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The Management of Residential Solid Waste in Mombasa, Kenya

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The Management of Residential Solid Waste in Mombasa, Kenya

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Islam and Swahili Cultural Identity, Fall 2012

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Abstract

Residential solid waste management refers to the managing of unwanted materials discarded by households so that these materials are either properly disposed of or reprocessed to reenter the production material stream. This issue is usually the responsibility of the municipal council; however in Kenya just like many other developing countries, this critical issue is often mismanaged, causing environmental pollution and exposing residents to health risks. Through one month of full-time archival research and field work, this study presents the current state of residential solid waste management in Mombasa, examines the roles played by various stakeholders involved in this area through personal interviews, and concludes by doing an in-depth case study of Old Town so as to develop a framework and suggestions for possible future improvements.

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A Note Regarding Names:

In this report, the names of people, places and businesses remain unchanged. However, in order to maintain informant privacy, only their first names would be cited. Details about relevant informants' places of employment are provided as an annotation to the first citation bearing their name in the Bibliography. For instances whereby sensitive information has been revealed and the author feels that the safety or job security of the informant might be threatened, his or her name would not be mentioned. Instead, “Informant” would be cited as the participant's name followed by an identifying number. The same would be applied to instances when the informant's name was unknown.

Publication Notes:

The unit of currency in Kenya is the Kenyan Shilling; at the time of this writing, the exchange rate was approximately 85 Kenya Shillings to 1 US dollar.

The unit of weight measurement in Kenya is kilogram (kg). 1 kilogram is equivalent to 2.205 pounds (lbs).

1. Introduction

Garbage, taka, sampah, laji – whatever people call it, solid waste is ever present in our daily lives. As such, the issue of solid waste management (SWM) has always been part of the conversation in all societies. The fundamental target of SWM is to protect the health of the population, promote environmental quality, preserve natural resources and maintain the platform for sustainable development. Unfortunately, this essential service is severely lacking in many developing countries with waste collection rates often lower than 70 percent and with the collected waste often disposed off through uncontrolled landfilling.¹ These are due to a combination of factors which include the lack of financial resources, apathy of municipal authorities, improper selection of technology for collection and disposal systems, as well as the lack of public awareness and participation.

Today, the issue of SWM has become ever more pressing as waste generation continues to increase with population expansion and industrialization. This is even more so in cities due to rapid urbanization which means that the infrastructure available is increasingly incapable of dealing with the amount of waste generated. As a result, many residents end up either dumping their garbage on public land, river and drains, or simply burning them. On top of that, the changing nature of consumer goods creates a new complication as new synthetic materials which were historically uncommon in nature's life cycles are now more prevalent in the waste stream. New methods of management are thus needed for these materials which are potentially hazardous when released into the environment.

While a number of SWM projects have been carried out in developing countries, many have failed to support themselves or to expand further when external agencies discontinue their support.² This could be attributed to the lack of understanding of the local conditions influencing the selection of appropriate SWM systems such as the local authorities' resource capacity and the nature of the solid waste generated. As such, this paper seeks to understand the residential solid waste management situation in Mombasa, Kenya. Residential solid waste refers to the materials discarded by households for which the municipal councils are usually responsible for collecting, transporting and disposing of.

The Mombasa district totals an area of 282km², with the town situated on an island totaling some

1 Prasad Modak and Shanghai Manual. "A Guide for Sustainable Development in the 21st Century: Chapter 5: Municipal
2 Ogawa, H. 1996. "Sustainable Solid Waste Management in Developing Countries Paper" presented at the 7th ISWA International Congress and Exhibition, Parallel Session 7, "International Perspective".

13km².³ It is situated in the Coast Province of Kenya with Kilifi district to the north, Kwale district to the south and west and the Indian Ocean to the east (see Appendix A). The Mombasa city is the second largest city in the country. It has a prominent port, and is an important regional tourism center and economic hub. Climatically, Mombasa has a warm-humid, hot tropical weather throughout the year. At this moment, it has an estimated population of over a million people with an annual population growth rate of 4% p.a.⁴ In Mombasa, the Old Town Conservation Area is further selected for a more in-depth study of house-to-house collection services and waste composition. The area has about 700 houses with a population of about 30,000.⁵

2. Statement of Problems

It is estimated that Mombasa generates approximately 700-800 tones of solid waste per day.⁶ Currently, collection of solid waste is approximately 68% of the generated waste.⁷ This means that the other 32% ends up being burnt or thrown on the streets, in the drains, at the sea shores and in open grounds. This is a growing concern due to the rising population, and having the gateway of Kenya's tourism industry drown under mountains of trash is definitely not economically sound. On top of that, mismanagement of solid waste, such as the burning of plastic that produces toxic fumes, can also be detrimental to the health of the environment and the population. Therefore, the municipal council has come under immense pressure to deal with this issue efficiently to the extent that in January 2012, Deputy Prime Minister Musalia Mudavadi had to publicly defend the Mombasa city council and pledge that efforts are being made to improve on the current state of SWM.⁸

As any talk about change and improvement has to start with understanding the current condition, the author wished to provide an overview of the existing methods of residential SWM in Mombasa, as well as an understanding of the stakeholders involved and the challenges they face. An attempt is also made to understand the characteristic of residential waste produced.

3 Mombasa District Development Plan 1997-2001.

4 <http://www.scribd.com/doc/8402509/MOMBASA-MUNICIPAL-COUNCIL-An-attachment-report#page=15>

5 Kalanda Khan. Personal interview. 12 Nov. 2012.

6 Rina Muasya. Mombasa Integrated SWM project report. 2010.

7 Ibid.

8 Brian Otieno. "DPM defends Mombasa and city council over garbage." The Star online. 16 Jan. 2012.

3. Objective

To understand the current state of residential solid waste management in Mombasa district.

4. Specific Objectives

This study seeks to:

- Understand the current methods employed by the municipal council in managing residential solid waste
- Understand the other non-governmental stakeholders of residential solid waste management and the challenges they face
- Understand the characteristic of the residential solid waste generated
- Analyze future directions for residential solid waste management in Mombasa given the cultural context surrounding it

5. Research Methodology

The following procedures were employed to obtain the wide range of data needed to achieve the specific objectives of this study:

Residential solid waste sampling

To understand the quantities and characteristics of residential solid waste produced, 18 households in Old Town Conservation Area were identified to participate in a sampling study. The households were selected by a snowball method where a few households were first selected before being asked to recommend more participants. It was also ensured that the households were well scattered throughout

the area, with an equal number of households coming from each of the four divisions (see Appendix B). This area was selected for this study due to its accessibility to the author as well its population demography that is a rather accurate representation of the average population in Mombasa.⁹ Solid waste from each household was collected on a daily basis from 8.30-10am for a week. After collection, they were separated into three major components – organic, non-organic non-recyclables, and recyclables, and weighed. A research assistant, Richard, was employed in the collection and separation process though the author was involved in the whole process for the first two days to train Richard and ensure that the study ran smoothly. Richard, a local scavenger who searches for recyclables at the Mackinon market collection site for a living, was selected due to his expertise and knowledge in the market for recyclables in Mombasa.

Interviews

To understand the different aspects of residential solid waste management in Mombasa, interviews were conducted with the various stakeholders identified. This is to obtain a holistic perspective on the issue, as well as to supplement the information obtained from structured questionnaires. Open-ended interviews also revealed the perceptions of the various parties of the current situation and the various challenges that they face. The targeted stake holders were divided into the following categories:

Category	No. of respondents
CBOs and organizations involved in waste management activities namely Kenya Environmental Trust, Mombasa Integrated Solid Waste Management (MISWM) project, Kisauni Polytechnic and Mombasa Old Town Conservation Office	4
Street waste pickers and scavengers	3
Municipal council staff i.e. drivers, supervisors and refuse collectors	3

⁹ Kalanda Khan. Personal interview. 12 Nov. 2012

Category	No. of respondents
Municipal council management staff	1
Mombasa residents	10

Standard Questionnaires

To understand the current practices of solid waste management on the household level, questionnaires with both open-ended and structured questions were utilized. All the questionnaires were administered to households by the author to ensure an accurate understanding of the questions by the respondents. A total of 28 households were surveyed. (See Appendix C for a copy of the questionnaire)

Observation and photography

To understand the SWM practices and operations in the municipality, observations and photography were used. Walk-through was done in different parts of Mombasa. The author also spent many hours at various collection sites to observe the activities surrounding the residential solid waste. On top of that, a day of participation observation was done by going around with a municipal truck for its daily operation that included visits to the various collection sites and dump sites in Mombasa district. The recording of the daily life related to SWM was a good way of cross-checking the information provided by interviewees and survey respondents. In addition, the living condition and occupational hazards of the different actors involved in SWM, as well as the environmental issues surrounding waste management could be better understood.

Secondary Sources of Data

A critical review of relevant literature by various researchers and organizations provided the

important background about the issue of solid waste management.

This research involved many interactions with human subjects. All subjects involved in the different components of this study were advised prior to their participation regarding the purpose of this research, and were reminded that their participation is voluntary and they may discontinue their participation at any point in time during the study. The interviews and surveys were also conducted in locations chosen by the subjects, at times most convenient to them. Finally, subjects were notified that they need not answer any questions that make them feel uncomfortable, and that the researcher was available before, during, and after the interaction by phone, email and in person to answer any further questions that the subjects may have had.

6. Study Limitations

There are a few limitations to this study. Firstly, the lack of time and resources means that studies like the waste composition sampling and residential survey were not able to be conducted throughout Mombasa. As such, they were performed only in the Old Town Conservation Area in hope of at least providing a slice of the whole picture. Secondly, some of the key informants particularly the Mombasa Municipal Council management were particularly hard to reach, thus secondary resources had to be used to obtain the information instead. Finally, the lack of official and updated record at the various personnel involved in residential SWM within Mombasa was also a major challenge.

7. Literature Review

A few relevant literatures were reviewed in this study so as to capture the wide range of information and perspectives related to SWM in Mombasa. In *Baseline Survey and Marketing Assessment on Community Waste Based Enterprises in Mombasa Municipality* completed in 2009 by ESF Apex Strategies LTD for the project implementation committee of Mombasa Integrated Solid Waste Management Project, the authors outlined the current waste management situation in Mombasa and examined the potential for community waste enterprises in SWM. The report started with a very brief outline of the current methods of SWM practiced by the municipal council. Various problems such as the lack of waste transportation facilities, the poor road conditions leading to the dumpsite and the proliferation of illegal dumping points at road sides and public open spaces were then identified. Next, the socio-economic status and the activities of various community-based organizations (CBOs) involved in SWM in Mombasa were delineated. Many of the CBOs are involved in waste recovery activities that include recovering materials like metals, aluminum, heavy plastic, light plastics, coconut shells, glass, polythene bags and bones. A majority of the CBOs earn between 1000-3000 Ksh per month. On top of that, 70% of the CBOs surveyed are involved in door-to-door household waste collection. Recyclable components are recovered from the collected waste while the remaining wastes are transported by handcarts to a collection point designated by the municipal council. A small fee is decided between the households and the CBO members. It was reported that at the moment, the council has partnered with 49 CBOs who obtained their registration certificate as a self-help group from the Department of Social Services (DoSS).

The report then went into the details of the potential of the development of CBOs' involvement in SWM. 70% of the CBOs manage to collect between 0.1-2 tonnes of waste per week, with most of the collections happening twice a week. Since Mombasa produce around 700-800 tonnes of waste per day and the municipal council only manage to collect 68% of that even with the help of private trucks, it is recognized that there is a huge market that the CBOs can tap in. The report mentioned that 60% of the groups only needed between 1000-5000 Ksh as their starting capital, and can then generate a savings level between 1000-5000 Ksh per month after subtracting their operating cost. Thus it is perceived that this is a very viable business plan.

This report is an excellent resource especially for its very detailed information about one of the growing actors in SWM in Mombasa – the CBOs. The quantitative data available also allows for an

easy calculation of the resources necessary and the economic potential of developing this sector of SWM in an effort to improve on the current practices. However, the authors did not give much detailed description regarding the current methods of SWM practiced by the municipal council. While many criticisms were leveled against the municipal council, not much effort was spent on explaining the current practices to start with. On top of that, some of the information regarding the current practices was not especially accurate. For example, it was mentioned that Mwakirunge is the only dumpsite in Mombasa when the municipal trucks still mainly goes to Kibarani dumpsite, with the Mwakirunge dumpsite being used by private collection companies. This reflects the lack of accurate research regarding the issue of SWM from the municipal council's perspective, probably due to the inherent bias of this report as its main objective was to justify the development of CBOs into a major actor in SWM in Mombasa. Finally, the report also did not address the perception and perspective of the users regarding the current services by the municipal council and the CBOs.

Citizens' report card on urban water, sanitation, and solid waste services in Kenya by city-level lead agencies including Ilishe Trust in Mombasa is a comprehensive report published in 2007 regarding the current satisfaction level and accessibility of Kenyan residents in Nairobi, Kisumu and Mombasa to water, sanitation, and solid waste services. An important objective was also to investigate the differences in access and satisfaction of services by poor and non-poor households. The survey consisted of 2,905 household interviews in three cities (Nairobi 1,378, Kisumu 719 and Mombasa 808) with the households being randomly selected by the Central Bureau of Statistics. Specific to the issue of solid waste services in Mombasa, it was reported that only 9% of households surveyed receive doorstep collection services from the municipal council, while 4% have council rubbish bins or official dumping sites within the area. Another 32% of the households surveyed have access to private collection companies. The rest are resorting to other personal methods, with 44% throwing their rubbish in open areas and drains, 33% burning their trash, and 5% burying their trash. Consequently, only 9% of the interviewed households were found to be satisfied with the municipal service.

The difference in accessibility to collection services between the poor and the non-poor is also reported to be vast. Only 1% of the poor households surveyed in Mombasa were found to have access to council collection services. Also, only 25% of the poor uses private collection services compared to 59% among the non-poor, suggesting that the cost might be an issue. The average amount paid per month for private services was found to be Ksh 230 in Mombasa.

While the interviews conducted were rather comprehensive and the report provides an excellent overview of the public perception of the current services, it would have been helpful to understand if the lack of accessibility to collection services differs for different neighborhoods, or if it boils down to individual households. This would show if the availability of the services is dependent on the ability of individuals to pay, or if the service just has not reached particular neighborhoods, with a bias against the poorer neighborhoods.

The academic paper *Municipal Solid Waste Management Challenges in Developing Countries – Kenya Case Study* by Rotich K. Henry, Zhao Yongsheng and Dong Jun in 2005 examined the current status of SWM by the municipal councils of major cities in Kenya. Based on records from 1999, it was reported that in Mombasa, 50 trucks were in demand for collection services even though the municipal council only have 34 trucks, with 14 of them being out of service. Due to the lack of sufficient resources, the council in turn focused their limited services in the central business districts (CBDs) and the more affluent communities which have better road access. The council was also reported to be highly inefficient, as a punctured tire was enough to take a collection truck out of service for weeks awaiting funds for replacement to be processed, while drivers lay idle earning their normal pay. The council was also overstaffed with poorly trained workers, creating financial difficulties in meeting the large payment of wages.

The paper further discussed how the infrastructure supporting SWM in Mombasa is very poor. For instance, the roads to dumpsites are not all-weather roads, making them highly inaccessible during rainy seasons. The same applies to roads in low income suburban areas. The use of open dumps instead of sanitary landfills in turns increases the probability of environmental pollution, especially that of surface water and groundwater. With all these myriad of problems, the council had made attempts to privatize the SWM services in hope of improving the situation through free market forces.

The paper definitely gives a comprehensive description of the framework of the municipal council's management of solid waste and the problems entrenched within the system. The only issue is that the data used is rather outdated being all from 1999, more than 13 years ago.

Finally, the *Mapping of Solid Waste Pickers and Organizations Supporting Waste Pickers in Kenya* report by David Kuria and Rina Muasya from Ecotact Limited in 2010 identified the support and efforts in organizing the stakeholders of SWM, especially that of waste pickers. The report

identified the Mombasa Integrated solid waste management project (MISWMP) as the current main project that included a Project Implementation Committee (PIC), Mombasa Integrated Environmental management organization (MIEMO) and Mombasa Integrated Environmental Organization Sacco (MIEMO Sacco) with the PIC members comprising of 8 CBOs representatives and 5 stakeholders, namely the National Management Environmental Authority (NEMA), Kenya Port Authority (KPA), Municipal Council, District Development Officer and Tourism Board. This showed that there is a current attempt by the local authorities in incorporating the different local organizations in their project to improve the current SWM condition. It was reported that 43 solid waste picker organizations from all four divisions of Mombasa were included in this project. The funding for this project came from the Ministry of Youth and Sports and Community Development Trust Fund (CDTF). The strength of this study is its discussion of the latest effort of collaboration between various stakeholders to come up with a comprehensive method of SWM in Mombasa.

Articles, reports and academic papers, including those reviewed above provided the foundation for this research. While this study cannot possibly compare in scope to the research already available in the literature, it attempts to offer both breadth and depth in the understanding of the current issues related to SWM in Mombasa. On top of that, it aims to give a more thorough anthropological consideration to the reasons behind the various problems of SWM so as to supplement the sea of quantitative data available regarding the topic of residential solid waste management in Mombasa.

8. Result and Analysis

The paper will first describe and analyze the current residential SWM system practiced in Mombasa, followed by the roles of various stakeholders involved, namely the municipal council, community-based organizations and independent waste pickers, before concluding with a case study of Old Town.

8.1. SWM system

This chapter will describe the various methods of storage, collection, transportation and disposal of residential solid waste observed in Mombasa during the research period with an analysis of the issues regarding these practices.

8.1.1. Storage

The main function of storage facilities is to keep the solid waste generated in a relatively hygienic condition until the arrival of collection services. A good storage facility would prevent attraction of pests and disease vectors like mosquitoes and rats, as well as keep the leachate¹⁰ produced from the rotting of organic waste contained. The type of storage facility used would depend upon the volume of solid waste generated and the frequency of collection services. The three main types of storage facilities for residential solid waste observed in Mombasa were dustbins, bulk containers and bags.

a. Dustbins

In many high and medium income households, it was observed that plastic dustbins are used. They are usually strategically placed in certain areas of the house – mainly the kitchen, which is observed to be the main source of waste as the bins are usually filled and every household has a storage facility there. Other areas such as the main sleeping rooms and living rooms were also seen to have bins

¹⁰ A solution containing contaminants that is a product of leaching, something commonly found in landfills

around. Often times, a plastic bag would be used to cover the dustbin such that the waste would be easily removable when the collection services arrive. The households would then just remove the trash with the plastic bag and hand them over to the garbage collector. A new plastic bag would then be replaced onto the bin. The bins used by the households' are their personal choices as the municipal council is not known for distributing any official containers.



Figure 1: Sample of different bins seen in Mombasa

b. Bulk containers

These are large communal storage facilities strategically placed in areas like Old Port, a site along Moi Avenue and a site near Kisauni Polytechnic. There are usually two containers available per site. The placement of these containers is dependent upon the availability of an open space and the population around the area.¹¹ The containers are scattered throughout Mombasa such that each residential area has a bulk container relatively nearby for which they can store their solid waste before collection. During collection, the containers are mechanically lifted onto a special tractor and then transported to a main collection site where they would be mechanically emptied. The process of lifting or emptying only takes about 3-5 minutes.

¹¹ Mohamed Bilafif. Personal interview. 21 Nov. 2012.

The use of these bulk containers has been reducing through the years.¹² For instance, before 2006, there used to be bulk containers at the site. However, today, the collection point is just an open dumping area just like many other main collection points observed.¹³ When James, a municipal council supervisor, was asked about this particular situation, he explained that the tractors necessary to lift and transport these containers have been wearing down throughout the years and have not been replaced. As a result, the container cannot be used as frequently and widely.

The use of these bulk containers helps in containing the waste and minimizing the contact between the waste and the surrounding. At the same time, the process of removing the waste is also more efficient and less likely to flick up pollutants and dust into the air, causing environmental pollution. The tidiness of the area is also maintained. However, in most cases these bulk containers are placed in open areas, which mean that animals like crows, rats and dogs are often seen going through the trash and in turn spilling it around the area. Therefore, bulk containers placed in a closed complex may be the best method for a collection point. Nevertheless, the presence of collection points is a reflection that door-to-door collection services are not prevalent and the transportation of collected trash for disposal is not frequent enough, thus waste has to be temporarily stored at another location prior to arriving at the final disposal location.



Figure 2: Bulk containers at Old Port, Old Town

¹² Richard. Personal Interview. 31 Nov. 2012.

¹³ Peter. Personal Interview. 31 Nov. 2012

c. Bags

Informal plastic bags and guni bags are the most common storage facilities observed in Mombasa. Most households keep their solid waste there as these bags are widely available. The plastic/polythene bags are usually obtained when households buy goods from the market or shopping malls. They are not very durable and break easily however as they are free and easily obtainable, they are widely used. The bags would simply be given to the garbage collector when they come. While these bags are highly convenient, they are a form of waste themselves as they are non-recyclable and inorganic.

Guni bags on the other hand are more durable. They are also larger in size so they can store a larger amount of waste. They are usually bought or obtained when households buy things such as charcoal in bulk. Due to their durability and size, they are usually used to store larger amount of trash, especially wet, organic trash as the leachate would be better contained. During the collection, garbage collectors are usually requested to return these bags as they are more valued and then to be reused over and over again. This can be considered equivalent to the developed countries' environmentally friendly reusable bags that are recommended to replace plastic bags.



Figure 3: Sample of plastic bags and guni bag seen in Mombasa

8.1.2. Collection

The collection process involves the transfer of the waste from the storage facilities to the vehicle for transportation to disposal. A good collection system would be one that minimizes the contact of the waste with people to prevent the spreading of pollutants. In addition, it should be convenient and frequent such that solid waste are not kept at the households for too long a period to allow the attraction of pests and disease vectors and the generation of leachate. The three main types of collection system

observed in Mombasa are communal collection, door-to-door collection and “no collection”.

a. Communal collection

For this method, the residents are charged with dumping their waste at a predetermined site, where there is usually bulk containers or an open land designated by the municipal council for garbage collection purposes. It was observed that many of these areas are selected to be beside a main market such as the Mackinon market and the Makupa market. This could be due to the high density of trash generated in those areas. This collection system makes the job easier for the municipal council as the trucks only need to visit these sites to collect all the trash from that area at once. Municipal collection happens every day in the morning, or even twice a day for main collection points that generate huge volume of trash such as at Mackinon market and the Kidongo site.¹⁴ For other places, they would only collect once a week or once every two weeks depending on when the site is considered full.¹⁵

This method however has a few major issues. Firstly, the decision to have collection points near major markets where most people buy their food is questionable as it maximizes the population of residents being exposed to health risks. This is especially so when there are no containers available and the waste are allowed to spill over onto the road. For instance, in Makupa market, it was observed that the wastes were only 2-3 meters away from the roadside stalls that sell vegetables. Secondly, all the bulk container tractors bring the trash to these major collection points where open dumping is practiced, before their trucks come and collect the waste.¹⁶ This is because these tractors are not able to reach the dumpsite as the roads are bad and the vehicles do not have sufficient power.¹⁷ This is highly inefficient and also unfair to the residents near these collection points as they have to bear with the bad odor and health risks. Also, leaving trash for up to two weeks in open site at residential area causes environmental pollution as the leachate generated from organic waste would easily flow onto the roads and drains nearby. Finally, this method puts the responsibility of transporting individual household waste to the collection points on the households themselves.

¹⁴ James. Personal Interview. 29 Nov. 2012.

¹⁵ Ibid.

¹⁶ Arusi. Personal Interview. 29 Nov. 2012

¹⁷ Ibid.



Figure 4: Collection point at Makupa market, Majengo

b. Door-to-door

With this method, the garbage collectors walk around the neighborhood with a drum or a cart collecting trash from each household. There are others who also simply carry the trash in the plastic bags provided by the households. After the collection, the trash would be brought to the nearest collection point. On top of the municipal council workers, certain CBOs and informal garbage collectors also provide such services. The rental of one cart costs around Ksh 100 per day.¹⁸

This method makes it more convenient for households to dispose of their waste. However, the garbage collectors have to deal with a rather poor working condition with certain health risks. Most of these collectors, including those working for the municipal council, were observed to not be wearing any protective gears like gloves and masks.



Figure 5: Drum and cart used for door-to-door collection

¹⁸ Richard. Personal interview. 31 Nov. 2012.

c. No collection

There are certain residential areas that are neglected and do not receive any collection services from the municipal council. Some residents would then acquire private services, while others who are not able to afford it have to turn to personal means of managing their waste. Often times, illegal dumping sites would arise where the villagers accumulate their waste at a particular spot before setting them on fire after a few days. This situation is observed for many areas outside of the central business district (CBD). (See Appendix D for the pictures of various illegal dumping sites found around Mombasa.)

8.1.3. Transportation

This process involves the transportation of waste from the collection sites to the place of final disposal. Usually, this is done either by the municipal council or private companies employed by the council. The modes of transportation usually depends on the volume of waste generated; capital, operation and maintenance cost of the vehicles; the condition of the roads; and the loading and unloading efficiencies of the vehicles. During the period of study, the two main types of vehicles used are bulk container trailers and trucks.

a. Bulk container trailers

These vehicles are specifically designed for transporting the bulk containers. They are usually smaller and more fuel efficient than the trucks. However, these vehicles are not able to go to the Kibarani dumpsite due to their weaker tires and engines.¹⁹ They would have toppled on their way to the dumpsite²⁰ due to the poor road conditions.²¹ As a result, these trailers would simply transport the bulk containers and empty them at major collection points.

¹⁹ Peter. Personal Interview. 29 Nov. 2012.

²⁰ As Mombasa practices open dumping, dumpsite thus refer to the designated site for dumping the all the collected waste.

²¹ Ibid.



Figure 6: Bulk container trailer

b. Dump trucks

These are the main forms of transportation from the collection sites to the dumpsite in Mombasa. The dump trucks are either from the municipal council or a private company like Keen Kleeners. The municipal council's protocol is such that each truck will have a driver and a helper. During the transportation process, a front loader will be at the collection point to scoop the trash onto the back of the dump truck. The scooping process was observed to be rather inaccurate as sometimes the trash would spill over from the other side of the truck. Also, the whole process often flicks up light waste materials into the air, spreading unpleasant smell and pollutants. After the truck is filled up, the helper would climb onto the back of the truck to lay a thin net over the top of the trash to prevent the dust from spreading. Most municipal dump trucks were observed to follow this protocol within the CBD, but some were observed to skip this step when outside the town center. At the dumpsite, the emptying of the truck can be performed mechanically.

It was observed that none of the workers wear protective gears like gloves and masks. They are thus constantly inhaling and coming into contact with solid waste, especially those helpers who have to climb onto the back of the truck to spread the waste and lay over the net. According to interviews²², none of these workers received any prior training before the job.

²² James, Peter and Arusi. Personal Interview. 29 Nov. 2012



Figure 7: Municipal and private waste collection trucks

8.1.4. Waste disposal

Open dumping is the only method of waste disposal practiced by the municipal council in Mombasa. There are currently two dumpsites - Kibarani and Mwakirunge. They are basically two pieces of vast open land designated for the disposal of waste. The Kibarani dumpsite has been used since independence while the Mwakirunge dumpsite was started in 2002.²³ At this moment, all the municipal trucks still empty their trash in Kibarani,²⁴ even though officially, the dumpsite has been relocated to Mwakirunge in 2002.²⁵ The Kibarani dumpsite was supposedly relocated due to the health hazards it posed and its unsightliness due to its location right next to the Makupa causeway and Nairobi-Mombasa railway. However, Kibarani is still heavily used by the council as it is only 5-10 minutes drive from the city center, making it highly convenient for the disposal of trash collected from the CBD.

The Mwakirunge dumpsite however, is about 15km from the city center. It is currently being used by private trucks, and the municipal council charges them a tipping fee of Ksh 2500 per trip.²⁶ When asked about the permanent relocation from Kibarani to Mwakirunge, all three municipal workers interviewed complained about the plan due to the distance and poorer road conditions. According to Arusi, one of the truck drivers, he will only be able to make three trips a day if they go to Mwakirunge, as opposed to the current 6 trips to Kibarani per day, as a one way trip to Mwakirunge from the city

²³ Standard Media. "Like a phoenix, Kibarani rises from trashes." 13 May 2010.

²⁴ Mohamed Bilafif. Personal Interview. 21 Nov. 2012.

²⁵ Standard Media. "Like a phoenix, Kibarani rises from trashes." 13 May 2010.

²⁶ Mohamed Bilafif. Personal Interview. 21 Nov. 2012.

center takes about 45 minutes to an hour. When probed about a possible solution to the additional waste that will not be disposed of, all the workers pointed out that V.O.K in Kisauni would have to become a main collection point where the additional waste will be transported to. And as V.O.K. is filled up, then the dump trucks would transport the trash to Mwakirunge.

According to informants of Kisauni Polytechnic Environmental group, there have been various complaints filed about the V.O.K. site. They said that the municipal council has always denied that they are turning V.O.K. into a dumpsite, and that it is only a collection point. A visit there showed that there really is not much difference between V.O.K. and Kibarani except that of size. After many complaints to the municipal, a few years back, a huge, long billboard was put in place to block the view of the V.O.K. site from the road even though the real state of the site has not changed.

The municipal council practice open dumping at all three sites. There is no sanitary landfilling or any effort in preventing environmental pollution. According to a report by Daily Nation in 2009²⁷, during the relocation plan from Kibarani to Mwakirunge, the people living in Mwakirunge were promised tarmac roads, a recycling plant, improved schools and health centers and a sanitary landfill instead of just open dumping. However, up to date, none of these promises were fulfilled and the Mwakirunge dumpsite is posing all the problems that were associated with Kibarani. It was reported that the government received Ksh 800 million from the French government for SWM in Mwakirunge,²⁸ but the original plan for the building of a sanitary landfill has been suspended.²⁹

During a meeting organized by ActionAid for the communities living around Mwakirunge,³⁰ it was clear from the reaction of the community members that no one was accepting of the dumpsite. The issues raised during the meeting were:

1. Bad smell.
2. Vehicles transporting the trash not properly covered.
3. Waste being disposed there without proper order and management.
4. Cattles getting affected having eaten the waste from grazing at the site.
5. Increased dropout rates as kids were attracted to the dumpsite to search for toys, recyclables and

²⁷ Mazera Ndurya. "Dumpsite puts damper on village." 5 Dec. 2009.

²⁸ Ibid.

²⁹ Mohamed Bilafif. Personal Interview. 21 Nov. 2012.

³⁰ Meeting on 27th Nov. 2012 at Boabab hotel, with an attendance of about 100 people including the author.

food.

6. Scavengers setting the trash on fire which sometimes burn kids and other people trapped in the site while scavenging.

At the Kibarani dumpsite, the situation was observed to be largely similar to that of Mwakirunge. Nevertheless, there are two bulldozers operating at the site moving the trash around and compacting them. However, the waste is not covered with fresh layer of soil as per the standard sanitary landfill. The dumpsite is not gated and there are scavengers, estimated at the upwards of 100 people scavenging at the site with many having set up houses there. They work on separating the recyclables and selling them for a living. Many times, they were also observed to be getting food from the dumpsite as well, presumably for personal consumption.

The Kibarani dumpsite is located right at the edge of the sea thus surface water and ground water pollution is almost a certainty. The dumpsite and the road leading to it often get flooded during the rainy season.³¹ The leachate from the dumpsite would have easily been carried into the sea then. It is clear that there are no efforts in dealing with pest control, dust control or methane gas control. This is why the site has been regarded as an environmental hazard by nearby residents. While the Kibarani dumpsite has been scheduled to be relocated due to many years of complaints, the approach is only shifting the problem to a new spot, as the practices are the same in Mwakirunge.

*See Appendix D for pictures taken at Kibarani dumpsite.

8.2. Roles and problems faced by various stakeholders

8.2.1. Municipal council

The municipal council is in-charge of the collection and disposal of solid waste in Mombasa. Information about the role of the council was obtained through an interview with Mr. Bilafif, the head of environmental department of the municipal council, the department designated with providing solid waste management for the municipality. He estimated that currently the department has around 550 employees, about 300 of which are workers on the ground, including supervisors, truck drivers and

³¹ Peter. Personal Interview. 29 Nov. 2012.

helpers. These workers are paid on average about Ksh 20,000 per month, and they did not receive any prior training for the job nor do they wear any protective gears.

One of the issues faced by the council today is the lack of manpower and equipment. “15 years ago, we had around 1800 employees, but the government has not done any recruitment for the past ten years and we have lost many employees through retirement, death and designation with no replacement,” said Mr. Bilafif. At the same time, he informed that 15 years ago, the department had around 25 trucks to manage the waste generated by 500 thousand people in Mombasa. Today, they have only around 20 trucks when in reality they need 50 trucks as the population in Mombasa is now the upwards of 1.2 million. “We have a lack of funds as we mainly get our budget from land rates, permits and municipal tax. We do not charge specifically for our garbage collection services,” said Mr. Bilafif. He estimated that the council has a budget of around 2 billion Ksh per year, most of which goes to employee salaries.

Due to the council's inability to fully manage the issue of waste management, they have welcomed the services of private companies. For example, Keen Kleeners has 10 trucks servicing different areas in Mombasa.³² These private collection companies have to first apply for a permit that costs them Ksh 17,000 per year. After which they can arrange for the payment fee with the neighborhoods and hotels themselves. All the private companies' trucks empty the waste collected in the Mwakirunge dumpsite, and they have to pay a fee of Ksh 2,500 per tipping.³³

Mombasa is divided into four different zones – Tudor, Majengo, Old Town and New Town within the Island, and three different zones outside the island – one across Nyali Bridge, one towards the airport and one across the ferry. Each zone has its own designated trucks and staffs and is treated equally. Mr. Bilafif estimates that the council collects around 500 tonnes of trash per day through various systems such as drums, bulk containers and open collection points. The council only deals with garbage collection and disposal at the dumpsite. There is no sorting done by the council, while at the dumpsite there are simply tractors to move the trash around to prevent the accumulation of methane gas. According to Mr. Bilafif, scavengers are allowed to enter the dumpsite to sort the waste to earn a living. However, it is illegal for them to burn the trash, and while there were previous issues of scavengers

³² Keen Kleeners workers. Informal interview. 22 Nov. 2012

³³ Mohamed Bilafif. Personal Interview. 21 Nov. 2012.

burning the tires at the site, it has been stopped.³⁴

While it might be true that the council requires a bigger budget and more manpower for it to provide sufficient SWM services throughout Mombasa, based on the observation of the daily operation of the council, various forms of inefficiency were observed. The summary of the operation on November 29th is as below:

Time	Location	Comments
8.45am	Leave Mackinon market	First collection point. Fueling of truck on the way to Kibarani dumpsite ³⁵ .
9.45am	Arrive at Makupa market	Second collection point. Front loader broke down, so two trucks were sitting there waiting for the repair to complete so that garbage can be filled onto the trucks.
11.10am	Leave Makupa market	-
11.52am	Arrive at Manyimbo site	Third collection point. 7 trucks have to be filled up and there was only one front loader, so the trucks had to wait in line with the workers and supervisor sitting there waiting.
12.45am	Leave Manyimbo site	-
1.33pm	Arrive at Kadongo site	Fourth collection point. Once again, 7 trucks had to wait in line.
2.20pm	Leave Kadongo site	End of operation of the day, with the last site being skipped due to prior delay.

Throughout the whole process, much of the time was spent waiting as there was only one front loader with many trucks waiting to be filled. The road leading to the Kibarani dumpsite is also poorly maintained such that it takes 15minutes to drive through the 1km stretch leading to the dumpsite. Also, the helper assigned to each truck was observed to only have one task, which is to put a thin net over the waste after the truck is filled. The task only takes 2 minutes, and was ignored at times, which raised the question if the drivers can be charged with the assignment instead of having an extra man. Nevertheless, the municipal council does require each truck to report to the office right before entering the dumpsite to keep track of the daily activities and ensure that the workers complete their assignments. On top of that, burning of trash was observed at the Kibarani dumpsite, as opposed to the claim by Mr. Bilafif. In fact, burning of trash was also observed at various illegal dumping sites beside the municipal council

³⁴ Mohamed Bilafif. Personal Interview. 12 Nov. 2012.

³⁵ After each collection site, the trucks would go to the Kibarani dumpsite to empty the waste before moving to the next point.

office. (see Appendix D for the pictures)

8.2.2 Community-based organizations (CBOs) and non-governmental organizations (NGOs)

There are a number of organizations present in Mombasa that deals with SWM and interviews were conducted with the members to understand the role they play in the area. These organizations include the Environmental Trust of Kenya (ETK), Kisauni youth polytechnic, and Mombasa Integrated SWM project (MISWMP).

ETK

ETK is an NGO established in 1997 with the aim of ensuring the environmental health of Mombasa. When asked about the issues of waste management in Mombasa, Mr Mwenye Hassan, the vice chairperson of ETK, the first issue raised was regarding the new dumpsite in Mwakirunge. “Kibarani was closed down due to the hazards it posed as well as the bad smell on a major road where visitors enter Mombasa. A blind teacher used to say that he always knows when he gets into Mombasa because he can smell it,” said Mr Hassan. The other hazards listed include the leachate that pollutes the sea, the air pollution from the burning of trash at the dumpsite and the health risks faced by the scavengers there. ETK was one of the organizations that petitioned for the removal of Kibarani, and while the council was requested to perform an impact assessment before shifting to a new site, that process was ignored and now the same problems are happening at Mwakirunge. Their petitions for the council to build a recycling plant and set up containers at the main collection points have been ignored.

Aside from their political effort to change the state of SWM in Mombasa, they have other yearly events such as the World Environmental Day cleanup in collaboration with the Divisional Environmental Committee from each county. This year, their event was very well-received and the Kenya Port Authority (KPA) donated cleanup equipments such as wheel barrows and brooms worth up to Ksh 500,000 to ETK. These equipments are also available to communities interested in doing cleanups every weekend.

Last year, Mr Hassan's other group, PUSH, wanted the municipal council to lease the tender for them to provide garbage collection services but their proposal was turned down. Mr Hassan thinks that it is unfair that the municipal taxes the residents of Mombasa yet do not provide the necessary services.

Kisauni Youth Polytechnic

Kisauni Youth Polytechnic is a community-based school and two years ago, they received a 20 million Ksh fund from Community Development Trust Fund (CDTF) to start an environmental program. Today, the department has three employees, with Peter being the one in charge of the waste management program. The CDTF grant mostly goes to their tree planting projects, with only a small portion going towards educational program for communities regarding waste issues. Their recycling program however is funded by VSO-Vitolee. They were recently given a Ksh 34,000 grant for three months of activities, after which they would have to reapply for a renewal. They have received three renewal cycles in the past 2 years. Their main projects have been practical trainings for local communities to learn how to make products from waste. The 3 types of materials that they are focusing on are plastic bottles, polythene bags and office paper. The plastic bottles are collected by the communities before being sold to an agent at a price of 15 Ksh/ kg. The polythene bags are collected and washed before being weaved into baskets, hats and handbags, and are sold at various shops around Kisauni. The office papers are made into bracelets and earrings.

The other interesting project by the group is producing charcoals from local waste materials such as paper, coconut shells, clay, leaves, maize cobs and charcoal ash. These materials are first mashed up, soaked in water, molded into a ball shape before being dried. According to Peter, this “charcoal” burns much slower and retains heat for a longer period of time compared to normal charcoals. Also, this is free for the community members themselves and they are selling it for 20 Ksh/kg which is much cheaper compared to the selling price of charcoal at 50Ksh/kg. However, the popularity of this product has been rather low as people still generally thinks that charcoal has to come from trees, so the groups are working on educational programs to spread the message of this new product. (See Appendix F for the various products created)

Mombasa Integrated SWM project (MISWMP)

An informal interview was conducted with a MISWMP representative³⁶. According to her, the MISWMP was started a few years back by bringing together various CBOs in Mombasa. Their primary

³⁶ Aziza. Personal interview. 29 Nov. 2012.

aim is to shift people perception of trash – instead of viewing trash as being dirty they see it as a resource that can be turned into money. Their motto is “taka ni mali” which means “trash is valuable”. Their projects include having youths providing garbage collection services, making compost out of food waste and collection of recyclables. All these projects are on a community level, with the products such as compost being used locally and not yet sold commercially.

The MISWMP had a project to build a recycling plant in Jovu, Mombasa funded by an 18 million Ksh grant by CDTF which started 2 years ago. The plant has been completed and fully equipped since last year, but has not been able to operate due to the lack of electricity cable.³⁷ When questioned about the project, the MISWMP representative refused to offer much explanation and claimed that it is “complicated” and “politics”.

These various organizations are helping create awareness about the issue of SWM in Mombasa. The various projects are also spreading creative methods of reusing the resources found within trash to create something of value, based on the local cultural contexts. This would go a long way to reshape the perspective of people in Mombasa of waste and SWM. However, it is fair to say that at the moment, these projects are rather small scale and only contributes towards reducing a very small percentage of the waste stream in Mombasa.

8.2.3. Independent waste pickers and scavengers

Interviews were conducted with a group of scavengers found at the Mackinon market collection point. Other collection points were visited and the activities of the scavengers at the sites were observed. Most of them are permanently stationed at a particular site scavenging for recyclables when the trash comes in. They pick directly and do not have gears such as gloves or masks. They are often known by the communities as “chokora” which means street boys.

According to the scavengers interviewed at Mackinon market, they are a pretty organized group where outsiders are not allowed to scavenge at their site. However, they act as individuals when it

³⁷ Peter. Personal interview. 1 Dec. 2012.

comes to the collection of the recyclables. The group collects a mix of materials such as plastics, tin, rubber, aluminum, brass, copper, cast aluminum, cardboard, paper, polythene bags, and milk cartons. They said they used to sell bones as well to a company that used it to make bowls and plates, but they have stopped the sales due the lack of transportation to the company. After the collection, plastic, rubber, paper and cardboards sold in a mixed bag to an agent who would carry it using a hand cart to his own place for storage, while the rest are sold separately. This is done as there is a lack of place for storage at the market. On an average day, the group is able to collect about 200kg of this “mixed bag” which goes for 15Ksh/kg.

Richard, one of the scavengers at Mackinon said that back in the early 2000s, the community at Old Town used to harass the scavengers. However, today, their presence has been accepted and sometimes, the stall owners at the market even help them out by sparing them some food. Nevertheless, they are still constantly harassed by the government. For instance, he himself has been in jail three times for a total of nine months, and the same applies to the whole group with everyone having been to jail for various reasons like loitering in the dark, and wandering around the neighborhood drunk. Throughout the whole interview process, the group kept stressing that they are here to stay. “Many people have come and tried to make the situation better and thought that they could get all of us out of the streets, but someone has to work with the trash. We have families too,” said Richard.

A separate interview was conducted with the agent of the group. It was discovered that he carries these bags to a back alley in Kizingo, where he further sort out items in the mix bag, before selling them to individual private companies that would come for collection. Within that alley, there were two other agents like him. During the day of the visit to the site, a recycling company came for collection of plastic bottles and offered a price of 25Ksh/kg, but he declined to sell it to them as he wanted 30Ksh/kg. The company’s worker shared that they are able to collect around 1600kg of plastic bottles per day throughout Mombasa.

The selling price of each collected material is as below:

Item	Price offered to scavengers (Ksh/kg)	Price offered to agent (Ksh/kg)
Aluminum	120	-
Brass	320	-
Copper	480	-

Cast aluminum	70	-
Paper and cardboard	2	-
Polythene bag	5	-
Mix bag of rubber, tins, plastic and paper	15	Rubber – 6 Shoe soles – 24 Soft plastic – 18 Tins - 17

It is clear that there is a huge informal sector that plays a huge role in the recycling business in Mombasa. While there are health risks due to their constant exposure to waster and pollutants, these waste pickers consider it a necessary trade-off that allows them to earn a livelihood. (See Appendix G for pictures of the working conditions.)

8.3. Case Study: Old Town³⁸

Further studies such as surveys and residential waste composition study were conducted in Old Town to provide a more in-depth understanding of the state of residential SWM in the area. This would then act as a case study for discussion of possible future directions for this issue.

Current household arrangements for garbage collection

Out of the 28 households surveyed and interviewed, only 50% of them are receiving house-to-house collection services from the municipal council. Of these 14 households who are receiving the service, six claimed that they have to bribe the municipal workers for service. For instance, Mrs Rukia mentioned that before she started bribing the workers, they used to just pass by the neighborhood without collecting the trash. “They asked for 200Ksh per month, before increasing to 300Ksh per month early this year,” says Mrs Rukia. From these informants, it was found that the payment rates are around 200-300Ksh per month, or 10-20Ksh per trip, depending on the prior arrangement. The other five of these households further have to supplement the municipal service with private collector

³⁸ Participants of the survey, interview and composition study will be listed in the “Work cited” section

services. Mr Mohammad cited the inconsistency of the council’s service as the reason, while the others use private services during the weekends when the council’s service is unavailable to avoid keeping the waste overnights at their houses.

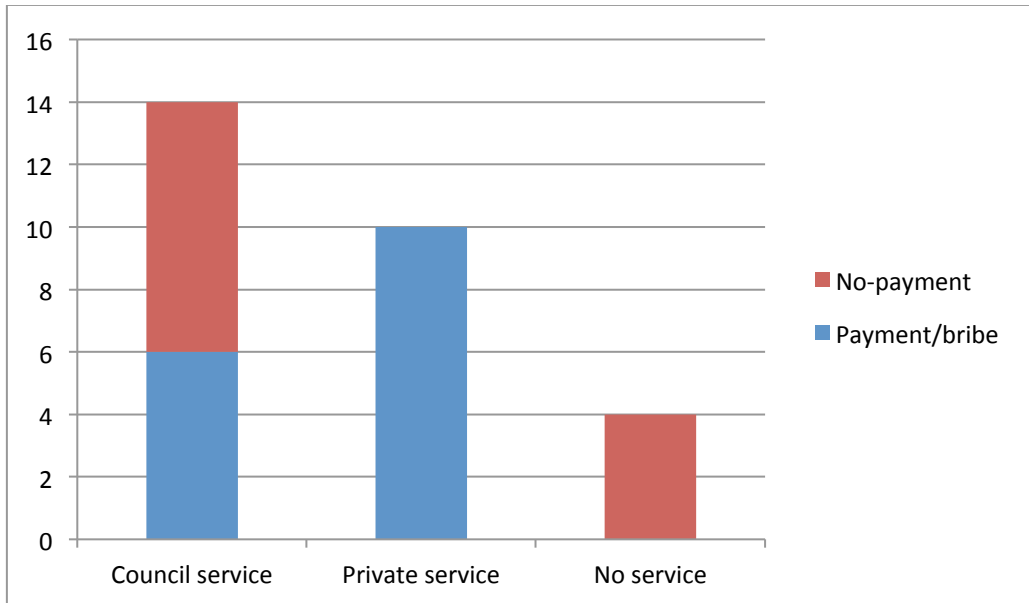


Figure 8: Access to garbage collection service

For the 14 households who do not receive service from the municipal, 10 of them employ private collection services, while the other four carry their trash to the designated municipal collection point at the Old Port, or the Mackinon Market. None of the private services are actually formal companies. Instead, they are usually just someone around the neighborhood, usually a teenager, who offers the service in exchange for a small fee. Most of the respondents did not even know the name of the person providing the service. The charges for the services vary. According to Mr. Ali, “the charges are dependent on the amount of trash. Sometimes it's 10-20Ksh per trip if there isn't much, other times it can be up to 50Ksh per trip.” From the responses, it was observed that charges tend to go by “per trip”, with prices ranging from 10-50Ksh each time. Mr Mohammad however, pays 3000Ksh per month for his services as he owns a shop and generates a huge amount of trash. Aside from this anomaly, most households spend around 300Ksh for garbage collection services, regardless of whether that is from the municipal or private personnel.

Of all the households, only four do not have their trash disposed of from the house on a daily basis, as most of them complain about the smell from the trash when kept in the house overnight. Of the four,

three of them dispose of their trash every two days, while one keeping it for up to three days. When asked about whether the households practice other methods of dealing with trash such as burning, burying, throwing in the sea.... none of the respondents do so, as all of them have the trash carried to the collection point. Many of them are aware that burning trash is against the law, and brought that up when asked about it. However, it is hard to determine if the responses given are honest, since the respondents might be wary of possible repercussions from admitting to these acts. Nevertheless, one respondent did admit that they used to throw the trash into the sea, but the Old Town Conservation officers approached them and requested that they stop doing so, and they gladly obliged.

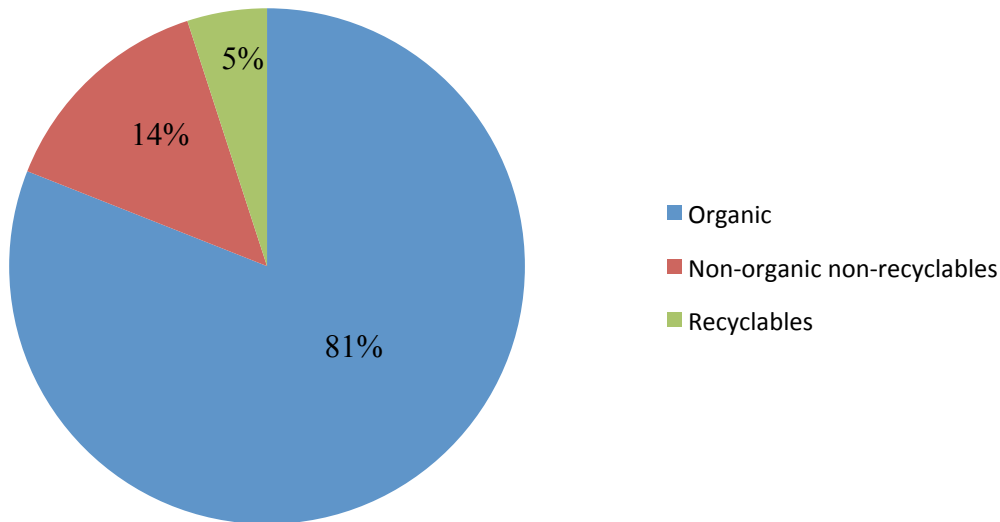
Of all the interviewed households, only three have sold recyclables in the past, with none of them doing it on a consistent basis. Mrs Binasi, just like the others, said that she only sells it when the scrap dealers come asking for it, but never on a consistent basis

Current household waste characteristics

The generation rate and composition of household waste are the principal parameters which are essential for the understanding and planning of residential SWM. The quantity and characteristic of solid waste produced by households were estimated through the direct measurement and field observations at the sources. The result of these investigation indicated that the average amount of solid waste produced daily is 3.0kg/household. As each household size is known through a prior survey, the individual generation rate was able to be estimated and was found to be at 0.53kg/person/day. Mombasa municipality with a population of about 1.2 million would thus generate about 637 tonnes of trash per day or 232 thousand tonnes per year.

The physical composition of the household solid waste was determined by separating the waste into different components before being weighed. It was found that the waste consist of 81% organic materials, 14% non-organic non-recyclables and 5% recyclables. Non-organic non-recyclables observed were mainly plastic bags, wrappers and hard plastic containers. Other materials observed include baby pampers, Styrofoam, and broken glasses though these were only found intermittently. The recyclables collected were mainly plastic bottles, scrap metals, paper and rubber.

Waste composition



Analysis

The garbage collection situation of Old Town is rather representative that of Mombasa, where municipal council's services are unequally distributed and unreliable, creating the need for residents to find outside solutions. In fact, Old Town's services are above average, probably due to its proximity to the municipal office, as based on observations and interviews, the council does not provide door-to-door collection in most areas. Whereas within Old Town, many residents who do not receive the services claimed that the council workers only pass by the main roads, thus do not go to their houses that are some way off those roads. Mr. Bilafif, the head of environmental department of the municipal council claimed that every house in Old Town is supposed to receive door-to-door collection services when in reality, the survey showed that only 50% of the houses are reached, with 40% of these houses having to bribe the worker. This clearly shows that the council lacks control over its workers, as the workers are simply taking salary and equipments from the council and then use that to start their own "private" garbage collection business. This can be regarded as a mismanagement of public funds, as the public do not receive the service that they paid for. The discrimination of service provision base on the locations of the households whereby people leaving off main roads in the case of Old Town, and people living outside of the CBD in the case of Mombasa as a whole are neglected, further worsens the

situation as these are usually households with lower income level and are less able to afford private services. As a result, they end up turning to means such as public dumping and burning of waste which create environmental issues for the public as a whole.

The current situation created a market for the development of an informal sector based around garbage collection and recycling. This market helps provide an essential service for the residents, while creating employment opportunities for others. However, their lack of formal recognition means that the job tends to be frowned upon, with poor working conditions and inconsistent income due to the lack of organization. As Richard, a street waste picker sums it up nicely, “I don’t know how much I earn per month. Sometimes I get 400Ksh a day, other days I don’t get any. No one wants to do this job; I am doing it because I have no other options.”

While the informal sector does help with reducing the waste stream through the collection of recyclables, we can see from the composition study that it only constitutes 5% of the waste stream. It is clear that to greatly reduce the waste stream and reintegrate the resources available within residential solid waste into our resource stream; organic waste has to be the main focus. If methods such as composting and manufacturing of waste charcoal can be fully implemented, we will be able to remove 81% of waste going to the dumpsite. These are also the materials that create the most environmental issues due to the production of leachate and attraction of pests and disease vectors. As for the 14% of inorganic non-recyclables, government policy and public education seems to be the only option, as consumption of these materials has to be reduced or curtailed as neither human technology nor the nature is able to get rid of these materials.

9. Conclusion

There are many problems with the current state of residential SWM system in Mombasa, however, there is also a huge potential for improvement and development. For one, the nature of residential waste here whereby there is a high component of organic waste means that there are already sustainable management methods present in the society and nature. From composting to livestock feeds, these wastes can be turned into valuable resources if put into the right hands. A greater investment in this area would be wise as this would remove around 80% of waste that would have ended up in the dumpsites.

As for the issue of dumpsites and collection points, often times the solution proposed are either to cover the trash up or to relocate the site. Even when it comes to the government level, a huge focus has been put in trying to set up a sanitary landfill. While that seems like “solutions” that Western developed countries tend to pursue, one has to realize that essentially the fundamental idea behind the management method recommended is still the same – that is to cover up the waste and hope that it will disappear eventually. The major difference is that Kenya lacks the financial capability to better cover up the waste properly. Therefore, instead of pursuing these high cost, high capital yet unsustainable methods, Kenya should look to its strength – the availability of cheap labor. The fact that every collection site and dumpsite has groups of scavengers there reflects the reality that people in this country needs job, and wastes are valuable resources that are good sources of income. Therefore, the government should look to providing these people formal training and protective gears such that they can be incorporated into the formal economy. This way, employment opportunities would be created, while the working conditions of these workers would be improved as well. Most importantly, valuable resources can be extracted and reenter the manufacturing material stream, thus providing the necessary cheap raw materials for sustainable development.

Finally, the public needs to gain more awareness regarding SWM issues so as to protect their own health as well as the cleanliness of the environment. Public dumping, burning of trash and excessive usage of unrecyclable plastic bags have to be cut down. Nevertheless, it is encouraging to see that many organizations have been involved in achieving these goals.

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Appendices

Appendix A: Map of Mombasa

Appendix B: Map of Old Town Conservation Area (with indication of divisions)

Appendix C: Questionnaire

Appendix D: Illegal communal dumping site

Appendix E: Pictures of Kibarani dumpsite

Appendix F: Products from waste by community members

Appendix G: How recycling happens in Mombasa

Appendix A – Map of Mombasa



A1: Map of Mombasa Island



A2: Location of Mombasa relative to Kenya as a whole

Appendix B – Map of Old Town Conservation Area (with indication of divisions)



Appendix C – Questionnaire

1. How many members are there in your family?

2. What is your average household salary per month (Ksh)?

- No salary
- 1 ksh – 5000 ksh
- 5001 ksh – 20,000 ksh
- 20,001 ksh – 40,000 ksh
- 40,001 ksh – 60,000 ksh
- 60,001 ksh – 100,000 ksh
- 100,001 ksh and above

3. Does the municipal council provide garbage collection service at your house?

- Yes, I have to pay the council _____ and the worker _____
- No

4. Do you use a private garbage collection service?

- Yes, I have to pay _____ to _____
- No

5. Do you sell any recyclables?

- Yes, I sell _____ to _____
- No

6. If you practice other ways of dealing with solid waste like burying, burning and others, please list them below:

Appendix D – Illegal communal dumping site



D1: Kisauni



D2: Beside Fort Jesus, Old Town



D3: Beside municipal council office, Old Town



D4: Bamburi



D5: Beside Old Town Chief's office

Appendix E – Pictures of Kibarani dumpsite



E1: Entrance to Kibarani dumpsite



E2: Settlements at Kibarani dumpsite



E3: Bulldozers leveling the trash



E4: Scavengers looking for recyclables and food



E5: Construction right at the edge of Kibarani dumpsite



E6: Office constructed on cleared Kibarani site

Appendix F – Products from waste by community members



F1: “Waste” charcoal from materials like paper, coconut shells, leaves, maize cob, clay and charcoal ash.



F2: Earrings from waste office paper



F3: Bracelet from waste office paper



F4: Handbag from waste polythene bags



F5: Earrings from coconut shells

Appendix G – How recycling happens in Mombasa



G1: Scavengers sorting out different recyclables at a collection point



G2: Backyard where mixed recyclables are further sorted and stored



G3: Private recycling company buying the recyclables