Ministry of Foreign Affairs

Market scan solid waste management in Egypt

sector overview & business opportunities

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MARKET SCAN

SOLID WASTE MANAGEMENT IN EGYPT

SECTOR OVERVIEW & BUSINESS OPPORTUNITIES

Table of Content

Table of Figures

Table of Tables

Acronyms

Agriculture Residue	AGR
Alternative Fuel	AF
Alternative Fuel and Raw material	AFR
Cairo Cleanliness and Beautification Authority	CCBA
Central Agency for Organization and Administration	CAOA
Community Development Associations	CDAs
Egyptian Environmental Affairs Agency	EEAA
Embassy of The Kingdom of The Netherlands in Cairo	EKNC
Environmental Impact Assessment	EIA
Giza Cleanliness and Beautification Authority	GCBA
Government of Egypt	GoE
Integrated Solid Waste Management	ISWM
Integrated Solid Waste Management Programme	ISWMP
Local Government Unit	LGU
Local Popular Councils	LPC
Medium Density Fibre Boards	MDF
Mechanical Biological Treatment Units	MBT
Micro, Small and Medium Enterprises Development Agency	MSMEDA
Ministry of Agriculture & Land Reclamation	MALR
Ministry of Electricity and Renewable Energy	MoERE
Ministry of Finance	MoF
Ministry of Housing Utilities and Urban Communities	MHUUC
Ministry of Local Development	MoLD
Ministry of Water Resources & Irrigation	MWRI
Municipal Solid Waste	MSW
National Solid Waste Management Program	NSWMP
Netherlands Enterprise Agency	RVO
Non-Governmental Organizations	NGOs
Refuse-derived fuel	RDF
Regional Branch Office	RBO
Small and Medium Enterprises	SMEs
Solid Waste Management	SWM
Solid Waste Management Unit	SMU
The Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH	GIZ
United Nations Industrial Development Organization	UNIDO
Waste to Energy	WtE
Waste Management Regulator Authority	WMRA

Executive Summary

With a rapid population growth in Egypt as well as change in patterns and consumption behavior of its inhabitants, waste remains an occurring and unsolved problem. Organizing the waste system remains a challenge, that not only Egypt is facing, but also an unprecedented challenge that the whole world is facing.

Solid Waste Management (SWM) in Egypt has become a major public health and environmental concern for many years now. The magnitude of the problem has increased due to rapid population growth, fast-growing urbanization rate, industrialization and shifting of consumption rates in Egypt that led to escalated amounts of generated waste.

The study concentrates on two types of solid waste: (1) the municipal solid waste, and (2) the agriculture waste or harvest waste. The study provides an overview of the value chain management of the waste starting from waste generation, collection followed by transportation, storage, treatment as well as final disposal.

It is worth noting that the municipal solid waste in Egypt is generated as mixed waste and many attempts to introduce segregation from source programs have not succeeded, and on the other hand there is no formal system available for collection, handling and recycling of the segregated waste. Waste is collected together even if it is segregated from source.

Agricultural waste is an additional burden when waste management is conducted in rural areas or villages where agriculture is the main activity of the area. Egypt generated about 31 million tons of agricultural waste in 2016. Burning of agricultural waste is a common practice in Egypt, especially rice straw. Large quantities of rice straw are burned in the fields as means of quickly clearing the land for the cultivation of other crops. Agricultural waste also pollutes the environment by polluting the water resources. The lack of equipment, services and infrastructure are the main problems facing the agricultural waste management.

In 2020 a new Waste Management Law was ratified. The law is Egypt's latest attempt to regulate the waste management industry by creating a new regulatory authority (Waste Management Regulatory Authority, WMRA) to oversee proper waste management and recycling practices, and develop a national strategy to improve waste disposal and recycling.

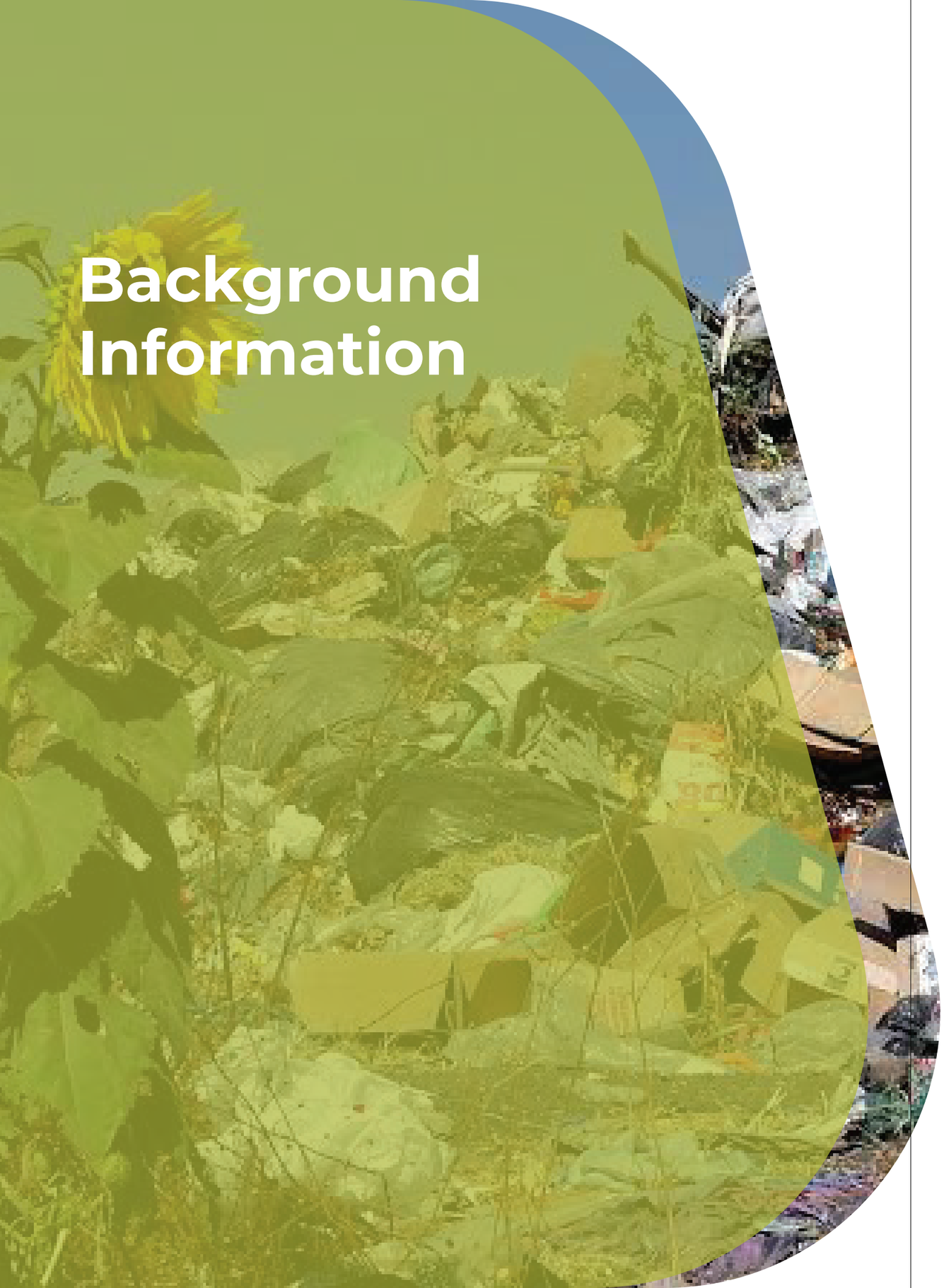
The law seeks to provide investment incentives and other measures to encourage garbage collectors, small companies, private contractors, and recycling centres to join the formal economy.

The Ministry of Environment through its National Solid Waste Management Programme has identified 19 business opportunities in the waste sector in Egypt. This report highlights the business opportunities and how can a foreign company carry out business in Egypt.

The report also highlights the key stakeholders in the solid waste management ecosystem in Egypt, as well as features private sector companies in the waste management value chain.

Chapter One

Introduction



Background Information

Solid Waste Management (SWM) in Egypt has become a major public health and environmental concern for many years now. The magnitude of the problem has increased due to rapid population growth, fast-growing urbanization rate, industrialization and shifting of consumption rates in Egypt that led to escalated amounts of generated waste.

Since the year 2000, the Government of Egypt (GoE) started focusing on an integrated solid waste management approach, and enhancing the role of the private sector participation. However, the waste management services and infrastructure are unable to keep pace with the Egypt population growth rates and increase in consumption and waste.

In the meantime, the Ministry of Environment has taken its role by issuing the Decree No. 113 of 2022 regarding the issuance of licenses to practice any of the activities of the integrated management of waste.

In addition, in the recently approved Waste Law No. 202 the Micro, Small and Medium Enterprises Development Agency (MSMEDA) is mentioned to promote the Micro, Small and Medium Enterprises in cooperation with Waste Management Regulator Authority (WMRA) in the field of municipal waste collection, transportation and recycling, by providing a parcel of financial and technical incentives.

Market scans and researches prove that there is evidence for market opportunities in the solid waste management (SWM), and specifically the municipal solid waste, as well as agricultural waste.

The Netherlands Embassy in Cairo (EKNC) and the Netherlands Enterprise Agency (RVO) are committed to promote inclusive growth through sustainable trade & investment by strengthening cooperation with the Egyptian private and public sector.

With the new policy on Foreign Trade and Development Cooperation, the Netherlands will invest more in the combination of trade and development by connecting Dutch businesses to development goals benefitting both countries, and leading to more sustainable economic activities.

There are numerous opportunities for collaborations to link the private sector in Egypt with Dutch organizations to bring and adapt Dutch solutions to Egypt. Accordingly, SWM is one of the sectors identified for potential linkages and private sector collaboration.

This study provides insights on the SWM ecosystem in Egypt. The study provides information on the current situation, opportunities and market demands for potential interventions and business opportunities.

Methodology

The study concentrates on two types of solid waste : (1) the municipal solid waste, and (2) the agriculture waste or harvest waste. The study provides an overview of the value chain management of the waste starting from waste generation, collection followed by transportation, storage, treatment as well as final disposal.

The market scan report provides an overview of the value chain management of the solid waste starting from waste generation, collection followed by transportation, storage, treatment as well as final disposal.

Due to the different nature of the waste generated from the urban and rural areas as well as those generated from touristic areas, the report provides overview information on the SWM in Egypt, and also focuses on different governorates to demonstrate the case of waste management in the Governorate in terms of the waste quantities, characteristics, collection efficiency, treatment methodology and disposal practices.

For the solid waste management, sample governorates include: Giza in Greater Cairo, Qena from Upper Egypt, Al Gharbeya from Delta, and Sharm El Sheikh as touristic destination in Sinai.

The agriculture waste are mainly the residues remaining after harvesting of the agriculture crops. These residues are seasonal and regionally distributed and are not produced in consistent quantities from all farms. The report provides overview on the agriculture waste in Egypt, with a focus on two kinds of agricultural residue mainly the rice straw and sugar-beet, given that they are priority crops in Egypt with a number of untapped opportunities in their value chain. Data presented with regards to these residues will include location of the crops, seasons and generation quantities as well as current handling, treatment and disposal methods practices for these residues.

The report also highlights the waste streams related to compost and animal feed, featuring business opportunities and private sector companies operating in this field of waste stream. The report focuses on opportunities in animal feed from agriculture waste, as this becomes currently a strong need because of high price of feed, with major business opportunities.

The market scan was conducted through:

1. Comprehensive Desk Study

A comprehensive desk study was carried out of all relevant published reports, market surveys, laws and strategies to get an overview of the following for both the municipal as well as the agriculture waste (References in Annex 1):

- Quantities of waste generated, collected, treated and disposed on national level as well at Governorate level for the short-listed Governorates.
- National regulatory framework including those related to the environment as well as waste management
- Stakeholders mapping to identify who is responsible or involved in the different parts of the value chain
- Private sector involvement in the value chain to identify the kind of service they are providing and in which governorate.

2. Stakeholder Consultation

Several meetings and interviews were held with identified key stakeholders mainly to verify information collected during the desk study, and to identify opportunities for private sector interventions (List of names and organizations in Annex 2).

For the Municipal Waste Management, interviews were held with the Waste Management Regulatory Authority (WMRA); Ministry of Local Development; private sector companies in waste management.

For the Agriculture Waste Management, interviews were held with representatives from the Ministry of Agriculture and Land Reclamation to collect data and information regarding the agriculture waste in Egypt, and an interview was held with the Chamber of Food Industries to provide insights on the role of private sector in the agriculture waste management in Egypt

3. Private Sector Mapping

A mapping of the private sector companies operating in Egypt across the waste management value chain form collection, transportation, treatment to recycling and material recovery.

This report features private sector companies to provide an insight on the companies for potential business linkages with Dutch companies.

Chapter Two

Solid Waste Management System in Egypt

General Overview

Solid Waste Management (SWM) in Egypt has become a major public health and environmental concern for many years now. The magnitude of the problem has increased due to rapid population growth, fast-growing urbanization rate, industrialization and shifting of consumption rates in Egypt that led to escalated amounts of generated waste. The current population of Egypt in 2022 is 110,990,103, a 1.58% increase from 2021 and consequently, waste generation is expected to increase as the waste generation rate per capita is around 0.82 kg/capita/day.

According to the Report on Environmental Status of Egypt (2016), the generated waste was around 90 million tons, of which, 34% is agricultural waste, 28% is waterways cleansing waste, 23% is municipal solid waste, 6% construction and demolition waste, 5 % is industrial waste, 2% is sludge, 1% is medical waste, and 1% is hazardous waste.

It has been reported that more than 40% of the waste generated is either accumulated in the streets or in illegal dumping sites. Moreover, 80% of the solid waste generated is dumped into public and random dumpsites while the overall recovery rate does not exceed 12%, resulting in serious environmental impacts.

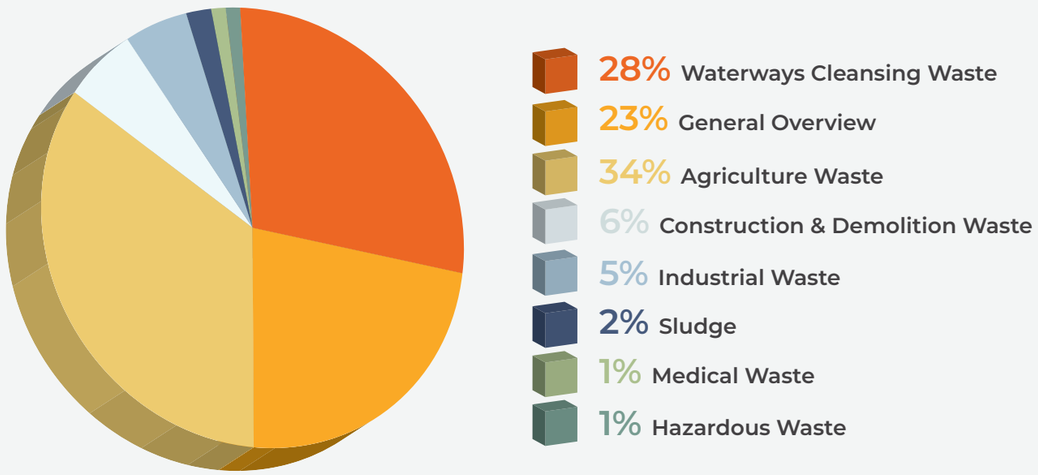


Figure 1 Waste Composition in Egypt

Sources: Report on the Environmental Status of Egypt, 2016

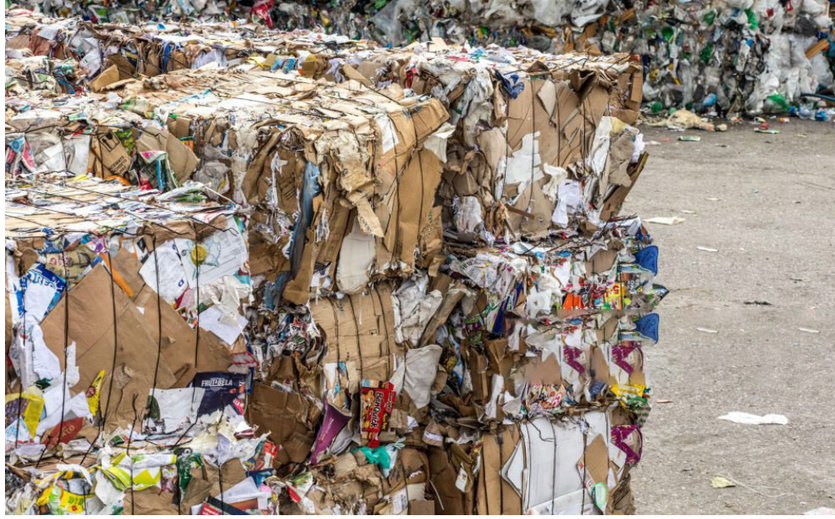
It has been reported that more than 40% of the waste generated is either accumulated in the streets or in illegal dumping sites. Moreover, 80% of the solid waste generated is dumped into public and random dumpsites, which are areas that are vacant for any other activity, but are used for waste dumping. while the overall recovery rate does not exceed 12%, resulting in serious environmental impacts.

Waste collection rates differ between urban and rural areas. It tends to be higher for urban areas than for rural ones since waste management is typically considered an urban service. The average waste collection rate in lower-middle income countries like Egypt is 71% for urban areas and 33% in rural areas . In Egypt, the collection rate was between 50-65% for urban areas and 0-30% for rural areas in 2012, which are bit lower than the average of similar countries.

It is worth noting that the municipal solid waste in Egypt is generated as mixed waste and many attempts to introduce segregation from source programs have not succeeded. It is worth noting, that this is a cultural issue as the citizens are not used to waste segregation at homes, or in restaurants, shops, or another outlet, and on the other hand there is no formal system available for collection, handling and recycling of the segregated waste. Waste is collected together even if it is segregated from source.

The mixed waste is collected and transferred to transfer stations or sent directly to the assigned disposal areas in each governorate. The waste is usually scavenged on its way to the disposal areas by the informal sector. In the case of door-to-door collection, the waste is segregated at the 'villages' of the waste collectors to recover the recyclables out of the mixed waste. Only in some Governorates, there are Mechanical and Biological Treatment Plants where the waste is segregated to extract recyclables and the remaining portion is turned into refuse derived fuel (RDF) and the organic content is composted (in Annex 3, there is a list of landfills in each geographical location). Sanitary landfills are starting to be constructed but usually the waste is disposed in dump sites or controlled disposal areas.

Agricultural waste is an additional burden when waste management is conducted in rural areas or villages where agriculture is the main activity of the area. Egypt generated about 31 million tons of agricultural waste in 2016 . Burning of agricultural waste is a common practice in Egypt, especially rice straw. Large quantities of rice straw are burned in the fields as means of quickly clearing the land for the cultivation of other crops. Agricultural waste also pollutes the environment by polluting the water resources. The lack of equipment, services and infrastructure are the main problems facing the agricultural waste management. This is in addition to fragmented small farms and plots geographically distributed over huge areas causing difficulty in agricultural waste collection.



Waste Management Set-up

During the last decades, Egyptian authorities managed solid waste in Egypt through central and local government. In Cairo and Giza Governorates, the Cairo and Giza Cleanliness and Beautification Authority (CCBA & GCBA respectively) formed the formal public sector to achieve the following:

Informal private partners such as garbage collectors and formal small private companies have been involved in SWM during the 1900s and until the beginning of 2000.

Main Objectives:

Supervise the various stakeholders involved in the waste management system

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

License new Egyptian private garbage collection companies

In Cairo, the so called "Zabaleen" was the community that carried out door-to-door collection since the 1900s. They were concentrated and working in "garbage villages" located in some areas in the Greater Cairo region such as Mokatam, Helwan, Ezbet El Nakhl etc. These "villages" originally housed waste recycling communities that had pig raising dens. This community raised pigs till the break of the swine flu when the pig population in Egypt was exterminated. Since then the organic waste in Cairo became a problem. Pigs used to feed on the organic waste and they were an excellent source of income for the waste collection contractors. The dens also generated income from the pig waste/manure which they sold as organic fertilizer. With the reduction in the pigs population, there is no incentive to collect the organic waste and it was left to accumulate and decompose or is burn in the streets.

CCBA and GCBA award licenses and contracts to private companies through competitive bidding and gave them a fee in return for their services while they assumed responsibility for sweeping and lighting main streets as well as maintaining public parks.

Outside Cairo and Giza, the responsibility for SWM at the local level is dispersed among different authorities. In some governorates, the Environment Management Unit (EMU) takes responsibility for solid waste management at the executive level while other governorates leave this responsibility for the Housing and Public utilities departments.

Public		Private	
Central Gov.	**Local Gov.**	**Local**	**International**
Ministries Ministry of Environment Ministry of Local Development (to lesser extent, other ministries such as the Ministries of Health, Industry, Agriculture, Water Resources and Irrigation)	Governorates Municipalities (cities and LGUs) Cleaning and Beautification Authorities	Contracted SWM Operators Informal Community	Contracted SWM Operators Donors
		NGOs	

Figure 2 Main Stakeholders Involved in the Waste Management System

Sources: MoE/WMRA/NSWMP, Economic and Financial Feasibility for Businesses in Egypt's Waste Sector, 2018

The international private formal sector has been involved in handling solid waste in Egypt since 2002 through fifteen-year contracts between Egyptian authorities and private international companies. According to the Private Public Partnerships and Private Sector Participation theories, there are essential prerequisites that should have been secured to achieve successful Public Private Partnership.

The SWM financial resources are insufficient as the allocated budget and the available resources do not cover cost of SWM processes and activities. The main source for funding SWM in Egypt is the central government, followed by the cleansing fund and other funds such as donors' funds that support SWM and funds are that are directed to NGOs or NGOs in cooperation with Ministries. There is no direct fund for SWM through the central government budget but it follows the central government regulation in other fields.

Despite efforts by the Egyptian authorities to continuously address the SWM crisis, the SWM system is still considered inefficient and not integrated. Specifically, the government has struggled to provide SWM services adequately due to the improper methods of waste handling and disposal, the inadequate nature of the existing regulations, lack of resources, institutional weaknesses, inefficient local taxation system, and low stakeholder engagement. A particularly crucial issue to waste management is the availability of resources. The failure to purchase modernized collection and treatment equipment alongside the poor maintenance of existing ones are key reasons to inadequate waste management. Moreover, the inadequate training and technical knowledge to those who are involved in these processes are additional constraints.

During the 1990s, Egypt followed an introduced program by International Monetary Fund (IMF) and the World Bank (WB). One of the main goals of this program was to increase the participation of the private sector in operating SWM facilities. In this regard, the private sector (especially international companies) became involved in the management of solid waste. The involvement of the international private sector, however, did not help in eradicating SWM challenges after several years of operation. The private sector struggled to be successful in the waste management sector, at that time, due to several reasons. The lack of nationwide collection infrastructure, the weak markets for the recycling of byproducts, the inability of the government to pay recyclers, and the small percentage of recyclables were all reasons for the private sector to be reluctant to invest in the solid waste management field .

The GoE made an attempt to bring the private sector back into the equation in 2012. A National Solid Waste Management Program (NSWMP) received funds from the European Union (EU) and Germany to build dedicated waste management departments in Qena, Assiut, Kafr El Sheikh and Al-Gharbia Governorates. This cooperation intends to bring both technical and financial assistance and to provide incentives for the private sector to invest in the SWM services. The government would provide companies with waste at no charge, pay fees to the companies depending on the waste service they deliver and sometimes lease them land to build recycling facilities .

According to the New Waste Law, a collection fee will be introduced on the national level to be collected with the electricity bill. The fees will be collected in the financial fund of the Governorates to be then added as a pool in the account of the Ministry of Local Development. This fund will be used for payment of the fees of the waste collection companies as well as payment of the gate fees of the MSW infrastructure.

Egypt's Agriculture & Agriculture Waste Landscape

Agriculture is a major component of the Egyptian economy, contributing to 11.3 % of the country's gross domestic product. The agricultural sector accounts for 28% of the jobs in Egypt, and over 55% of employment in Upper Egypt is in the agriculture sector. Egypt's agriculture sector is dominated by small farms using traditional practices that do not meet international standards.

The amount of agricultural waste in Egypt can range from 30-35 million tons a year. These crop residues result after harvesting, on the farm level. Only about 7 million tons are used for animal feed, and about 4 million tons are used for organic manure, where the majority of the agriculture waste remains untreated, unused, or not recycled, which results in burning the agriculture waste (especially the rice straw waste).

This method of burning agriculture waste is not only considered an economic loss but also has harmful effects on the environment.

Two of the priority crops in Egypt with potential opportunities in agriculture waste are the Sugar Beet and Rice.

Below are tables for the top priority crop production in Egypt:

Table 1 Sugar Beet Crop Production

Governorates	Area (hec)	Main crop (Tons)	Secondary (Tons)	%
Beheira	15,825	731,945	150,716	7%
Dakahlia	55,689	2,594,172	530,372	26%
Fayoum	11,351	504,143	108,104	5%
Bani Sueif	12,915	618,075	123,000	6%
Total 4 gov.	95,780	4,448,335	912,192	44%
Rest of gov.	121,758	5,835,752	1,159,596	56%
Total	217,538	10,284,087	2,071,788	100%

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Agricultural Income Estimates Bulletin, 2021.

Table 2 Summer Rice Crop Production

Governorates	Area (hec)	Main crop (Tons)	Secondary (Tons)	%
Beheira	78,393	665,034	466,625	16%
Dakahlia	136,606	1,303,924	813,133	27%
Fayoum	1,127	8,317	6,708	0.23%
Bani Sueif	762	8,145	4,535	0.15%
Total 4 gov.	216,888	1,985,420	1,291,000	43%
Rest of gov.	282,273	2,455,574	1,680,195	57%
Total	499,161	4,440,994	2,971,195	100%

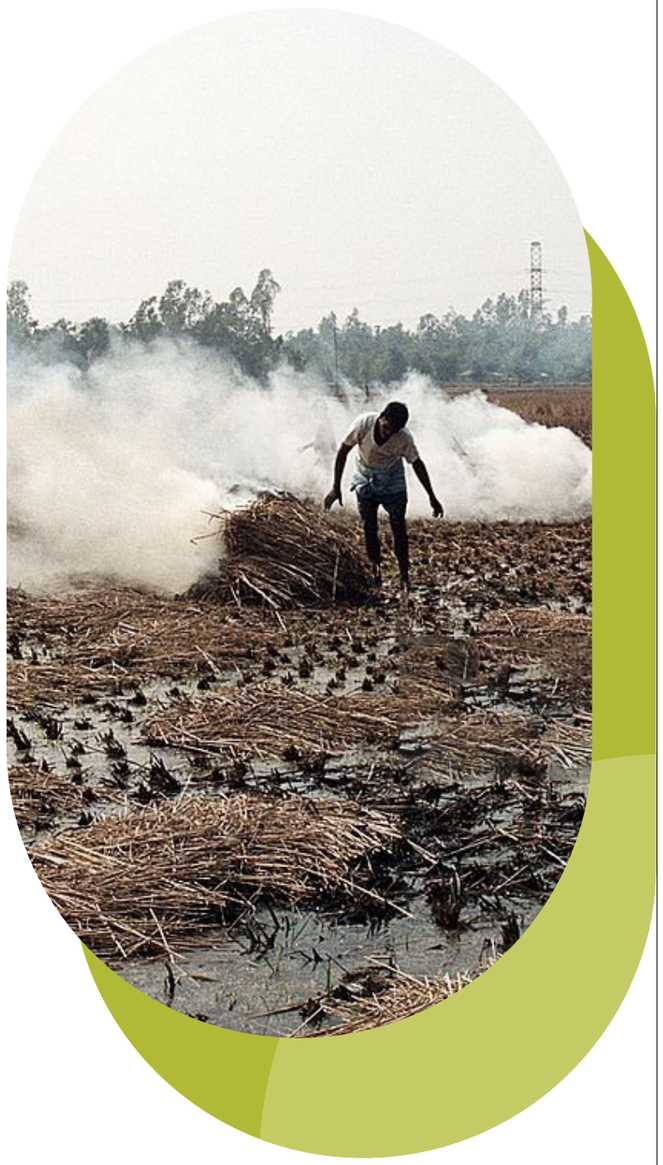
Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Agricultural Income Estimates Bulletin, 2021.

The problem of agriculture waste becomes very obvious and aggregated after the harvest of summer crops. That is because at this time of the season, the farmers are in a rush to recultivate the land, therefore getting rid of the wastes has the highest priorities, which is usually by burning. This method of burning, not only is considered an economic loss but also has harmful effects on the environment.

Rice is one of the most common crops cultivated by farmers in Egypt, and it is a staple food for the vast majority of the country's population. A black cloud caused by the burning of rice straw – a by-product of rice farming – appears at the end of the harvest season.

Quantitative and Qualitative Characterization of Agricultural By-Products in Egypt

According to the Ministry of Agriculture and Land Reclamation, agricultural by-products as a result of agricultural activities have been estimated to be more than 25 million tons per year as mentioned before. 11.7% of this waste is produced during winter season, 52.9% is produced during summer while 35.4% produced from permanent plantation. On the other hand, these wastes are geographically distributed between Nile Delta, Upper Egypt and other regions as 48%, 41% and 11% respectively. Most of these wastes are produced from maize, sugar cane, rice and cotton crops harvest. It has been found that only 30 % to 35% of these wastes are utilized as compost or non-traditional animal feed. Therefore still 65% unused which need to be managing to exploit its potential if utilized as animal feed and organic fertilizer (compost).



Animal production sector in Egypt currently suffers from animal feed shortage and the volatile price of feed which is mostly imported from abroad. This feed gap was estimated to be equivalent to 5 million ton of concentrated animal feed. Costs of feeding animal in general account for 65% to 70% of total production costs. Feed shortage is one of the obstacles facing developments of animal production sector. Therefore, utilization of crop residues as non-conventional alternative feed resources is highly recommended by scientists to fill part of feed gap and reducing production costs. In the meantime, reduces demand on the foreign currency which itself a big problem to be available for importing feed stuffs.

The total quantity of crop residues in Egypt is listed in the below table. Rice straw, sugar beet and sugarcane bagasse, wheat straw, banana residues, and date palm residues are some of the chief contributors to biomass products in Egypt.

Table 3 Current situation of AGR in Egypt

Crop residues	Quantities (million ton)	%
Dry AGR		
Wheat straw	2.9	11.4
Other straws	0.9	3.5
Maize Stover	3.5	13.56
Rice straw	2.5	9.69
Sorghum Stover	1.2	4.65
Corn cobs	0.6	2.3
Rice Hulls	0.5	1.94
Sugar cane bagasse	1.0	3.88
Sugar cane leaves	1.5	5.8
Cotton stalks	0.1	0.39
Rice bran	0.5	1.94
Green AGR		
Vegetable and fruits residues	4.5	17.44
Sugar cane tops	4.6	17.83
Sugar beet leaves	1.5	5.8
Total	**25.8**	**100**

Source: Economic Affairs Sector, Ministry of Agriculture & Land Reclamation 2021

In 2021, only about 4.3 million tons of crop residues out of 25 million tons produced were used in feeding. Approximately two third of the crop residues were burned or wasted.

There were attempts to upgrading the nutritive value of the crop residues through mechanical, chemical and biological treatment. The treatment of crop residues takes place at farm level, however there are opportunities for biological treatments to produce green crop residues that can be used as organic fertilizers or silage.

Utilization of agriculture waste in an environmentally friendly way is very important, and is a market opportunity for private sector. Across the value chain from collection, transportation to production, the below are four different interventions that can take place for the agriculture waste recycling:

Compost production

by fermenting the agricultural in the main way for recycling them. This will help in re fertilizing the soil organically and reduce the production cost.

Energy production Bio gas

it can be concluded that recycling agriculture wastes is a must for environment as well as economical saving. This recycling will not only increase agricultural production but also will improve its quality.

Animal feed production

by treating some wastes such as rice straw by Urea or ammonia to increase its nitrogen content hence its nutritional value.

Food production

a. This can be done by growing mushroom on agricultural wastes such as rice straw as a substrate. This means the conversion of wastes to economic, nutritional human food.

b. Growing vegetables on rice straw compacted bales in areas where soil disease and salinity are constrains.

Fodder & Agricultural Wastes

Animal fodder is one of the most important requirements for animal production in Egypt, and it is considered an important productive element that determines the capacity of animal production.

Egypt suffers from shortage of animal feed materials. A large amount of alterative is used such as: yellow corn (which is imported); at a time when there is more than 2/3 of the agriculture waste residue is not used. Despite this, there is a deficit in rough fodder estimated at about 4.5 million tons.

Agricultural waste (by-products)

The agricultural waste by-products can be used as non-traditional fodder into:

- Coarse plant waste: It is represented in the parts unfit for human consumption, which are left behind in the different stages of production and harvesting, such as wheat straw, rice straw, corn stover, corn kernels, cotton firewood, peanut stalk, cane marrow, cottonseed husk, lentil husk, bean husk, husk Peanut straw, lentil straw, fenugreek straw, bean straw, alfalfa straw, chickpea straw, barley straw, sugar beet straw, lupine firewood, sesame firewood, cane straw, sorghum firewood.
- Oil press waste: It consists of hulled cottonseed meal, un-hulled cottonseed meal, flaxseed meal, sesame seed meal, peanut seed meal, maize germ meal, sunflower seed meal, rice meal, extracted starch, soybean meal.
- Waste of mills: it is represented in wheat bran, corn bran, barley bran, rice bran, rice bran, rice kernels, rice germ, bean crumb
- Plant wastes of factories: These are maize gluten, corn husks, corn germ, corn starch industry residues, rice starch industry residues, molasses, dry sugar beet pulp, and beer dregs.
- Slaughterhouse waste: It is represented in blood powder, meat powder, bone powder, animal fat, meat and bone powder, and poultry feathers powder.
- Poultry slaughterhouse waste: powder and poultry droppings powder.
- Waste of fish factories: It consists of shrimp meal, fish melts, fish meal, and cod liver oil.

Chapter Three

Legal & policy Framework

Solid Waste Management
Legal and Policy Framework in Egypt

On October 13, 2020, President Abdelfattah Elsisi ratified Egypt's new Waste Management Law (this New Law is for all waste types) (# 202/2020), which was approved by the House of Representatives on August 24, 2020. The law is Egypt's latest attempt to regulate the waste management industry by creating a new regulatory authority to oversee proper waste management and recycling practices, and develop a national strategy to improve waste disposal and recycling. The law seeks to provide investment incentives and other measures to encourage garbage collectors, small companies, private contractors, and recycling centres to join the formal economy. The Law aims to create a waste management regulatory authority (WMRA) to oversee proper waste management and recycling practices. WMRA will be in charge of creating a national strategy to tackle the issue of waste management.

Waste Management Law No.202 of 2020

This Law consisting of 80 articles aims at regulating the organization of waste management in Egypt. The main goals of the Law are:

1. Develop an integrated management of municipal, industrial, agricultural, demolition and construction waste as well as their safe disposal
2. Reduce waste generation
3. Promote reuse
4. Work to ensure the recycling, treatment and final disposal of waste
5. Manage waste in a way that reduces damage to public health and the environment.

A Waste Management Authority is established at art.3 with the following tasks:

1. Regulating, tracking, auditing, evaluating and developing everything related to Integrated Waste Management activities
2. Attracting investments in the field of Integrated Waste Management activities to ensure sustainable development
3. Following up the implementation of the plans required to regulate waste management in cooperation with governmental institutions, municipal governments, the private sector, NGOs and international organizations
4. Issuing the licenses needed to undertake waste management activities.

The main planning and organizational actions of WMRA are:

1. Preparing the national strategy for integrated waste management
2. Establishing and managing the national system for managing waste information and data
3. Determine the geographical scope of the service areas of the integrated municipal waste management and the type of services required
4. Ensuring the availability of financial resources with the administrative authority to cover the contracted services

5. Control over the activities of integrated waste management, and prepare key performance indicators to monitor, follow up and evaluate the work
6. Preparing and reviewing proposals to develop and update legislation, laws, regulations, standards and technical rules that regulate the method of integrated waste management
7. Providing technical consulting services, support, and recommendations to the competent administrative authorities as well as to the actors in the waste management system
8. Encouraging investment opportunities by setting incentive prices for compost outputs, excreta and alternative fuels
9. Encouraging research, applied studies, experimental projects and initiatives that contribute to improving and developing performance in waste management.

Articles 6-14 deal with the organizational structure of the Waste Management Authority. The Law expressly prohibits (i) open burning of waste (art.20); (ii) mix without approval any type of waste with each other by the licensee to practice any of the activities of integrated waste management (art.21); (iii) throw, sort, or treat municipal waste except in the places designated for this (art.38); (iv) dump agricultural waste into waterways or disposed of in places other than those designated for this (art.45); (v) use empty packages of hazardous materials or use products resulting from their recycling except in accordance with the requirements specified by the Executive Regulations of this Law (art.58); (vi) export hazardous materials or waste to outside Egypt without approval (art.59); (vii) dump hazardous materials or waste into the regional sea, continental shelf, exclusive economic zone, or high seas of Egypt (art.64).

In order to protect the environment, the following measures are provided:

1. For single-use plastic bags: the Law establishes that (i) their manufacture, import or export shall be in accordance with the technical controls, requirements and specifications issued by a decision issued by the Minister of Trade and Industry, including their ban in case of components with inputs or materials that seriously harm the environment; (ii) their sale, circulation, storage, free distribution, or disposal may take place only in accordance with the controls, conditions and technical specifications determined by the executive regulations of this Law; (iii) it will be issued a system of financial and economic incentives and tax and customs exemptions to encourage the import, production and manufacture of safe, environmentally friendly alternatives for single-use plastic bags (art.27)
2. It is established a sanitation fund in each governorate or new urban communities apparatus for the collection services of municipal waste (art.35)
3. As for the industrial waste, the Waste Management Authority, in cooperation with the Ministry of Trade and Industry, establishes a "green label" system (a certificate attesting products manufactured in a way that limits the generation of waste or helps to recycle them after consumption, and a mark is placed on the products to introduce the consumer to environmentally friendly products) to motivate manufacturers to increase the percentage of recyclable inputs and reduce the generation of industrial waste (art.52).

The Law classifies waste as (a) hazardous or (b) non-hazardous. The requirements for the management of each are as follows (a): (i) obtaining a special license for the integrated management of hazardous waste and substances; (ii) obtaining an approval from the Waste Management Authority for its circulation; (iii) maintaining a register of such waste and the methods of disposal; and (iv) sterilizing and disinfecting the place where the facility producing such waste was established in case it was moved or its activities suspended; (b): (i) obtaining a license for the integrated management of non-hazardous waste; and (ii) taking all precautions required to avoid causing any harm to the environment.

Previous SWM Legislations and Regulations

The previous legal framework related to SWM was dispersed in many bylaws, decrees and regulations and under the responsibility of different ministries. There was no single legislation devoted to SWM. The most important laws are law 38 of 1967 and its amendments in law 10 of 2005, and the Environmental law 4 of 1994 with its amendments and executive regulations. The laws are presented below:

- **Law 38 of 1967** addresses the General Public Cleaning and its amendment **(law no.31/1976)** is concerned with regulating the collection and disposal of solid waste from residential, commercial, industrial, and public areas. It also enforces taxes on all housing units equivalent to 2% of the rental value. Article 6 of law 32 of 1976 also addresses the requirement of having a license for all waste collection workers. Law 31 of 1976 address the tools that should be used for waste transportation and the preferred schedule of picking solid waste.
- Ministry of Housing **Decree no.134/1968**, implementing **Law no.38/1967**, governs the requirements and distribution of disposal sites, including the methods of treatment needed. It also requires that space be provided to sort waste, and remove the glass, the metal, the rubber, the stones, and any other material that is inorganic from the waste. Requirements are also placed on the use of organic waste as animal food.
- **Law 66 of 1977** addresses traffic routes and management of litter and other materials.
- **Law 3 of 1982** addresses the importance of locating spaces for public services and utilities during urban planning by environmental consultants.
- **Law 43 of 1979** addresses the local administrative unit's roles and responsibilities regarding SWM.
- **Law 137 of 1981** addresses occupational safety where Article 117 of this law specifically necessitates that workers should be aware of occupational hazards and trained on the safety measures.
- **Law no. 48 of 1982** grants authority to the Ministry of Irrigation to issue penalties for the protection of the Nile River and other waterways against waste pollution.
- **Presidential Decree 284 of 1983** requires the establishment of Beautification and Cleaning authority in Both Cairo and Giza governorates. The main responsibility of this authority is to collect solid waste and dispose it in the designated areas.
- **Law no. 4 of 1994** on protecting the environment and its executive regulations **(law no. 338 of 1995)**, created the EEAA, which was mandated to develop environmental impact assessments of new developments, and to implement strategies for preserving the environment. It discusses the handling of solid waste in general and hazardous waste in particular in addition to addressing the preferred location of dumpsites. The law also calls for incentives system to encourage individuals, groups, small and large companies to create projects with environmental protection value. The laws encourage recycling and reuse activities for the different types of waste streams. Article 37 of law 4/1994 and Article 38 of its executive regulations considers the use of waste as Alternative Fuel and Raw material (AFR) part of the legally approved recycling processes and prohibits disposing of any solid wastes, including agricultural solid wastes, outside designated areas, according to the agreement between EEAA and local authority.
- **Law no. 10/2005**, establishes a solid waste collection fee to be added to electricity bills paid by households and businesses.
- **Decrees no. 1741 of 2005, 5/2011, 1095 and 964/2015,** amending the Executive Regulations of Law 4/1994, covers regulations for the selection of recycling and landfilling facilities as well as specifications regarding waste collection and transfer equipment.
- **Law no. 9 of 2009**, amending **Law no.4 of 1994**, prohibits open burning of solid waste as well as necessitates that sorting and treatment of wastes should be carried out in areas away from residential, industrial and agricultural areas and waterway.
- **Presidential Decree 86 of 2010**, necessitates the closure of existing dumping sites and the landfill at greater Cairo. It also calls for allocation of five new sites outside Cairo's residential and commercial belt.
- The law along with Prime Ministerial Decree No. 964/2015 set requirements for establishing waste management facilities:
  - Approval of the location for waste storage or treatment facilities by EEAA (Article 37 of law 4/1994 and Article 38 of the executive regulation).
  - A requirement that all facilities involved in waste recycling and treatment conduct an EIA study to ensure compliance with all environmental legal requirements.
  - An environmental management plan, monitoring plan, contingency plan and time frame for removing any violations.

Moreover, the law sets requirements for the operation of waste management facilities, including:

- Operational permit from the governorate.
- Waste transportation contracts.
- An environmental register including all operations, follow up forms, delivery and receipts for transported waste amounts.
- An approved system for waste collection, transportation, handling and disposal of waste (remains of pre-processing).
- An environmental register for handling any hazardous waste generated.
- An approved system for final disposal, collection and transportation of any hazardous waste generated.
- EEAA approval of the location of final disposal, controlled landfills.

Prime Minister Decree 3005 of 2015, aims at establishing an independent Waste Management Regulatory Authority (WMRA) responsible to develop and manage a waste management strategy, in accordance with the Environment Law.

As for the Agricultural Waste is addressed in the following legislations and protocols:

- Law no. 9 of 2009 mandates that farmers who practice rice straw burning would be fined up to LE 20,000 and prohibits the dumping of waste in residential, industrial and agricultural areas and waterways. It also prohibits agricultural residue which is used as animal fodder from being used for other purposes.
- Prime Ministerial Decree Number 1740/2002 regulates the collection of agricultural waste and banning the burning of agriculture waste. It also bans disposal of agricultural waste in locations other than those designated by the competent authority.

Moreover, the agricultural legal framework does not address the management of crop residues as “waste”. However, it does address fertilizers and may impact the management of crop residues to the extent that compost is manufactured from crop residues and is considered a fertilizer:

- Ministry of Agricultural and Food Safety Decree No. 590 for the year 1984, amended by decree No. 518 for the year 1986, specifies the chemical composition of fertilizers.
- Law 53/ 1966, articles 69 and 70, regulates fertilizer production and the claims that can be made regarding a fertilizer.
- Ministry of Agricultural and Food Safety Decree 100 for the year 1967, establishes that fertilizer made from household waste should meet the following specifications:
  - Nitrogen percentage is not less than 0.5%.
  - Organic content percentage is not less than 18%.
  - Moisture percentage is not more than 30%.
  - Sodium chloride percentage is not more than 5%.
  - Percentage of the carbon to the nitrogen is between 1:17- 1: 25.

- Directive 63/2002 of the Ministry of Agriculture and Land Reclamation prohibits the growing of rice (except in certain amounts) and the burning of rice straw to minimize air pollution in Greater Cairo. The annual land area officially devoted to rice plantation is mandated by a Ministerial Decree from the MWRI. Moreover, for safety reasons, it is illegal to store agricultural waste on agricultural land. This issue poses a problem of allocating special plots for storage within agricultural lands.
- Ministerial Decree No. 554 for the year 1984 specifies that incase of pressing straws and rice straw in bales to be used in animal consumption; ropes made out of plant or synthetic fibers should be used while metal wires are prohibited for use as it could harm the animals in case it is broken and mixed with the fodder.

As for laws encouraging investments in SMEs, these include:

- Law 141/2004 and its executive regulations based on Prime Ministerial Decree number 1241/2004 which is related to establishing SMEs. It promulgates the environmental safety requirements. The law develops necessary funding mechanisms (through the Social Development Fund) to finance cement companies interested in investing in alternative fuel (AF) and provides funding mechanisms for SMEs who are interested in becoming involved as part of AF supply chain. It also governs the issuance of relevant regulations to formalize the participation of informal actors involved in waste collection.

The Ministry of Environment along with the Ministry of Agriculture and Land Reclamation have joined efforts for the last five years to combat the practice of open burning of the rice straw in the Governorates of the Delta. They have made tremendous efforts to aid the farmers in providing feasible solutions for collection, transport, storage and reuse of the straw. A number of projects, protocols and pilot projects have been developed to valorize the rice straw to treat it as a valuable residue rather than the misconception of handling it as a waste without value. Close coordination between the Ministry of Environment through its two agencies EEAA and the newly established WMRA and the Ministry of Agriculture and Land Reclamation through its local and regional environmental directorates and environmental cooperatives have demonstrated to the farmers that rice straw can be recycled into animal fodder, compost or sold for fiber or as alternative fuel. The EEAA has also closely monitored illegal acts and violations regarding open burning of straw through its regional air quality monitoring stations as well as through satellite imaging

Chapter Four

Key Stakeholders

Solid Waste Management
Key Stakeholders in Egypt

Essentially, SWM environmental guidance regarding laws, regulations and standards falls under the responsibility of Ministry of Environment (MoE) while SWM operations' responsibility falls under the Ministry of Local Development. The Waste Management Regulatory Authority (WMRA) (under MoE) is a new authority that was established in response to a decree No. 3005 issued by the Prime Minister in 2015. Furthermore, the role and mandates of WMRA were more emphasized in the new waste law 202 of 2020, by stating that WMRA is the main entity to oversee and regulate an Integrated Solid Waste Management (ISWM) in Egypt and it is an economic entity now responsible to attract new investments and create new jobs within the sector.

The different entities regulating municipal and agricultural in Egypt are:

Ministry of Environment (MoE)

The Ministry of Environment is the main body responsible for defining and providing the overall direction of SW national policies and enforcing regulations and laws through its technical arms the Egyptian Environmental Affairs Agency (EEAA) and its newly established arm WMRA.

Egyptian Environmental Affairs Agency (EEAA)

The main responsibility of the EEAA is to ensure implementation of the provisions of SWM legislation. The EEAA formally interacts with local waste management planning through the Environmental Impact Assessment (EIA) process. The waste management facilities are granted licenses to operate subsequent to the approval of the EIA. On this basis, the role EEAA can be summarized as follows:

- Drafting strategic documents on municipal solid waste management.
- Preparing guidelines and codes of practice emphasizing different stages of the proposed system.
- Coordinating efforts for establishing final waste disposal sites and facilities.
- Providing technical and financial support to Governorates within available capacity and encouraging Governorates to apply for funds from donors.
- Revising EIAs prepared by specified administrative entities.

In addition to that, the regional offices of EEAA in the governorates act the technical arm of WMRA's operations in these areas.

Waste Management Regulatory Authority (WMRA)

The main planning and organizational actions of WMRA are:

1. Preparing the national strategy for integrated waste management
2. Establishing and managing the national system for managing waste information and data
3. Determine the geographical scope of the service areas of the integrated municipal waste management and the type of services required
4. Ensuring the availability of financial resources with the administrative authority to cover the contracted services
5. Control over the activities of integrated waste management, and prepare key performance indicators to monitor, follow up and evaluate the work
6. Preparing and reviewing proposals to develop and update legislation, laws, regulations, standards and technical rules that regulate the method of integrated waste management
7. Providing technical consulting services, support, and recommendations to the competent administrative authorities as well as to the actors in the waste management system
8. Encouraging investment opportunities by setting incentive prices for compost outputs, excreta and alternative fuels
9. Encouraging research, applied studies, experimental projects and initiatives that contribute to improving and developing performance in waste management.

Regional Branch Offices of the Ministry of Environment

The Regional Branch Office (RBO) of EEAA under the Ministry of Environment is a local representative structure and an executive agency of the MoE. It supports the governorate to prepare and implement plans and policies, monitor, evaluate, and inspect SWM facilities. The RBOs also assess EIAs coming from the governorate. The waste departments of the RBOs are the "technical arm" of WMRA to support the activities of WMRA in the governorates.

Ministry of Agriculture and Land Reclamation (MALR)

The Ministry of Agriculture and Land Reclamation (MALR) is responsible for planning and management of agricultural lands in Egypt. It is the entity that controls, guides, and directly supports Egyptian farmers through its local directorates. Therefore, it is the entity that has direct relation with the farmers and is the one responsible for working with the farmers on management of the generated agricultural residues during the harvest season.

Ministry of Local Development (MoLD)

The Ministry of Local Development (MoLD) is the responsible entity for enhancing service quality in governorates in general, and more specifically the municipal solid waste policy development and implementation in the local governorates. Moreover, its responsibilities include issuance of tenders and inviting service providers to submit offers such as private sector and/or NGOs.

According to the Law of Local Administration 43/1979, the relevant roles and responsibilities of MoLD can be summarized as follows:

- Providing technical assistance to local administration including trainings to local units' personnel.
- Applying legal views on local administration matters among local administration units.
- Proposing legislations relevant to local administration systems.
- Supporting local units to prepare local budgets.
- Managing grants and loans designated for investment projects in Governorates and following up on the implementation of these projects.
- Assisting the Governorates in developing SWM facilities, mainly recycling facilities.

Ministry of Finance (MoF)

The Ministry of Finance (MoF) plans, prepares, and manages the Government of Egypt's budget and public debt. For solid waste management activities in the country, the Ministry is responsible for approving budgets allocated to waste management operational costs. The Ministry avails financial resources at governorates level for the treatment and final disposal of waste.

MoF acts as an auditor and checks on the accounts both at the Governorate and Markaz levels. The Markaz reports on the accounts of its villages. The Accountability State Authority reviews the budgets and accounts of the local units. There is no budget line for "solid waste management" but rather waste services fall under "landscape and environmental protection" budget item. The maintenance of waste management equipment is taken from the general "equipment management' budget item.

Since 2006, a Public-Private Partnership (PPP) Central Unit was established at the MoF to coordinate the PPP projects stages across the concerned public authorities or ministries .

Ministry of Water Resources and Irrigation (MWRI)

The Ministry of Water Resources and Irrigation (MWRI) is the primary government agency in charge with the management of water resources in Egypt. Regarding waste management, the Ministry has the authority to issue penalties for those who dump in the waterways. However, the local administration is the entity responsible for handling solid waste along the sides of canals and drains.

Ministry of Housing Utilities and Urban Communities (MHUUC)

In 2012, the Minister issued Decree 475 to establish a committee of experts to prepare the Egyptian code of SWM, which is still being discussed. WMRA and other stakeholders have recently been involved to complete the code.

Ministry of Electricity and Renewable Energy (MoERE)

The Ministry is responsible to collect tariffs of waste management through the electricity bill. Regarding waste to energy projects, Article 25 of Law 202/2020 sets that the Ministry along with the Prime Minister is responsible to determine the "feed-in-tariff" for the electricity generated from waste-to-energy facilities. According to an official statement by the Prime Minister, the tariff was determined to be 140 piasters/kWh. It will be paid in EGP and will remain in place for 25 years. Under this statement, the governorate, in which the waste-to-energy project is located, will be responsible to pay the tariff to the project developer. It will collect part of this tariff (103 piasters/kWh) from the electricity distribution companies, while the rest will be paid from the Hygiene Fund affiliated to the Governorate (37 piasters/kWh).

Governorates/Municipalities

In general, the governorates are directly responsible for solid waste management services by providing it to the citizens directly or by contracting private companies. They can also formulate local solid waste management plans that suit their respective governorates. Moreover, they are responsible for the siting, operation, monitoring of solid waste activities and facilities.

The Central Agency for Organization and Administration (CAOA) is an agency responsible to approve new or revised organizational structures and roles and responsibleness with the public administration.

At Governorate Level

There is a general Department of Solid Waste at the governorate level under the direct supervision of the Secretary General. This department consists of three divisions:

- Planning and technical support
- Capacity building, training, and community communication
- Monitoring and follow-up.

At City Level

There is a Solid Waste Department at the city level under the direct supervision of the head of the city. This department consists of two divisions:

- Operation and technical support
- Monitoring, follow-up, and awareness.

At Rural Local Units Level

There is an adoption of the functional elements of SWM at the village level, under the supervision of the head of the local unit and technical support from SWM in the city. Local government is divided into four levels: governorates, markaz, districts and local units (at the village level). In other words, each governorate is made up of number of markaz and each markaz has a main city and a number of mother villages. Each mother village has associate satellite villages and hamlets.

In general governorates are responsible to approve budges and investment plans for MSW management and then distribute the budgets to the districts, cities, and local units which are responsible to execute MSWM in their areas of responsibilities.

The collection of street waste, waste from public places, operating existing composting plants and supervising the landfill and dumpsite operation are the responsibility of the local authorities (in other words, districts or cities or local units). In case these authorities are contracting SWM services to private sector companies, they are still responsible to regulate and monitor the performance of the private sector companies. More specifically, the provision of MSW management is the responsibility of the “Cleaning Departments”. The local authorities are entitled to coordinate with EEAA to site solid waste treatment, burning or disposal sites and to issue licenses related to are workers and peasants.

Environmental Management Units (EMUs)

There are Environmental MSW transport and disposal.

Local Popular Councils (LPC)

A local popular council, within state’s general policy, is responsible for the supervision of facilities include those of SWM and for determining the cleaning fees. The council is formed through direct elections from all levels of administrative units and half of the members

Management Units at each governorate, and they are responsible for monitoring and enforcing environmental legislation provisions including SWM. These units receive technical support from RBOs of EEAA in some governorates, while they receive their operating expenses and salaries from the Governorate budget.

Solid Waste Management Unit (SMU) at the governorate level

These units are generally responsible to set regulations and conditions associated with solid management factories and landfills. They are also responsible to review contracts with private companies or investors, and they are required to implement projects in case of possible SWM infrastructure projects. It is important to mention that it is within their responsibility to approve and distribute budgets to Markaz and local units, to approve SWM investment plans and to determine the cleaning fees in coordination with the LPCs.

Solid Waste Management Unit (SMU) at the city level

While the cleaning department of the cities are responsible for general provision of MSWM services, the tasks of SWM units at the city level include collection, transportation, and disposal as well as the operation of existing dumpsites and treatment plants. In case some waste management services are contracted to private entities (individuals/groups or companies), the control and regulation, and performance of these services are under SWM units’ responsibility. Moreover, they are responsible for the collection of the cleanliness fees.

Solid Waste Management Unit (SMU) at the village level

While the supervision of the MSWM services are under the Cleaning Department, collection and transportation of waste, collection of cleanliness fees are the responsibility of SWM units at the villages. These units are authorized to contract MSWM services to private sector or NGOs.

Public Companies

Public companies work under the local authorities. They usually provide a particular service, such as waste collection, to one city or group of cities/villages. They are staffed with public employees and their profit is directed to public funds. They are restricted with the general direction of municipal leaders which can hinder their effectiveness sometimes.

Private sector

The private sector is considered any group of people who work together to produce a service within the waste value chain (collection, transfer, treatment recycling or disposal services) with the aim to produce a profit. These groups are of formal status and carry out their agreement with the local authorities. This sector can range from SMEs to large business firms. They can also be local or international companies.

In general, the sector has greater freedom to use its money and higher experience in SWM, and thus can become more efficient than local government in operating their services.

Community Development Associations (CDAs)

Community Development Associations are groups of people who are volunteering to work on local projects including waste management projects. They are registered under the Egyptian law as Non-Governmental Organizations (NGOs). By the Egyptian definition, CDAs are small and grassroots NGOs and represent 60% of the NGO sector in Egypt. CDAs are dependent on donor funded grants or the Social Fund for Development (SFD) to operate their services or sometimes they use/rent equipment from the local unit. Sometimes, CDAs carry out community awareness campaigns in the field of solid waste as well.

Non-Governmental Organizations (NGOs)

These are usually organizations that can provide and promote cooperation with the public. They are also registered under the Egyptian law as Non-Governmental Organizations (NGOs). Their value is essential in making links with the local people and officials and with their experience in strengthening community involvement and participation. They can help in building capacity of the local citizens to play an active role in a local SWM service (e.g. monitoring and evaluating an operating collecting system), and by sometimes increasing awareness of solid waste issues existing in an area . In some governorates in Egypt, NGOs can play an active role in waste collection and collection of fees while being appointed by the municipalities/local authorities.

Informal sector

The informal sector, on the other hand, consists of activities carried out by individuals, groups or small enterprises that are neither registered nor regulated. The informal sector often operates on a small scale. However, it can have a high degree of organization and networking sometimes as demonstrated in the network of dealers involved in processing and trading of recyclable materials. Recyclables may be collected by the informal sector from door to door or gathered from collection points at streets or even dumpsites. Sometimes, municipal street sweepers can also be part of this informal system when they sort and sell recyclables to increase their income.

a. The Informal Sector: Individual scavengers

Scavengers sort waste at random collection points, transfer stations in the governorate and the dumpsites. Their presence and number vary from Governorate to Governorate. For example, Qena and Assiut Governorates had no scavengers, but their number started to increase in the past four years while they are working in large numbers in the Greater Cairo Region. The scavengers usually have other jobs in agriculture and construction, and they carry out the waste sorting activities to increase their income.

b. The Informal Sector: Itinerant Waste Buyers (Sarreha)

Sarreha are more abundant in the urban areas and few of them exist in villages. They buy recyclables directly from households or commercials establishments. Consequently, they sell their purchases to waste dealers.

c. The Informal Sector: Dealers

They exist in all Markaz but more predominantly in capital cities. They buy their recyclables form scavengers, Sarreha and street pickers. Cardboards, plastics and soda cans are the most selling recyclables due to their high market price.

Chapter Five

Urban & Rural Waste Composition

Solid Waste Management in Sample Governorates

The composition of the MSW waste varies between rural and urban areas, governorates, as well as the socio-economic conditions of the governorates. Rural areas are expected to have higher percentages of organic waste than urban areas.

There is a diversity of MSW composition between governorates with dominant rural population versus more urbanized ones. According to the Study of Economic and Financial Feasibility for Businesses in Egypt's Waste Industry , the following waste composition and amounts can be used as guidelines for businesses focusing on MSW:

- Per capita generation of waste in rural areas is 0.5 to 0.6 KG/day
- Per capita generation of waste in urban areas is around 1.0 KG/day
- Rural areas generate 70 - 80% organic waste with roughly 2/3 food scraps and 1/3 animal manure
- Rural areas generate approx. 6% plastic waste, 6% diapers, 4% paper and cardboard, 2% glass and 1% metals

Cairo's solid waste output is by far greater than the rest of the 26 governorates combined as shown in the figure below.

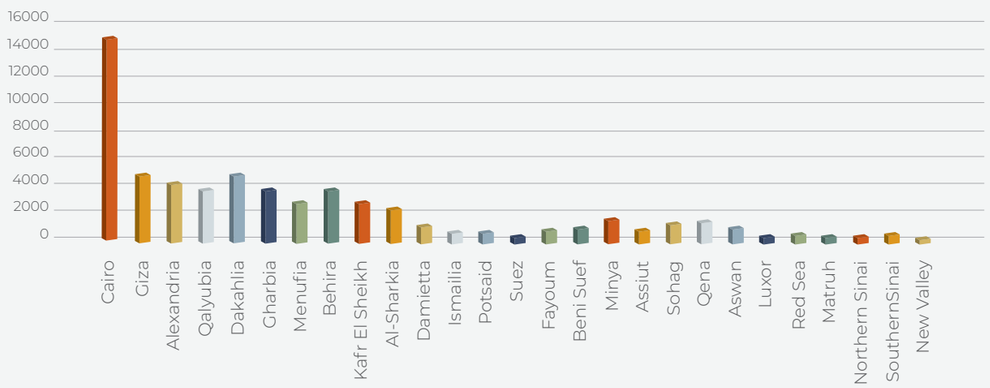


Figure 3 Waste Generation Rates in Egypt's Governorates

Source: Environmental status report – 2016

The Study focuses on four Governorates of Egypt as a sample; Giza representing one of the Greater Cairo governorates, Gharbia representing one of the Delta governorates, Qena representing Upper Egypt governorates and South Sinai representing the Sinai region with its touristic cities (Sharm El Sheikh).

It is worth noting that there are two main projects that are working now in Egypt related to solid waste management:

- The National Solid Waste Management Project (NSWMP) is a GIZ funded project working in the field of waste management in 4 of Egypt Governorates (Gharbia, Kafr El Sheikh, Assuit and Qena)

- The Kitchener Drain Solid Waste project is another project that aims at the de-pollution of the Kitchener Drain alongside wastewater & sanitation and drain infrastructure rehabilitation investment components and seeks to significantly improve municipal solid waste management (MSWM) - which includes collection, transportation, sorting, recycling and final disposal of waste throughout the three targeted Governorates (Gharbia, Kafr El-Sheikh and Dakahlia).

Giza Governorate

Giza Governorate is one of the three Governorates of Greater Cairo Region and is one of the oldest Governorates of Egypt. It covers an area of 85,153 km2 of which only 4.2% of this area is inhabited. The agricultural lands of this governorate covers 192,000 feddans which represents 2.55% of the total agricultural areas of Egypt. The governorate is administratively divided into 8 districts (North Giza, South Giza, Warak, Aghouza, Dokki, Boulak EL Dakrour, Haram and Omraneya) and two new urban communities (Sheikh Zayed and 6th October cities). The total waste generated from the governorate in 2017 was about 6.7 million tons of which 2.8 million tons is municipal waste and 0.24 million tons agriculture waste. The daily generation rate of municipal waste is estimated as 4465 tons/day which could reach 5358 tons if commercial waste and street sweepings are included.

Giza Beautification Agency is the entity responsible for waste collection from street containers and waste collection points. In some areas where the citizens pay a waste fee with the electricity bill, waste collection is done by licensed contractors also from the streets while in the high-income waste collection contractors collect the waste door-to-door against a monthly fee that they collect from the house residents. About 67% of the generated waste is collected by the Beautification Agency and 11% by the waste collectors.

The governorate has two waste treatment plants in Shabramant and Abu Rawash but they are not operational and need to be rehabilitated. The beautification agency currently operates the only disposal area of the governorate which is also located in Shabramant which lies 23 km from the governorate center. This disposal area has been operating for 20 years and receives around 4000-5000 tons per day. There is a plan to turn this dumpsite into a controlled disposal area or even a landfill to be operated by the private sector.

Opportunities in Giza Governorate

- Waste collection contracts will be tendered for some districts for the private sector
- Shabramant treatment facility as well as the newly constructed landfill will be offered for the private sector to operate

Qena Governorate

Qena Governorate is located in the Southern and Upper part of Egypt. It covers an area of 9,434 km2 but only 14% of this area is inhabited. The governorate is administratively divided into 9 markaz (districts). The names of the districts are Abou Tesht, Farshot, Naga Hammadi, Deshna, El-Waqf, Qena, Qeft, Qous, and Nakada.

The MSW generated is 1,134 ton/day in 2017. The highest generated MSW is generated from two cities: Naga Hammadi and Qena, both representing 49% of the total generated waste of the governorate. The other 51% is generated from the rest of the cities of the governorate.

The highest generated waste is generated from sugar cane, most important crop in the Governorate, is the highest in Qena (90% of the total waste generated), while maize wastes come second (8%). It was estimated that an average of 20.4% of the agricultural waste is actually recycled into animal feed, composting, and RDF.

Table 4 Waste Types and Quantities in Qena Governorate

Type of waste	Quantity of the waste (tons/year)
Municipal solid waste	488,005 (2017)
Agricultural waste	4,596,778

Source: Characterization and sustainable management strategies of municipal solid waste in Egypt, 2020

In a recent study , waste composition was estimated in Qena Governorate as the shown in the figure below.

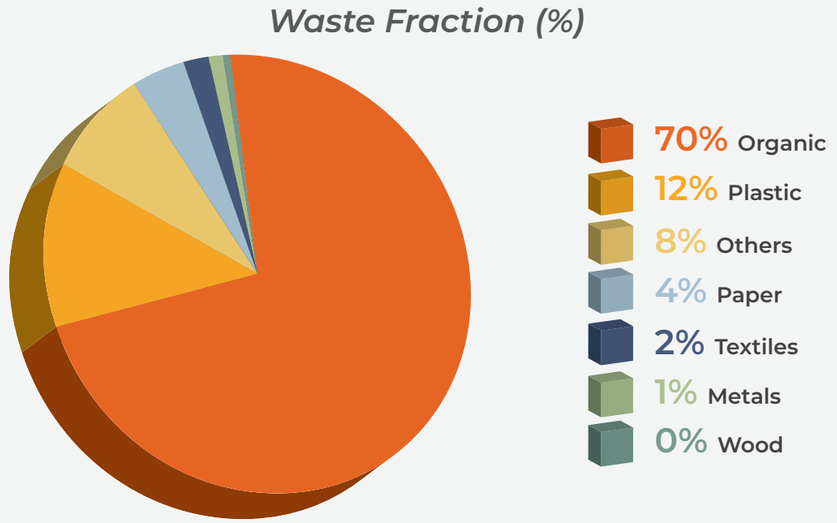


Figure 4 Waste Type and Fraction in Qena Governorate

Source: Characterization and sustainable management strategies of municipal solid waste in Egypt, 2020

The organic waste seems to constitute the highest percentage of all (70% of total waste), followed by plastic (12%) and paper (4%).

As per stakeholders' consultation, it was reported that there is no door-to-door household collection of municipal solid waste but rather waste is disposed in collection points where it is collected by the workers of the local units. In Qena there are no waste fees on electricity bill.

The municipality handles waste collection and transportation except for some villages where 12 NGOs operate. In cities, the collection and street sweeping services take place regularly from two to three times a week while villages suffer from irregular cleaning services and NGOs step in sometimes as a solution to the irregularity of these services. There is no presence for private sector in the SWM sector in Qena currently. However, there are many NGOs working in the collection and transportation. Most NGOs working in this field are driven by community service, not aiming to make profit as they charge limited fees for the collection services.

In addition, NGOs do not receive the needed support from the municipality. They are suffering from financial problems and lack of support from the municipality. Shortage of drives and operational budgets are other challenges faced by the villages, making it hard to utilize the collection equipment made available by ongoing support projects such as the NSWMP. Also, waste in villages is transported to allocated dumpsites without any monitoring or security at the dumpsites.

There are two transfer stations at Qena governate. The first one is located in Naga Hammadi and it is operational but not up to date. Also, the site of the station is in the middle of the city where there is tight space for operation and where traffic is another burden. The other transfer station is in Abo Tesht District, but it is currently not operating. There is a plan to establish 6 transfer stations in the governorate to solve the problem of having long transportation distances to disposal sites.

Qena is composed of 70% rural and 30% urban areas, which makes most of its waste unattractive for the investment by the private sector due to high organic waste composition and low percentage of recyclables.

Opportunities in Qena Governorate

- The governorate is considering establishing a share-holding company in cooperation with the private sector to run the SWM sector.
- The plan of establishing of 6 transfer stations is neces-sary to encourage entities to work on waste transfer.
- There are opportunities for private sector to work in agricultural waste
- There is a plan to create a sanitary landfill in Kous within the next two years to serve Keft, Kous, Negada cities.
- There are success stories in composting of waste whether municipal or agriculture. There has been a number of trials or pilot projects for composting but have not be applied on large scale as there is not system in place for the waste collection and treatment.

Al Gharbia Governorate

Al-Gharbia Governorate is located in the Northern part of Egypt in the Delta region. It covers an area of 1942.3 km2. Al-Gharbia Governorate is administratively divided into 8 Markaz, 8 cities, 4 districts, 318 villages and 1,249 hamlets. Waste generation rates in the governorate are estimated as follows:

- 0.60 kg/person/day in 2017 for urban areas of Gharbia
- 0.52 kg/person/day in 2017 for rural areas (including semi-rural areas)

The quantities of waste generated at Al-Gharbia governorate is represented in the following table:

Table 5 Waste Types and Quantities in Al-Gharbia Governorate

Type of waste	Quantity of the waste (tons/year)
Municipal solid waste	1,187,958 (2017) 1,346,689 (2019)
Agricultural waste	701,000 (estimated figure, 2015)

Source: NSWMP, ISWMP for Gharbia, 2019

The waste quantities of Tanta and El Mahalla Alkobra Markaz were recorded to be the highest, while that of El Santa and Qotor Markaz to be the lowest.
In terms of waste composition, a recent study showed the following municipal solid composition (Figure **): The most significant waste fractions were food (62.67%), plastics (11.67%), and paper (4.33%).

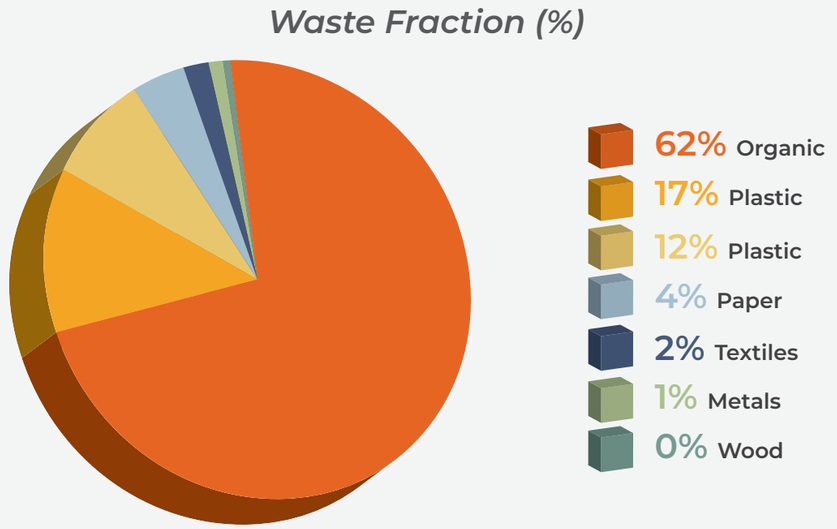


Figure 5 Waste Type and Fraction in Al-Gharbia Governorate

Source: NSWMP, ISWMP for Gharbia, 2019

With regards to agricultural waste in Al-Gharbia Governorate, high quantities of waste is burned. Around 175,000 tons of rice straw is managed through animal feed and composting.
Collection is currently done by the municipality in addition to private contractors (small companies) such as the British Company and NGOs. There are a total of 15 companies operating in the governor-ate in addition to some NGOs serving villages by waste collection and transportation services to the recycling plant in Tanta. Some local companies (medium-size) supply the governorate with the uniforms and containers.

Door to door household collection service is considered expensive for the citizens of Al-Gharbia Gov-ernorate and so most of the collection is carried out from collection points in the streets. Households are charged with collection fees from private companies and NGOs in return for the collection service.

The waste collection coverage is not carried efficiently by the local government due to some obsta-cles. First, lack of both financial and human resources put a burden on the local government. The local government expenditure on SWM services is high and it is covered by the Social Fund in the governorate. Secondly, workers are not attracted to work in the field of SWM due to the low salaries and low social status associated with this type of work. Thirdly, human behavior of the citizens results in waste accumulation in the streets. Some citizens do not take their garbage bags to the designated waste containers in the streets or sometimes they miss the collection timings.

Thus, the local government seeks contractual agreements with the other parties to carry out the waste management services on its behalf in order to address deficiency of waste management resources,. The parties can include contractors which usually work at the LGU level, private sector companies which usually work in the big cities, and CDAs.

There are plans to construct 3 transfer stations in Samanoud, Bassioun, and Zefta as the disposal site (in Sadat) is far from waste generation. The recycling plants belong to the municipality and they are responsible for managing them. All previous attempts made by the private sector to run those plants did not succeed. The main reasons for failure were lack of experience of the private sector and the high rates for renting the plants.

Opportunities in Al Gharbia Governorate

- There are no initiatives on agricultural recycling and thus this is a potential sector to invest in by the private sector.
- There is an opportunity for to work on manufacture of uniforms and containers for waste management
- There are opportunities for the private sector to participate in municipal waste collection and recycling.
- KfW and EU support Kitchener drain rehabilitation project and they are the only donors currently working in Al-Gharbia Governorate. There can be more donors to support SWM projects.

South Sinai Governorate

South Sinai Governorate had a population of 102,018 capita in 2017. It is mainly a touristic governorate with many cultural and natural heritage besides agricultural and industrial activities. It covers an are of 31,727 km2 representing 3.1% of the total area of Egypt. Administratively, South Sinai is divided into 9 cities, 12 rural districts and 146 Bedouin clusters. The 9 cities are Abu Zenema, Ras Sidr, Abu Radees, Sharm El Sheikh, Dahab, Saint Katrine, Taba, Naweiba and Tor Sinai. Sharm El Sheikh district has the highest population representing 53.4% of the total population and is famous for its touristic activities.

It was estimated in that the Governorate generates 88 million tons annually in 2015 . The per capita solid waste generation is 0.7-1 kg waste/capita in urban areas and 0.4-0.5 kg waste/capita in rural areas. In touristic areas such as Sharm El Sheikh the per capita of waste generation can reach 1.3 kg.

The quantities of waste generated at South Sinai governorate is represented in the following table:

Table 6 Waste Types and Quantities in South Sinai Governorate

Type of waste	Quantity of the waste (tons/year)
Municipal solid waste	21 million
Agricultural waste	30 million

Source: NSWMP, Integrated Solid Waste Management Master Plan-South Sinai Governorate, 2018

The main agriculture crops in South Sinai are mainly wheat, barley, olives and palm tree.

The average composition of waste is illustrated in the figure below while it varies from district to district as the district with the highest organic content is Dahab and Saint Katrine reaching 50% and the highest in recyclables are Sharm El Sheikh and Nuwaiba reaching 40%.

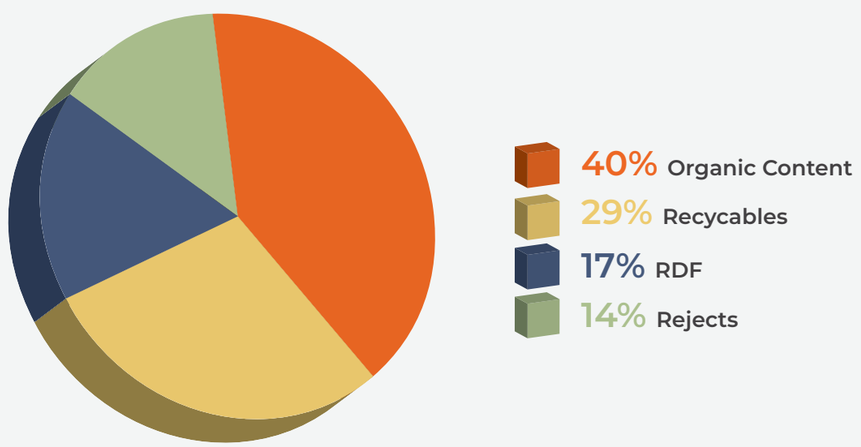


Figure 6 Waste Type and Fraction in South Sinai Governorate

Source: Source: NSWMP, Integrated Solid Waste Management Master Plan-South Sinai Governorate, 2018

The average collection of efficiency of waste is 74% reaching up to 90% in Sharm El Sheikh. The City Council was responsible for collection of waste in 5 districts with the exception of Sharm El Sheikh, Dahab, Neweiba and Taba which are served by the private sector and NGOs. Currently, BEEAH Group, UAE, and Green Planet, an Egyptian Company, have formed a partnership to provide and integrated waste management service to Sharm El Sheikh in South Sinai. The international consultant is responsible for setting the operational plan and training of the workers and the Egyptian partner for the human resources and equipment. They are responsible for collection of the waste from the hotels which includes the mixed waste, food waste and landscape waste. The mixed waste is segregated and treated in a MBT plant that they have rehabilitated to produce recyclables, RDF and compost (mixed with the landscape waste). The food waste is sold to the local community as fodder for their livestock.

Five of the administrative districts has a transfer station which collects the waste before transferring it to a disposal area with the expectation of Dahab and Taba which do not have transfer stations and the waste goes directly to the disposal area, Sharm El Sheikh as it has a waste treatment facility and a sanitary landfill and Tor Sinai which has transfer station and also a sanitary landfill.

Opportunities in South Sinai Governorate

- There are opportunities for the private sector to participate in municipal waste collection and recycling for the 8 districts of South Sinai as per the contract of that of Sharm El Sheikh
- Innovation for the food and landscape waste generated from the hotels and touristic resorts to compost their waste and use it back in landscaping.

Chapter Six

Waste Streams in Egypt

Highlighting Selected Waste Streams in Egypt

Plastic Waste

According to the UNIDO Plastic Value Chain Study (2021), for MSW, plastic waste is generated at an average rate of 4.5 million ton/year. Only 5% of it is reused, 30% is recycled, while 32% and 3% go to incineration and dump sites respectively. Moreover the following were concluded from the study:

- Total plastic consumption equals 8 M ton per annum.
- Total plastic returned either to plastics in¬dustry or end users (recycled and re-used), equals 1.8 M ton.
- Total plastic that reached dumpsites and is incinerated, equals 2.9 M ton.
- The 5 M ton difference between consump¬tion and disposal rates including reached dumpsites and incineration are estimated to be amounts of plastics that either are col-lected and recycled by the informal sector or directed to long term applications (multi-use plastics).

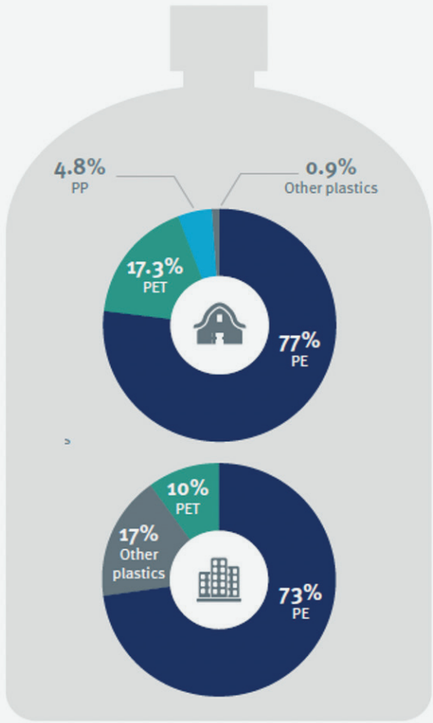


Figure 7 Plastic waste % per type from MSW in rural and urban areas (UNIDO, 2021)

The informal sector controls the collection and recycling of recyclable waste (municipal waste) in the majority of governorates in Egypt and greatly contributes to keeping certain types of single-used plastics away from the streets. The informal sector size is estimated at 1,060 informal factories and 450 registered factories and workshops. Although the informal sector's grip on waste collection makes it hard for SMEs to enter the plastic recycling market, the informal sector is already lifting a huge burden off the government when it comes to waste collection.

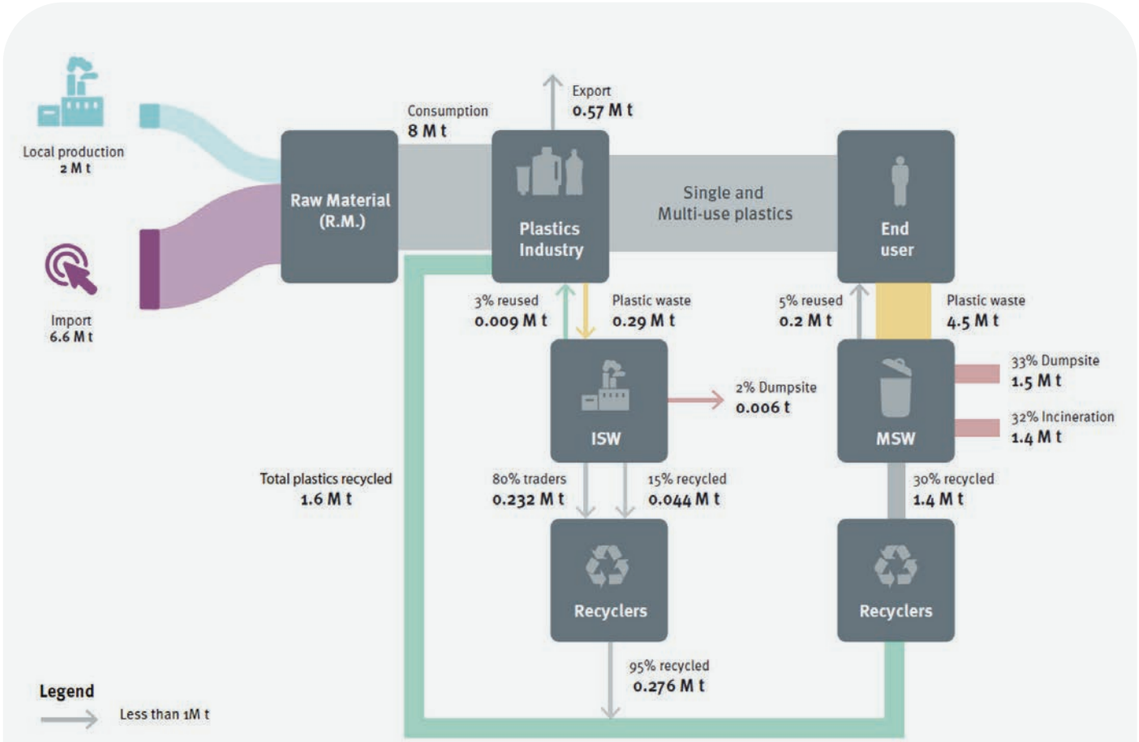


Figure 8 Overall mass balance on plastics annual rates (UNIDO, 2021)

The Plastic Bank, a Canada-headquartered for-profit social enterprise that began operations in Egypt in 2020, worked with the mission of stopping ocean plastic through the monetization of plastic waste. One of the tools used to achieve collection aims was a mobile app through which it pays bonuses to local waste collectors ("zabbaleen") on top of the commodity price for the types of plastic they collect. The users include not just collectors but balers, processors, transporters and other components of the ecosystem which made plastic flows fully traceable. In Egypt, Plastic Bank now has more than 600 collectors as registered users.

Composting (Organic Waste Streams)

Numerous researches and studies have been conducted by the Egyptian researchers. Such researches results have showed that the benefits of compost are that it is a major and continuous store for major and minor nutrients. It is also used as a basic reformer for the natural and chemical properties of the soil. Compost is a clean growing environment for plants, as it is free from pathogens, nematodes, weed seeds, and latent insect phases.

Under the intensive cropping system, Egyptian farmers used to use huge amounts sets of mineral fertilizers. Mineral fertilizers have the potential to perform a crucial function in Egyptian agriculture development but they also are non- renewable and many damage the plants and soil. The long-term uses of chemical fertilizer change the physical and chemical characteristics of the soil. Thus, the utilization of organic fertilizer is becoming more important especially under the stress of climate change.

More than 250 companies are dealing with solid waste recycling either for animal fodders and/or compost. Due to the huge number of various wastes either agricultural or other types of wastes, therefore, a lot of opportunities have been raised for partnership with some of the interested international companies who do like to invest in such sector. One of the most reputable companies is The Egyptian Company for Solid Waste Recycling (ECARU). It operates solid waste and composting facilities in 40 locations across Egypt, processing a variety of organics, recyclables and trash. Some receive up to 600 tons of commingled trash daily, which is sorted for recycling and processing of organic materials.

Rejects, says Dr. Hisham Sherif, CEO of both ECARU and the Engineering Task Group (ENTAG), are about 35 percent of the incoming waste stream. Those are landfilled, but the possibility of combusting material to produce electricity or steam is being evaluated. Other locations receive up to 5,000 tons/day of biomass seasonally. Much of this feedstock is rice straw, which is mixed with manure to produce 100,000 tons of compost annually.

In three Egyptian governorates – Dakahlia, Gharbia and Kalubia – ECARU collects and treats 300,000 tons of agriculture waste per year. "This is the first contract of its kind in Egypt," says Sherif. The areas serviced cover 40,000 square kilometers – 11,583 square miles, similar in size to the state of Maryland – and incorporates 35 composting sites. "Each facility covers an area of 100 square kilometers, and the overall project employs more than 1,200 people," he adds. "ECARU plans to produce animal fodder, fuel pellets, paper pulp and medium-density fiberboard through the project's lifetime."

ECARU has also operated a composting facility in Menia, Egypt, since 1996. Each year that facility receives approximately 30,000 tons of combined sugar beet, bagasse and aromatic plant debris and produces 10,000 tons of material under the brand name Nile Compost. In 2005, ECARU started its second private investment in composting plants by establishing an agricultural residue composting plant at El Nobaria on the Cairo-Alexandria Desert Road [the main highway connecting Egypt's two largest cities.

The plant receives 100 tons/day of animal wastes, tree trimmings, etc., and produces 10,000 tons of compost per a year.

Animal Feed

The limited resources of the available animal feed in Egypt is considered the most hindering factor blocking the development of animal production in Egypt. It is expected that the gap between the available feeds and animal requirements will be more than 5 million tons total digestible nutrients. On the other hand, potential of using crop residues as an alternative source of animal feeds is limited due to its poor nutritive value, low digestibility and low palatability. Crop residues are mainly fibrous materials that are by-products of crop cultivation which form high percentage of the total feeds produced annually in Egypt.

Production of Animal Feed from Agricultural Waste in Egypt:

Ruminant animals (cows, buffaloes, sheep, goats) are distinguished by their ability to feed on coarse materials (straw - hay - wood - hay) due to their ability to digest and benefit from them.

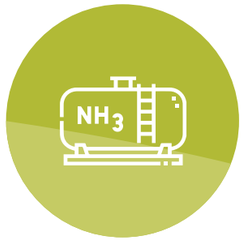
One of the most important characteristics of agricultural waste is its high fiber. On the other hand, it has low protein content and low nutritional value.

Different treatment of the agriculture waste leads to an increase in the nutrition and protein content, which increases the efficiency of digestions, improving animal production.

However, most agricultural waste, especially rice straw, has drawbacks such as low digestion, low protein, and low content of mineral nutrients. Therefore, the treatment focused at the farm level is needed as it is a business/market opportunity, the following are example of treatments:

Method of treatment of agricultural waste with useful liquid

Method of treatment of agricultural waste with urea solution



Method of treatment of agricultural waste with Gaseous ammonia

Silage production

Circular Protein

Opportunity study on Circular Proteins for Aqua feed in Egypt

Egypt has been investing in the field of fish farming during the last two decades. Almost 80% of the Egyptian fish consumption are coming from the fish farming. Therefore, a lot of studies have been taken to the most important factor of fish farming industry which is feed fish. Various companies have the up-to-date industrial technology putting into consideration the circular protein which is shown in the following figure 38.

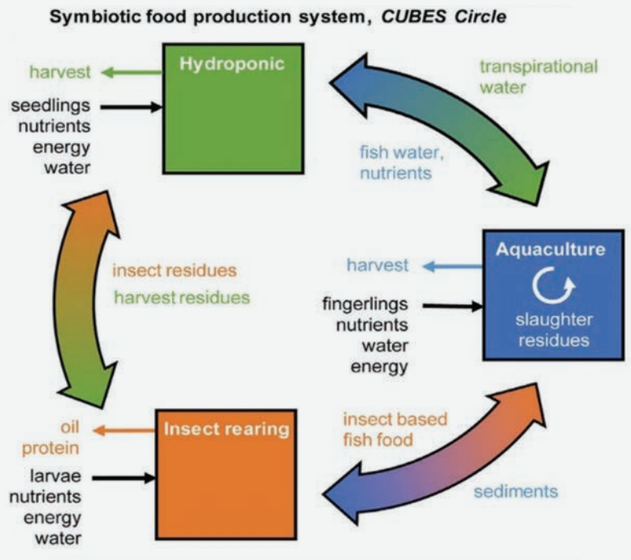


Figure 9 Symbolic Food Production System for Circular Proteins

Source: Circular-proteins for Aquafeed in-Egypt (2021)

However, it has been found in plants and is divided mainly into two groups one of which is the sunflower trypsin inhibitor with the second being the larger as well as more prolific cyclotides. In Egypt, implementation toward the use of cyclic proteins is not proactively used.

Chapter Seven

Business Opportunities

Business Opportunities in Waste Management in Egypt

The Ministry of Environment through its National Solid Waste Management Programme in its report “Executive Summary: Economic and Financial Feasibility for Businesses in Egypt’s Waste Industry Study Report” (2018), had identified 19 business opportunities in the waste sector in Egypt as per the figure below.

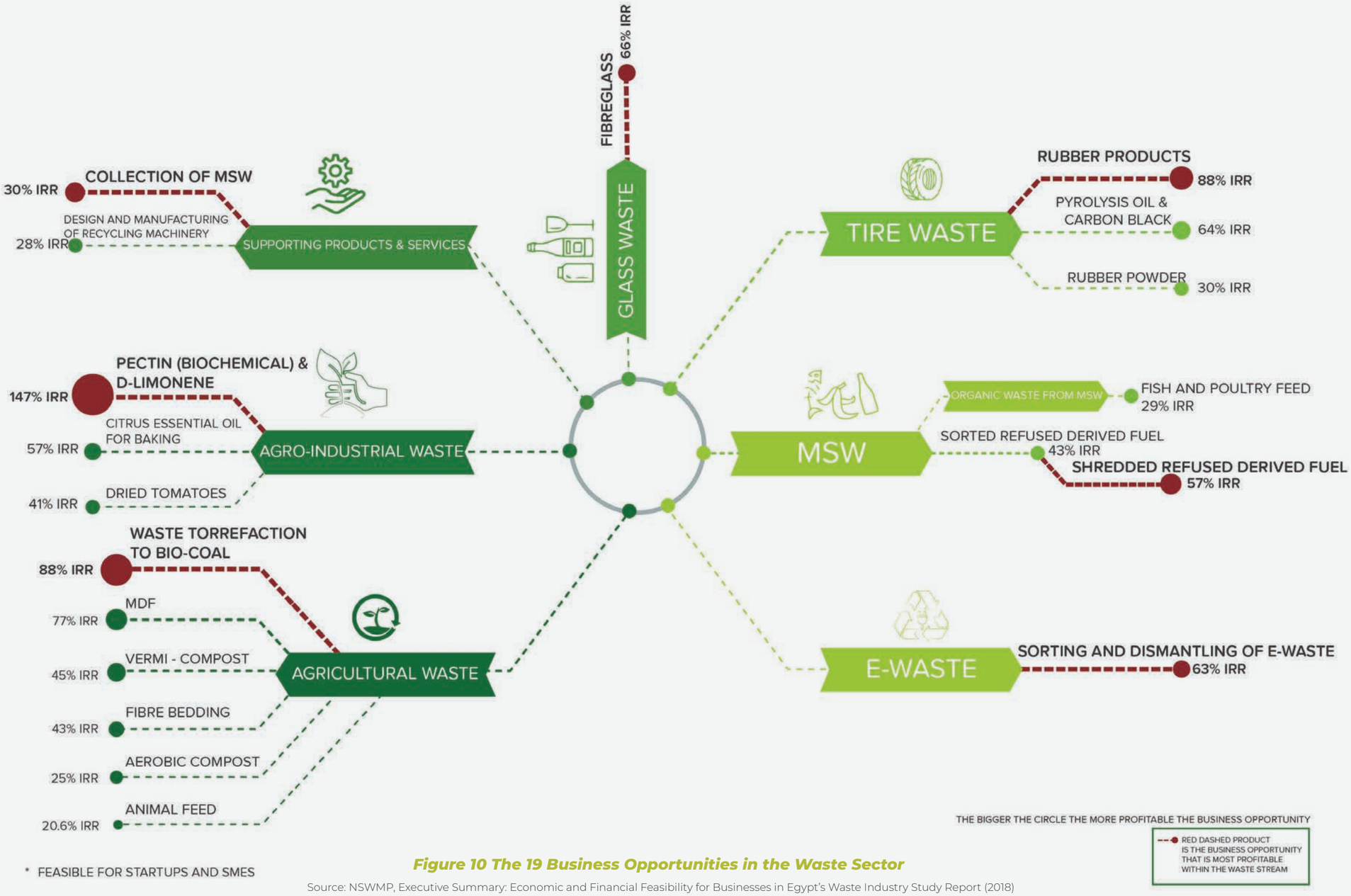


Figure 10 The 19 Business Opportunities in the Waste Sector

Source: NSWMP, Executive Summary: Economic and Financial Feasibility for Businesses in Egypt’s Waste Industry Study Report (2018)

It is estimated that the amounts of waste that can be absorbed through the identified business models serving the local markets amount to 14.9 million tons annually divided as follows:

- 13 million tons of agricultural waste
- 372,000 tons of organic waste from MSW (3% of annual generated organic waste)
- 840,000 tons of glass waste (4% of annual generated MSW and 100% of glass waste)
- 88,000 tons of e-waste
- 560,000 tons of waste tires (100% of annual generated waste tires)
- 30,000 tons of citrus peels waste from industrial stream

These businesses are also estimated to create 60,000 direct and 790,000 indirect job opportunities. Some of these business opportunities in include:

- Production of **Medium density fibre boards** (MDF) from Mixed Agricultural Waste (such as corn stalk and bagasse)
- Production of **compost from aerobic digestion** of agricultural and animal waste
- Agricultural **waste torrefaction** (thermal processing) to bio-coal
- Breeding of worms on the organic fraction of MSW to produce **high protein feed** for fish and poultry farms
- Designing and manufacturing custom made **recycling machinery**
- Waste tire to **rubber powder** through crushing for material or energy recovery
- Waste tire to **carbon black** through pyrolysis

Other business opportunities were identified through the stakeholder's consultation carried out during preparation of this report. These opportunities include:

- **Waste collection and transportation** contracts. International companies are encouraged to partner with Egyptian Companies for waste collection and transportation contracts. The waste contractors have to be enlisted in WMRA as per the legal requirements.
- Design and management of **Biological and Mechanical Treatment Facilities** to produce recyclables, RDF and compost. There are also 60 mechanical biological treatment units (MBT) that are planned to be established in the different governorates. There are a variety of financial models for running the MBT plants. If the Governorates have constructed and equipped the MBT (i,e. paid for the CAPEX), then the private sector would operate the plant without receiving any gate fee. The other scenario would be giving the private sector the land and the private sector would be responsible for the design, build, operation and eventually transfer for the plant (after 15-20 years). In this case as the private sector will provide the CAPEX, then they will be paid a gate fee. Sometimes the MBT plant is tendered with operation of the landfill and in this case a gate fee will be paid for disposal or the landfill operation. The fee also depends on the location of the landfill and if it is far from the MBT plant, the transportation cost will be accounted for.
- Management and operation of **sanitary landfills** as nineteen landfills are already constructed and will be tendered for private sector to operate. It is planned by the government that the private sector will be tendered to run the landfill for a gate fee for operating the first cell established by the government. The private sector will be responsible for closure of the cell and building the other cells. A higher gate fee will be received for the new cells which will be constructed by the private sector.

- **Waste to energy projects** to produce heat, bio-fuel or electricity Waste to energy plants are also a good opportunity for investment also by having a joint venture between an international company and a local one. For the waste to electricity plants, WMRA and Egyptian Electric Utility and Consumer Protection Regulatory Authority are working together to revisit the feed in tariff to raise it over the current fee of 1.4 EGP/kWh also to make these projects feasible and attractive to investment.

- The Egyptian Ministry of the Environment has signed a contract with Energy3 International (E3i). The American company will convert solid waste into biofuel, hydrogen and graphene for industries in Fayoum.
- Green Tech Egypt is the project founder and sponsor of the first 3 WtE projects in Egypt. Working since 2017 on W2E in Egypt. A strong international consortium was formed in 2020 with OAK holding, WTEI and the Ministry of Military Production (NOMP). The consortium signed a protocol for a 500 million USD project to process 1.8 million tons of waste per year in 3 phases.
- Another example for partnership is between Enviro-Taqa for Sustainable Environmental Services & Renewable Energy (Egypt) and the European company Renergon International AG (Switzerland) for biogas production & waste to energy plants in Egypt.

- Design and implementation of **biogas projects** in rural areas

The UNDP-GEF Project in Egypt entitled “Bioenergy for Sustainable Rural Development” (BSRD or Project) was implemented to increase the use of biomass energy in promoting sustainable rural development in Egypt. It extended from December 2009 to December 2013. The project installed household biogas systems for 100 households in Fayoum and Asyut with each biogas system designed to produce 50 kg of biogas daily, sufficient fuel for 4 families.

- **Composting of agriculture waste** through a variety of technologies
- Manufacturing of **small scale composters** to landscape residues and food waste for hotels and touristic resorts
- Production of **waste collection containers**.

How to Carry Out Waste Management Activities Professionally in Egypt

The New Law aims at improving safe waste management methods for all kinds of waste, whether toxic or non-toxic, and to encourage investment in the various waste management services such as collection, transportation, treatment of disposal of different kinds of waste and recycling.

In order to carry out any waste management activities professionally, one must obtain the necessary licenses from the Waste Management Regulatory Authority. The prerequisites and process for such licenses are outlined in the New Law’s Executive Regulation (“ER”) which is announced as per the New Law’s entry into force.

Any person who exercises waste management activities in a professional capacity without proper licensing will bear a fine.

All companies working in waste management in Egypt should have a registration in WMRA. Therefore, the Dutch companies could have joint ventures with the licensed Egyptian Companies to operate in Egypt.

Chapter Eight

Featuring Private Sector Companies

Spotlight on Private Sector Companies in Waste Management in Egypt

Spotlight on Private Sector Companies in Waste Collection

Ertekaa Integrated Services

https://ertekaa.org/

Ertekaa is collection company responsible to collect, sort, transport, and recycle waste aiming at an integrated waste management. The company was awarded a contract to carry out their operation in El Gouna in 2014. Solid waste generated from El Gouna is collected, transported to Ertekaa Gouna station, and then recycled. The company has reached an 85% waste recycling performance rate.

Bekia

https://www.bekia-egypt.com/en/about-us

Bekia is on-demand recyclable waste collection that collects recyclable waste from customers to sell to local recycling factories. It allows people to sell their household waste (plastic, paper, electronics, cooking oil, etc) and earn points that they can use later to buy groceries, school supplies, mobile credits, among others or they can use them to donate money to different causes.

Electrobekia

https://www.facebook.com/ElectroBekiaApp/about

Electrobekia is considered the first company in Upper Egypt and one of the pioneers in Egypt to provide electronic waste management services (Collection and Recycling). Based on green technology, Electrobekia provides an easy to use mobile app and website to facilitate the process of e-waste collection. ElectroBekia helps individuals and organizations benefit from getting rid of their e-waste appropriately. ElectroBekia buys and collects any old, unused or damaged electronic devices like TVs, computers, Rams, printers, receivers, keyboards, copy machines, etc. After dismantling, they resell parts that can be reused to shops, sell plastic to recyclers and sell e-scrap to recycling facilities.

GreenTec Egypt

https://greentech-egypt.com/

GreenTec Egypt plans, supplies, installs, and operates waste recycling plants. They design the facility according to the type of the input waste, and according to the requested output of the market demand study. The products of the waste recycling plants (Material facilities) are:

- Recyclable materials.
- Compost.
- Refuse Derived Fuel (RDF).
- Biogas, electricity, or any energy products.

GreenTec Egypt offers waste collection services from compounds, touristic, commercial, and industrial facilities. All collection services are performed in a professional manner and in accordance with environmental regulations.All collected waste is transported and then either recycled or disposed of in authorized facilities.

EnvironAdapt

https://introgroup.org/intro/environ-adapt.html

EnvironAdapt is a startup that offers performance-rating services, and industry capacity development, in addition to waste collection and waste management services. It owns a mobile application called 'Dawar' that connects authorized collection companies, where users take photos of uncleaned streets and send them to these companies along with GPS locations. After the company cleans the street, it sends back a photo of the clean street to the user. The application also informs the user of environmental initiatives in their own neighborhood.

The startup's app covers seven governorates, including Cairo, Giza, Alexandria, Assiut, Kafr El-Sheikh, Qena, and Gharbia.

Very Nile

www.verynile.org

VeryNile is the first initiative to develop large scale means to clean the Nile River; it was established in 2018. It organizes cleaning events and develops environmentally friendly solutions to remove trash from the river. VeryNile also empowers local communities through their participation in such events. It aims on educating individuals and raising awareness about the importance of reducing plastic consumption. The company was co-founded by two Egyptian start-ups, Greenish and Bassita, and is supported by the Ministry of Environment. They also established Very Nile Shop, which sells up-cycled products, handmade by the women.

Spotlight on Private Sector Companies in Materials Recovery

Up Fuse

https://up-fuse.com/

It is startup that focuses on producing fashionable bags and other accessory products from upcycled plastic bags and sustainable sourced materials. Each upcycle bags is made of 30 plastic bags. The startup also creates wallets, camera straps, and laptop cases. It partnered with Roh Elshabab NGO at Zabbaleen community in Cairo, where women from the NGO are responsible to buy the plastic bags from the garbage city at Manshiyit Nasir, clean it and compress into a new material called 'Sabi'. Sabi is then used and shaped to produce different products. In 2017, the startup won the WeMena competition, which is a competition designed for female entrepreneurs in the MENA region.

Tagaddod

https://www.tagaddod.com/

Tagaddod is a waste management company specialized in producing bio-diesel from used cooking oil. The company's production capacity of biodiesel is 300 tons per month and 95% of the produced biodiesel is exported to EU countries.

Outgreens

https://outgreens.com/

Outgreens focuses on collection and recycling of solid waste, agricultural waste and waste to energy solutions (RDF). The startup also offers consultation services regarding waste management and supply of waste processing technologies. The startup facilities have different recycling lines that are specialized in different areas of processing (plastics, food and organic waste, metals, C&D). Outgreens has more than 150 local partners.

ReTyre

https://thestartupscene.me/MenaEcosystems/9-Egyptian-Startups-Ingeniously-Turning-Trash-into-Cas

Retyre is a startup that focuses on recycling car tires into rubber cubes and then sell them to factories for further processing to create new rubber products.

Go Clean

https://www.facebook.com/gocleaneg/

The startup promotes recycling activities and awareness in Egypt by including the consumers in the process. It encourages consumers to sort their waste into plastic, paper and metals. The consumer then contacts the startup to send someone to collect and weigh these recyclables, in exchange of cash or household products. Go Clean is now covering Cairo, Alexandria and they are planning to cover other governorates too.

MARSO

https://www.marso-egy.com/

MARSO is an eco-friendly company that converts thousands of tires annually from scrap tires to useful products such as automotive rubber flooring and car mats, gym flooring, and rubber spare parts. MARSO uses environmentally-friendly reprocessing practices through shredding and grinding the End-of-Life Tires (ELTs) to separate the metal scrap and textiles from the tires using high quality machines. Today, MARSO claims 50% of the local market for recycled rubber production and is increasingly exporting across the Middle East and North Africa (MENA), Turkey, Greece, and South Africa.

The factory produces about 1.5 tons of rubber per hour, having 9 machines working in parallel supplying 5 production lines producing various finished rubber products. A byproduct throughout this process is the separated scrap metal that is resold to local metal manufacturers. A new manufacturing line has been added to produce anti-vibrant rubber pads for bridges and large constructions. In total, the production site has a capacity of 9000 tons of ETLs.

Geocycle Egypt

https://www.lafarge.com.eg/en/Geocycle

Geocycle is an international network of over 50 companies, located in five continents, serving more than 10,000 customers worldwide, with 80 waste pre-treatment facilities, 180 cement plants with co-processing installations, and 2000 employees worldwide dedicated to waste management.

Geoycle Egypt is a fully integrated waste management service provider. It applies the technology of “co-processing” and utilize existing facilities in the cement industry to resolve waste challenges sustainably. This enables them to recover energy and recycle minerals from waste, leaving no residue. Their technology encompasses a pre-processing network, including three sorting stations and a combined pre-processing platform, as well as final co-processing facilities in Lafarge cement kilns which helps them to offer effective, tailored solutions to their customers.

Geocycle Egypt has been operating since 2012 under the name of “Ecocem Industrial Ecology Egypt”, with its main purpose to supply alternative fuel to Lafarge-Holcim Egypt cement plant. In the period from 2015-2017, Geocycle Egypt handled, pre-processed and transported over 800,000 tons of waste (industrial, agricultural as well as municipal). It enabled LafargeHolcim Cement Egypt to use over 450,000 tons of local alternative fuels that would have otherwise been dumped or burnt. In fact, it saved the Egyptian economy more than 180,000 thousand tons of fossil fuels that should have been imported, and more importantly saved the environment from more than 600,000 tons of CO2.

BARIQ

https://www.facebook.com/bariq.egypt/?ref=py_c

Bariq is the first “bottle to bottle” company in Africa and MENA region. They recycle post-consumer plastic PET bottles by converting them into polyethylene terephthalate (PET) pellets where the later are used by international bottle and food container manufactures and major fiber producers throughout Europe and the United States. The company recycles around 1 billion bottles annually. BariQ, a subsidiary of Raya Holding for financial investments, and it has been awarded to be the best waste recycling company in the Middle East for 2019.

Biodiesel Misr

https://www.biodieselmisr.com/

The startup collects used cooking oil from different restaurants to convert into biofuel and then sell it to petroleum companies to be blended with diesel. The startup produces 600 metric tons of biodiesel a month.

Tile Green

https://www.facebook.com/bariq.egypt/?ref=py_c

- Established in 2020
- Make building materials, such as paving tiles, from plastic waste through their unique technology
- Aim on replacing cement and utilizing plastic waste to give it a stronger value

Reliance Egypt

http://www.relianceegypt.com/trad.html#tabs-16

Reliance is headquartered in Cairo and has extensive operations throughout Egypt with additional operations in Dubai and Singapore. The company is specialized in bulk commodity trading (clinker & cement), logistics, fuel supply, mining and minerals, as well as concrete ready mix production.

Since 2013, Reliance Investment decided to expand its services to waste management through the operation of two waste processing facilities in Ismailia and Port Said. These two facilities have been fully operational since late 2015 and mid-2016, respectively. They both process municipal solid waste into RDF and compost as well as recover recyclables.

Reform Studio

www.reformstudio.net/

Empowers underprivileged women with job opportunities, promoting craftsmanship and empowering communities

- Established in 2012
- Creates bags, shoes, furniture, and accessories out of Plastex
  - Plastex: studio-created upcycled material made of plastic bags and cotton threads
- Aims to revitalize the weaving industry

Spotlight on Private Sector Companies in Recycling Agricultural Waste

Biomix

https://egyptinnovate.com/en/users/biomix-company-renewable-energy

The startup is originally based in Sohag Governorate. The startup aims at converting agricultural waste and animal manure into biogas and organic fertilizers. The startup is now active in 12 cities across Egypt in Upper Egypt and the Delta Region. The project generates around EGP 200,000 annually.

Papyrus

https://thesentiment.com.au/papyrus-expands-in-egypt-allowing-companies-to-convert-banana-waste-into-food-packaging/

World-leading agricultural waste fibre technology company, Papyrus Australia Ltd. (“PPY”/ “Company”/ “Papyrus”) has established a facility in Egypt. The sustainable tech company Papyrus Australia (ASX: PPY) has a leased moulded fibre packaging facility in Sharqiah producing packaging items from the banana waste.

Jereed

https://www.facebook.com/Jereedeco/

Jereed introduces furniture, parquet and accessories made from palm midribs. Palm midribs is a discarded natural resource that could replace wood in product design and surfacing. The Palm midrib comes from the annual pruning of the palm therefore palm midrib is a valuable environment-friendly material significantly tougher and more durable than other imported wood

Chitosan Egypt

https://chitosaneg.com/

Chitosan Egypt is a biotech company that specializes in the research, development & commercialization of 100% organic crop protection & nutrition solutions for high-tier crops in the industrial, export, feed & organic value-chains which are designed to resolve climate & pathogen bottlenecks & empower excellence in quality, productivity & yield seed2harvest with a guaranteed increase of up to 40%.

Chitosan Egypt for Agricultural solutions holds its HQ, Lab & Factory in Cairo, Egypt - our operations extend from Cairo to Capetown, where to date we have earnt the loyalty of +2000 growers & command a B2B network of 70+ Points of Sales of a cumulative portfolio of +100,000 Acres in 25 crops which boasts some of MENA’s top agribusiness companies. Our 100% organic & holistic Seed2Harvest portfolio consists of 12 Products including seed starters, Micronutrition, vegetation, flowering/fruiting specialty fertilizers as well as foliar fungicides, soil fungicides, nematicide, virucide & post-harvest solutions that are designed & manufactured in compliance with EU & USDA standards for organic agriculture as well as accredited for GMP, Halal & Non-GMO.

Meigos

www.miegos.com

Meigos is the market leader in the production of compost and organic fertilizers in Egypt, the Middle East, and Africa. The company is a part of the Outgreens Group, which implements sustainable alternatives to everyday life. Meigos was founded in 2009 with the goal of raising the quality standards of Egypt's organic fertilizer industry. Meigos has three factories across the country — in Giza, Suhag, and Qalyubiyah — and a production capacity of around 120,000 tonnes per year, making it the region's fastest growing compost manufacturer. They sell five products: Compost, Potting Mix, Biochar (soil revitalizer), Vermi (vermicompost), and Nabati (plant compost).

Vermidutch

https://www.facebook.com/startegypt-com/posts/481760019106525/

Vermi dutch is a leading company in the field of vermicompost. The worms used are imported from the Netherlands to recycle organic waste (agricultural waste and animal manure) into a valuable organic fertilizer (vermicompost). A ton of worms eats 1 ton of waste and produces 1/2 a ton of compost daily. Since most of organic waste is incinerated or dumped in canals and other water streams, Vermidutch aspires to reduce those environmental hazards, as well as produce a safe compost that can reduce the need for chemical fertilizers.

Pyro

https://pyroegy.com/

Pyro offers Pyrolysis system that works on any agricultural waste to generate bio-charcoal. The system takes in the cellulosic agricultural wastes and produces bio-charcoal as briquettes.

Baramoda

https://baramoda.org/about-us

Baramoda is the first agri-tech start-up in the in the MENA region , focused on sustainable agricultural innovations, develops products that help farmers to to maximize the efficiency of agri-waste management, minimize the cost of production agricultural, reduce excessive use of chemical fertilizers, and increase crop production, at minimal usage of water resources , Through organic fertilizer based on the land , crops needs and The goal of agriculture.

Agri-tech Egypt

http://www.Agritech-Egypt.com/

Agri-tech Egypt provides many services in the agricultural sector including agricultural waste management. The waste management services include recycling of any agricultural waste to produce silage and compost, recycling of rice straw, palms and dates, sugarcane, and corn waste into animal fodder.

Egypt is rich in agricultural waste, whether it comes from from palm trees and date rejects, residues from sugar cane cultivation, and trimmings from fruit and ornamental trees, which are usually disposed of by incineration. Therefore Agri-tech Egypt decided to utilize agri-in their organic fertilizer production plant in Luxor Governorate

The company also has other activities such as:

- Supporting and providing technical support to the palm plantation community and assist in combating the red palm weevil.
- Establishing animal production farms.
- Establishing fish farms in desert lands and providing technical support and fodder.
- Cultivation of tomatoes to produce dried tomatoes
- Marketing of agricultural crops that are produced by organic farming, such as hibiscus.

Napata

https://www.facebook.com/NapataEgypt/

The startup is located in Aswan and it promotes for green industry development in Egypt. The startup succeeded to train a team of local workers on innovative uses of date palm residues to produce handcrafts products

Spotlight on Private Sector Companies in "Waste-to-Energy" Solutions

EnviroTaqa

https://envirotaqa.com/wte/

EnviroTaqa creates and develops biogas plants with various capacity of small, medium and largescale plants using the advanced dry fermentation technology in Biomass. EnviroTaqa is also a provider of environmental consultancy services to the waste and recycling sector, providing advice to a range of clients including waste producers, the waste management industry, its regulators and investors.

EMPOWER

https://www.empower.eco/

Empower is the first and leading biogas company providing waste to energy solutions since 2011. In Kafr El-Sheikh governorate, a new wastewater-to-power plant was set to be inaugurated in September 2019 with investments of EGP 84 million to produce about 1 MW as per power purchase agreement with the North Delta Electricity Distribution Company. The company currently owns five power plants that use methane gas generated from animal manures and wastewater with total investments of EGP 420 million.

Empower aims to increase its investments in the local market to $250 million by 2030 through the establishment of 32 waste-to-energy plants which will process 1.6 million tonnes of waste at a capacity of 46 MW to directly provide consumers with electricity.

ECARU

The Egyptian Company for Solid Waste Recycling)

www.eracu.net

- Established in 1997
- Sister company of ENTAG
- Operates under Qalaa Holdings, formerly known as Citadel Capital
- Offers collection, transportation, and processing services for all types of biomasses,
- Collects and processes approximately 1.5 million tonnes of agricultural residues annually
- Highly experienced in MSW management, upgrade, maintenance, equipment supply, and technical support
- Products produced include alternative solid fuel and organic compost

Annex 1:
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Annex 2:
List of Interviews

- Eng. Doaa Ahmed, Head of Central Department of Strategies and Investment, WMRA
- Dr. Khaled El Fara, Consultant/ Technical Advisor to WMRA
- Eng. Karim El Sabee, CEO of Reliance Group
- Mr. Ahmed Atef, Manager of the Executive Unit for Solid Waste Management Sector, MoLD
- Dr. Nabil Nagib, Technical assistance and capacity building development, MoLD
- Dr. Khaled Moustafa Kassem, Assistant Minister for Institutional Development and Policy Support, MoLD
- Dr. Saad Nassar, Advisor to the Minister, MALR
- Dr. Shaaban Salem, Head of the Economic Affairs Sector, MALR
- Dr. Aly Abdel Mohsen, Director of the Agricultural Economics Research Institute, MALR
- Dr. Tarek Soliman, Head of Animal Production Sector, MALR
- Mr. Mahmoud Al-Bassiouny, Executive Director- Chamber of Food Industries

Annex 3:
Location of New Sanitary Landfills

Table 7 Sanitary Landfills Locations

	Governorate	Location
1	Giza	Shabramant
2	Sharkeya	Belbeis
3	Menofeya	Kafr Dawod
4	Beheira	Badr
5	Fayoum	Kom Oshim
6		Youssef El Sedeek
7	Beni Suef	AlWasta (Senour)
8		Somosta
9	Sohag	Dar El Salam
10	Luxor	Madamod Desrt
11	Aswan	El Hager Edfu
12	El Wadi Al Gadid (New Valley)	El Dakhla
13		El Kharga
14		El Farafra
15	Suez	Km 5 Suez
16	Matrouh	Matrouh
17	Red Sea	Hurghada
18		Marsa Alam
19	South Sinai	Sharm El Sheikh

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