could come in different forms:

- i. Open Sources: Radioisotopes that are not permanently sealed in containers, so they may come in direct contact with objects or environmental matrices. They include, for example, isotopes used for medical diagnosis (e.g. isotopes of iodine),
- ii. Sealed Sources: Radioisotopes that are permanently fixed within completely sealed capsules or within tightly sealed solid enclosures that can be opened only by special equipment. [11]

- iii. Radiation Generators: Equipment capable of generating ionizing radiation, e.g. x-ray, neutrons, or electrons, when operated.

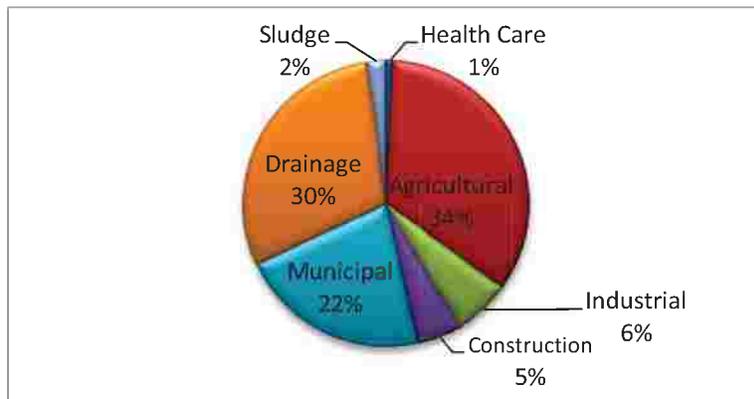
### 2.2.7. Water Way Dredging Residue

The main bulk of this waste came from the maintenance and widening of canals. [11]

### 2.2.8. Sewage Sludge

This waste type results from sewage treatment facilities. [11]

Types of wastes and their estimated values in Egypt according to the EEAA are displayed in figure 2 as shown below without mentioning the Hazardous waste value as it is a portion from every type of waste.



**Figure 2, the Wastes Amounts According to the EEAA Survey in Egypt**

### 2.2.9. Hazardous Waste

Hazardous wastes can stem from any of the above sources as residues or ash of different activities and operations containing properties of hazardous substances. Therefore it should not be taken as a part of the classification of wastes by source, rather as a cross-cutting character for all these wastes. There is no agreed definition of the term "hazardous waste". Some countries

define "hazardous wastes" only in terms of danger to human health, whilst others include damage to, the environment. The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal makes no attempt to provide a definite definition to hazardous wastes [14], it just states that: wastes to be categorized hazardous are "Wastes that are defined as, or are considered to be, hazardous wastes by domestic legislations".

Hazardous characteristics of wastes according to BASEL Convention are:

- i. Capable, by any means, after disposal, of yielding another material, e.g., leachate, which possesses any of the characteristics listed above.
- ii. Corrosives,
- iii. Ecotoxic,
- iv. Explosive,
- v. Flammable liquids,
- vi. Flammable solids,
- vii. Infectious substances,
- viii. Liberation of toxic gases in contact with air or water,
- ix. Organic Peroxides,
- x. Oxidizing,
- xi. Poisonous (Acute),
- xii. Toxic (Delayed or chronic),
- xiii. Wastes liable to spontaneous combustion,
- xiv. Wastes which, in contact with water emit flammable gases.

While many countries refer to similar hazardous characteristics in their environmental legislation, there may be considerable differences in the testing procedures used to determine whether a waste exhibits actually one or more of the characteristics.

It is almost impossible to obtain reliable information on hazardous waste raisings in any country because of poor data collection methods, infrequency of surveys, reluctance of industry to supply data, and because of ambiguities in the definitions of what constitutes a hazardous waste, and even continuously changing definitions of "hazardous waste" within the same country. [15] Treatment and disposal of hazardous waste is often difficult and very costly. This has made ocean dumping and export to countries with less strict regulations an attractive option.

#### **2.2.9.1. The State efforts regarding HS and HWM in Egypt**

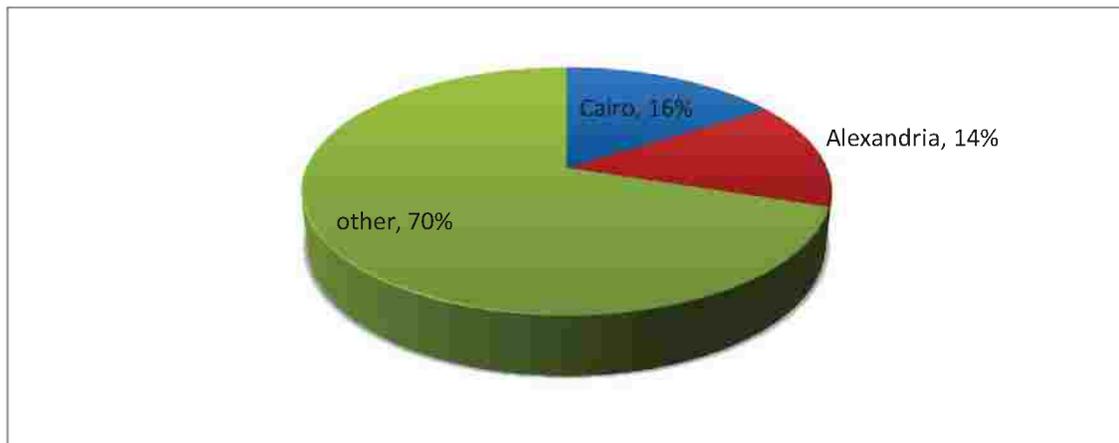
- i. Undertaking a comprehensive survey of the lead sources in the industrial region in Shobra El Kheima. Participating - jointly with the Egyptian General Organization for

Standards and Quality Control - in the issuing of the first Egyptian standard specification regarding incinerators of hazardous waste from health and veterinary facilities.

- ii. Implementation of the program planned to provide governorates with incinerators for hazardous medical waste and surveying the requirements of each governorate in this respect.
- iii. With the participation of the International Working Group formed under the Basel Convention, the technical roadmap of the environmentally safe management of POPs as waste had been issued.
- iv. Some projects in the area of integrated hazardous waste management had been implemented in Alexandria. [16]
- v. Finalizing the conclusion of the Frame-work Agreement between the Basel Convention Secretariat and the Government of Egypt with regard to the established Regional Centre for Training and Technology Transfer to Arab Countries.

#### 2.2.9.2. Hazardous Waste Generation Rates

Due to the current situation with hazardous waste management, the Ministry of Environment has determined that there is an imminent need for constructing hazardous waste treatment and disposal facilities nationwide in Egypt. In the two major industrial city areas, Cairo, and Alexandria, the quantity of industrial waste generated is approximately 60,000 tons/year. Of this quantity, Alexandria generates approximately 28,000 tons /year of hazardous wastes. There are approximately eight industrial areas in Egypt generating different types and quantities of hazardous wastes. It is estimated that up to a total of 200,000 tons/year of hazardous waste are generated from the eight areas. [17] As demonstrated in the following figure 3 the distribution percentage of Hazardous Wastes generation among the different Egyptian Governorates



**Figure 3, the Distribution Percentages of Hazardous Wastes Generation among the different Egyptian Governorates**

The EEAA has been involved in a project; which has been completed in September 2006 a facility for the treatment and disposal of industrial hazardous waste has been established in Alexandria. The responsibility of operations is now in the hands of the HWM Unit of Alexandria Governorate. The personnel of the HWM Unit of Alexandria Governorate are now well trained and experienced to operate the site.

### **2.2.9.3. The Nasreya Centre**

The facility is the first of its kind in Egypt, and represents the nucleus for the integration, improvement and further expansion of different hazardous waste management practices and services in Alexandria. [18] It has been developed within the overall legal framework of the Egyptian Law for the Environment, and is expected to improve prospects for enforcement of the regulatory requirements specified in this law. It has been developed with the overall aim of promoting the establishment of an integrated industrial hazardous waste management system in Alexandria, serving as a demonstration to be replicated elsewhere in Egypt.

#### Phase I, Start Up Phase

The Centre only accepts inorganic industrial wastes. In this respect, a waste acceptance policy has been developed.

#### Phase II, Running Phase

Policy review, with an expansion of the waste types accepted.

The following facilities and activities are available:

- i. Hazardous waste landfill for inorganic waste.
- ii. Evaporation ponds for rain water, leachate from the landfill and neutralized waste water from physical-chemical treatment plant.
- iii. Physical-Chemical treatment plant for liquid and sludge hazardous inorganic waste.
- iv. Solidification-stabilization unit for inorganic waste.
- v. Office, extended laboratory, garage, vehicles for transportation of hazardous waste.
- vi. Storage facility for inorganic waste Transfer station for organic waste.
- vii. Trained personnel capable of receiving and processing hazardous waste.

The waste types that are either accepted at the facility or rejected are demonstrated in table 1 below:

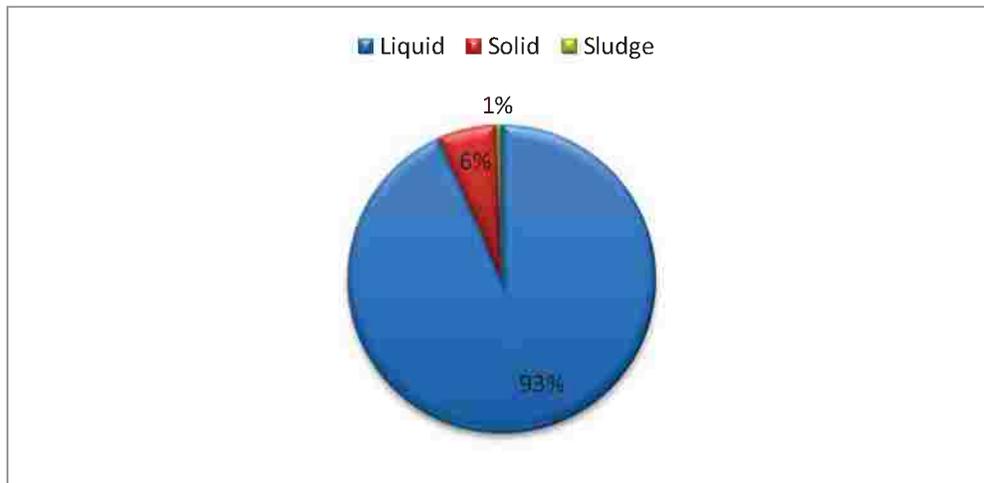
**Table 1 Types of Hazardous Wastes those are either Accepted or Rejected at the Naserya Centre in Alexandria**

Accepted Wastes	Rejected Wastes
Asbestos and Carbon Waste	Oil sludge and wastes oil
Contaminated Soil	Flammable organic waste
Metallurgical linings	Organ chlorine waste
Heavy Metals Wastes, Dry or Dewatered Sludge and Paint Sludge	Radioactive waste falling within the scope of the National Center for Nuclear Safety and Radiation Control
Waste Chemicals and their Containers	Medical waste falling within the scope of the MSWM
Resins and Polymers, Inks, dyes and lacquers	Explosive waste falling with the scope of the Ministry of Interior

The total quantity of hazardous wastes generated is approximately 27,900 tons per year in Alexandria. [18] The types of all HW are mainly classified in table 2 with their relevant quantities in terms of ton per year and illustrated in figure 4 below in terms of percentage:

**Table 2 HW Types and Quantities**

Type	Quantity (ton / year )
Solid	1718
Liquid	26,047
Sludge	135



**Figure 4, the Amounts of HW Generated in Alexandria Governorate by Type**

All industrial wastes are not necessarily hazardous, although industries account for the majority of hazardous wastes generated. Collection, transport, treatment and disposal of hazardous waste are more expensive than for non-hazardous waste. It is important therefore to accurately identify and characterize hazardous wastes at the industry sources. Every effort must be made to reuse or recycle discarded materials prior to land disposal. The first step is to evaluate the process flow diagram in the industry to identify waste streams that need to be disposed. [18] Each of the waste streams must be tested to determine whether the waste is hazardous.

#### **2.2.9.4. Legal Framework**

Environmental protection has been always one of serious concerns of the Egyptian legislation. This concern is reflected in a number of laws on environmental issues. The key legal documents on management of hazardous substances and wastes in Egypt are:

- i. Law No. 4 / 1994 on environment protection and its Executive Regulation issued by the Prime Minister's Decree No. 338 / 1995, amended by the Prime Minister's Decree No. 1741 / 2005.
- ii. Law No. 38 / 1967 concerning public cleanness, promulgated in 29th of August 1967 and its executive regulation, issued by the Housing and Utilities Minister's Decree No. 134 / 1968 issued in 13th of February 1968.
- iii. Law No. 93 / 1962 concerning the disposal of liquid wastes promulgated in 17th of May 1962 and its executive regulation issued through the Minister of Housing Decree No. 44 / 2000.
- iv. Law No. 48 / 1982 concerning the protection of the River Nile and the water ways, issued on the 21st of June 1982 and its Executive Regulation issued by the Minister of Irrigation's Decree No. 8 / 1983 on the 17th of January 1983. [16]

#### **2.2.10. E- Waste**

Electronic wastes or e-waste [19] for short is the term used to embrace various types of electric and electronic equipment that have ceased to be of any value to their owners.

## **2.3. MUNICIPAL SOLID WASTE MANAGEMENT (MSWM)**

MSWM according to the Egyptian National Strategy for Solid Waste Management is the term used to describe all activities related to the collection, sorting, processing, and disposing of solid wastes. [11] There is a wider definition for MSWM issued by the European Union in which it considers the aspects that concern the impacts of poor MSWM and that a proper management chain must include [10] so, proper MSWM can be defined as the generation, separation, collection, transportation and disposal of waste, taking into account parameters such as public health, economics and environmental safety.

SWM is highly affected by:

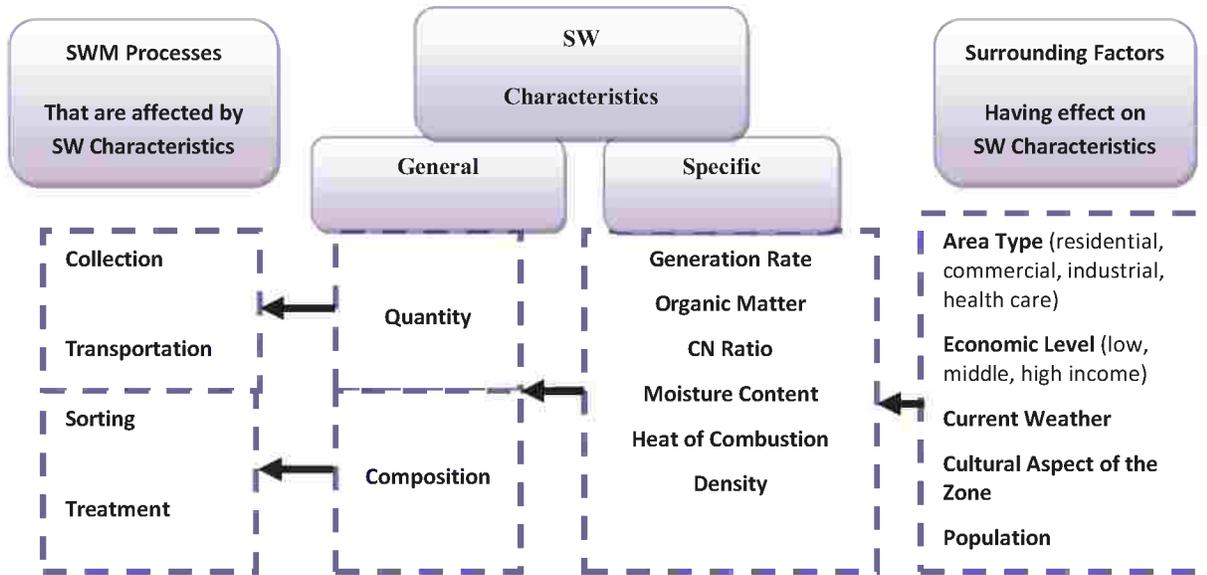
- i. Waste Characteristics,
- ii. People culture and their level of awareness,
- iii. The legal Framework that regulates the management process.

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 efforts. [6]

### **2.3.1. Waste Characteristics**

The waste characteristics are very necessary when setting up the SWM processes. For example the Quantity of waste affect the distribution of dust bins that act as temporary storage points, collection frequency and equipment, transportation techniques and routes, the consequent treatment technologies and finally the environmentally safe final disposal. These characteristics are also affected by other surrounding factors. [21] As for the same characteristic of Quantity is affected by the type of area the waste is thrown in, the weather in this area and people culture. This relationship of factors effecting and affecting are all illustrated in the following figure 5. This figure demonstrates the characteristics of solid wastes that affect the decisions regarding their management and the surrounding factors that have effects on these characteristics. Although these characteristics are divided into two main classifications; General characteristics that are used to describe waste in a wide point of view and specific characteristics that are needed to settle determined decisions for proper management methods since that these characteristics are of great concern when decisions are to be made about the collection vehicle type and the storage system which are also interrelated. Although such decisions are of great effect on the budget required to create a sustainable solid waste management system. Therefore consultants and project teams concerned on waste management are required to spend

considerable part of their time investigating and undertaking full waste surveys, concentrating mainly on measuring the proportions of various categories of material in the waste.



**Figure 5, Solid Waste Characteristics as a mediator that has an effect on Solid waste Management processes and at the same time affected by surrounding factors**

These characteristics are of great importance especially in a Developing Country as Egypt where the priority is given to optimizing the vehicle productivity in preference to labor productivity as vehicles compromise the majority of the solid waste budget expenditure (as it will be discussed in chapter 4) in order to maximize the total tonnage of waste transported per vehicle per day in preference to the total tonnage of waste collected per worker per day.

These characteristics differ considerably depending on the relative affluence of the community [21]; these variations are caused by many different factors including evaporation, decomposition, compression by self-weight in the container, scavenging by animals or people, and air entrainment or release during handling, loading, compaction and travelling.

### 2.3.2. History of SWM (People Culture)

Egypt generates an estimated 20 million tons of municipal solid waste in 2009, and the amount of solid waste produced annually is growing at an estimated 3.4% per year. Waste collection systems have left large areas of towns and cities without service or under-served [22], and the

majority of collected waste is dumped in facilities that lack any effective management with no preventive measures at these sites to prevent the self-ignition of waste.

But this issue has become a real problem since that passing decade since the urbanization rate increased with the population growth rate. To accurately evaluate the situation, the history of waste management in Egypt needs to be discussed until the present time to regard the full image of the emergence of this field and how it has evolved and developed till now. So, below is the story of the solid waste field emergence with relevant to the collector.

### 2.3.2.1. The Informal Sector Generally

Worldwide, not only in the Developing Countries there are several hundred thousands of waste pickers. Their activities are closely related to recycling, post-consumer waste reduction and, to a certain extent, to environmental protection. Waste pickers or scavengers as they are called operate without proper facilities and equipment, so they are typically exposed to a range of public health and environmental hazards associated with open landfill sites. Although they are organized and everyone has his role as they agreed together to do since that their work was not closed on just waste removal they also worked in recycling and composting. Waste pickers have a long track record in waste management in Egypt as will be mentioned next. Informal activities in solid waste management have a long tradition and started with the itinerant waste collectors and buyers and scrap dealers in the end of the 19th century. [23] Today, several hundred thousand people work in the collection, segregation and processing of recyclables. Thus, they are contributed to different missions according to everyone's role as explained in table 3 below. This table displays the different roles played by the waste pickers which determine the specialty of each one in their community and accordingly their material of interest.

**Table 3 The Organization of Roles inside the Informal Waste Sector and the Materials of Concern**

Role of Worker	Category of Work	Materials of Concern
Waste Pickers	Recovery, Pig Raising	Cans, Bottles, Food Waste
Landfill Pickers	Recovery	Bottles, Paper, Plastic bags, Cans, Other valuables
Collection Crews	Recovery on Route	Bottles, Cardboard, Cans, Valuables
Itinerant Buyers	Door to Door Buying	Cardboard, Plastic bottles, Glass bottles, Aluminum cans
Dealers	Buying and Retailing	Metal, Iron, Steel, Paper, Cardboard, Plastic bottles, Glass
Small Scale	Buying and Trading	

Entrepreneurs		bottles, Miscellaneous
Large Scale Entrepreneurs	Buying and Large Scale Processing Technology	

In developing countries, the informal sector carries out a significant proportion of recycling activity in SWM. For the purposes of this study, the term ‘informal waste sector’ designates people who make a living from waste, but are not formally tasked with providing the service by the responsible authorities. [24] Here are the most important characteristics of the informal sector which enhances its success and continuity:

- i. Existence of low entry barriers
- ii. Utilization of domestic resources
- iii. Predominance of family businesses and child labor
- iv. Domination of small-sized enterprises
- v. Use of fairly labor-intensive and adapted technologies
- vi. Training for the skills required takes place outside of the formal school system
- vii. Utilization of unregulated and competitive markets.

Their system works as waste pickers collect the waste by picking through dumps, landfills and street bins. Middlemen, intermediary buyers and wholesale merchants are also involved in this informal waste system and small enterprises operate with recycling machines, processing machines or maintenance equipment. [24] Occasionally the illegality of certain economic activities is used as a criterion. However, in reality there is usually a range of illegal formal arrangements as well as legal informal agreements. The intersection between informality and illegality might be significant. The informal sector does not stand isolated next to the formal sector. In fact, it is closely connected to it in various ways through markets for goods and services. For example, numerous formal companies in developing countries are being supplied with cheap intermediary goods or components by the informal sector. Within the waste sector, collectors sell to waste buyers who sell to recyclers. The rather short-term character of many informal arrangements leads to a latent instability of economic and social relationships, which, for example, is demonstrated by frequent changes of jobs. Even if waste collectors are allowed to work on a landfill, this agreement might change any day, for example after elections, when a new political party takes over the local government. Definite advantages of the informal sector lie in its extreme flexibility to quickly and appropriately react to changing framework conditions and to understand such disruptions as challenges.

### **2.3.2.1.1. The development of the Informal Sector in Egypt**

The development of the informal waste management sector in Egypt as recorded goes back to the early 1910's, when a group of migrants from the Dakhla oasis in the Western desert of Egypt relocated to Cairo. The Wahiya assumed the sole responsibility for the collection and disposal of Cairo's household waste under the framework of contracts with building owners in Cairo. In the 1930s and 40s, there was a second wave of migration. This new group is mostly landless peasants. Henceforth, the Wahiya collaborated with the Peasants, who purchased waste from the Wahiya for use as fodder for pig farming. Thus, Wahiya and Peasants together formed the Zabaleen community that emerged as the informal garbage collectors and recyclers of Cairo. They provided residents with a daily door-to-door collection service using donkey carts for transportation. By time, and due to the increase in the quantity of solid waste, which was a direct result of population growth, the system grew. This expansion enabled garbage collectors to bring their relatives on board, who, in the order of things, migrated and settled in the same area of garbage collectors. [23] All these activities were unofficial with no formal authority involvement. With the appearance of plastic and metal in household waste, recovery facilities and trading networks for these materials emerged within the Zabaleen settlements. No laws, ordinances or regulations existed to determine the sector or the service. [25] At these times solid waste management was efficient and no wastes were accumulated on the streets and its worth to mention that people were paying money willingly to Zabaleen for their service. By the 1990s, Zabaleen started becoming aware and conscious of the challenges they are facing. Some became literate and were able to deal directly with the authorities on their behalf as well as on behalf of their fellow Zabaleen who were still illiterate. The Zabaleen community managed the municipal solid waste management service randomly as described below:

- i. The service fee was not standardized; it varied from house to house for no consistent or preset criteria.
- ii. The service also lacked a monitoring system.
- iii. The service was forbidden to low-income neighborhoods.

### **2.3.2.1.2. The Current structure of the Informal Sector**

There is a sizeable informal recycling sector, thriving economically and extending across the entire country. It recovers, trades in, processes and re-manufactures plastic, scrap metal, paper, cardboard and bones. Specialized towns and centers for the recovery and trade of specific items developed in the municipal, industrial and commercial waste streams in all Egyptian towns and villages. The waste collectors sort and recycle around 80- 85% of the resources/waste they collect, making a living from recovering, recycling and trading recyclable materials. A diversified network of collecting and recycling activities has developed, concentrated in

recycling neighborhoods and integrated in a complex value chain and recycling industry. Besides the waste collectors, roamers buy trade and exchange recyclable waste items. Waste pickers collect the waste by picking through dumps, landfills and street bins.

Middlemen, intermediary buyers and wholesale merchants are also involved in this informal waste system and small enterprises operate with recycling machines, processing machines or maintenance equipment. By 1990 the Cairo and Giza Governorates forbade waste collection in donkey carts and formalized the subcontracting of door-to-door waste collection. [25] As a result, many Zabaleen formed co-operatives to be able to buy hand trucks to continue their waste collection services.

### **2.3.2.2. The Formal Sector**

The formal Sector here represents the Governmental means and authorities handling the management of solid wastes.

#### **2.3.2.2.1. The 1980's**

The EEAA was established in 1982 as an institution. At the central level, EEAA represents the executive arm of the Environmental Ministry and; As an institution that was initially established to take care of the environmental affairs with sub administrations for certain authorities; like the Cairo Cleansing and Beautification Authority (CCBA) and Giza Cleansing and Beautification Authority (GCBA) that started organizing the waste management system of the city and gave licenses to collect residential waste from designated areas in the mid-eighties. [26] The EEAA was and its sub administration was established to achieve the following main objectives:

- i. Supervise the various stakeholders involved in the waste management system.
- ii. Provide SWM services to poor, low-income neighborhoods where garbage collectors refuse to provide this service because of the low value of the garbage collected from these areas.
- iii. License new Egyptian private garbage collection companies.

There were a few Egyptian private companies that were licensed to collect garbage from areas not serviced by garbage collectors. While CCBA and GCBA awarded licenses and contracts to private companies through competitive bidding and gave them a fee in return for their services, Zabaleen acquired their licenses by paying deposit money to the CCBA or GCBA to allow them to work. Unlike private companies, they were not contracted and were not given a fee in return for their services. On the contrary, they collected their fees from their clients who on many occasions were willing to pay. CCBA assumed responsibility for sweeping and lighting main

streets as well as maintaining public parks. Greater Cairo was divided into 2000 zones. Zabaleen had to pay an insurance deposit of around 3000 LE to get the license.

In addition, CCBA and GCBA charged Zabaleen between thirty piaster and one Egyptian Pound per apartment per month. Zabaleen charged households between two and three Egyptian Pounds per apartment depending on the socio-economic level of the district. Zabaleen owned the collected garbage, particularly the recyclables. [23] Wahiya acted as an intermediary on behalf of Zabaleen in the process of acquiring licenses from CCBA because the peasants were illiterate.

#### **2.3.2.2.2. The 1990's**

Since the 1990s, Egypt, like many developing countries, started to implement the Economic Reform and Structural Adjustment Program that was introduced by the International Monetary Fund (IMF) and the World Bank (WB). The program advocated privatization and private sector participation in the provision of public projects. In 1994, Egypt has issued its first law for the protection of the environment; Law 4/1994; that has been considered the highest institutional umbrella for actions regarding protection of the environment. The law re-structured the EEAA and widened its mandate. Later in 1997, the Ministry of State for Environmental Affairs was created. The new Ministry had focused, in close collaboration with national and international partners, on defining environmental policies, setting priorities, implementing initiatives/agreements within the context of Sustainable Development. It advanced the economic liberalization in the form of privatization. The Cabinet of Ministers issued in 1997 a document entitled "Egypt and the 21st Century". The document addressed many topics, the most important of which is the role of government in relation to private sector participation in the provision of public services. [26] Against this backdrop, the role of the government took a momentous turn to become a regulator and an enabler of an environment conducive to economic activities rather than an implementer of public projects. This change highlighted the need and the importance of introducing policies that guarantees free and fair competition.

#### **2.3.2.2.3. Institutional Framework of the SWM Formal Sector**

The responsibility of solid waste management in Egypt is mainly governmental. [2] Its base is represented by the service provider headed by are municipalities at each Governorate headed by the Governorate. Then, the Governorates are headed by several Ministries each with a certain role as follows:

- i. The Ministry of State for Environmental Affairs (MSEA) and its technical arm, the EEAA: hosting a General Directorate for solid waste management to formulate policy directives and the provision of guidelines for proper management of municipal waste.
- ii. The Ministry of Finance (F): approving budget allocations for operational costs.
- iii. MPH and Ministry of Local Development (LD): comprising a steering committee that overlooks implementation of issues related to MSW.

The MSWM frame work is illustrated in figure 6 as shown below in the pyramid of the Institutional Frame work of SWM responsibility as supposed to be according to government



**Figure 6, Hierarchy of the SWM Formal Sector Structure**

#### **2.3.2.2.4. The Privatization**

One of the globalization objectives was to liberalize the economy by increasing private sector involvement in operating public projects; i.e. "Privatization". Based on "Privatization," the government changed its approach in the field of SWM to play the role of the organizer who provides the appropriate environment for economic activities, in addition to its main role in formulating policies. They started in Alexandria then moved to Cairo and Giza governorates. The year 2002 witnessed the shift in SWM system from a provision system orchestrated by the public authorities and the private informal sector to a system managed by the international private sector. [27] The involvement of the multinational private sector companies in solid waste management is one of the most controversial issues that is often quoted as a main reason for the failure of SWM in Egypt. After eight years of international private sector participation in SWM in Egypt, particularly Cairo, Alexandria and Giza governorates, the situation has deteriorated as admitted by the Minister of State for Environmental Affairs in a report issued in 2009.

Nowadays, the waste is on the streets in all large cities. All the international companies have broken their contracts and some inadequate national companies are responsible. On, the 5th of July 2012 The Prime Minister Kamal Al-Ganzoury has called for a meeting to consider solutions for waste management in Greater Cairo. [26] The following table 4 summarizes the previous history of solid waste in Egypt according to collectors, collection place, transportation methods ....., etc. as shown below.

**Table 4 History of SWM in Egypt since 1910 until now**

From – T0		Collectors	Collection Place	Transportation	Actions – Actor		Final Disposal	Fees
1910	1940	Wahiya	Houses- Streets	Donkey Carts	Sort- Reuse	Wahiya	Open dumps	Minor value paid by homes' residents willingly
1940	1985	Wahiya	Houses – Streets	Donkey Carts	Sort- Reuse- Trade	Peasants	Open dumps	
1985	1994	Zabaleen Community	Houses – Streets	Hand trucks	Sort- Recycle- Recover- Trade	Zabaleen- Roamers- Middlemen- Merchants	Open dumps	
1994	2002	Zabaleen Community	Street Bins - Open Dumps- Houses	Hand trucks	Sort- Recycle- Recover- Trade	Zabaleen- Roamers- Middlemen- Merchants	Open dumps	Average to Major value unpaid despite that Cleaning fees are charged on electricity bills
2002	2010	International Companies, Zabaleen Community	Community Bins - Open Dumps	Highly Equipped pick-up trucks, Hand Trucks	Sort- Recycle- Recover- Trade	International Company - Roamers- Middlemen- Merchants	Open dumps- Sanitary landfills	
2011	Now	National Private Companies, Zabaleen Community	Community Bins -Open Dumps – On Access of Roads	Highly or Semi Equipped Pick-Up Trucks, Hand Trucks	Sort- Recycle- Recover- Trade	National Company - Roamers- Middlemen- Merchants	Open dumps- Sanitary landfills	

### 2.3.3. MSWM Legal Framework

This section of the study reviews the solid waste management laws and regulations that are currently in effect in Egypt as the third element in the factors affecting MSWM. By the 1994 the Law 4 for The Protection of The Environment has been designated as the highest coordinating body in the field of the environment that will formulate the general policy and prepare the necessary plans for the protection and promotion of the environment. It also, follows-up the

implementation of such plans with competent administrative authorities according to the Law 4/1994 for the Protection of the Environment. [28] This doesn't mean that before this law there was no environmental laws more or less considering the SWM issue. Laws were set since 1947 and in the 1950's but since the Law 38/1967 was edited it cancelled all the previous laws [11] and the below is a list of all the Egyptian environmental laws with the sections regarding the SWM since 1967.

#### **2.3.3.1. Law Number 38/1967 on General Public Cleaning**

It is the primary law governing the management of solid waste in Egypt. It came into force in 1967 and replaced all previous laws dealing with solid waste, including law 97/1956 on organization of solid waste collection and transfer, law 159/1953 on cleaning public squares, streets and highways and law 151/1947 on cleaning fences and unused areas. Since 1967, law 38/1967 has been amended four times. In 1968, the Minister of Housing issued the executive regulations for the law. [28, 29] Although the law and its executive regulations deal primarily with solid waste, they also address wastewater and fencing of open areas. The provisions of solid waste management in this law are:

- i. Prohibition of placing solid wastes anywhere except in areas designated by the local council,
- ii. Prohibition of treatment and/ or disposal of solid wastes to any temporary undesignated container,
- iii. The collection, transfer and disposal of solid wastes is the responsibility of the local authority for general cleaning or the contractor licensed by the authority,
- iv. The previously mentioned operations must be handled in accordance with the specifications in the executive regulations,
- v. Authorization is given to the local council to impose a fee of not more than 2% of the rent to fund the service,
- vi. Authorization is given to the local council to impose penalties (fines) for violating the law, a fine up to L.E 100 can be put on the violator and may be higher in cases mentioned in other laws,
- vii. Establishment of a general cleaning fund by the local authority its main resources are the imposed fees and fines augmented by funds from the general budget to ensure adequate funding of the service,
- viii. Open land owners are required to remove any accumulated wastes at their lands and keep land clean,
- ix. Local authority is authorized to remove the accumulated waste from open land at the owner's expenses in case the owner refrains within 15 days after notification,

- x. Implementation of the law is authorized to be by competent employees in local government.

There are important notes on this law to be mentioned in order to clearly visualize the image of the legal structure of SWM in Egypt as listed below:

- i. Article 1 in presidential decree number 272 for the year 1982 transferred the jurisdiction for general cleaning from Ministry of Housing to local administrative units,
- ii. Law 31/1976 amended this law in the regard of solid wastes (as this one did not include sewages and sludges) and the publicly open areas,
- iii. Laws 209/1980, 177/1981 and 129/1982 amended this law in the regard of penalties to be put charged on law violators,
- iv. Law 10/2005 amended this law in the regard of the collected fee to be accustomed on the electrical energy consumed by the customer.

#### **2.3.3.2. Law Number 4/1994 on the Environment**

It is the first comprehensive environmental law to be issue in Egypt. One article in law 4/1994 addresses general solid waste management while another article addresses management of construction and demolition debris. In addition, two articles deal with solid waste management on ships and offshore platforms. Moreover, five articles address hazardous waste management.

Prime Minister's decree number 338 for the year 1995 issued the executive regulations for law 4/1994. The executive regulations contain two articles addressing general solid waste management and one article addressing the management of construction and demolition debris. Law 4/1994 and its executive regulations also contain provisions requiring establishments to conduct environmental impact assessment studies. Also, articles for establishments to control air and noise pollution, and address worker safety are present in the executive regulations. These provisions apply to solid waste management facilities such as recycling and composting plants, medical waste treatment facilities, and sanitary landfills. Violation of Law 4/1994 can be more severe if so prescribed by other law. [29] However, solid waste management fines in Law 4/1994 are higher than those specified in any other law. This law has been amended by law 9/2009. The provisions of solid waste management in this law are:

- i. Prohibition of disposal of solid wastes except in areas designated by local authorities,
- ii. Prohibition of dumping , treating or burning of solid wastes except in areas designated for such a purpose,
- iii. Promulgation of certain specifications for containers and vehicles used in the solid waste collection service,
- iv. Addressing special management and disposal aspects related to construction and demolition debris,

- v. Addressing special safety factors to be considered by personnel involved in storing, transporting and disposal of construction and demolition wastes,
- vi. Charging a penalty for illegal disposal of wastes or open burning in an undesignated from L.E 1000 to L.E 20,000; with imprisonment added to the fine in cases of recidivism; also higher fines can be charged stated by other laws,
- vii. Violating the management aspects stated for construction and demolition wastes is a fine ranging from L.E 500 to L.E 1000 with court authority to suspend the license of the violator or revoke it in cases of recidivism,
- viii. Reporting of violations to authorities is a right given to every citizen and organization concerned with the environment,
- ix. Authorization of law enforcement is to those stated as inspectors of administrative authorities who have the capacity as judicial officers,
- x. Formation of a police force specialized in environment is required by the Ministry of Interior to enforce law implementation.

This Law has been amended once by law 9/2009 in the regard of SWM regulating procedures especially when dealing with open burning and offshore issues.

#### **2.3.3.3. Law Number 48/1982 for the Protection of the Nile and its Canals**

Law number 48 for the year 1982 addresses protection of the Nile and its canals. The executive regulations for law were issued by the Minister of Irrigation's decree number 8 for the year 1983. The law and its executive regulations primarily focus on wastewater discharges to the Nile and its canals [28], but also contain articles that address solid waste. The provisions of solid waste are:

- i. Prohibition of either the disposal of solid wastes in the Nile and its canals nor the temporary placement of solid wastes on their banks,
- ii. Charging a penalty for violation of the law from a fine ranging from L.E 200 to L.E 20,000 to the removal of the violation on the violators expenses plus the charged fine,
- iii. Authorization is given to irrigation engineers at the Ministry of Irrigation along with surface water police of the Ministry of Interior to enforce the law within their jurisdictions.

#### **2.3.3.4. Laws Concerning Public Ways**

Two laws concerning public ways (highways, streets, and squares) contain restrictions on solid waste management and disposal. [29] These are:

- i. Law number 140/1956 amended by Law number 84/1968 for the Occupation of Public Ways,
- ii. Law number 106/1976 amended by Law number 101/1996 on Building and Construction

The provisions of solid wastes in these laws are:

- i. Prohibition of placing solid wastes on public ways,
- ii. Prohibition of placing of construction and demolition debris on public ways unless a license is obtained to occupy an identified public area with such debris,
- iii. Addressing methods of management for construction and demolition debris,
- iv. Charging a fee for the occupation of public areas with such debris to be added to the funding budget of the solid wastes management service,
- v. Authorization for law enforcement is given to both Ministers of Municipal and Rural affairs Ministry and Justice Ministry

Again, Article 1 in presidential decree number 272 for the year 1982 transferred the jurisdiction for general cleaning to local administrative units.

#### **2.3.3.5. Other Laws**

There are other laws that don't relate to SWM but has mentioned SWM provisions in their regulations as stated below:

- i. Law number 58 01/ 1937 for Penal Codes (General Egyptian Penal Law); this law specifies penalties on all types of solid wastes illegal disposing like on public roads, public areas i.e. gardens and in the Nile and its canals especially those obstructing navigation and the enforcement authority is Ministry of Justice and its courts.
- ii. Law number 66/1977 for Vehicles Transporting Wastes; this law identifies the requirements needed for the different vehicles that carry different types of wastes. [30]
- iii. Law number 43/1979 for SWM Authorities; this law identifies all the infrastructure bodies involved in the SWM process and states the role of each from policy formulators, regulatory procedures identifiers to monitoring administrations and authorized bodies and personnel for law enforcement.
- iv. Law number 137/1981 for Labor; this law requires employers to inform the employees of the hazards associated with handling solid wastes as it requires employers to provide safety equipment and training to their employees before dealing with solid wastes. [28]
- v. Law number 155/1999 for Traffic; this law prohibits vehicle drivers from disposing wastes on public ways.