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Urban Solid Waste Management in Karachi, Pakistan

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Abstract: Karachi is the largest metropolitan city of Pakistan with a population of 207,774,520 (Statistics, 2017). Ironically, a megacity of a developing state has its drawbacks and discrepancies in solid waste mechanism being one of them. Karachi has always been the center of businesses and government offices since independence, first as capital of Pakistan and later as a provincial capital. This study evaluates the importance of solid waste management for an urban city such as Karachi, and the steps which have been taken by the successive governments to fulfill the demands of this growing megapolis since independence. In this study, models of solid waste management adopted by different cities will be analyzed and a suitable model for Karachi will be proposed. Needless to say, Karachi has the potential to become an eco-friendly city by adopting the public private partnership. In short, the civil society's role is of paramount importance.

Keywords: Solid-waste management, refuse, overpopulation, planning, landfill.

Introduction

It was necessary to study the Urban Master Plans of Karachi in order to propose a suitable model for solid waste management. Crucially, we tried to strike congruence between the aims and goals set out by the different governments and how successful they were in achieving their targets. It is rather unfortunate that since the independence of Pakistan in 1947, there have only been four Master Plans for Karachi.

1) Great Karachi Plan 1952

2) Karachi Development Plan 1985

3) Karachi Development 2000

4) Karachi Development 2020

Except the Karachi Development Plan 1985, all were approved by the government. Furthermore, in the first plan of 1952, there was no particular heading or subheading for solid waste management. The biggest loophole in the 1985 plan was its lack of direction. Instead of stressing upon what should be done, the plan was peppered with vague suggestions of what could be done. The Master Plan 2000 was a progress towards development, although it had not elucidated upon the strategies, policies, and their implementation. One is left bewildered after learning that the role of authorities and masses, a catalyst in solid waste management, wasn't given its due share. The Master Plan 2020, which was issued in 2007, is well drafted. Not only does it show the clarity of ideas, aims and objectives of the team, but also studies the previous three plans in the light of problems faced by the previous governments. It also includes the ways in which the current and future governments would tackle the problem of solid waste.

Well, we are nearing mid-2019, but Karachi is far from achieving its solid waste management targets. Disturbingly, the current situation is even worse than what it was a decade back.

1. Karachi Solid Waste

When it comes to producing solid waste, Karachi has trodden an upward trajectory. From 2000 tonnes per day prior to 1974 (Karachi Plan 1974-85) it gradually moved to 6000 tonnes in 2001 (Mansoor Ali and Hasan, 2001). However, by 2005, it had leapfrogged to 9000 tonnes per day (Zaheer, 2007). Now, it stands at a staggering 12000 tonnes per day (Mahmood, 2019).

Multiple factors have contributed to the vast growth of garbage in Karachi. Overpopulation, apparently, enjoys the dubious distinction. The vast migration that had started in 1947, continued till 2001 when the war on terror was initiated. Replicating the scenario of the 1979 Afghan-Soviet war, Karachi once again witnessed the influx of Afghan refugees.

Karachi has always accommodated the rapidly growing population. There have been five mass migrations in the city excluding the internal displacement. However, if the growth spurt is so frequent, it becomes quite a herculean task for a city to plan settlements and manage the resulting solid waste.

In addition to that, people living in Katchi Abadis were deprived of solid waste disposal facilities. Hence, they dumped solid waste in natural drains, streets or open plots. The proliferation of fast food restaurants in 21st century took improper solid waste disposal to a new

level. The smaller restaurants mostly do not adhere to the relevant policies towards hygiene and health and sadly, dispose solid waste out in the open.

Today, the refuse management is worst in Karachi as bridges, roads, localities are surrounded by solid waste. In 2014, the Sindh Solid Waste Management Board was formed under the 'Act of Sindh Assembly' to manage and control the refusal system. Previously, Karachi's solid waste management fell under the ambits of the Karachi Metropolitan Corporation (KMC) and 13 other districts, but now it's handled by Sindh Solid Waste Management Board.

The (Table 1) summarizes the names of the agencies involved in collection and transportation of solid waste in Karachi. These statistics have been shared by the KMC.

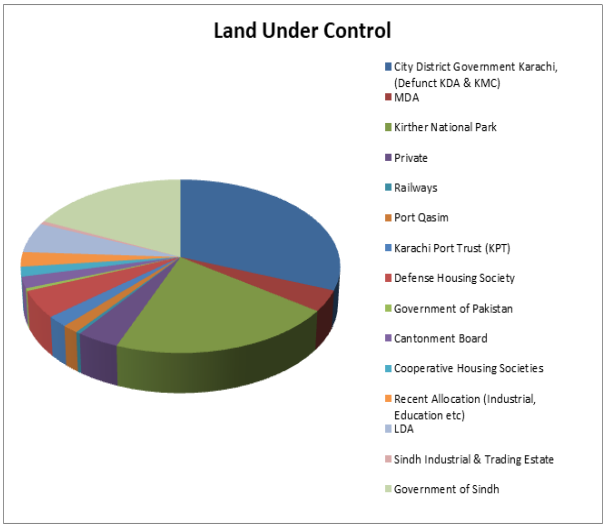

Fig. 1 Land under control Karachi (Hasan, 2015).

Table 1. The following table summarizes the names of the agencies involved for collection and transportation of waste in Karachi given by KMC official.

1.	KMC through its Six DMCs now SSWMB	7
2.	KDA/MDA/LDA	1
3.	Cantonment Boards	5
4.	Sea Port (Karachi Port Trust and Bin Qasim)	2
5.	Airports (Civil Aviation)	1
6.	Sindh Industrial and Trading Estate (SITE), / New Karachi Industrial Area, / Korangi Industrial area	3
7.	Pakistan Railways/ Steel Mill/Steel Town/ PWD	3

Importance of Waste Management System

Solid waste has been in existence since the inception of human beings. The only difference between the present and the past is that most of the waste produced before industrialization was organic in nature, easily absorbed by the soil. But in today's age of urbanization, Karachi is not the only city facing refuse management problems. In-fact, is now a global dilemma. Developed countries have managed the problem in time, owing to their compassionate attitude towards the environment. What is more, is that they are also technologically equipped for this.

London was the first city to introduce the structure for managing the problem by door to door garbage collection in 1900 s, and it has evolved during the years in tandem with the population growth and economic expansion. Similarly, other urban cities are also facing the same challenge and have realized the importance of solid waste management. Sau Paulo state in Brazil has been trying to bring the informal waste pickers into the formal system that can ensure the governance of the recycling process.

In addition to that, New York city has also taken steps to counter the refuse by facilitating waste recycling. Infact, entrepreneurs are providing waste management and recycle services to housing societies, buildings, and companies (Ahmed, 2017).

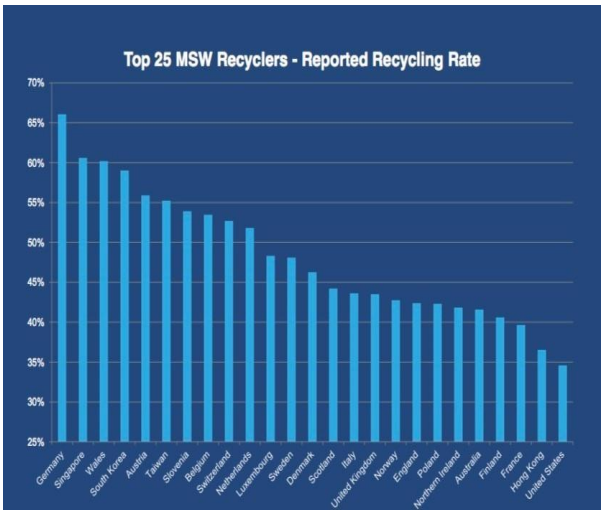

Fig. 2 Showing the top countries that recycle the most in the world (Grey, 2017).

This chart indicates that these countries have achieved the goal of managing solid waste. Despite the fact that most of European states and have been working on this goal from more than a century, some states have left them behind. Indeed, if there is a political will than the aim can be achieved regardless of the new or old system.

Solid Waste Management System in Karachi:

Karachi, a city with a heart bigger than its land, has the highest number of ethnic groups, and accounts for more than 6% of National population in Pakistan, According to Karachi Municipal Corporation (KMC), this city produces various categories of solid waste which are household municipal waste, commercial

waste, institutional waste, restaurant waste, street sweepings, landscaping waste, agricultural waste, animal slaughterhouse waste, fish market waste, vegetable market waste, sewage sludge, and tires. All of these categories constitute Karachi's refuse along with other industrial, hospital, and hazardous wastes.

How did the solid waste system evolve in this megacity and what were the contributing factors, steps taken by authorities and their results have been discussed over a span of four time periods, from 1947 to 2018.

3.1. During 1947 - 1967:

14, 1947 August brought new challenges to the 'Paris of Asia. Mass migration was seen in the city from three different routes namely Sindh, Punjab and through sea. After independence, Karachi was declared the capital of the state which made it the hub for government offices and businesses, thus attracting the educated populace and labor force to the city.

The population rose to 1,064, 557 in 1951 from 435,887 in 1941, with a growth rate of 161% (Khan, 2016). Later on, in 1958, another wave of migration took place, this time the evacuees were from India who were disbanded for being traitors (Khan, 2016). The city merited extra attention, especially after losing its capital status. However, no local government or system was introduced considering that it was the biggest economic hub of the country. Due to the political tensions between different political parties, the city was not given as much importance, as is still the case in 2019.

After independence, the significance of a Master Plan for Karachi was strongly recognized, and consequently, the Plan of 1952 was introduced. Though infrastructural and urban developments were given a fillip, solid waste management was neglected for an unknow reason thus, the consequences were not good for the city and its residents.

Furthermore, garbage collections operated from door to door in those but were thrown into open areas far away from the population of each locality and roads were cleaned with water as well. These responsibilities were fulfilled by people of Municipal Commission which was made during British rule.

Karachi Plan 1952 was very beneficial for the city because the infrastructure and societies were made through its implementation but it was plan with no solid waste management that could have helped in sustaining the population growth of the city with proper refuse collection system and dumping sites. With no proper management from the start, effects will be seen in near future with the rapid growth of population. In addition to that, no other plan was made for this fast-growing urban city of Pakistan.

Fig. 3 A history of Karachi's garbage outbreaks, 2017): Picture of refuse in 1985 (Paracha).

During 1968 – 1988:

Between 1968 and 1988, two big catastrophes struck Pakistan and Karachi suffered quite a lot. Firstly, the separation of East Pakistan led to the influx of hordes of migrants in the city. Secondly, the Afghan refugees came in, who blended with the Pakistani citizens. Only two city Mayors served during this time, and that too after the 'Sindh Local Ordinance 1979' was promulgated in 1979. Later on, the 1985 ethnic riots were a major setback for the improvement of refuse system.

In 1986, the Karachi Plan 2000 was drafted, and it was a reflection on the growing solid waste problem. The plan was made under the city Mayor Abdul Sattar Afghani and his team. It was a step forward in developing the solid waste system. Later on, in 1988 the Mayor of city, he established the department of solid waste management (SWM) in KMC, which was responsible for financial allocations, drafting and approval of local legislation.

When the Karachi plan 1974 was not approved and the influx of population was prevalent, the lack of local governance for the ensuing 17 years exacerbated the problem. Furthermore, in this unapproved plan, no proper strategy was devised for solid waste management. An urban city like Karachi with no plan from 1952 till 1985 resulted in poor condition (Fig. 3.3) to observe that how the old system failed.

3.3. 1989 - 2009:

In this era, during both the democratic government tenures and the dictatorship regime, Karachi witnessed

a population increase. It was either the policy of favoritism by political leaders who formed coterie at the higher positions, or by internal migration of labor for completion of numerous projects that started under the M.K. Mayor. Another contributing factor was the riots, that broke out in 1990s between the ethnic groups, which destabilized the solid waste system in Karachi. Heaps of garbage were found on roadsides, vacant lands and in sewage drains.

This era marked both the chaos and the betterment of Karachi. In 1990's, due to uncertainties in Karachi, the local government system had collapsed. In 1995, the Japanese International Coordination Agency (JICA) invested in the solid waste management program in Karachi but the agreement was cancelled due to some reasons (Director Operations, 2019). In the mid-1990s, a landfill site at Surjani was also identified with the help of World Bank, where both the landfill sites of Karachi exist today; Gond pass and Jam Chakhro. In 1997-98, a contract with a Chinese firm was signed for integrated waste, land filling, door to door collection and construction of garbage transfer stations (GTS) but it was terminated later on (Mahmood, 2019).

However, in the 21st century, more authority was given to city governments and the efforts were made to counter the refuse problem. Furthermore, Karachi Plan 2020 which was made with emphasis on solid waste management with short term and long-term goals in accordance with the needs of the city.

With an increasing population, the waste is also increasing at an alarming rate, but in the 21st Century, the problem was managed better than the previous years and the future looks promising as well. The sewerage line was kept clean so that waste doesn't accumulate in it. The agreement with the Chinese company was canceled due to lack of required machinery for the process, besides some other unknown reasons. The burning of garbage in landfill sites, where every type of waste is dumped, is leading to air pollution and various diseases in the surrounding areas.

3.4. 2010 - 2018:

After devolution of local government ordinance 2001, the responsibility of waste collection and transportation came under Town Administrators, and treatment and disposal of refuse was handed over to the City District Government Karachi (CDGK). Rapid increase in fast food chain restaurants during these 8 years has been immense. These restaurants have opened up in cantonment areas and even small congested areas. The absence of a Mayor for five years after 2010 had affected an already outdated system of solid waste management.

Under the Sindh Act No.4 of 2014, the Sindh Solid Waste Management board was formed which was responsible for the solid waste management of areas that fell under KMC. Importantly, all the documents and information had to be transferred to this Board from solid waste management department in KMC. According to the Director Operations of Solid Waste Management Board (SSWMB), Karachi now has 12 GTS with 5 operative ones in EMB Cosway (District East), Sharafi Goth (District Malir), Baldia (District West), Kasba (District West) and Dhobi Ghaath (District South). Moreover, four of these GTS are planned to be scientific, where anaerobic digestion will be used to produce electricity in the near future. According to the Secretary of SSWMB 80% of garbage is lifted from the grounds and dumped into GTS and later on at night it is transferred to landfill sites. However, according to the survey on solid waste management for this study, 74.8% of the population is not satisfied with the government's efforts in countering the disposal problem, 23.7% is unsure, while 1.5% gave the nod of approval.

Fig. 4.1 Describes the recyclable goods (Zabaleta, 2008).

General composition	Typical composition	Specific composition	Recyclable Materials
ORGANIC	Biodegradable material	Food and vegetables	Recyclable
	Paper and cardboard	Paper and cardboard	Recyclable
	Plastics	HDPE, LDPE, PVC	Recyclable
	Clothes and fabrics	Leather, rubber, fabrics	Recyclable
	Garden waste	leaves and grass	Recyclable
	Wood	Wood	Recyclable
	Organic wastes	Bones	Recyclable
INORGANIC	Metals	Cans, aluminium	Recyclable
	Glass	Non-colours and colours	Recyclable
	Soil and ashes	Soil and ashes	Recyclable
	Non-classified materials	Voluminous objects	Recyclable

In these 8 years, Karachi has seen more refuse on roads, under the bridges and in localities than ever before. Open dumping of garbage is more common and lifting of waste on regular basis is a rare. This has led the citizens to burn solid waste, which causes air pollution producing Carbon monoxide, Carbon dioxide and Nitrogen oxide. Practice of burning garbage has led to the deterioration of air quality in Karachi. The Plan 2020, that looks very promising, has not been implemented so far. Health problems such as respiratory diseases, chest infections, cough and cold and waterborne diseases such as gastric problems and hepatitis are prevalent (Abbasi et al., 2015).

Conclusion and Recommendations

Solid waste management is a problem for every society, but it varies according to the respective history, socio-cultural values, population, and political situation. To counter the refuse problem in Karachi, various steps have been taken such as agreements with foreign companies, private recycling companies, and informal waste pickers. Currently under the Sindh Solid Waste Management Board system (Fig. 4).

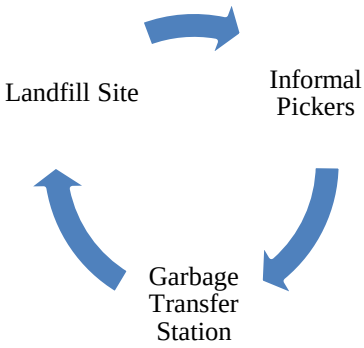

Fig. 4.2 The current system is not enough to sustain the severe waste conditions in Karachi.

There should be more transparency between the masses and the government as public doesn't have easy access to the information about either the factors or steps taken by the government. Computerized and manual data should be kept for the functioning of the government properly and it will help future governments as well for they can be aware about the projects as well. Discussion with the KMC officials showed that no computerized data is kept. Relevant employees should be hired to make work more effective.

A board should be formed where all the land owners of Karachi should be given a membership. In this way, they can collectively work on the problem and help each other in terms of using innovative techniques to counter solid waste problem. A meeting should be held at least once a month.

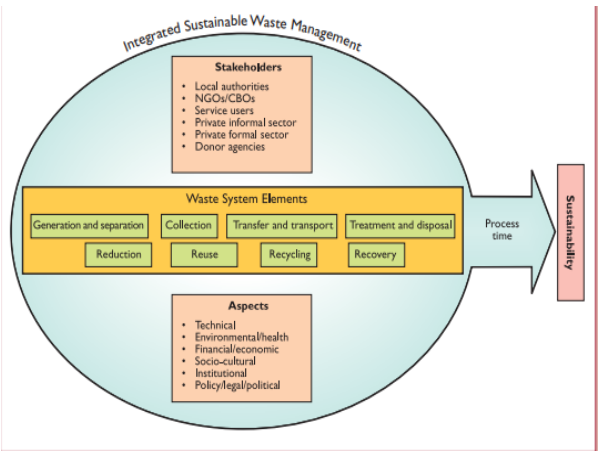

Fig. 4.4

Educational institutes play a vital role in this sector for they can help motivate their students to recycle and undertake garbage collections through different activities and volunteer programs. For example, agricultural waste can be recycled through four ways, out of which, two can be done in households like the use of vegetable biomass as a fertilizer for the production of vegetables and fruits; and it can also be used as food for livestock. The other two methods can be espoused for energy production and chemical products' production (Maria et al., 2005).

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