

3. CHAPTER 3

OVERVIEW OF SOLID WASTE MANAGEMENT PROBLEM IN EGYPT

3.1. CURRENT SITUATION

The current situation of MSWM in Egypt represents a measurable threat to the public health and the environmental quality in the nation and requires national attention of the highest priority. This situation can't have a better display than that shown in figure 7 in the form of street shot photos in June 2013 which show how wastes are left to accumulate on the streets, so close to residential areas i.e. houses, schools and even large malls.



Figure 7 , Photos that Display the Deteriorated Situation of MSWM in Egypt

3.2. THE PRESENT SWM PRACTICES IN URBAN AND RURAL AREAS

3.2.1. Urban Area Method

3.2.1.1. Organizational and Administrative Arrangements

- i. The system is run by different agencies at the national and regional levels and management differs in the urban areas and rural areas,
- ii. Regional governmental bodies and cleaning organizations collect and transport street cleanings, clean streets and storage containers, supervise dumping grounds as well as operate composting plants either directly or indirectly through the private sector,
- iii. The role of those that collect solid wastes “garbage collectors” [11] differs from Governorate to Governorate. However, these collectors primarily provide service to private housing units for an agreed upon service fee ; Governorates oversee this service and collect a service fee from,
- iv. Private companies within areas allocated by the collect residential, commercial and street solid wastes under the oversight of and
- v. NGOS play only a small role in IMSWM

3.2.1.2. Management Approaches Processes

- i. Aerobic composting plants process a total of 2000 tons of municipal solid waste per day [about 7% of the MSW generated in Egypt]. To date, anaerobic composting has not been utilized.
- ii. Open dumps owned by regional authorities in areas specially designated the Governorates are numerous and are the principal method of managing MSW ,
- iii. Sanitary landfills are beginning to be sited [30], but advances such as protection of groundwater and control of landfill gas are not included in the designs,
- iv. Indirect violation of Law 4/1994, open burning is common at the open dumps, at accumulations of solid waste and by generators in any open space and
- v. Daily generation rate ranging from 0.7-1.0 kg/capita/day with efficiency of collection service ranges from 40 % to 85 %.

3.2.2. Rural Area Methods

3.2.2.1. Organizational and Administrative Arrangements

- i. No organized management system for solid waste generated in the rural areas,
- ii. Inadequate collection of solid waste due to inadequate collection equipment and
- iii. Lack of an organizational system and administrative infrastructure to provide services.

3.2.2.2. Management Approaches Processes

- i. Solid wastes is used for fuel and animal feed because there is no organized system,
- ii. Open dumping, accumulations of solid waste,
- iii. Actions by individuals to discard and dispose of their solid waste any way they can and
- iv. Daily generation rate ranging from 0.4-0.5 kg/capita/day with efficiency of collection service ranges from 0 % to 35 %.

In order to clearly get the image about waste generation, it is important to know the generated amount from all the Egyptian regions as displayed in figure 8 below.

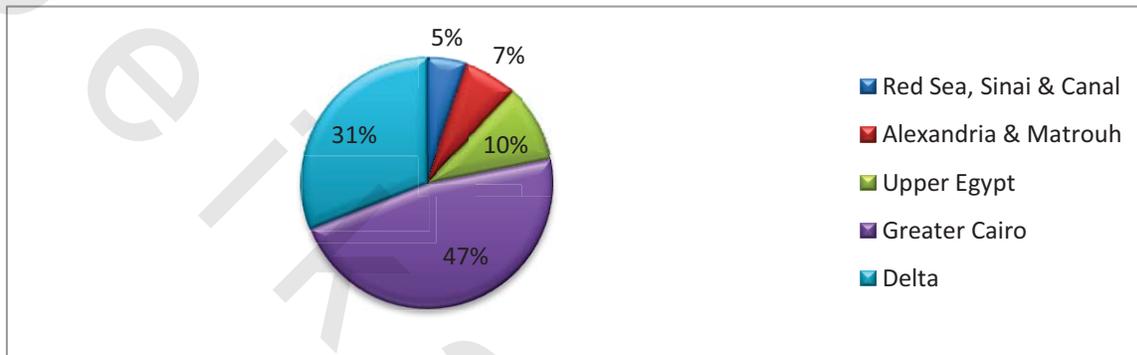


Figure 8, Amounts of Wastes Generated among the Egyptian Regions

3.3. DATA ABOUT WASTES

To accurately evaluate the current situation of solid waste in Egypt there are some quantitative and qualitative data that are needed to be known.

3.3.1. Quantitative Data

In order to understand the majority of the problem statistical data are the suitable method of explanation so they are provided to describe the statistical characteristics [30] of wastes which are as follows:

3.3.1.1. Generation Rates of MSW

- i. The Annual Generation of MSW is 21.1 million tons/year,
- ii. The Average Daily Generation in Urban Areas is 0.8 Kg/capita/Day with average collection efficiency of 62.5%,
- iii. The Average Daily Generation in Rural Areas is 0.45 Kg/capita/Day with average collection efficiency of 17.5% and
- iv. The expected Annual Growth is 3.4 %.

3.3.1.2. Composition of MSW

The composition of MSW as generated from its different sources is explained in the following table 5 that shows demonstration of composition type and its relevant amount in percent.

Table 5 Amounts of Different Composition of MSW in percentage

Composition	Amount
Metal	2 %
Textiles	3 %
Glass	4 %
Paper, Cardboard	10 %
Other	12 %
Plastic	13 %
Organic	56 %

The table is summarized and clearly displayed in the following figure 9 that shows the amounts of different composition of MSW in percentage.

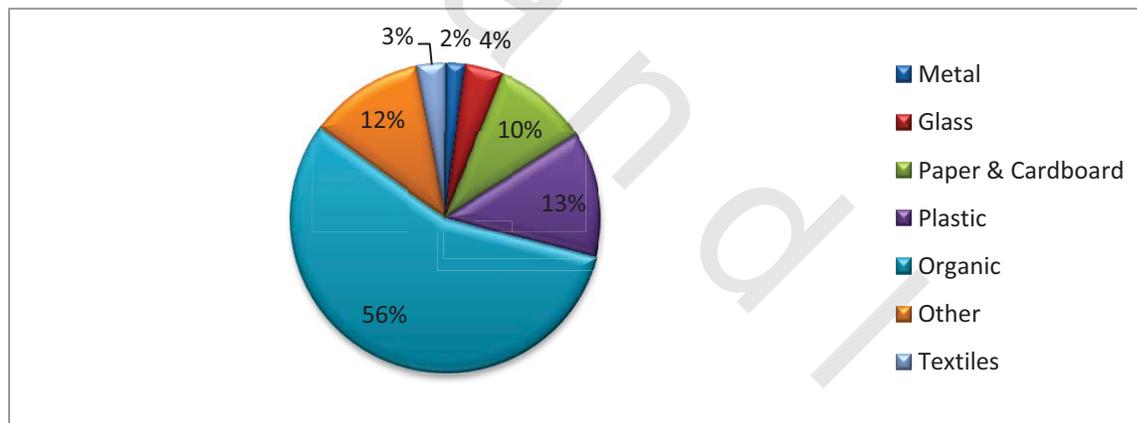


Figure 9, Amounts of Composition of the Solid waste

3.3.1.3. Technical Performances Done on MSW

The technical performances to be taken on MSW starts after its being generated and collected as this is the last step and varies from open dumping (very primitive) to recycling and/or composting (medium technology) until it reaches WTE (high technology) which is still not available in Egypt despite there is a great need for it regarding that energy starving Egypt is suffering. The different technical performances done on MSW in Egypt is summarized in the

following table 6, followed by figure 10 in which both demonstrates the relevant amounts of performances in percentages.

Table 6 Technical Performances Done on Wastes in percent

Performance	Amount
Recycled	2.5%
Sanitary Land Filled	5%
Composted	9%
Open dumped	83.5 %

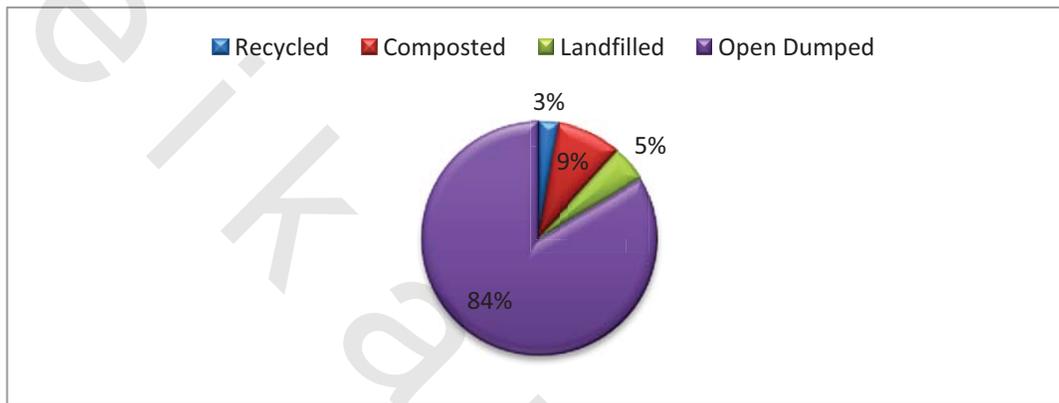


Figure 10, Different Technical Performances done on MSW and their relevant Amounts in Percentage

3.3.2. Qualitative Data

There are other issues that control the evaluation of solid waste management either than numbers. These cannot be measured by statistics but still needed to be evaluated to get a full image about the current situation. These issues are discussed one by one below as follows:

3.3.2.1. Policy framework

The Egyptian Environmental Policy Program was prepared within 1999 - 2002 to support political, institutional, and regulatory reforms in the environmental sector. One of the objectives of this program was to improve efficiency and performance [30] of the SWM sector through the combination of strategic planning, improved administration, enhanced public awareness, with specific focus on supporting private sector participation.

3.3.2.2. Legal framework

The legal framework of SWM is mentioned in many pieces of different legislations with no strict enforcement on penalties.

3.3.2.3. Institutional framework

The responsibility of SWM is distributed between the Ministry of State for Environment Affairs, Ministry of Local Development, Ministry of Housing, Utilities & Urban Development, Ministry of Health, Ministry of Water Resources & Irrigation and Ministry of Agriculture & Land Reclamation (they are all involved according to the laws issued mentioned in chapter 2). Moreover, Ministries of Finance, Investment, Trade & Industry, Communications & Information Technology and Interior are important stakeholders. [11]

EEAA emanates the policy directives and acts as a general facilitator, ensures implementation of the provisions of environmental legislation, and associated regulations and decrees, and assists governorates in identifying sites for waste facilities.

The governorates, municipalities, or the cleansing and beautification authorities in large cities such as Cairo and Giza, are responsible of handling the implementation and operation of the system directly. And sometimes give permissions for informal sectors to get involved like Non-Governmental Organizations and Zabaleen community.

3.4. MONETARY ASSESSMENT OF THE SWM PROBLEM

An assessment of the cost of environmental degradation in 16 Arab countries associated with some environmental categories has been prepared for the Arab Economic Forum. The study addresses the health care costs linked to inadequate potable water, sanitation and hygiene, and to outdoor air pollution as well as the land degradation costs all of them are mainly related either directly or indirectly to inadequate waste management [30]. According to the assessment study, the annual cost of environmental degradation in these 16 countries was US\$27 billion in 2008. The cost estimates for each country are indicated in figure 11 below, the figure shows 9 countries only of the total 16 as sort of simplification. Of the 16 Arab countries studied, the highest annual degradation costs were observed in Egypt at US\$5.6 billion.

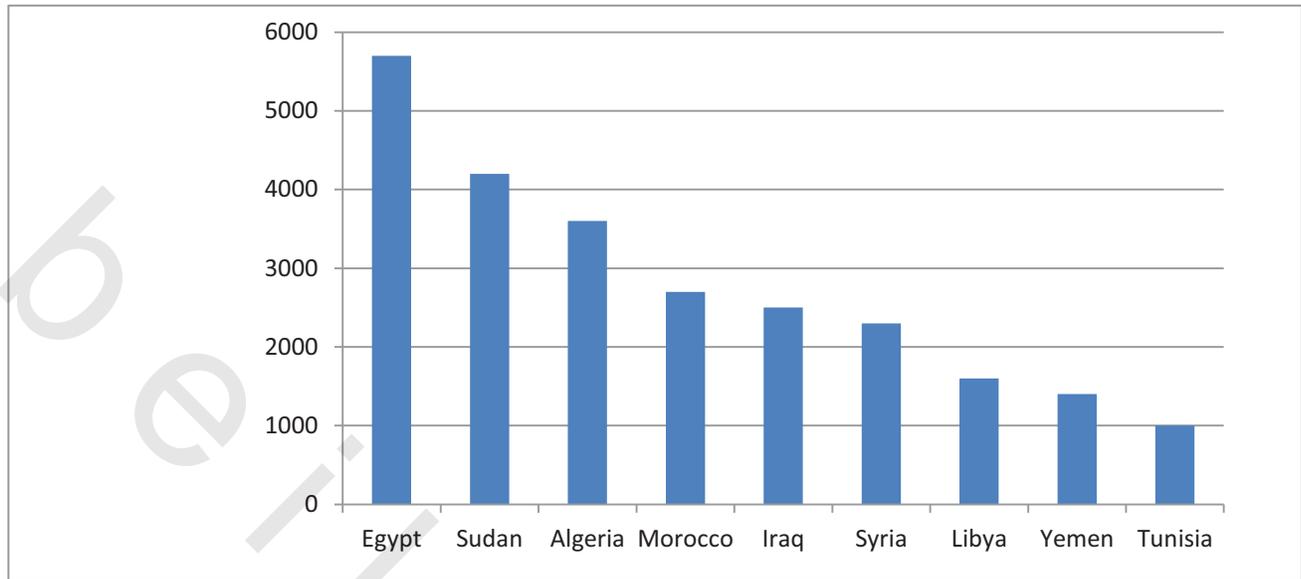


Figure 11, the Estimated Annual Costs of Environmental Degradation in the Arab Countries

3.5. EGYPT'S WORLDWIDE MSWM POSITION

As developing countries suffer from solid wastes, developed countries claim that they have problems however they have gone so far in the management of solid waste. This conflicting situation between both types of countries is going to be discussed in brief as follows.

3.5.1. MSWM History in Developed Countries

Since, that developed countries have made their way through in this field long ago as anciently as the Greek were the first to build a waste dump. So, the history of waste management of developed countries starts almost as early as 400 BC. [31] All the evolution in the field of solid waste management in developing countries is described in table 8 below which shows the methods used in different cities since 1905 which states that the first incineration facility was used as early as 1905 in New York.

Table 7 History of SWM in Developed Countries since 1905

Year	Place	Action
1905	New York	First WTE (waste incineration to produce electricity)
1920	Many Cities	Sanitary Landfill is the common method of waste disposal
1932	Many Cities	Usage of Compactor Trucks to Collect and Transport Wastes
1961	USA	First Suggestion for Segregation at Source for Recyclables
1970	USA	First Earth Day
1979	USA	Prohibition of Open Dumping
1990	USA	Enforcement of Recycling Laws
2000	USA	Waste Hierarchy Starts with Recycle
2011	USA	Waste Hierarchy Starts with Reduce

According to the previous table it is obvious that developed countries have reached what developing countries are struggling to reach its start like activating the forbidding of open dumping and open burning or establishing a special law for wastes. This struggling situation made developing countries when it came to privatization of the service seek for help from international companies that have good reputation in MSWM in developed countries which from the search point of view is a mistake (will be comprehensively discussed in chapter 4).

3.5.2. Egypt and the World

When evaluating our situation against the world there are two main indicators that are generally compared which are the first, the average per capita daily generation and second, the different final performances done on the collected waste. In this search two more indicators will be added which are third, the composition of the waste and forth, the collection rate. The first and the forth indicators can be compared with different countries actually as many countries as possible can be involved while the second and the third needs specific country to be compared with in order to be able to perform gap analysis on the second and for this purpose the USA has been selected. So the indicators will be rearranged as follows the first will be the per capita generation, the second will be the collection coverage rate, the third will be the composition amounts and finally the fourth will be the final performances done on the collected wastes. The gap analysis is used to falsify the dependency on developed countries when seeking for MSWM consultation. Beside this there is a wider perspective to look at which is the waste hierarchy in developed countries versus developing countries.

3.5.2.1. First Indicator: Per Capita Waste Generation

The average per capita generation is compared among a few selected countries as shown in figure 12; however these countries are not all necessarily developed. Some are developed others are developing; it is just to decide either our situation is the hardest among the world according to quantities or it is just normal but the management is that making it hard.

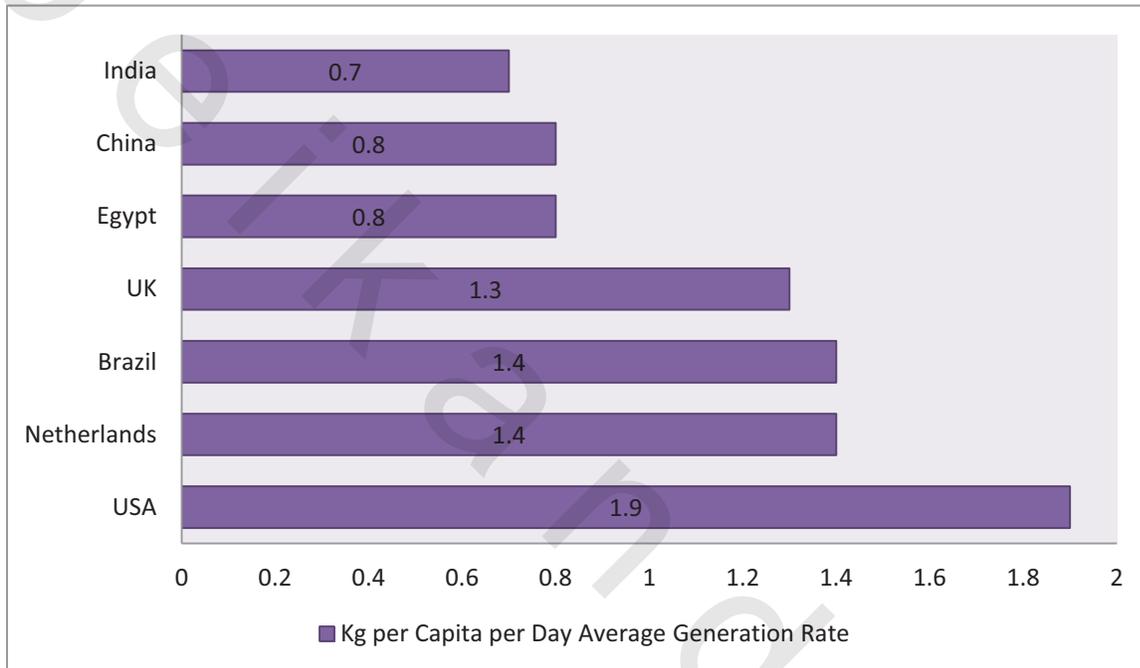


Figure 12, Average Generation Rates among a Few Selected Countries

From the previous chart it is obvious that our generation rate is normal. As when it is compared to other countries taking into consideration the population of these countries it is not that hopeless.

3.5.2.2. Second Indicator: Efficiency of Waste Collection

The efficiency of waste collection is generally estimated according to the country income according to the World Bank estimates. [32] So, generally this classification will be displayed in table 8 which shows the formal collection rate of SW according to World Bank estimates in which Egypt is classified as a Lower-Middle country.

Table 8 Formal Collection Rates of Wastes According to World Bank Estimates

Country Income Level	Low	Lower-Middle	Upper-Middle	High
Maximum Formal Collection Rate	43 %	68 %	85 %	98 %

So, according to table 8 it can be observed that Egypt’s official estimated rate of collection coverage at its maximum is 68 %.

The remaining two indicators which are the composition and the final performances are going to be compared with USA.

3.5.2.3. Third Indicator: The Waste Composition Amounts

The different compositions of both wastes found in Egypt and USA [33] are displayed in the following figure 13.

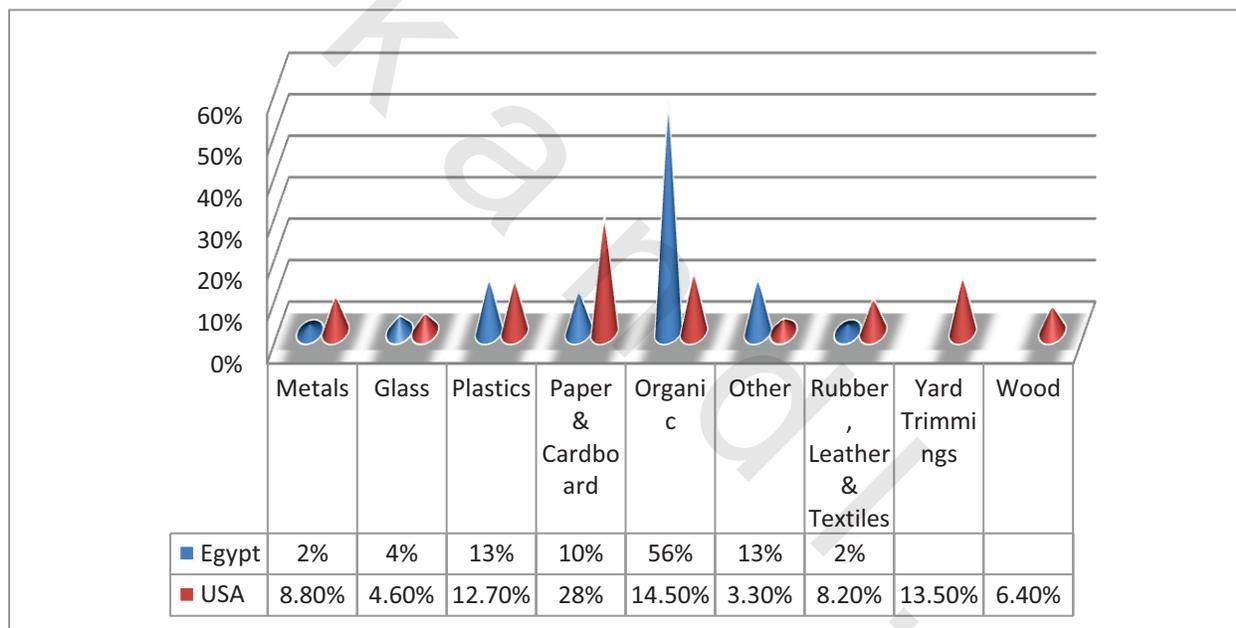


Figure 13, the Difference in Composition of Wastes and their Relevant Amounts in Percentage in both Egypt and USA

From the previous figure 13 it is obvious that there are huge differences between the composition amounts and even composition constituents in both countries.

3.5.2.4. Fourth Indicator: The Final Performances

The last indicator is the final performances done on the collected solid wastes in both countries. [34] The performances are compared using the spider chart as shown in figure 14 below which displays the huge differences in the means of treatment after collection.

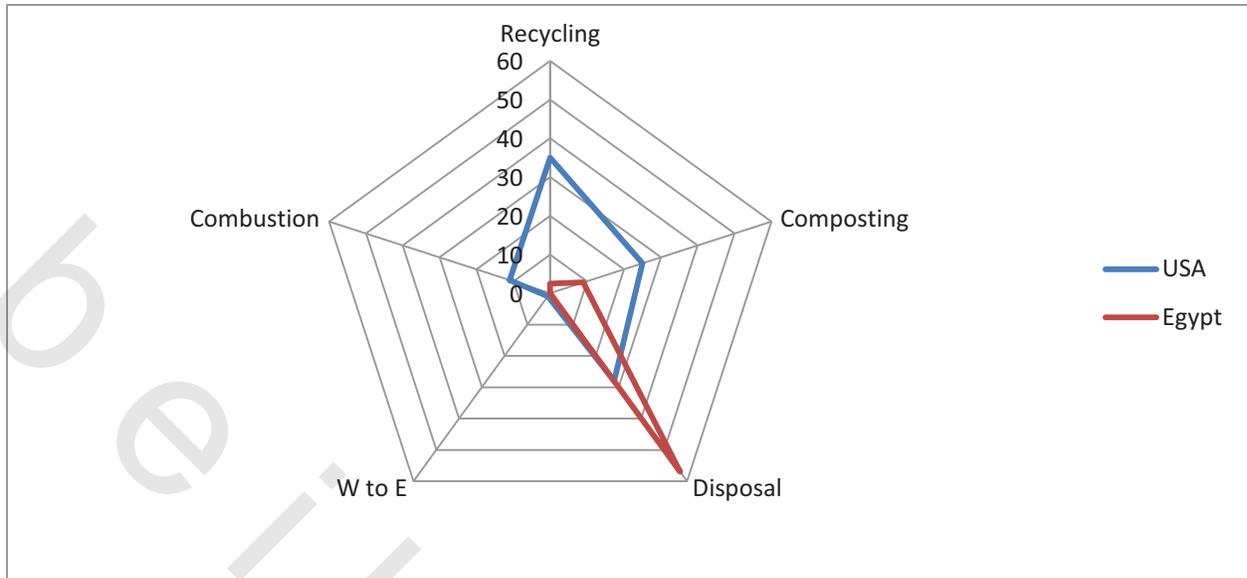


Figure 14, Spider Chart for Gap determination between the Technical Performances Done on the Collected MSW in Both Egypt and USA

Again the gaps are huge between the technical performances done in both countries. These gaps refer to the retarded technological situation that developing countries like Egypt are still suffering from.

Furthermore that now in America they are heading for new methodologies in separation, that they separate organic waste from agricultural green waste as organic waste is used as a source for composting while the green waste is used as an alternative day cover for a landfill area. [35] Besides this they are also encouraging the certification of the MSWM facilities by ISO 9001-2008 to ensure qualified management of these facilities. [35]

3.5.2.5. The Waste Hierarchy

The waste hierarchy in developed countries [36] now is starting with avoid or “zero waste” that targets the prevention of wastes by product formation and advocated putting an end to landfill activities; while the developing countries hierarchy is struggling to encourage the start of recycling by means of enhancement of segregation at source principles. Both hierarchies are shown below in figures 15 and 16 respectively.

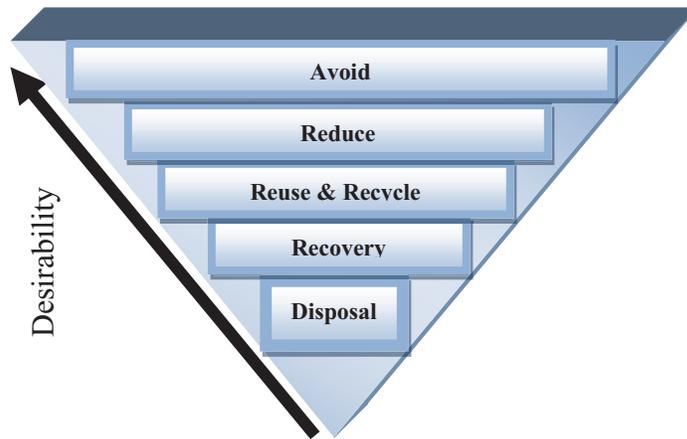


Figure 15, The Waste Hierarchy in Developed Countries

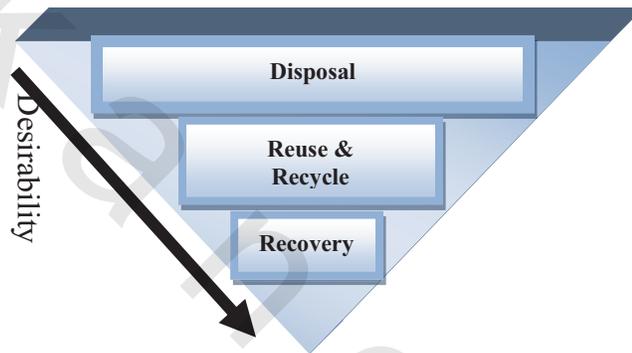


Figure 16, The Waste Hierarchy in Developing Countries

3.6. THE EGYPTIAN EFFORTS REGARDING SOLID WASTES MANAGEMENT

To summarize all what the country has been involved in to solve the problem and improve the quality of the service, table 9 shows all the issued laws regarding solid waste followed by a list that summarizes the strategic issues [37] Egypt has either signed or published in the regard of the MSWM and environmental field in general; this list is set for example not as limitation.

Table 9 Summary of the Laws Issued Regarding MSWM

Law		Amendments	
Number / Year	Name	Law	Regard
58 01/1937	Penal Code		-
140/1956	Occupation of Public Ways	84/1968	Prohibition of Litter on Access Roads
38/1967	General Public Cleaning	31/1976	Sewage & Sludges and Unused Open Areas
		209/1980	Penalties to be put on the Violators
		177/1981	
		129/1982	
10/2005	Refuse Charges on Electricity Bills		
106/1976	Building and Construction	101/1996	Management of Construction and Demolition Debris
66/1977	Vehicles Transporting Wastes		-
43/1979	Identification of SWM Infrastructure Authorities		-
137/1981	Labor Law		-
48/1982	Protection of the Nile and its Canals		-
4/1994	Egyptian Environmental Law	9/2009	Regulations and Procedures of SW Open Burning, Offshore issues
155/1999	Traffic Law		-

The list of the strategies / protocols that Egypt has signed / issued towards MSWM:

- i. National Environmental Action Plan (NEAP) 2001-2002.
- ii. Integrated Municipal Solid Waste Management National Strategy (IMSWMNS): Framework for action, 2000.
- iii. Arab Regional Strategy for Sustainable Consumption and Production, Final draft, 2009.
- iv. Kyoto Protocol.
- v. Basel Convention.

3.7. PROBLEM CONFIGURATION

So, finally to configure the problem correctly there are three things needed to clarify the image which are; problem definition, summary and general assessment.

3.7.1. Problem Definition

It can be defined as:

“Inadequate collection service of solid waste in urban areas mostly neglecting squatter settlements and rural areas, accompanied by overall financial shortage affecting the integrated efficiency of the system followed by unsafe means of disposal.”

3.7.2. Problem Summary

This unreliable service causing the problem has two main points regarding the service management; the first is that the actual hierarchy of collection put the informal waste collectors above the formal. This is illustrated in a block diagram as shown in figure 17, which explains the actual steps in waste collection.

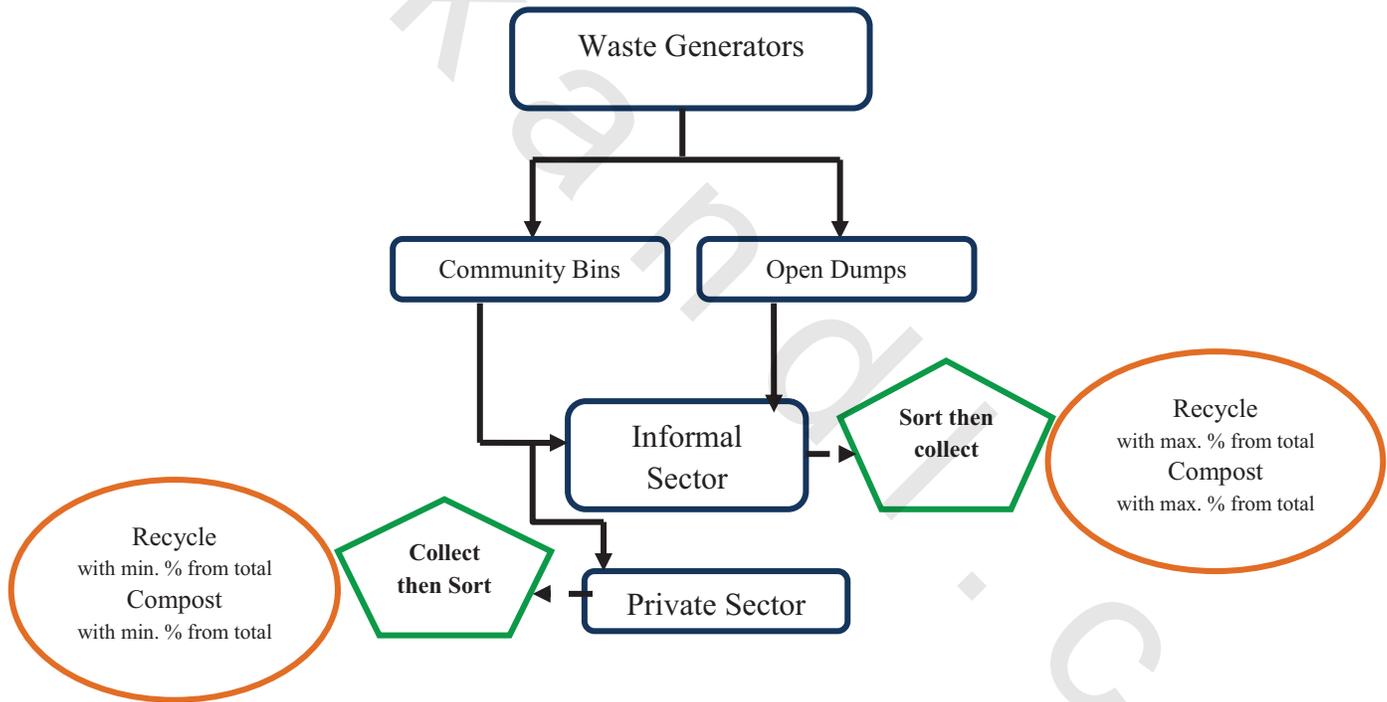


Figure 17, Summary for the SWM Actual Collection Process

The second part of the problem is the technical performances done on the generated waste. In a quick review the collection coverage is of 68 % at maximum leaving 32 % at minimum not collected, the performances done actually treats only 11 % from total; thus leaving the remaining untreated with the best chance for environmentally safe dealing will be landfilling for an amount

of only 5 %. Leaving all the remaining quantity representing the majority of the generated wastes an amount of 84 % to be open dumped either in a controlled manner for 52 % or an un controlled open dump for 32 %. And as mentioned before that these are the highest estimates of collection coverage. So it is obvious that the technical performances or treatments are very poor either regarding the quantities assigned for treatments or the nature of treatments. This is shown in figure 18 below.

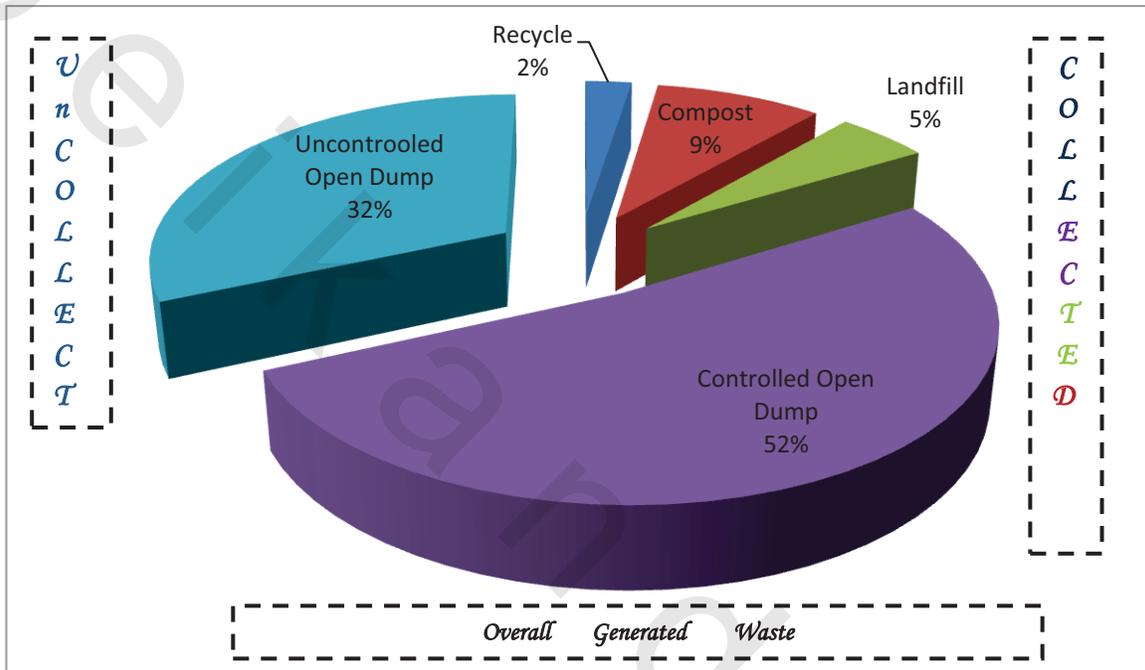


Figure 18, Illustration of all the Technical Performances done on the Overall Generated waste

3.7.3. Problem General Assessment

To assess any situation or problem, the characteristics of this situation have to be listed. These characteristics cannot be all either good or bad. So to criticize the problem's characteristics and surrounding circumstances are going to be classified using a SWOT analysis as shown in figure 19. The **SWOT** analysis shown in figure 19 is carried out to evaluate the current situation of SWM in Egypt and also to gather all the dimensions involved in the problem in a weighing manner for each dimension to offer a focused concise image about the situation.

<p>Strength</p> <ul style="list-style-type: none"> • Availability of Expertise • Availability of general laws and regulations • Availability of landfills • Existence of a system • Informal Waste Sector • National Private Sector involvement • Waste variety in composition 	<p>Weakness</p> <ul style="list-style-type: none"> • Absence of initiatives addressing waste minimization and segregation at source • EEAA role is only advisory • Incomplete legal framework • Inefficiency of the current system • Insufficient waste data • Lax organization and Lack of coordination • Small amount of finance • Unavailability of waste data base system • Weak enforcement of the law
<p>Opportunity</p> <ul style="list-style-type: none"> • Considering the MSW as a Resource • Egypt's involvement in many international agreements and protocols considering SWM as a main issue • Increased focus on SWM by people and government • Increased interest of industrial facilities to get an ISO 14001 environmental safety standard certificate 	<p>Threats</p> <ul style="list-style-type: none"> • Cultural habits • Environmental degradation and its costs • Fees collection • Illegal dumping • International Private Sector involvement • Political Instability • Poor management of the available finance • Population growth • Rapid urbanization

Figure 19, SWOT analysis for the current SWM situation in Egypt

From the points displayed in the SWOT, it is obvious that the problem is extended along all the MSWM ideal chain, which represents the stages that solid wastes pass through as shown in figure 20 below. This chain divides the processes done on solid wastes into three main categories Pre collection, Collection and Post Collection.

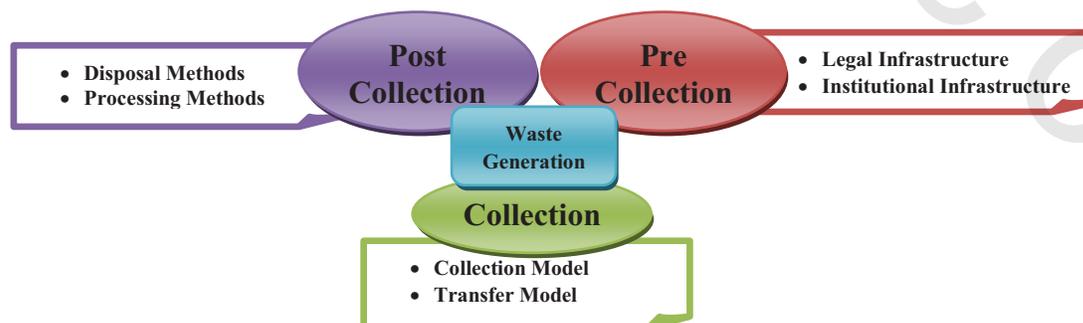


Figure 20, the MSWM Ideal Chain

After all the explanations above the whole problem of municipal solid waste management in Egypt with all its factors either as causes or impacts can be summarized as follows in figure 21 below.

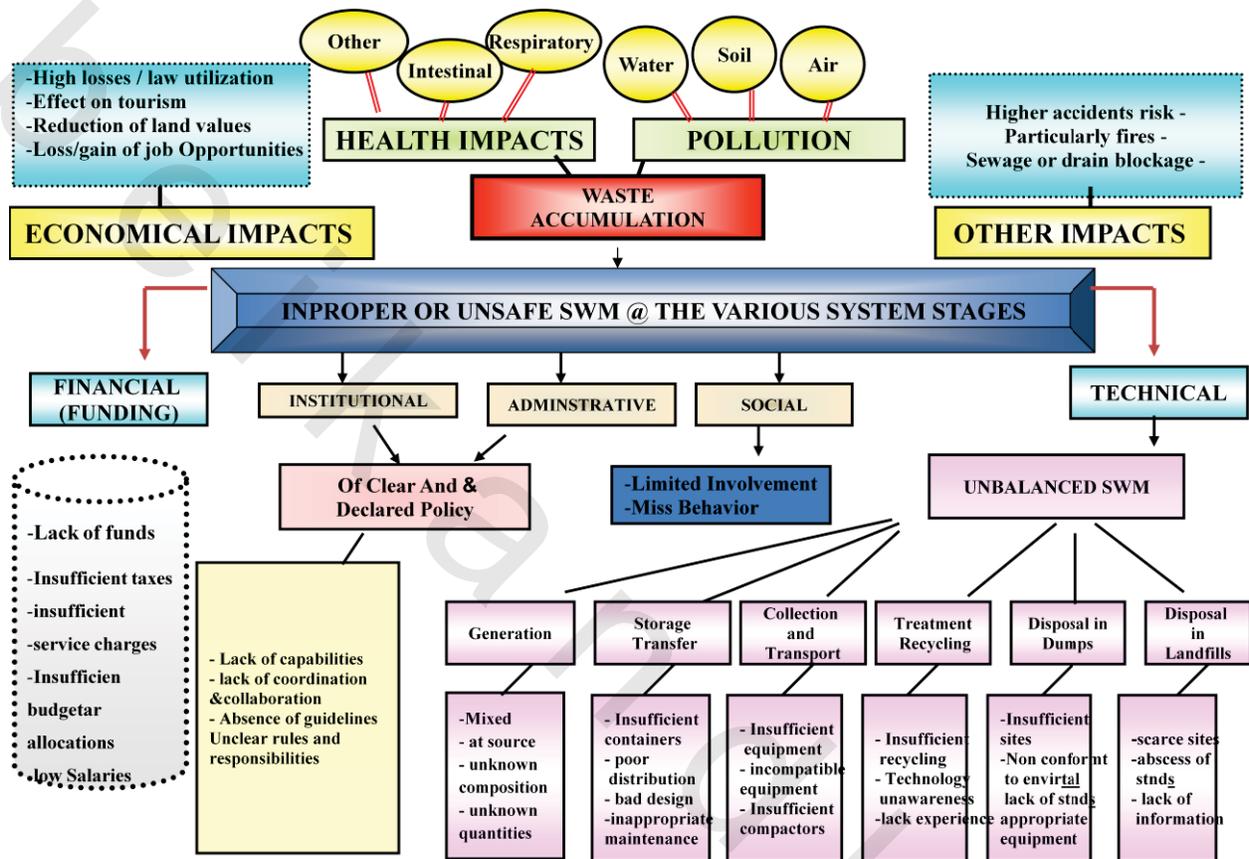


Figure 21, The MSWM Problem in Egypt Causes and Impacts