

Municipal Waste Management in Egypt: An Investigation Study of Collection and Generation Process in Alexandria City, Egypt

Rasha Fahim El Gazzar, Bakr Gomaa

Abstract— Decision-makers at all levels are faced with the task of how to resolve urban problems. Wastes are becoming a big problem and constitute a burden on the environment and authorities to find a right system to manage these wastes. Cities need to become more aware of the impact that their consumption patterns on other regions and ecosystems. This research empirically addresses the issues of Municipal Solid Waste (MSW) management as a key of sustainable development through showing other developing countries experience in waste management. Furthermore, this paper evaluates the generation and collection processes of the waste management system in Egypt and showing the significance of the right waste management on the environment and economy in Egypt. The data collection method involved sorting and weighing the wastes from one house consecutively for seven days, observations, and interview with the chief of waste collection and environmental services in the company for the reconstruction and tourism development. The findings of this study indicate that solid wastes generation rate at household level was found to be 1.2 kg/person/day, having a high percentage of metal (cans) plastic (water bottles) and food products. In addition, the waste generation rates at summer time are the double of wintertime. Further, the collection times often are shifted according to the traffic congestion and the quality of roads. MSW management system not only enhances social, economic and environmental efficiency, and promotes sustainable development, but can also help resolve the dual crisis of resource shortages and environmental deterioration. Only authorities cannot solve waste problems, but also need a public participation and awareness in achieving an appropriate solid waste management system and waste reduction.

Index Terms— waste management, sustainable development, Municipal Solid Waste (MSW).

1 INTRODUCTION

Solid waste (SW) management is becoming a problem for major cities worldwide. This is especially true in developing countries as a result of the rapid increase in SW generation caused by rapid population growth, urbanization, rapid industrialization and economic development [1]. Municipal Solid Waste (MSW)—more commonly known as trash or garbage—consists of everyday items we use and then throw away, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries. This comes from homes, schools, hospitals, and businesses [2]. In Egypt the Municipal solid waste become a big current problems, the amount of municipal solid waste generated daily 55 tons, according to estimates by the year 2011, with an estimated amount of waste generated annually about 20 million tons and this amount expected to increase by 2016 [3].

Environmental damage not only results from the amount of waste generated but also from the way the wastes are disposed. Uncollected wastes in the streets causes bad smell, drain blockage, invites scavengers, general public nuisance and become good breeding site for insects. Municipal solid waste management (MSWM) involves activities associated of six basic principles of waste generation, storage, collection, transfer and transport, processing and disposal [4]. However, in most Counties, the MSWM system comprises only four activities, i.e. waste generation, collection, transportation and disposal. The problem of MSWM in Egypt due to lack of awareness, management, edu-

cation, resources, technology and finance which resulted into open dumping, low collection and uncontrolled incineration of wastes. To ensure better human health and safety, there is need for effective municipal solid waste management systems, which should be both environmentally and economically sustainable.

2 LITERATURE REVIEW

Integrated Sustainable Waste Management (ISWM) Model is a model that allows studies of the complex and multi-dimensional systems in an integral way. ISWM model was developed by WASTE advisers on urban environment and development [5].

The model acknowledges the importance of three dimensions when analyzing, developing or changing a waste management system. The dimensions are: the stakeholders that have an interest in solid waste management the elements or stages of the movement.

Especially, ISWM model focuses on investigating the stakeholders' action/behavior and factors that influence the elements of the city's waste management system and the technical but also environmental, socio cultural, legal, institutional and economic linkages present to enable the overall system to functioning. To facilitate the analysis of information, existing elements of the waste management systems are described in terms of waste generation and separation, collection, transfer and transport, treatment, recycling and final disposal [1].

Waste management is also affected by the aspects or enabling factors that facilitate the performance of the system. They are: technical, environmental, financial, socio-cultural, institutional and legal.

In the context of waste management, the involved stakeholders, either individuals or organizations, are: national and

- Rasha F. El Gazzar is currently a teaching assistance and pursuing masters degree program in Architectural Engineering and Environmental Design department in Arab Academy for Science and Technology, Alexandria, Egypt. E-mail: arch.rashafahim@gmail.com
- Bakr M. Gomaa is currently Assistant Professor in Architectural Engineering and Environmental Design department in Arab Academy for Science and Technology, Alexandria, Egypt. E-mail: gomaa.architect@yahoo.co.uk

local government; municipal authorities; city corporations; non-governmental organizations (NGO's); households; private contractors; Ministries of Health; Environment, Economy and Finance and recycling companies [1].

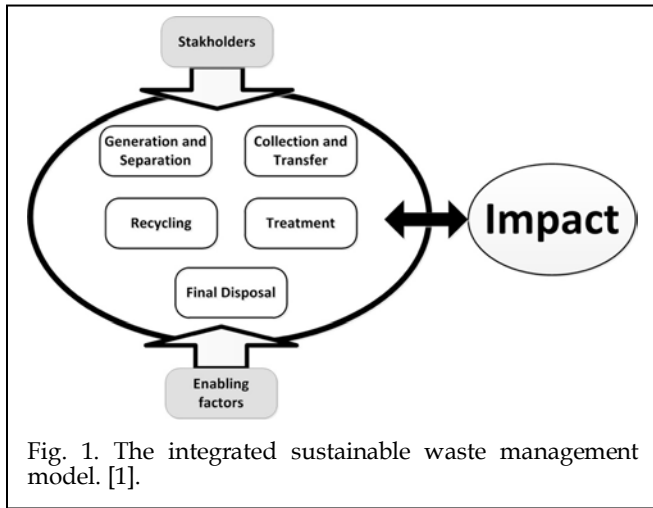


Fig. 1. The integrated sustainable waste management model. [1].

Source reduction, or waste prevention, is designing products to reduce the amount of waste that will later need to be thrown away and also to make the resulting waste less toxic.

Recycling is the recovery of useful materials, such as paper, glass, plastic, and metals, from the trash to use to make new products, reducing the amount of new raw materials needed.

Composting involves collecting organic waste, such as food scraps and yard trimmings, and storing it under conditions designed to help it break down naturally. This resulting compost can then be used as a natural fertilizer. For waste that requires disposal it is important that it is done in ways that protect human health and the environment [2].

Landfills are engineered areas where waste is placed into the land. Landfills usually have liner systems and other safeguards to prevent polluting the groundwater.

Incineration of MSW is done to reduce the amount of landfill space needed and to generate electricity, but it's has bad environment impact [2].

Most of the disposal sites in the cities are open dumps without leachate treatment, protection at the bottom by a geomembrane or clay-lined layer, gases treatment or other infrastructures needed. Besides the official disposal sites, the cities suffer from the illegal disposal of waste in rivers, lakes, oceans, drainage channels, empty lots and roadsides.

3 METHODOLOGY

The study was conducted in 2014 in Alexandria, Egypt at Al Ma'amoura residential area with total area about 1.5 km², which is considered to be a summer resort and a high class residence area. Data collection involved sorting and weighing the wastes from one house consecutively for seven days, personnel observations, and interview with the Chief of waste Collection and Environmental services in Al Ma'amoura Company for the reconstruction and tourism development.

3.1 Case of Egypt

In Egypt the amount of municipal solid waste generated daily 55 tons, according to estimates by the year 2011, with an estimated amount of waste generated annually about 20 million tons [3].

Table 1 shows that the Most Generation amounts of Egypt Comes from Cairo and the Lowest from New Valley province, which proofs that the population is a most important factor in the generation of the MSW.

Fig. 2 and 3 shows decreasing of the Collection process and increasing of disposal sites, which shows the lack of waste management (Collection Process) in Egypt. Waste recycling, there are many countries recycle their wastes to produce energy and use the benefits of organic wastes in fertilization [7]. MSW in Egypt contain components make it possible to recycle 100%, high-end garbage in Cairo is composed of 65% organic material is a leftover vegetables, fruit and bread and other food scraps and remnants of the kitchen, 15% paper, 3% glass, 3% Plastic, 3% cloth, 1% bone, 1% metals, 9% other materials [7]. Table 3 shows the percentage of recyble materials in the Egypt. The Ministry of the Environment reported an increase in the size of the garbage year after year dramatically (see Fig. 2), especially with the growing population, and collected half of the garbage leaving a large section in the streets, and the volume of garbage in 2000 was 20 million tons and is expected to reach to 30 million tons in 2016 [7].

TABLE 1
WASTE GENERATION IN EGYPT PROVINCES [3]

Province	Daily MSW (Ton)	Annually MSW (Ton)
Cairo	15000	5.47
Alexandria	4000	1.46
Giza	4500	1.64
Kaluobya	3500	1.27
Ghrabya	3500	1.27
Behyra	3500	1.27
Sharkia	1800	0.65
Louxe	250	0.09
Aswan	650	0.23
Matroh	250	0.09
Seuz	400	0.14
Red Sea	450	0.16
New Valley	100	0.03

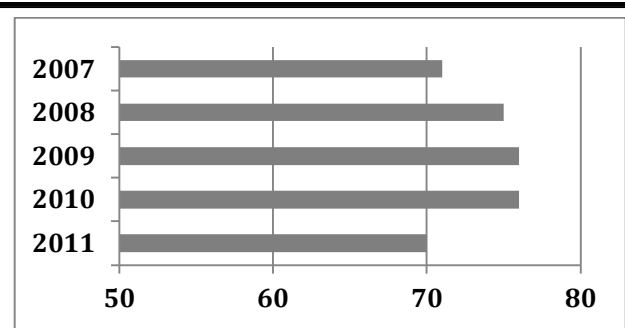


Fig. 2. Percentage of Collected Wastes in Egypt [3]

TABLE 2
MSW PERCENTAGE IN EGYPT [3]

Type of MSW	%
Organic Waste	60-50
Cartoon, Papers	12-8
Plastic	15-10
Glass	3-1
Metals	2-1.5
Fabric	3-2

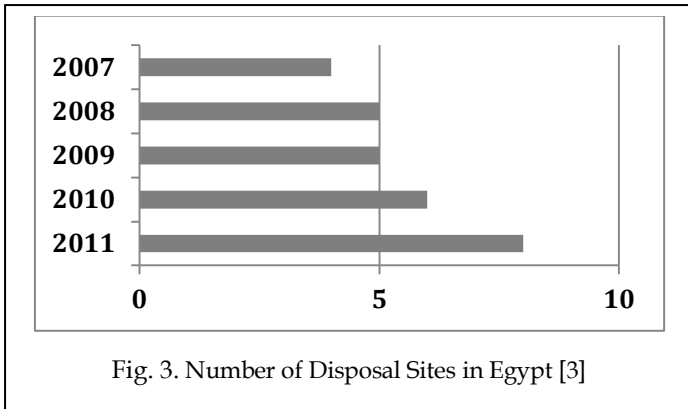


Fig. 3. Number of Disposal Sites in Egypt [3]

4 RESULTS AND DISCUSSION

By Experimenting MSW generation at household level, which is calculated by weighing the wastes from house consecutively for a whole week. Solid wastes generation rate at household level was found to be 6 kg from 5 members family which means 1.2 kg/person/day, having a high percentage of metal (cans), plastic (water bottles) and food products [by researcher, 2014] (see Table 3). The Interview with The Chief of waste Collection and Environmental services in Al Ma'amoura Company for the reconstruction and tourism development Shows that about (12 tons) are generated daily during wintertime. The wastes are collected twice during the day at 7:30 AM and 1:30 PM. During the summer time about (22 to 20 tons) of wastes are generated, and the wastes are collected 4 times during the day at 7:00 AM, 1:00 PM, 4:00 PM and 9:00 PM. This is means the generations rate at summer time are rise to the double of winter time. Collection times often are shifted according to the traffic congestion and the quality of roads. The company which is responsible for the waste collection are (Nahdet Masr for Environmental Services), which is Governmental company managed by Al Mokawelon Al Arab Company. The company is responsible for the waste collection in Al-alexandria city not only Al Ma'amoura area.

The wastes are collected every day at time mentioned above form about 150 big garbage boxes and 100 small boxes distributed over Al Ma'amoura area. The Collection is done by large vehicles with capacity (9 tons) and transported to the disposal area and recycling factories in two main sites in Alexandria, At Al Amrya Area and Al Debana site at Al Malhat area. The wastes are

TABLE 3
MSW PERCENTAGE IN AL MA'AMOURA FOR HOUSEHOLD [RESEARCHER]

Day No.	Week Day	Waste for (5 Family Member) (Kg)	Waste per Person (kg)
1	Friday	3.5	0.7
2	Saturday	6	1.2
3	Sunday	5.7	1.14
4	Monday	5.5	1.10
5	Tuesday	6.5	1.30
6	Wednesday	4.5	0.9
7	Thursday	3.5	0.7

sorted by wastes pickers which they pick plastic, paper and metals from the garbage boxes, while the rest of the wastes are managed in the factories to produce the fertilizers.

5 CONCLUSION

MSW management system not only enhances social, economic and environmental efficiency, and promotes sustainable development, but can also help resolve the dual crisis of resource shortages and environmental deterioration. According to the experiment and the interview, which shows the waste production, are very high in the summer time, it is important to spread awareness about waste reduction.

The waste problems cannot be solved by the authorities only, but also need a public participation and awareness in achieving an appropriate solid waste management system and waste reduction. However, Improving SWM system in Egypt and starts to but an action plans to get the benefits of MSW and improve the quality of roads and find solutions for the traffic congestion.

REFERENCES

- [1] L. A. Guerrero, G. Maas, and W. Hogland, "Solid waste management challenges for cities in developing countries," *Waste Management*, vol. 33, no. 1, pp. 220-232, 2013.
- [2] *United States Environmental Protection Agency*. Retrieved May 20, 2013, from Wastes: <http://www.epa.gov>.
- [3] *Ministry of state for Environmental Affairs: Egyptian Environmental Affairs Agency*. Retrieved May 10, 2013, from Municipal Wastes: <http://www.eeaa.gov.eg>
- [4] H. R. Sharma, B. Destaw, T. Negash, L. Negussie, Y. Endris, G. Meserte, B. Fentaw, and A. Ibrahime, "Municipal solid waste management in Dessie City, Ethiopia," *Management of Environmental Quality: An International Journal*, vol. 24, no. 2, pp. 154 - 164, 2013.
- [5] *WASTE. Integrated sustainable waste management. 2004* Retrieved May 10, 2013, from Approaches : <http://waste.nl>.
- [6] A. M. Damghani, G. Savarypour, E. Zand, and R. Deihimfard, "Municipal solid waste management in Tehran: Current practices, opportunities and challenges," *Waste Management*, vol. 28, no. 5, pp. 929-934, 2008.
- [7] G. Ali, (2009, Septamber 12). *Wastes Recycling in Egypt*. AL Shrouk Al Gaded Newspaper: <http://www.masress.com/shorouk/111118>