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## LOGISTICAL CHALLENGES FACING SOLID WASTE MANAGEMENT IN LIBYA

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### ***Abstract:***

*Municipal solid waste logistics management is necessary to take care of the growing stream of waste and the need to act on this issue through an effective logistics management system. Logistical operations include collection, transportation, handling and intermediate storage in addition the final disposal. Many developing countries are still struggling to provide these services. There is no doubt that many obstacles and challenges stand against its adequate management. This paper aims to clarify the most important challenges and logistical obstacles in managing municipal solid waste in Libya, and concluded that all stages of this administration face fundamental challenges, starts from the obsolescence of the mechanisms used and poor collection processes and the lack of intermediate collection points, which most of them have been closed, because they are open temporary dumps, and ends of the far final dumps and their non-conformity with specifications. The local authorities are responsible to give this issue the right attention because of the environmental impact it represents, in addition to the associated direct and indirect costs.*

### ***Key words:***

*MSW, challenges, landfill, collection, transshipment point*

## INTRODUCTION

Integrated solid Waste Management can be viewed as a logistic system that aims to face the growing challenge of municipality solid waste in urban cities, especially in developing countries. A successful municipal solid Waste Management system, from the point of view of integrated management, is that system that deals with the economic, environmental and social aspects - in addition must consider all the components of the system.

The responsibility of the local authorities is to manage effectively the integrated system of solid waste management, starting with the control of local solid waste generation, handling, transportation, intermediate storage, treatment and final disposal. The cost of transportation and collection is an important part of the total cost of the whole system level. There is no doubt that human activities generate large amounts of waste, which are often useless, especially if they are not managed in the right way. That reduces their harm to the environment and public health [1]. Usually these wastes are in the solid state and from municipal origin [1], which has been defined by the World Health Organization as some things the owner of which has come to be unwilling at some point, and has no perceived market value [2].

Usually, some practices can be adopted in order to minimize its negative effects on the environment and the public health of societies. In addition to benefiting some of its physical components, these practices involve reducing and minimizing waste generation (through reuse, recycling, etc.), sorting it at the source, collecting, transporting, storing, treating it (composting, extracting energy from it, etc.) and the final disposal from it in the sanitary landfills [3].

Historically, and for more than a century and a half in the past, the responsibility for managing municipal solid waste was a direct responsibility of individuals (population), but as a result of the great development in industry and in changing consumption habits that led to an increase in the quantities of waste generated and the difficulty of dealing with it individually, this responsibility was transferred to Municipalities and government agencies [4].

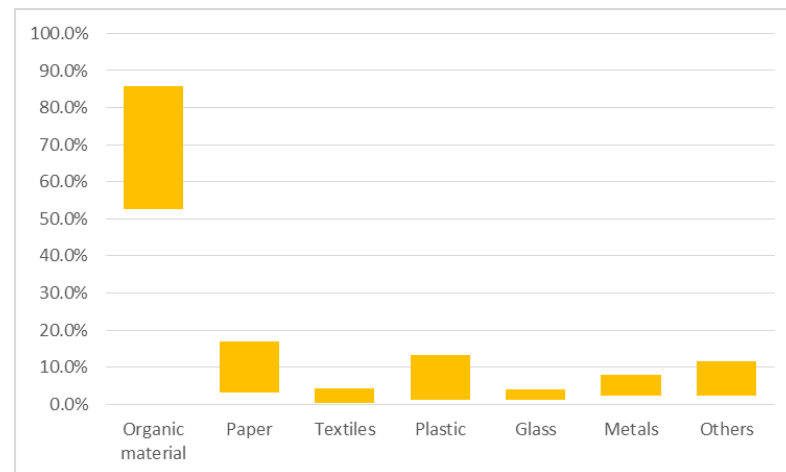
Looking at that time, it can be found that the practices used to manage this type of waste is traditional and does not exceed the processes of collection, transportation and disposal in the streets, in random dumps, in waterways, or burning it in the open air. None of the sources sorting, recycling and energy recovery processes were followed [4]. Primitive collection processes were often carried out by some people who roam the streets in search of some items that can be reused, such as worn clothes or some utensils and metals, and because that these processes were not sufficient to get rid of these wastes and may cause diseases and health problems, Western governments were forced through its local authorities to transport this waste by ship and dispose from it at sea [5]. But this method also caused pollution to the beaches and damages to aquatic organisms, which forced the legislative authorities in the United States of America to enact federal legislation in 1934, preventing the solid waste dumping into the seas [5]. In 1935, the authorities in California resorted to the use of low-lying land (pits) as a place to bury waste and covering it with sand. This process constitutes the basis for modern today landfills. Where the process of selecting these landfills depended on their proximity from waste generation sites and the availability of large pits, and this selection process (selection of landfill sites) was not carried out in a scientific manner that ensures the safety of the environment and the health of society [4]. All these events and other pressures contributed to the development of municipal solid waste management. In 1959, the American Society of Civil Engineers published the first engineering manual sanitary landfill for solid waste, which focused on compacting waste and covering it with a layer of sand to prevent its scattering and the spread of odors and insects on it [5]. It is believed that the historical development in the field of municipal Waste Management has been affected by 6 main factors: public health, environment, resource scarcity, waste value, climate change and public awareness. Wrong practices such as methods of collecting and transporting waste using traditional methods and improper disposal methods that often result in emissions of odors and harmful gases have reinforced this development [6]. All these factors were areas on for the developed countries to imposition a legislation towing directly towards reducing waste generation and recovering the materials for recycling. For example, the Netherlands imposed

legislation prohibiting the use of some materials, which enabled it to ban more than 35 types of waste by 1995. In addition, it imposed a tax on the use of landfills, which contributed to an increase in waste recycling rates from 45% to 50% between 2001 and 2009 [7]. The great global development in the field of technologies and logistics of municipal solid Waste Management has led to the improvement and the protection of the environment from the dangers that result from this waste. For example, the strategies followed by Germany showed a significant development in reducing waste generation and in recycling operations, which amounted to 62% of the total waste generated in 2010 in Germany, that led to a reduction of waste landfill with an approximate volume of up to zero during that year [7]. Policies continued to develop this sector in the countries of the European Union until the rate of waste collection generated in these countries reached almost 100% recently [6].

## **1 THE REALITY OF SOLID WASTE MANAGEMENT IN LIBYA**

Despite the global development in the techniques and methods of municipal solid waste management, it still represents a multi-difficult challenge (environmentally, economically, socially, legislative and others) facing municipalities and government agencies concerned with its management in general at the global level, and in particular in developing and low-income countries [2].

The focus of this paper is on the logistics of municipal solid Waste Management used in Libya, which generates more than 3.2 million tons of municipal solid waste annually (an average of 1.25 kg/person/day) [8]. Libya is among the developing countries that use on traditional methods to manage their solid waste through a weak service provided by the local authorities in the municipalities [9], where it suffers from not using the best and most appropriate methods and practices from a waste collection to its disposal. There is a lack of the training and nonqualified persons for municipal solid waste management. In addition, accountability for solid waste management systems is non-existent throughout the country, and there are often no violations of any kind regarding the mismanagement of this waste . This weakness is attributed to the absence of sufficient budgets to cover the costs associated with the development and modernization of its systems and equipment for waste collection, storage, treatment and disposal, which makes it almost unable to carry out its tasks. It can also be considered that there are no plans and strategies related to solid waste management, and that the financing of the various activities of the bodies responsible for solid Waste Management is almost non-existent, the processes of collecting and transporting waste do not have any fees in most cases, whether for citizens or companies. The lack of environmental awareness is also one of the factors affecting the delay in addressing this problem in Libya. This management often causes a number of health problems and is a major environmental concern [6]. Population growth and the change in consumption habits in developing countries in general have contributed to the exacerbation of the problems related to solid Waste Management it is natural the increasing of the amount, which creates greater logistical obstacles, especially of waste generated by the increase of these elements. This will create greater logistical obstacles, since the practices followed for the management process are weak. Looking at the population growth in Libya, the estimated increase of about 2.2% during the last four decades, also the level of urbanization has increased by 80% at the present time, compared to 50% in 1970. This increase made it difficult to deal with and manage this waste [10]. Figure (1) shows the components and ranges of MSW in eight main Libyan cities.

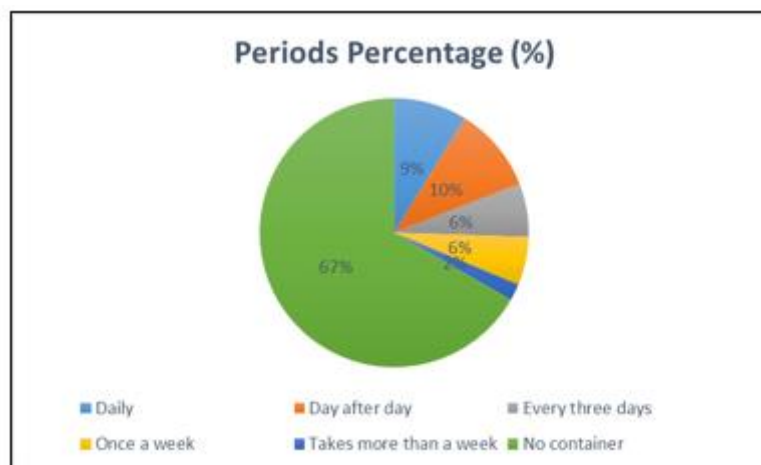


*Fig. 1 Components and ranges of MSW in eight main Libyan cities*

## 2 OBSTACLES FACING LOGISTICAL OPERATIONS

The most important obstacles can be summarized in the following points:

**Waste collection:** Reliance on technologies and special logistics for collection and transportation policy is insufficient and not given the real importance. In addition, the participation of the private sector in Waste Management is unsatisfactory [2]. In fact, rubbish bins are almost non-existent in the streets, and therefore citizens find it difficult to dispose of waste. Even if they find these bins, they are mostly old and damaged. For instance, Figure (2) shows the number of times for a collection process in one of the Libyan cities [2]. In this regard, about 66.7% of a resident indicated that there were no containers in their living areas, and 10.3% of them mentioned that the collection process occurred day after day, while only 8.8% of them mentioned that the collection process occurred daily.



*Fig. 2 The number of times for the collection process*

In front of the houses, the garbage is often placed directly on the road without placing it in special bins given for the use from the owner of the house, which causes difficulties in the collection and in the final transport due to the reliance on traditional collecting tools (by hands), In addition to the environmental damage that results from this situation, especially when the municipality is late in transporting these wastes [9]. The fleet of vehicles used for collection is, for the most cases, the same as that used for transportation to the final landfill,

which reduces transportation efficiency. In addition, poor infrastructure and roads within cities make the movement of trucks difficult [9]. Also, this fleet is mostly old, worn out and often breaks down, lacks maintenance and spare parts, which disrupts maintenance operations, and makes them ineffective in the final transportation process. On the other side, routing processes depend on the experience of drivers, or it is a reaction to the accumulation of wastes in certain areas. Actually, there is no fixed or specific schedule for the passage of trucks from a certain area, and it may take weeks for the garbage truck to re-pass from the same street, which leads to the accumulation of waste, or the citizens resorting to transport it and throwing it in an open place (such as on the seashore, for example).

**Waste transportation:** Most cities suffer from the lack of intermediate collection points. Mostly there were middle points but in recent years they have been closed due to people's pressures (land owners). These pressures came due to the environmental effects of these transshipment points like the unpleasant odors they cause and distorting the general landscape. The exact description of these points is open dumps within the population centers. This is reflected in the transportation processes, which are taking a long time to reach the final dumps.

**Final disposal:** It can be said that only 1% from the total solid waste generated in Libya is recycled and 3% are what is composted from this waste [11,12]. The rest of the practices or methods that are followed for solid waste the final disposal, including demolition and construction waste, and medical waste in Libya, 95% of which is dumping in landfills, about 67% are open dumps managed by the authorities, in a primitive way, and 30% are random open dumps that are not controlled by the authorities concerned with the management of these wastes [13]. These dumps are usually located at far distances from cities, mostly due to resistance of the residents. The transportation cost becomes difficult for a country like Libya, with its vast area of about 1.8 million square kilometers and sprawling cities with a relatively low population density. In addition, these dumping sites are not considered sustainable, and there are no strategies or scientific bases for their selection, as most of them do not take into account any criteria, but rather rely on temporary solutions, which causes environmental, economic and social damage to the areas in which these landfills are located [8].

### **3 CHANGES REQUIRED TO IMPROVE THE LOGISTICS SOLID WASTE MANAGEMENT IN LIBYA.**

The discovery of oil in Libya contributed to the rise in the value of GDP, which in turn led to a change in people's consumption habits. This change occurred both in the amount of municipal solid waste generated, and in the composition of these wastes. As a result of these circumstances, authorities will have a greater obligation to identify solutions to current problems, taking into consideration the predicted population growth and the changing habits of consumption.

It is important to develop more effective procedures and approaches for determining better collection routes. This begins with developing a nationwide postcode system; the country's buildings have yet to be numbered. Selection of appropriate software tools will help in the analysis of waste generation patterns, resulting in better collection services. It's very important also to have an enough number of garbage bins that are correctly dispersed through the streets, and residential areas. The collection fleet must also be renewed, as the majority of the existing trucks are old or out of service. Authorities also need to make the right decisions about the best technologies to be used in treating their waste, as well as the best sites to the final dump.

Currently, many cities in Libya are facing challenges in the management of their solid waste. However, logistics becomes an important factor of being successful, and it is also a necessary part of achieving the best results for waste management problem. The efficiency of

logistics can be further improved by promoting the efficiency of a transportation system, i.e., through green transportation. The reason behind adopting the greening strategy in transportation is to reduce the level of air pollution, which affects both the environment and also the economy. Moreover, an important attention must be given to the transport infrastructure of the city which is defined through the quality of roads, followed by the access point within them. These access points lead to a metropolitan area while providing important considerations toward travel time, distance, and the overall travel cost. It is important that a smooth infrastructure in transportation network's results in providing a direct effect on the management of solid waste.

Consequently, the appropriate solution may be to consider the Waste Management in Libya as an increasingly valuable resource for extraction, recycling, recovery and reuse. This requires raising awareness among citizens for contributing in the sorting process at the source. Furthermore, qualification of human resources, decision makers, are also an important factor for success. Moving to assigning the logistic operations processes to the private sector, even partially, may contribute to solve the problem. This will help in the process of taking fees from solid waste producers, whether individuals or institutions. Taking a monthly fee of 20 Libyan dinars will result in an annual sum exceeding 120 million dinars, which will contribute to solve this problem. Future planning is also very important, for example, estimating the number of the population, which will lead to the development of appropriate strategies for Waste Management.

#### **4 CONCLUSION**

Waste Management is a global environmental problem and a significant issue today. This work demonstrates the current waste generation, collection and transportation, and final disposal situation in Libya. Most of the solid waste in the country is dumped on land in an uncontrolled procedure. Such ineffective disposal practices lead to problems that will harm both human and animal health and result in environmental problems. Logistics services become an important factor of being successful, and it is also a necessary part of achieving the best results for an efficient Waste Management system. There are various issues related to the current solid waste system which are observed in the country, mainly no waste bins at source, non-segregation at source, no regular collection of waste, inadequate transportation of waste, no processing of waste, disposal of waste, lack of institutional and management involvement. No stakeholder can completely overcome all these barriers alone, and consequently; a more integrated approach should be applied. Finally, this work concluded that the lack of resources such as infrastructure, financing, suitable logistic planning, and an efficient strategy in transportation, are the main barriers in Waste Management system. The increases of service demands combined with the Population growth for municipalities are putting a huge strain on the existing Waste Management system.

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