



Country report

# Municipal solid waste management challenges in developing countries – Kenyan case study

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## Abstract

This paper provides an overview of the state of municipal solid waste management (MSWM) by local authorities in Kenya as a case study of a low-income developing country. Approaches of possible solutions that can be undertaken to improve municipal solid waste (MSW) services are discussed. Poor economic growth (1.1% in 1993) has resulted in an increase in the poverty level which presently stands at 56%. Migration from the rural areas to the urban areas has resulted in unplanned settlements in suburban areas accommodating about 60% of the urban population on only 5% urban land area. Political interference also hampers smooth running of local authorities. Vulnerability of pollution of surface and groundwater is high because local authorities rarely considered environmental impact in siting MSW disposal sites. Illegal dumping of MSW on the river banks or on the roadside poses environmental and economic threats on nearby properties. Poor servicing of MSW collection vehicles, poor state of infrastructure and the lack of adequate funding militate against optimization of MSW disposal service. The rural economy needs to be improved if rural-urban migration is to be managed. Involvement of stakeholders is important to achieve any meaningful and sustainable MSWM. The role of the informal sector through community-based organizations (CBOs), Non-Governmental Organizations (NGOs) and the private sector in offering solutions towards improvement of MSWM also is explored.

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## 1. Introduction

Kenya is located in the eastern part of Africa. It lies between latitudes 4°N and 4°S and between longitudes 34°E and 41°E. The country is bordered by the Indian Ocean, Somali, Ethiopia, Sudan, Uganda and Tanzania. The climate is tropical along the coast, temperate in the interior and semi-arid to arid in the eastern and northern parts of the country. The topography is characterized by a plateau which gradually rises from sea level at the coast and peaks at Mount Kenya (5199 m) in the central part of the country. The rift valley splits the country into two parts: the western area which is more agriculturally fertile and the eastern part which receives low rainfall and is mainly inhabited by shepherds.

Kenya is a developing country, with a land area of about 569,137 km<sup>2</sup> and a population of about 33.4 million. The urban population constitutes about 34% of the total population and is mainly concentrated in three major cities and two towns as shown in Table 1. There are 194 urban centers distributed across the country. Each urban center is managed by a local council made up of elected or nominated councilors and a town clerk nominated by the Ministry of Local Government to which all local authorities are answerable. The Ministry of Local Government drafts laws governing the administration of local authorities and has the power to dissolve the local authority's management and call for new mayoral elections.

Kenya is administratively divided into the following eight provinces: Nairobi area, Eastern, Northeastern, Coast, Rift Valley, Western, Central and Nyanza. Each province has a provincial administrative headquarters

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Table 1  
Urban population distribution and composition in some selected regions

City/town	Population	Population density (persons/sq. km.)	Population living in slums (%)	Absolute poverty (%)	Unemployment rates (%)	Rainfall (mm/year)
Nairobi	2,312,000	3079	57	52.24	48	800–1500
Mombasa	695,000	2896	80	38.32	45	1250–1650
Kisumu	500,734	1560	70	63.75	60	1740–1940
Nakuru	317,000	1000	65	40.58	35	950
Eldoret	167,016	855	60	35.76	30	1270–1790

that is answerable to the central government. About 80% of the land is arid to semi-arid and supports only 20% of the population, while 20% of the land is arable and supports 80% of the population. According to reports by the Ministry of Finance and Planning and the Japan International Cooperation Agency, (GOK, 2001; JICA, 2002), the rate of urbanization stands at 10% per annum compared to the country's overall population growth rate of 2.6%. This shows that there is a significant rural–urban migration rate. The composition of the urban population shows that about 60% live in suburban areas, concentrated in 5% of the total urban land area. The data in Table 2 provides the population distribution of selected areas in Nairobi (GOK, 1999). The trend is similar in most urban areas in Kenya.

The suburban areas generally are densely populated and lack good infrastructure, basic social services and amenities. The suburban population is mainly constituted by rural–urban migrants, poor unemployed persons and low-income workers who live in poor accommodation structures. Like many developing countries, Kenya has continued to experience socio-economic pressures, which have led to a decline in economic growth, from 4.8% in 1995, to 1.8% in 1998 to an estimated 1.1% for 2003 (GOK, 2002; JICA, 2002). This has had adverse effects on both rural and urban dwellers. In urban areas, the households with a prevalent lack of adequate food as a percentage of total population is

estimated at 42.58%, while those living at poverty levels (<1 US\$/day) is 9.29% (Mukui, 1994). Per capita income was as low as 239 US\$ in 2002 in Kenya, and those living at poverty level stands at 56% nationally (Waithaka et al., 2003).

Life expectancy has also been on the decline. In the 1980s, it was 57.9 and 65.9 years for males and females, respectively, while in 2002 the figures had dropped to 52.8 and 60.4. This is because of the rise in poverty and the dwindling provision of health services by the government. The rate of unemployment stands at 23% of the total population.

### 1.1. Municipal solid waste management

Municipal solid waste management (MSWM) encompasses the functions of collection, transfer, resource recovery, recycling, and treatment. The primary target of MSWM is to protect the health of the population, promote environmental quality, develop sustainability, and provide support to economic productivity. To meet these goals, sustainable solid waste management systems must be embraced fully by local authorities in collaboration with both the public and private sectors. Although in developing countries the quantity of solid waste generated in urban areas is low compared to industrialized countries, the MSWM still remains inadequate.

Table 2  
Population sizes and densities in selected areas in Nairobi (1999)

Residential area	Population	Number of households	Area (hectares)	Density (persons/hectare)
<i>High income areas</i>				
Karen	9764	3381	2730	4
Muthaiga	6786	1681	1410	5
Lavington	18,966	5815	1100	17
Loresho	15,784	5131	950	17
<i>Middle income areas</i>				
Langata	16,118	5051	4450	4
Highridge	46,642	13,019	4230	11
Parkland	11,456	3369	460	25
Kitisuru	27,459	8603	2090	13
<i>Low income areas</i>				
Kibera Silanga	16,518	6281	20	826
Korogocho Gitathuru	22,899	7415	30	763
Mukuru Nyayo	36,232	10,224	230	158
Mathare	69,003	24,525	150	460

In Kenya local authorities are charged with the responsibility of collecting and disposing of solid and liquid municipal wastes within their areas of jurisdiction. Centralized MSW management systems are used by most local authorities in Kenya. According to estimates from the World Resources Institute and USAID, many local authorities in developing countries spend over 30% of their budgets on refuse collection and disposal but can only collect at most 50–70% MSW (Matrix, 1993). Most do not meet environmentally safe MSW disposal levels because of a lack of sanitary landfills. In Kenya plans are underway to shift towards sanitary landfilling. At present, MSW is disposed in open dumps which lack of proper environmental pollution control and monitoring. An economic survey by the Ministry of Finance and Planning, 2001 showed that most local industries operate their own solid and liquid industrial waste handling services independent from the local authority. Poor disposal of MSW in Nairobi forced the Minister for Local Government on the May 29, 2003 to order the relocation of the Dandora dumpsite, the only landfill in Nairobi, to Ruai citing that it had become an eyesore, a recipe for diseases and that the large swarms of birds at the dumpsites could cause plane accidents any time ([www.nation.co.ke](http://www.nation.co.ke), March 29th, 2003).

## 2. Methodology

In this study, five local authorities (Nairobi, Mombasa, Kisumu, Nakuru and Eldoret, town) were chosen as a representative sample of the current and future urbanization trend in the country. The first four are provincial administration headquarters, while the last is the fastest growing town in Kenya.

This study was carried out in three stages:

- Stage 1:* This stage involved a desk study in which documents and records relating to municipal solid waste management in Kenya, as well as, census and economic planning, were studied to obtain background information as well as data to enable construction of a conceptual model on MSW management in Kenya.
- Stage 2:* This stage involved interviews with department heads from: Social Services and Housing, Inspectorate, Water and Sewage, Planning and Environment. Information obtained was used to update the data collected during the desk study.
- Stage 3:* A site visit was conducted to the Dandora dumpsite in Nairobi where a few people involved in scavenging were interviewed at random. Local residents and a private MSW handling company were also interviewed. The questions asked during the interviews

were tailored to derive information on: (1) MSW collection and disposal status and problems; (2) environmental fate of uncollected MSW; and (3) ways to alleviate MSWM problems.

## 3. Results

In cases where data were insufficient or not available from other local authorities studied, data from Nairobi city were used as a reference because its data and records on MSW were much more complete and available.

### 3.1. Status of MSW collection and disposal in Kenya

The growth in MSW generation has been rapid, while the capacity to collect and safely dispose of the material has been on a general decline. The information presented in Fig. 1, for Nairobi, gives a typical situation in most local authorities in Kenya over the years. The capacity to provide disposal services by Nairobi city declined due to their inability to keep all MSW collection trucks at full operational capacity. The data in Table 3, interestingly, show that in 1999, a large portion (>1/3) of the MSW collection vehicles were out of service in each of the five local authorities studied. Most of the trucks were old considering that they had been in use for more than 10 years. In Kisumu and in Mombasa, for example, a punctured tire was enough to take a collection truck out of service for weeks awaiting funds for replacement to be processed, while drivers earned their normal pay.

Uncollected MSW at the upper and middle income zones tends to increase in the rainy seasons when road conditions are worsened by rains. The situation in the low income suburban zones is worse because of inappropriate disposal of MSW. A survey of road infrastructure in the five local authorities studied showed that most of the dumpsites are not served by all-weather roads which make their access during rainy seasons difficult if not impossible. The suburban areas, which are mainly occupied by the urban poor rural migrants and the jobless, are characterized by high population densities and unplanned poor residential structures which are hardly accessible. Local authorities tend to concentrate their limited services mainly in the central business districts (CBDs) and the more affluent communities, which have better access. Local residents that were interviewed blamed the inappropriate disposal of MSW in paths, riversides, road reserves on the failure of local authorities to provide prompt collection services. From Table 2, it is evident that the local authorities were not operating at full capacity in providing collection and disposal of MSW. The collection efficiency ( $E$ ) of MSW can be

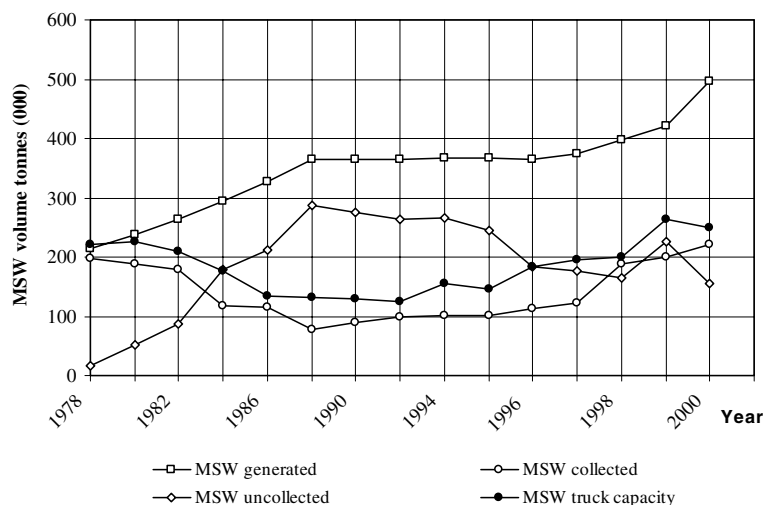


Fig. 1. Comparison of MSW generation and disposal in Nairobi.

Table 3  
Status of MSW collection trucks in the local authorities in 1999

Local authority	Total number MSW trucks	Number of breakdowns	Average age of trucks (years)	No. of trucks in demand	% Waste collection
Nairobi	66	34	12	100	30–45
Mombasa	34	14	9	50	34–50
Kisumu	28	14	12	40	28–48
Nakuru	25	10	15	40	35–58
Eldoret	28	11	15	40	36–54

obtained by comparison of maximum capacity of local authority's trucks (assuming all trucks are operational), with the actual amount of waste collected. The relationship is given by expression below

$$E = \frac{TW}{TC} (\%),$$

where  $E$  is the MSW collection efficiency,  $TW$  is total MSW collected, and  $TC$  is total capacity under normal conditions where there are no breakdowns.

A high value of  $E$  indicates that there are few MSW collection truck breakdowns and operation is at optimized capacity. If, under such conditions, the percentage of MSW collected is low, then the purchase of more trucks is needed to increase MSW collection. If, on the other hand, the value of  $E$  is low, then that is an indication that the operation is under capacity, that possibly there may be breakdowns, and that the management needs to release funds for servicing or replacement of collection trucks. A plot of the percentage of MSW collected and the efficiency of collection is shown in Fig. 2. The data in Fig. 2 show that in 1986, Nairobi city had been operating under capacity in providing MSW. In addition, the information in Table 3 indicates that more than 50% of its MSW collection trucks were out of service due to breakdowns in 1999.

### 3.2. Environmental impacts of MSW disposal

In all the five local authorities studied, it was found that little or no consideration of environmental impacts was paid in the selection of dumpsites, including those currently in use. Convenience took priority in the siting of dumpsites. An example was in Eldoret where an abandoned sand quarry at Mwenderi was used for the disposal of MSW, yet it was clear that the site was a water catchment area for small streams that drain into the Sosiani River. Inspection and monitoring of the dumpsite was not consistent, except for Nairobi which had started occasional inspection of MSW waste in 2001. No sanitary practices such as application of daily soil cover or fencing were practiced in any of the five local authorities studied. None of the dumpsites in Nairobi or the other four local authorities meet the basic requirements in protecting ground water from pollution by leachate as they have no liners.

In the poor suburban zones, indiscriminate disposal of MSW at the river sides, road reserves, and roadsides was common. Fig. 3 shows such a scenario in the Kibera slum area (Nairobi).

In Nakuru an outbreak of diarrhoea was traced to a vegetable farm which was being irrigated by surface water contaminated by MSW dumped upstream. In

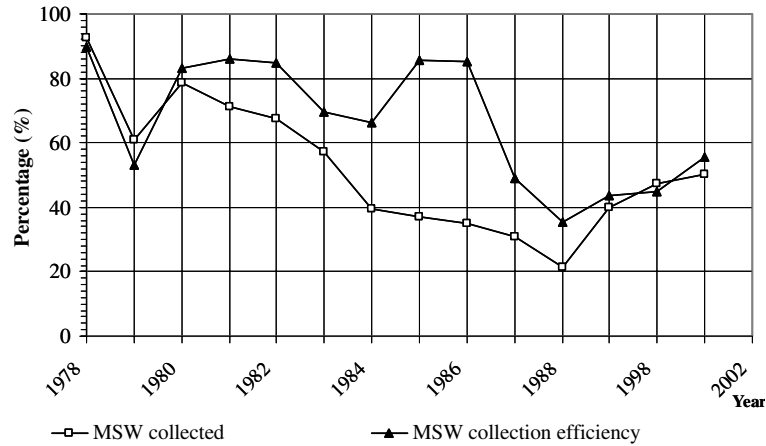


Fig. 2. Comparison of percentage of MSW collected and the efficiency of collection.

Lake Victoria, accelerated growth of water hyacinth (*Eichhornia crassipes*) is partly attributable to illegal disposal of solid and liquid municipal wastes in rivers (for example Kisat river) which drain into the lake (Ecoforum, 2001; World Bank, 1995; UNEP/ACTS, 2001; Obera and Oyier, 2002).

### 3.3. Local authorities and MSW management

A centralized solid waste management approach still is used in most local authorities in Kenya. Decisions have to await approval from the senior management in every department. This has resulted in delays in the discharge of services. Involvement of the private sector is minimal although Mombasa City has privatized all of its MSW services in the island zone. The management of local authorities is comprised of a council of elected and nominated councillors headed by a mayor and town clerk, who wields a considerable amount of power, and

is nominated by the Ministry of Local Government. The councillors chair various committees which approve funding of various departments in the local authority, while the town clerk is the chief executive responsible for the day-to-day operation of the local authority. The town clerk is answerable to the Ministry of Local Government.

Local authorities especially Mombasa, Nairobi and Kisumu are overstaffed with poorly trained workers. The local authorities often are faced with financial difficulties in meeting the large payment of wages. Hardly a year goes by without threats of strikes by workers demanding past due wages.

Most local authorities have become economically constrained in offering efficient management of MSW, and are now more willing to embrace new ideas that can improve the management of MSW. Although there is sufficient legislation covering waste management, local authorities lack the capacity to implement them.



Fig. 3. An illegal MSW dumpsite at Kibera slums in Nairobi.



Many local authorities are now more willing to seek partnership with the private sector as well as embrace decentralization of MSWM.

#### 4. Discussion

##### 4.1. MSW collection and problems facing local authorities

In this study, it was found that local authorities in Kenya are faced with a myriad of problems that have greatly constrained provision of services. In this section a look at some of the problems and possible solutions shall be discussed.

##### 4.1.1. Political interference and economic constraints

The introduction of political pluralism in Kenya has led to political jostling for power across the country which peaks at the local authorities. The councillors get elected or nominated to local authorities through their affiliated political parties and will usually pursue the interests of their parties when voting or decision making in the committee they chair.

The local authorities maintain an inflated workforce, most of whom are redundant but keep the jobs for political reasons. Planned retrenchment by local authorities of the workforce in Nairobi and in Mombasa cities had to be shelved because of political fallout pitting different political parties and the local authorities. The upgrading of Nairobi slums has not been implemented because some councillors incite their constituents to reject such a move out of an unfounded fear of voters who might be moved out once slum upgrading efforts get underway. There are instances when some councillors hinder particular projects for political reasons only.

The rapid population growth especially in urban areas has overstretched the capacity of local authorities to adequately provide services often provided in most developing countries. Most local authorities maintain inflated numbers of workers which exhausts most of the revenue in the form of wages leaving very little to cover for other services. This explains why collection and disposal of MSW is given low priority by the local authorities. Table 3 shows that the provision of MSW collection and disposal is under utilized due to a lack of capacity to keep all of the trucks running which would have increased the capacity for collection up to about 70% of the total MSW generated.

The improvement of MSW collection and disposal capacity needs a broader approach to address the improvement of local infrastructure; including the need to upgrade roads leading to dumpsites to all weather roads. Many local authorities blame breakdowns of their MSW collection trucks on the poor condition of the roads and on vandalism. Poor coordination, deci-

sion making delays in disbursement of funds causes unnecessary delays in the provision of services in most local authorities. Decentralization of services would improve efficiency and save time.

Laws governing MSW disposal, revenue collection and project implementation and management often are not enforced. This is worsened by financial mismanagement which results in a persistent lack of funds to expand and improve municipal solid waste handling capacities as well as capacity-building.

Rural–urban migration needs to be reduced by economic diversification in order to boost rural incomes, which would act as an incentive to remain in the rural areas rather than end up in slums in the urban areas. Subsidized housing projects in the slum areas need to be initiated to replace the unplanned shanties. This will enable proper planning in suburban areas and thus enhance MSW service provision. Initiatives such as the Mathare 4 slum upgrading project sponsored by the Catholic Church and which failed due to political interference should be given full government support.

##### 4.2. MSW disposal and environmental pollution

The use of open dumps for MSW in Kenya makes environmental pollution highly probable. Both surface water and groundwater remain vulnerable to MSW pollution because disposal dumps were chosen for convenience rather than based on environmental safety considerations. The extent of groundwater pollution in and around the dumpsites still is unknown because adequate pollution assessment studies have not been done conducted on the groundwater. Based on the degree of surface water pollution, it is possible to identify when pollution is taking place in the groundwater. An investigation into the extent of pollution of groundwater urgently needs to be carried out within the vicinities of the MSW dumpsites.

From Fig. 3, it can be seen that MSW and leachate from the site can easily find their way into the nearby water bodies. The Nairobi Dam, commissioned in 1953 as a reservoir of potable water supply, has been heavily contaminated by MSW washed downstream from the adjacent Kibera slums by storm water.

The state of the Nairobi Dam has greatly compromised the quality of the environment in the surrounding residential areas and poses considerable health risks even to the very people generating the waste. It was found that despite the poor quality of the dam's water, some slum residents irrigate their food crops with it downstream. Nairobi River and Nairobi Dam have been victims of MSW pollution from the slums surrounding them. Kibera slums have contributed greatly to pollution of the once potable water reservoir of Nairobi Dam (Mwangi, 2000). The mal-

odors from the dam have impacted residential properties in the vicinity. A comparison of accommodation rents between two similar residential estates, Nyayo Highrise and Komorock, shows that although Nyayo Highrise is close to downtown and has better security, its rental apartments go for two thirds the price of those in Komorock. High and middle income people shun Nyayo Highrise apartments for Komorock because of the mal odors from the Nairobi Dam which is adjacent to Nyayo Highrise.

The presence of toxic chemicals in MSW is highly probable because of a lack of strict monitoring of the MSW entering the dumpsites and the presence of many illegal dumpsites. When people scavenging at the dump sites were asked where they wash the wares they scavenged, most responded that they do it in the streams or wells. This practice can become a major source of pollution. Strict inspection of the waste received at the dumpsite should be in place to safeguard against illegal dumping of toxic chemicals and to protect the health of people scavenging for recyclable materials.

Mombasa is a gateway to Kenya from the Indian Ocean and a tourist destination in winter; tourism plays a very important role in its economy. Thus any degradation in the environment could negatively impact its fragile economy. Polluted rivers feeding into the ocean are threatening coastal recreational beaches and sites such as coral reefs (Rakodi et al., 2000). Strict supervision of solid and liquid municipal waste disposal needs to be put into place to ensure that the beaches remain clean to safeguard the tourism industry. Other sources of pollution may include shipping activities at Mombasa port and the Changamwe oil refinery; however, the impact is not significant since they operate their own liquid and solid waste treatment and disposal facilities.

Lake Nakuru, a home to 78% of the world's lesser flamingo birds, has witnessed a drastic decline in flamingo population due to pollution of the lake. The birds have been a major source of tourist attraction in Nakuru. The decline has hurt the local tourism industry as well as the ecology of the area. In Eldoret town, the operation of an open dumpsite near Mwenderi has greatly polluted the Sosiani River; this is because the dumpsite, formerly a sand quarry, has small streams draining into the Sosiani River (UNEP, 1998; Kimani, 2001).

The Ministries of Local Government, Environment and Natural Resources, and Health have to work together to ensure that sanitary disposal of MSW in the country is achieved. Nairobi is to relocate its only dumpsite to Ruai which will be developed to meet sanitary standards. Mombasa has embarked on a beautification program, aimed at making it a beautiful city. Disposal or discharge of waste into lakes, rivers and seas has been banned in Kisumu and Mombasa. Strict inspection and surveillance should be put in place for meaningful results to be achieved.

#### 4.3. Strategies towards improvement of MSWM

The problems facing developing countries in handling of municipal solid and liquid wastes are not impossible to solve but they need concerted effort from all sectors of society. MSW management is the responsibility of every resident. An all inclusive approach should be adopted in order to achieve any meaningful and lasting solution. Important areas which might bring about this are discussed below.

##### 4.3.1. Source reduction and reuse

Local authorities should undertake management reforms to bring an end to unsightly areas of uncollected or illegally dumped solid wastes. This would involve minimization of waste reaching the drop off points. The 3Rs approach – Reduce, Reuse and Recycle of wastes – is gaining acceptance. Source reduction of MSW involves measures such as: (a) product design and packaging to make them easy to reuse; (b) use of existing packaging materials as opposed to producing new ones; (c) lengthening usage life of products to minimize the frequency of replacement; and (d) developing alternatives to disposal such as composting of grass and food wastes and other compostable solid wastes from farms or markets. Reuse has worked well with packaging of drinks where reusable glass bottles and cans instead of non-reusable plastic or paper packaging are being used for bottling. This strategy, however, may need changes in industrial technology and in consumer choice and preferences, as well as taste. The Ministry of Local Government should consider offering a tax concession to industries involved in developing reusable products that will reduce solid wastes intended for disposal.

In Kenya, local artisan groups such as “Jua Kali” (private artisan groups) provide another avenue for reuse of old and disposable items. These groups work in government built shades where they purchase and resell old office equipment, household wares and used industrial wares. They are also involved in producing inexpensive farm tools such as sprays and watering cans. These products are low in cost and have a big market among the low income population. Their contribution in reducing waste, although low, is not to be ignored. As an example, in Nairobi they contribute about a 0.25% reduction of MSW reaching drop off points.

##### 4.3.2. Recycling of municipal solid wastes

With the increasing cost of raw materials, recycling provides a cheaper source of raw materials for manufacturing industries. This has given value to the otherwise worthless MSW and has encouraged a second look at it before making a decision to dispose. Sorting and separation of municipal solid waste is gaining importance in various sectors. A visit to a MSW dumpsite reveals

Table 4  
Composition of MSW disposed by three groups in Nairobi (1999)

MSW component	% Composition		
	High income	Middle income	Low income
Food	52	50	57
Paper	17.3	17	16
Textiles	2.7	3	2
Plastic	11.8	14	12
Grass/wood	6.7	8	2
Leather	0.9	1	1
Rubber	1.5	1	2
Glass	2.3	2	2
Cans	1.7	2	1
Other metals	0.9	1	0
Others	2.7	7	4

intense scavenging for recyclables in the disposed waste. Scavenging initially was driven by poverty and a desire to earn a living, but the emergence of recycling industries has given a boost to search for recyclable materials in the dumpsites. In Nairobi, a number of non-governmental organizations (NGOs) and community based organizations (CBOs) such as the Undugu Society among others have gotten involved in projects aimed at improving the livelihood of unemployed street children through mobilization towards self-employment groups (Gathuru, 1994). These groups are engaged in collecting recyclable materials such as paper, metal scraps and plastics, which are sold to generate some income. Other groups are involved in composting of organic solid wastes (food wastes), which are sold to urban farmers or landscapers. Some of these groups include the City Garbage Recyclers (CGR) – Nairobi – Kenya, Mbolea Meupe (white fertilizers). From Table 4, it can be concluded that since MSW is comprised mostly of solid food wastes (50%), strengthening groups involved in composting can reduce the amount of MSW reaching the landfills considerably.

In Kisumu one self-help group is now making mattresses from recycled polyethylene. This group and other affiliated groups have successfully engaged large numbers of unemployed poor in gainful self-employment. Such projects, which are poverty alleviating, appeal to donors and hence attract funding support; however, they are often hindered by poor infrastructure and facilities. A Dagoretti based group, which was making glue from bones and hooves disposed by a nearby Dagoretti slaughter house, had to close down due frequent lack of water and electricity. The government need to create enabling conditions for such upcoming self-help groups which will not only create employment but also make the city cleaner.

#### 4.3.3. Privatization and community involvement

Some local authorities such Nairobi, Eldoret and Mombasa have embarked on providing services through

training and hiring of qualified personnel. To improve management of MSW collection and disposal, the Ministry of Local Government has approved the involvement of the private sector through privatization of some of the services. Private MSW collection and disposal services have successfully worked in the Central Business Districts (CBDs) and in upper class residential areas in Nairobi. In Nairobi, the Kenya Refuse Handlers Limited (KRHL), Domestic Refuse Disposal Services Limited (DRDSL), and Bins (Kenya) Limited have been licensed to clean the CBD and some residential areas; the result has been improved efficiency. Private MSW handling may be an expensive venture which can only be sustained by high monthly charges (10 times those charged by the City council). For the more affluent communities this is a welcome relief. A survey of residents of Nairobi has shown that 47% of those paying US\$1.25/month or less would be prepared to pay more than US\$2.5/month for good waste management services. Similarly 50% of those paying US\$4–5/month indicated a willingness to pay up to 10 US\$/month (Esho, 1997). This shows the eagerness of the residents to have a cleaner environment. This is, however, not practical in suburban areas where incomes are too low. With privatization of MSW services in the upper to middle income areas, local authorities can then divert some of the services to the poor suburban areas communities where private services may not be affordable.

## 5. Conclusions

Developing countries, though poor, should develop area-specific solutions to their problems in the management of municipal solid waste. Consideration of the composition of MSW can help developing countries make the correct choices in importing MSW handling equipment. For example, there is no need to import compactor trucks which are suitable to less dense MSW; dense MSW which needs no compaction but just needs hauling trucks which might be cheaper. Other management issues that need to be taken into consideration include decentralization through subdivision of urban areas into small units (boroughs) in order to enhance management and service provision.

Community involvement through neighbourhood groups of people from middle and higher income groups and business individuals can provide the needed solution in mobilization of community-based efforts. Clean neighbourhood groups can mobilize financial resources and engage private groups or hire private trucks to occasionally collect and dispose MSW from their neighbourhoods. Other measures include cultivation of a sense of clean environment through clean community awareness programmes. These can go a long way in sensitising



people to keep the environment clean. Regular activities such as clean up of the neighbourhoods, schools, parks and roadsides can be effective in changing the “NIM-BY” attitudes even among the poor communities. Sponsors can be drawn from UNEP (United Nation Environmental Programme which has its headquarters in Nairobi), Ministry of Environment Conservation, Ministry of Health and private organizations. In general, the proper management of municipal solid waste is determined by the attitudes of people towards waste, such as the ability to refrain from indiscriminate dumping. Socio-economic characteristics may determine attitudes such as the ability/willingness to recycle MSW. These attitudes, however, may be positively influenced by awareness-building campaigns and educational measures. In a word, it is the desire of the people that can keep the city clean.

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