# Municipal Solid Waste Management in Kenya: A Comparison of Middle Income and Slum Areas

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# Municipal Solid Waste Management in Kenya: A Comparison of Middle Income and Slum Areas

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## ABSTRACT

*Municipal Solid Waste Management is one of the most crucial environmental health problems facing African cities. Kenyan urban population has been growing rapidly over the last decade. Consequently, generation of solid, liquid and gaseous wastes has been increasing at the same tremendously due to increased population and industrial development. The amount of solid waste generated is expected to increase as the country strives to be a middle income country by 2030. The increased population in urban areas coupled with slow expansion of the economy has led to increase in slums and hence compounding the problem of solid wastes. This paper gives an overview of solid waste management in Kenya by comparing the solid waste situation in middle income estate of Langata and a low income area of Kibera slums. Although the solid waste composition is similar in terms of the fractional components, the overall solid waste management is different in both areas with Langata having a good solid waste collection system compared to the improvised Kibera. Kibera is characterized by unregulated disposal of refuse, thereby courting serious environmental disasters and health risks to the residents.*

*Key words: solid wastes, solid waste management, environmental disaster, slums and middle income*

## INTRODUCTION

Municipal solid waste (MSW), often called urban waste, is a waste type that includes predominantly domestic (household refuse), institutional wastes, street sweepings, construction and demolition debris, and commercial waste collected by a municipal authority or council within a given area. They are either in solid or semi-solid form and generally exclude hazardous waste. Municipal solid waste management (MSWM) encompasses the functions of collection, transfer, resource recovery, recycling, and treatment and or disposal. The four important goals of MSWM are; (Rotich, *et al*, 2006, Schübeler, *et al.* 1996).

a) To protect environmental health
b) To promote the quality of the urban environment
c) To support the efficiency and productivity of the economy
d) To generate employment and income in the sector

MSWM constitutes one of the most crucial health and environmental problems facing governments of African cities. This is because even though these cities are using 20-50 percent of their budget in solid waste management, only 20-80 percent of the waste is collected (Achankeng, 2003).it therefore means that a lot of waste is left uncollected causing serious environmental disasters and health risks to the population. Refuse left to rot in the streets of residential areas attract insects and rodents which are associated with various diseases such as plague, cholera among others.

Kenyan urban population has been growing rapidly over the last decade. Consequently, generation of solid, liquid and gaseous wastes has been increasing at the same tremendously due to increased population and industrial development. The amount of solid waste generated is expected to increase as the country strives to be a middle income country by 2030. A problem with rapid urbanization in third world countries (like Kenya) implies increase in slums and creation of new ones due the fact that the economies in these countries are expanding slowly compared to the population growth. Solid waste management in Kenya is the responsibility of the local authorities where they collect and dispose the waste in their areas of jurisdiction. In

Nairobi, the City Council of Nairobi is mandated to offer solid waste management services to the residents of Nairobi. However, the council, like other local authorities in Africa lacks adequate resources to handle solid waste management in their areas of jurisdiction and therefore most residents of Nairobi are faced with serious sanitation problems. Muniafu and Otiato (2010) observed that for close to two decades services provided by the local authorities have been on the decline thus other players have come on board. These include private companies, Non-Governmental organizations, community based organizations etc

The emergence of informal settlements in urban areas in Kenya has compounded the problem of sanitation where these settlements are characterized by people living in abject poverty with,poor sewerage services, poor solid waste collection and disposal systems and poor housing among other environmental problems. Mutisya and Yarime (2011) noted that, over the years, Kibera slums have been isolated by the Nairobi City Council with no garbage collection systems, no solid waste dumping sites and no recycling plants.

## METHODOLOGY
*Study Area*
This study was carried out in Kibera area (low income) and Langata (middle income).Kibera is one of the largest slums in Africa. It has a population of about nine hundred fifty thousand people (Mutisya and Yarime, 2011). Kibera settlement is located on two Nairobi divisional administrative areas; Dagorett and Lang'ata divisions. The slums is divided into 14 villages Kianda, Olympic, Soweto West, Gatwekera, Raila, Karanja, Kisumu Ndogo, Makina, Kambi Muru, Mashimoni, Lindi, Laini Saba, Silanga and Soweto East as indicated in figure 1. Langata Estate is a middle income area in Nairobi. It is adjacent to the Kibera Slums.
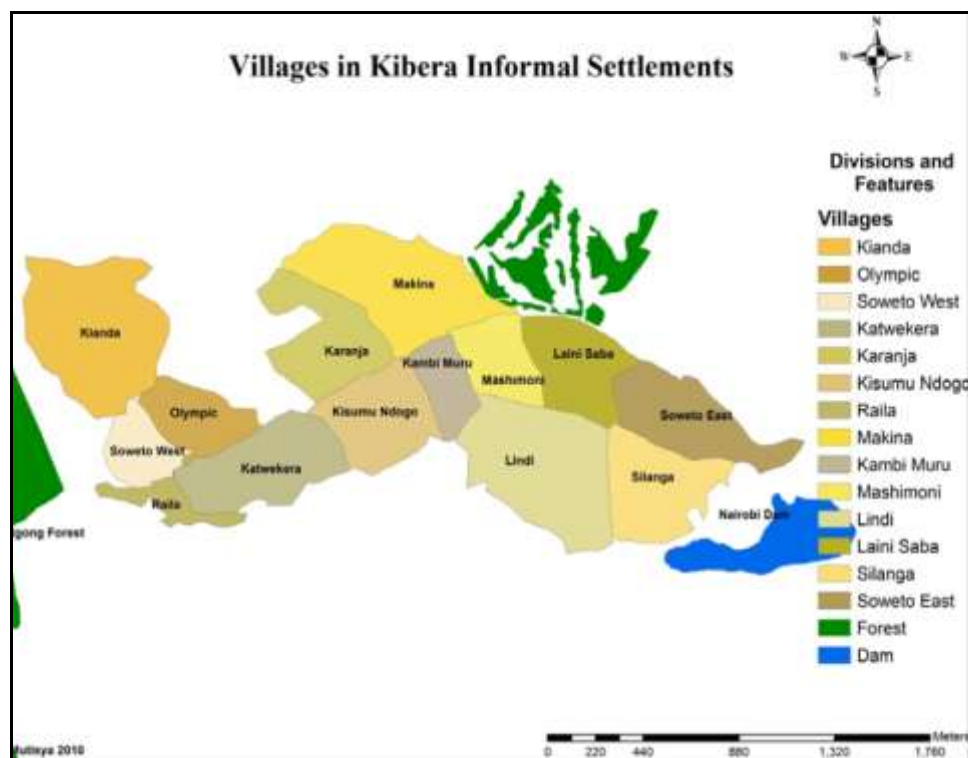


Figure 2 Villages in Kibera slums (source:Mutisya and Yarime, 2011)

## METHOD
In this study, for purpose of obtaining the composition of solid wastes, samples were obtained from four areas of Kibera area which included Kisumu Ndogo & Gatwekera, Ayani & Kiandaa, Mashimoni & Olympic and Laini Saba & Soweto. All the samples were sealed to avoid moisture

loss and transported to the laboratory for sorting and testing. For Langata area samples were obtained from a waste collection truck. The composition of the solid waste was obtained by weighing the different components of the samples. The main components considered were organic waste, rubber/plastics, paper/cardboard, metal, textiles/ fabric, glass, wood and others.

The formula for determination of moisture content of the solid waste is given by:

$$M_c = \frac{W_w - W_d}{W_w} \times 100$$

Where $M_c$: moisture content (%)
$W_w$: weight of wet sample (g)
$W_d$: weight of sample after drying in an oven for 24 hours (g)

Questionnaires were distributed randomly to individual households to obtain information about the satisfaction of the people and their willingness to pay for waste management services and also to private solid waste recycling organizations in both areas.

## RESULTS AND DISCUSSION
### Composition of solid wastes
The composition and generation rates of solid waste are important for effective management of solid waste. This information is necessary for planners and policy makers to determine the mode of disposal and also the possibility of adoption of waste management hierarchy of minimization, re-use and recycling. The analysis of the waste was carried out from the samples obtained from the two areas of Kibera and Langata estate in Nairobi.

Table 1: Comparison of solid waste for Kibera and Langata

| Category | Percentage composition | |
|---|---|---|
| | **Kibera** | **Langata** |
| Organic | 66 | 70 |
| Plastics/ Rubber | 14 | 15 |
| Glass | 1 | 1 |
| Paper | 7 | 2.5 |
| Metals | 1 | 0.5 |
| Textiles | 2 | 1 |
| Others (unclassified) | 9 | 10 |
| **Total** | **100** | **100** |

### Moisture Content and Density
From table 1, it is observed that the solid waste from the two areas have a high organic content because the areas are residential hence most of the wastes are from consumables.

Table 2 Comparison of moisture content and Density

| Item | Kibera | Langata |
|---|---|---|
| Average moisture content (%) | 26 | 19 |
| Mean Density (kg/m$^3$) | 507 | 500 |

The organic fraction comprised mainly of kitchen waste including food, rotten fruits, vegetables, leaves, crop residue, animal excreta and bones. Plastics, glass, metals and paper account for less than one fourth of the total solid waste components due to the fact that these components are often re-usable and/or recyclable and therefore rag pickers segregate and collect these components at sources, collection points and disposal sites. The low percentage of glass and

metals in Langata can be explained by the high recycling rate at the area where the house workers sell these items to middlemen to supplement their income and therefore could not be found on the trucks ferrying the wastes for disposal.

High organic content and moisture content (Table 2) reinforced by high temperatures increases the decomposition of these wastes releasing odours and attracting vermin which can create environmental disasters. This therefore necessitates the need for frequent removal or there should be alternative disposal mechanisms such as compositing which will minimize the quantity of waste to be landfilled. Studies by Sharholy, *et al.,* (2008) indicate that aerobic composting and vermin-composting are one of the leading disposal methods in India because the solid waste is composed mainly of organic components (about 40-60 percent).

**Solid waste handling in households and collection**
In many households in Kibera, solid waste is thrown haphazardly to open spaces within the vicinity of their dwellings. In some cases there are open tins which are provided for those that have subscribed to private collection services. Due to the fact that most of these wastes have high organic fractions coupled with high temperatures, there is rapid decay of the waste releasing bad odours besides attracting flies and other rodents. However, in Langata, the individual households have had their wastes stored in plastic containers (bins) which are provided by the collection company.

In Kibera, majority of the households do not have collection services with very few having their wastes collected twice in a week. In general, the amount waste generated far exceeds the volume collected. When the waste is left unattended, it emanates foul smells especially in this low income area where the waste is often mixed with human waste due to inadequate sanitation facilities. This is a serious problem in all slums in Kenya which makes the slum population in Kenya vulnerable to disease outbreaks related to sanitation and hygiene. The collection system for those in Langata is however, adequate. The wastes are collected three times in a week which is facilitated by provision of about fifty plastic bags per month per homestead.

**Solid Waste Recycling and Re-use**
In Kibera, waste Re-use at the household level is carried out through the use of plastics, glass bottles, paper and cardboards and cans for domestic purposes. These materials are disposed off only when they are no longer of any use to the owners. Outside the household level, there are small scale recyclers who collect the items. Small scale farmers collect the organic waste, sometimes paying a small fee, for use as organic fertilizers.

In the high income area of Langata, recovery of solid wastes is carried out by domestic workers who sell the materials to middlemen. Metals especially aluminium (from old *sufurias* and kettles) are recovered and sold to small scale recyclers (*Jua Kali* artisans) who use them to produce valuable items.Scavenging in solid waste is carried out prior to collection in Langata and at the disposal site for both Kibera and Langata. Solid waste pickers sort through the waste in lastic containers and from incoming trucks at dumping sites. The re-use and recycling of organic waste should be encouraged as this will ultimately reduce the quantity of solid waste to be landfilled. Composting of this organic fraction is a viable method which can be encouraged as it has been proved to be effective in other cities like in India.

**Solid waste Disposal**
Solid waste disposal by burning is common practice in Kibera due to lack of access to waste disposal facilities. In some incidents, residents dispose their wastes by throwing them in open pits. A large percentage burn their waste while few burry them. This uncontrolled dumping is a recipe for environmental disaster. Plastics and metal tins if not properly disposed can retain water and act as breeding grounds for insects such as mosquitoes. Plastics due to their non-biodegradable nature can be eaten by domestic animals leading to deteriorating health and therefore ruining the economic base of those depending on them. In Langata, a few of the

respondents burn their waste but majority transferred the responsibility of the disposal to the collection company hired by local organization called 'Langata association' which collects and dumps the solid waste at the only city council of Nairobi dumpsite in Dandora. This dumpsite is an open dump which means that it is not engineered to any sanitary and environmental conditions therefore resulting to pollution of the air, soil and water.

**The cost of Waste management**
For sustainable waste management, the company or authority responsible for waste management should charge a fee to meet the capital, operation and maintenance costs. In common cases, the collection fees are usually based on a communities' wealth, ability to pay and the quality of services desired. In low income areas of Kenya (such as Kibera), the charges for solid waste collection and disposal services were about Ksh. 1000 per month while for Langata (a high income area), it was found to be about Ksh. 650 per month.

Kibera residents were unwilling to pay for solid waste management services due to variety of problems facing them which include low incomes and therefore the priority of their needs were to meet the basic needs such as food, hence relegating other basic services such as sanitation which are supposed to be provided by the government. The government through the local authorities should explore the possibility of engaging the private sector to participate in solid waste management in the urban areas. This will encourage efficiency. The authority should offer incentives to these arrangements to make these services affordable to the poor especially in the slums. There exists a potential in formation of public private partnerships between scavenger groups and micro-enterpises and the public agencies as it has been proved in other areas such as the water sector.

**Legal and institutional framework for solid waste management**
Before the enactment of The Environmental Management Coordination Act (EMCA) of 1999, local authorities were the sole institutions mandated to deal with all issues relating to sanitation and solid waste management through the Local Government Act Cap 265. Through the EMCA (1999), considerable progress has been made in the legal and institutional set up for solid waste management in Kenya. For example the Act provides the citizens the right to clean environment. The citizens can now compel polluters to pay for the dangers posed or nuisance caused by their actions. This Act established the National Environment Management Authority (NEMA) as the principal agency dealing with environmental management with its mission being to safeguard the quality of the environment.

A major challenge is the implementation of these laws and existence of legal loopholes. It is difficult for citizens to sue organizations polluting the environment due to the cost of litigation both in terms of finances and time. Also there are no provisions to encourage re-use and recycling which has been advocated world wide as one of the principles of Solid waste management. Another major legal milestone is the constitution of Kenya (2010) which enshrines the provision of sanitation services as a basic right and therefore compels the government to provide these services to the populace. This in essence is difficult to implement due to the difficulty in compelling the government to do so because of the inadequacy of resources.

**CONCLUSIONS AND RECOMMENDATIONS**
From the results, it was found that the low income areas (Kibera) have inadequate solid waste management system while high income areas (Langata) have privately financed system. The solid waste characteristics for both areas were almost similar in terms of composition and therefore a similar management system can be adopted. The municipal solid waste management service (by the City Council of Nairobi) which is relied upon by the low class residents is no longer on the priority list of the local authority. This is partly due to inadequate resources by the local government. Generally refuse collection and disposal services receive low priority. There were no presence of City collection trucks in Kibera while in Langata, the waste collection and

disposal services were carried out by private company contracted by neighborhood organizations. Recycling is left to scavengers who generally operate in very difficult circumstances.

From the findings, the following recommendations are made;
   a) Source separation should be encouraged to facilitate recycling and re-use
   b) Adequate policy should be developed to enhance reduction and re-use and recycle of solid waste.
   c) Alternative disposal methods such as composting should be explored to determine its suitability with a view of reducing the quantity of solid wastes to be disposed in a landfill.
   d) Properly engineered sanitary landfill should be developed to minimize environmental impacts caused by disposal in open dumps like Dandora

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