

## THE NEED FOR AN INTEGRATED SOLID WASTE MANAGEMENT IN KISUMU, KENYA

**G. Munala and B. O. Moirongo**

*Department of Construction Management, Jomo Kenyatta University of Agriculture and Technology, Nairobi*

*E-mail: gerryshom@yahoo.co.uk*

### **Abstract**

The composition and amount of solid waste being generated in Kisumu has been on the increase. This can partly be attributed to changing urban lifestyles, resource consumption patterns, improving income levels and other socio-economic and cultural issues. Thus, new approaches in handling these wastes need to be introduced to cope with their increase. This study has triangulated its findings through various literature reviews, interviews and field survey observations. It provides documentary evidence on the level of conditions and level of practice in solid waste management in Kisumu. The findings indicate that only about 20 % of the 400 tonnes of solid waste generated in Kisumu is collected and transported to the dumpsite. Residents do not separate waste at household level and burning is a common mode of disposal. The findings affirm to the need for a change in management regimes to become more commercially viable, adaptive and inclusive. There is also need for a socio-cultural attitude change among the residents at household level.

**Key words:** Kisumu, minimisation, recovery, recycling, solid waste management

## **1.0 Introduction**

Solid Waste Management (SWM) is one of the important obligatory functions of any urban local authority. It refers to all activities pertaining to the control, collection, transportation, processing and disposal of those in accordance with the best principles of public health, economics, engineering, conservation, aesthetics and other environmental considerations. According to Rotich, Zhao and Dong (2005), the fundamental target of solid waste management is to protect the health of the population, promote environmental quality, develop sustainability and provide support to economic productivity through utilisation of waste as a resource. These objectives should be attained in a viable manner that is affordable by the residents over the long term with minimum risks involved to the persons doing it. This essential service, however, is not efficiently and properly performed by many cities in developing countries. For instance, many urban centres in Kenya are grappling with increasing piles of waste, disposal technologies and methodologies, and overflowing dumping sites. A combination of all of the factors including lack of resources - financial and personnel, institutional weakness, improper selection of technology, transportation systems and disposal options, public apathy towards environmental cleanliness and protection have made this service unsatisfactory in many of these cities.

In Kisumu, SWM is not receiving much attention and recognition as it should, as evidenced in the sporadic actions and the overshadowing of this issue by the other general environmental issues such as water, sewerage, the water hyacinth and mobility. What the planners and managers at the council seem to forget is that all urban problems are intertwined and interlinked. The composition and amount of solid waste being generated in Kisumu has been on the increase. This can partly be attributed to changing urban lifestyles, resource consumption patterns, improving income levels and other socio-economic and cultural issues. Furthermore, the changing nature of solid waste is complicating the already difficult task of dealing with waste management in this lakeside city in Kenya. According to Furedy (1998), the general trends noted in Kisumu are: the great increase of plastic film (small plastic bags), heaps of domestic waste, construction debris, street waste and industrial residues from unregulated industries. A research by Carl Bro indicated that about 400 tonnes of solid waste is generated daily in the city. The local authority collects 10% and the private collectors can manage to deliver to the dumpsite another 40 tonnes (10%) only (Carl Bro Report, 2001). The remaining 80% accumulates into eyesores evidenced in garbage heaps and litter everywhere.

As would be expected, the peri-urban areas are most affected by the poor management. These areas are expanding at 7-12% annually (Mireri, Letema and Majale, 2007) and are synonymous with dense unplanned (informal) settlements – often unrecognised and sidelined by the local authority – and without basic services such as water, sewerage, roads and of course solid waste services. Vermin, for instance rats, co-existing with people in this fragile environment, thrive on the mountains of waste that accumulate around squalid settlements and are the principal carriers of bubonic and pneumonic plague. Of course not forgetting the nuisance and germ-carrying flies. Unfortunately, these settlements are home to over 60 % of urban residents (UN-HABITAT/UNEP, 2005). With the population of

Kisumu increasing at an estimated 2.8% annually, it is expected that the problem will get out of hand if urgent action is not put in place (UN-HABITAT, 2004).

As is common now in all Kenya towns – with no exception – the problem of solid waste management has gained an even much dangerous phase. Plastics, mainly low-density polyethylene (LDPE) carrier bags, and other non-biodegradable waste are strewn in many areas of the town (especially in the peri-urban settlements), and are causing great concern both to the public health and environment. The most intractable problem relating to plastics and the environment is their disposal. In Kisumu, plastics are disposed off in the open dumpsite or burned. These plastics get blown around easily and are sometimes ingested by livestock and lately have been blamed for causing some deaths. Others find their way into drains, causing blockages. This ‘plastic menace’ as it is now known, has become a symbol of what is wrong with the entire solid waste management strategy in the country (ILO, 2001).

Despite these challenges, community-based initiatives are catching up on waste management but it is obvious more needs to be done. This paper therefore explores the challenges posed by poor solid waste management, considers the current broad management regimes and suggests possible avenues that would lead to improved and efficient solid waste management in Kisumu.

### **1.1 Objectives**

This study had the following objectives:

- (i) To identify the major solid waste management issues in the neighbourhoods of Kisumu.
- (ii) To explore a range of promising practices and innovations at local level.
- (iii) To recommend alternative integrated solid waste management practices for Kisumu.

### **2.0 Methodology**

Two approaches were used to investigate management strategies of solid waste management in Kisumu. First, an urban scan that took a descriptive approach that involved observation, photography and walk-through the estates in the city was done. A snapshot of the challenges, priorities and aspirations of the local residents at neighbourhood level was done. Second, analytical-inductive methodology that was used to review and interpret various documentary information on this topic. Sources include non-governmental organisations (NGOs) and independent research reports supplemented by United Nations publications. The Internet has been used as a primary facilitator for information collection. Library searches yielded important background information on the solid waste management. Several references cited in the reference section were also downloaded from home pages of various institutions visited in the process of writing the paper. This process reflected on existing and viable options for improved solid waste management services. These two data sources form the basis of the information used in the discussion in this paper.

### 3.0 Threat of Poor Solid Waste Management

The generation of solid waste in Kisumu is on the increase, as a result of rising population and high rates of resource consumption, among other reasons. The composition of solid waste has witnessed three key trends:

- (i) increase in sheer volume of waste generated by its residents;
- (ii) change in the quality or make-up of waste generated as a reflection of the changing lifestyles;
- (iii) the disposal method of waste collected by, incineration or use of organic waste for urban agricultural purposes.

While this is expected, the handling capacity of the council has been exceeded. The sheer volume and poor management manifests itself in large volumes of waste being dumped illegally in areas that have been reserved for roads and other services (Plate 1). The legal framework that is supposed to provide guidance on solid waste management, the Municipal Council of Kisumu (Solid Waste Management) By-laws 2008, are held captive by inadequate capacity of the council.



*Plate 1: Illegal dumping ground blocking part of a road*

*Source: UN-HABITAT, 2006*

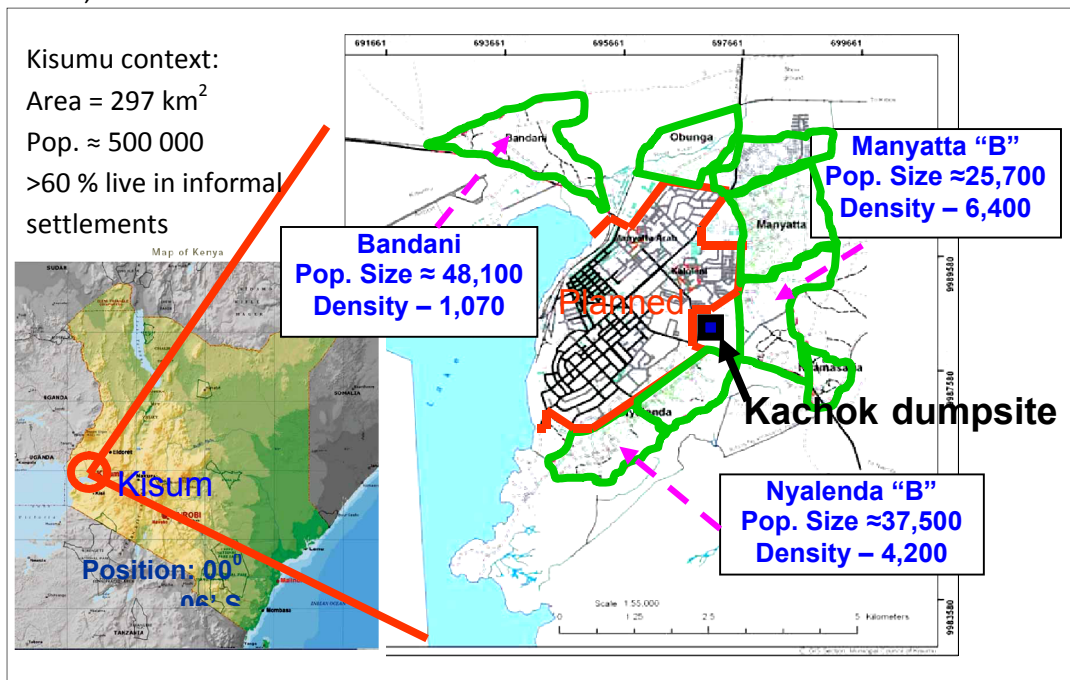


*Plate 2: Scavenging at Kachok open ground dumpsite*

*Source: Field survey, 2008*

The dumpsite at Kachok on the Kisumu-Ahero Road, 2 km from the town centre (Map 1), receives residential/commercial garbage mixed with industrial residues, sometimes toxic,

and untreated hospital waste. People from nearby informal settlements use the dumpsite as a source of income, oblivious of the harmful fumes from waste burning and methane fires in it. A survey of the dumpsite found that hazardous substances such as chemical and hospital waste abound on the dumpsite. The human scavengers on the dumpsite were observed to have skin sores, evidence of skin disease, and frequently coughed, evidence of some respiratory problems. These scavenging activities (Plate 2) are a symptom of poverty of the residents and poor management on the side of the council on how to handle the waste. In its development plans, the municipal council intends to move this dumpsite to Mamboleo centre, on the outskirts of the town.



Map 1: Location of Kachok dumpsite in the context of Kisumu city  
 Source: Munala, 2009

It was evident from the field survey that uncollected garbage is a leading solid waste problem across the neighbourhoods visited. This finding is further supported by previous studies undertaken in Kisumu, for instance, KARA, SANA and Ilishe Trust, 2007; Obera and Oyier, 2002; Carl Bro Report, 2001; Ecoforum, 2001; World Bank, 1995. However, there is little progress towards finding a lasting solution to the problem. Evidently, the environment in Kisumu is deteriorating at a fast rate and solid wastes are a key contributor of this. A recent study reported that only 17% of households in Kisumu have access to private collection (KARA, SANA and Ilishe Trust, 2007). Field survey reinforced this through observation of overflowing litter bins in the town (Plate 3) and drains that have heaps of plastics (Plate 4).



*Plate 3: Overflowing litter bin degrades city aesthetics*

*Source: UN-HABITAT, 2006*



*Plate 4: Plastics from trench at market-place*

*Source: Field survey, 2008*

### **3.1 Current Management Regimes**

In 2008, Kisumu passed its set of solid waste management by-laws. These by-laws provide a legislative framework for the management of all types of solid waste within its area of jurisdiction. The by-laws identify several categories of solid waste, namely, bulk waste, bundle waste, domestic refuse, garden refuse, hazardous waste, hospital objectionable waste and trade refuse (MCK, 2008). They further state that it is the duty of the council to provide suitable refuse receptacles and subsequently remove and dispose off the waste at suitable site or using the recommended tipping means. The by-laws prescribe three means of solid waste disposal namely controlled tipping, dumping or incineration depending in the quantity and quality of refuse and facility available (Part I (17)). The most common methods of waste disposal observed in use were dumping and incineration. Waste recycling is practiced by a few operators but they have not sufficiently marketed their recycled products. In the peri-urban areas, some households dig their own pits to bury the waste on site.

*(i) Waste collection*

A walk through estates, especially those in the low-income areas, gives a clear picture of the extent of the solid waste challenge in Kisumu. Waste collection services are provided only sporadically to peri-urban areas because of poor accessibility and very high waste generation which cannot be contained with available vehicles and equipment. Uncollected heaps of garbage find their way into open drains, which become blocked and thereby promote breeding of mosquitoes – the most dangerous insect in Kisumu today. Many peri-urban settlements are infested by swarms of flies, insects and rodents. Decomposing waste from council trucks transporting garbage to the dumpsite spill over on roadsides and birds and animals have infested the dumpsites. Worse still, uncollected waste is an eyesore and health hazard to the residents. Bad odour abounds in many settlements as a result of decaying waste. Children who play in the vicinity of these heaps get injured too.

*(ii) Transportation*

Transportation of garbage to the dumpsite is done in open trucks (Plates 5 and 6), spreading pollution along the routes of transportation.



*Plate 5: Council's open truck*

*Source: UN-HABITAT (2006)*



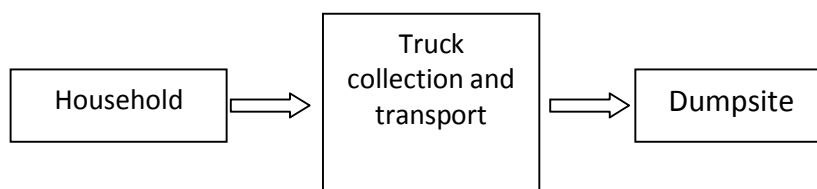
*Plate 6: Open truck private waste collectors*

*Source: Field survey (2008)*

In areas where solid waste is collected, two principal collection methods are in use:

*(a) Door-to door Type Collection Method*

This is the typical method for an efficient system. This system occurs in three steps: from household, collection, then to dumpsite (Figure 1). In Kisumu though, the door-to-door system has crumpled as large amounts of waste continue to be generated. Poor management of resources leads to, among others, aging refuse-collection vehicles, vandalism and misused bins (some used for roasting maize), poor working conditions for workers, lack of sufficient citizen commitment, limited managing capacity, poor roads conditions to the dumpsite. Due to high unemployment within the city, some small-scale entrepreneurs are trying to collect waste from neighbourhoods. However, as they are small in size, they are overwhelmed by the sheer volumes of waste within these areas. These demand-oriented initiatives, by various formal and informal groups and individuals has received support from the affluent residents, but the poor still dispose off the waste by natural decomposition or burning. These survey findings are further enforced by the *Citizen's Report Card 2007*, which indicates that only 10% of the poor in Kisumu use private solid waste collection agencies. Currently, there exist about 3 different types of initiatives: community-based, private-based and cooperative/association-based. A common characteristic of these initiatives is that they tend to have social objectives as their main driving force and many of them have integrated business (economic) objectives with various degrees of success. The community-based initiatives are mostly active in peri-urban settlements, while private initiatives are most common in affluent neighbourhoods. The work involved is labour-intensive, and the income generated from these activities is meagre.



*Figure 1: Door-to-door collection method*

*(b) Station-type Collection*

In this mode of collection, waste is generated in the home and stored until a sizeable amount has been accumulated. It is the responsibility of the householders to carry their wastes to the nearest solid waste bins or identified location and deposit the waste there. The council is then responsible for the transfer of this waste from the neighbourhood depository locations to the final disposal site (Figure 2). The trucks visit these locations at regular intervals and collect and haul the accumulated waste to dumpsites. This is a reactive mode of waste collection (as waste could remain in one location for weeks, even months) and has left the council reeling behind in its efforts. With the tropical climate,



these wastes quickly begin to decompose within days, posing a serious health challenge to the inhabitants.

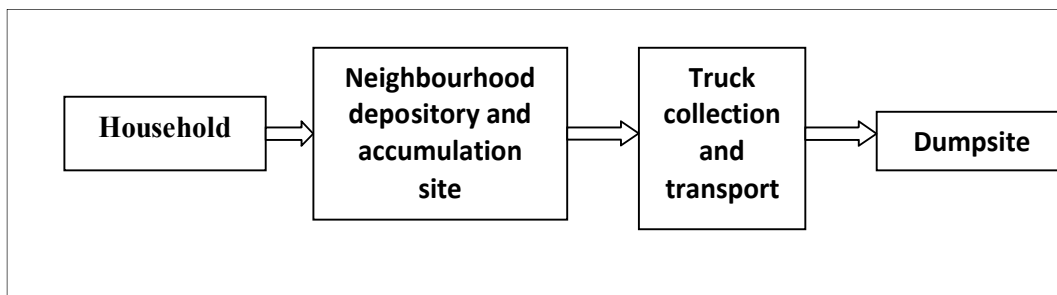


Figure 2: Station-type collection method

As can be expected from the current management systems, waste that ends up at the dumpsite is contaminated as there are no policies for separation at the source.

### (iii) Disposal

That which gets to the dumpsite is reduced through open air burning, releasing harmful pollutants into the atmosphere. Residents also burn heaps of garbage within the estates and in the process release a mixture of harmful gaseous matter into the atmosphere. This uncontrolled burning is ecologically unacceptable, in the view of uncontrolled air pollution and emissions of toxic fumes. Moreover, burning could lead to serious explosions (though this so far has not happened) that could destroy entire neighbourhoods and property.

One shortcoming of the by-laws is their silence on the location of incinerators and dumpsite in relation to residential areas. The absence of these requirements leaves room for abuse and exploitation, as haphazard burning of refuse was observed within the residential areas.

## 3.2 Solid Waste as a Socio-Economic Opportunity

These problems, however, also provide a window of opportunity for people to find innovative and inclusive participatory solutions - involving the community and the private sector; innovative technologies and disposal methods; behaviour changes and raising awareness. Traditionally, the municipal council has emphasised collection and disposal of waste rather than on an integrated SWM approach that creates room for income and the much-needed employment opportunities. However, due to lack of service provision, a number of private groups have taken up the challenge to rid Kisumu of the unsightly scenes that are the heaps of garbage. Their involvement is captured in four major roles:

- (i) gap-fillers in response to demand;
- (ii) pioneers through innovative technologies and solutions;
- (iii) sub-concessionaires through availing materials for some industries
- (iv) managers and initiators of viable small-scale solutions.

These groups have started to engage in viable options for generating increased income mainly at household level that include waste recycling, marketing recycled products, composting and energy generation.

Unfortunately, these 'informal' private sector participators are weary of competition, individualistic in their operations, difficult to upscale and have taken long before formal recognition by the council system. Further, their involvement in the decision-making process is not structured yet they are subject to the consequences of decisions made by the council.

### 3.3 The Detour in Solid Waste Management

The requisite conditions for the tackling of the above challenges is the understanding of local conditions, full range of technological options available and factoring on of the traditional wisdom and systems that the local people have developed over time in handling waste. This is fundamental to availing a system that will become viable and sustainable. Several technical and commercial feasible options present themselves for exploration. These options would call upon the engagement of labour-intensive and decentralised strategies to map out ways of managing the solid waste. As revealed in the survey, the dumpsite receives a mixture of solid waste, some that are harmful and difficult to decompose, for instance hospital waste and e-waste. These wastes needs to be separated and sorted out at source of generation. At the moment, this is not being done in Kisumu. An integrated approach, as shown in Figure 3, needs to be explored.

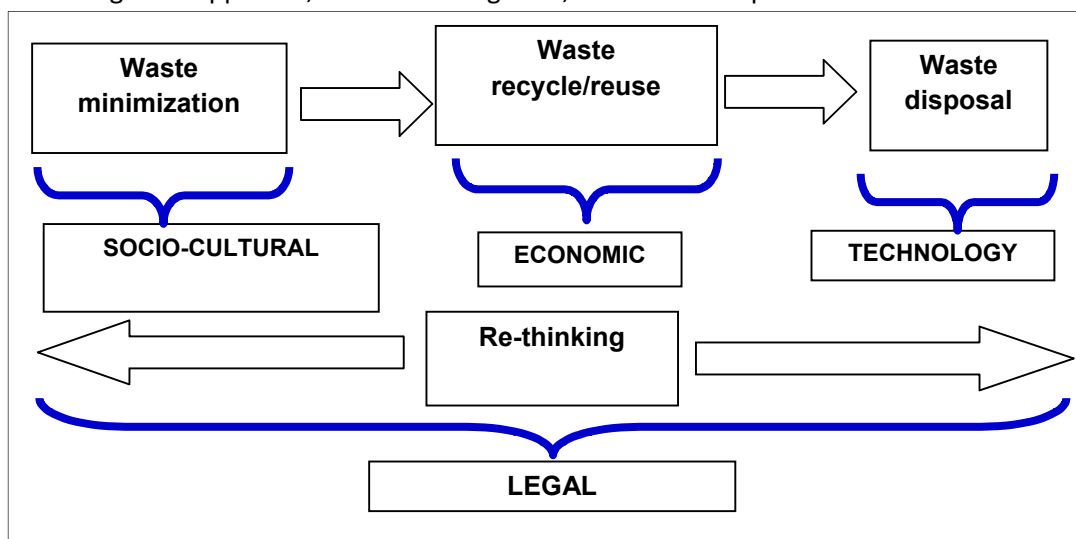


Figure 3: Integrated approach of solid waste management

#### (i) Waste Recovery/Reclamation

The survey showed that Kisumu in the past has concentrated its efforts primarily on the disposal part of waste management. Though some efforts are being directed towards encouraging recovery of these resources, evidence from the survey show that these efforts are not bearing much fruits, especially in the low-income residences. If recovery is to succeed, practices such as burning have to be minimised. In addition, waste separation at source has to be practised. Evidence from developed countries, where this is done, show that the success of waste recovery must begin at source of generation through proper separation of wastes. For instance, Germany has developed a culture of waste separation at

source (Areba, 2010). Kisumu needs to follow suit and inculcate this culture to its residents, initially through regulation but in the long-term, through mass education.

### *(ii) Waste Recycling*

The waste produced in Kisumu has some materials that can be successfully recycled. Approximately 60 to 65% of the total generated waste being organic, enormous recycling opportunities exist for farm use. Incidentally, the benefits of recycling do not lie solely in diversion of waste away from disposal – the filling of dumpsites unnecessarily - but, even more importantly, in the reduction of the amount of new materials that need to be harvested and processed for the manufacture of new products. Given that there is potential and possible demand, recycling and resource recovery offers good scope for employment generation, and potentially has both positive economic and environmental impacts. One such opportunity is scavenging. As observed, scavenging has become a common phenomenon at the dumpsites in Kisumu. Though the scavengers working in unsanitary conditions earn a living through trade in reclaimed, recyclable waste, they put their health at risk. These activities are driven by poverty and a desire to earn a living. The reclaimed materials usually undergo intermediate processes like washing, drying and sorting. This is rudimentary and little value-addition is done. The products end up having a low cost and their market being mainly among the low income population. However, their contribution in reducing waste, although low, cannot be ignored. This effort needs to be up-scaled and the scavenging made safer for the persons involved.

Despite the clear existence of a market that accepts these activities, exploitation by middlemen has left the scavengers reeling in a cycle of unending poverty. Secondly, this activity has also been blamed for child labour, earning it a bad reputation. Thirdly, prices are exploitative. Finally, the role of the scavengers and their contributions are not recognised at all at policy level.

### *(iii) Waste Processing*

Solid waste processing was observed to be done at small-scale, evidenced by activities like product reuse - rethreading tyres, recovery of demolition materials, re-use of plastic bags, second-hand clothing, reconditioning and repair of furniture and appliances in the estates. Value-addition from these activities is minimal.

Between 60 % and 65 % of the waste that is biodegradable needs to be pre-treated before discarding at the dumpsite. This pre-treatment will turn fermenting, rotting and foul-smelling residues into substances resembling soil. When this pre-treated residue is disposed off to dumpsites, it will no longer be harmful to the environment and public health. This is critical in protecting the land for future reclamation and the groundwater resources that are critical for wells and springs. Pre-treatment further reduces methane gas that would have been released into the atmosphere as a green gas.

When successfully done, waste processing comes with benefits including more effective use of resources, employment opportunities in the service and repair industries and a change in attitudes towards disposable products and the campaign of keeping the environment green. What is needed is the recognition and incentives within the policy framework.

*(iv) Waste Minimisation*

The huge waste heaps observed scattered in the estates of Kisumu should be reduced or eliminated altogether. One means of doing this is through avoidance of waste generation. This will require more producers' (sources') responsibility. Much of the waste observed, for instance, plastic bags could be re-used hence minimising their production. This would maximise the efficiency of available resource use without investing in new technologies. Minimising waste generation has the potential to reduce costs and the amount of waste to be disposed. It seems residents do not realise or are oblivious of the advantages of buying items in bulk, purchasing products in materials/packaging that is readily reused, use existing packaging materials as opposed to the urge for new ones, lengthening usage life of products to minimise the frequency of replacement and use of alternatives to disposal, e.g. vermiculture practices.

*(v) Re-thinking*

The shortcomings observed in the whole process of SWM in Kisumu require an overhaul. This will require an update of all areas of concern from socio-cultural attitude changes, economic value-addition of products produced, up-scaling of technologies to policy changes as shown in Figure 3. For this to be successful, integration of adaptive strategies concepts that emphasise the development of sustainable livelihood and environmental systems by adapting to and building of opportunities inherent in the communities that live in Kisumu has to be incorporated in all the new changes to be implemented. The activities observed and sentiments made by the resident clearly attest to the fact that the public is concerned with perception and economics as much as technical issues. Therefore, for solid waste to succeed, the process has to be all inclusive.

The potential of implementing the above suggestions will be enormous for the council of Kisumu by:

- i. Making an economic breakthrough from turning waste into high-value products that will be marketable.
- ii. Creating employment.
- iii. Recovering of energy and other energy-releasing materials from waste that could provide a saving on fossil fuels such as kerosene, gas and charcoal which are in common use in Kisumu.

In a city in which human population is growing faster than available physical resources, we can no longer afford to consider any material a waste.

**4.0 Conclusion**

This paper has identified niches in Kisumu that require change if SWM is to succeed. First, a clear path of exploration of the commercial viability of waste has to be put in place. Waste has to be viewed as a potential raw material at the wrong place or/and in the wrong state. The waste industry needs to evolve beyond its current low-end economic status to assume its place as a modern industry. If this is to be achieved, appropriate technology that is efficient in terms of resource recovery/use should be implemented. Secondly, waste must be appreciated as part of everyday living and its management is what will make the

difference between a good environment and a poor environment. In this light, proper frameworks should be put in place in an effort to respond to improvements in technology and changes in waste quality and quantity. Third, waste infrastructure starting from the location of collection points to the final destination should be well defined. Finally, the populations' willingness to participate in the process is what will make it succeed. This has to start from a socio-cultural behavioural change at household level to full participation at decision-making level.

This paper emphasises the need to change approach and reform SWM in a city that is facing a huge challenge in handling its waste. Kisumu must start seeing the issue as urgent and act now. It must desist from the 'business-as-usual' attitude and start to implement innovative ideas to bring the changes the town desires and wants to see. This can be revolutionised through managing waste right from the source. The implementation of the 5Rs is a prerequisite. Many technologies that would facilitate some of these processes are already in existence. All that is needed is the will to change.

## References

Areba T. (2010). In Germany, recycling garbage is big business. Financial Journal in The Standard Newspaper. Tuesday, March 2, 2010.

Carl Bro report (2001). Study of the Environmental Situation in Three Urban Centres.

Ecoforum, (2001). Lake Victoria: Economic Lifeline, Regional Toilet. (Water hyacinth prob), **25** (2) Cold Season.

Furedy C., (1998), *Sustainable consumption and municipal solid waste reduction in developing countries of Asia*. In UNCHS Promoting Sustainable Consumption in Asian Cities. Report of a Regional Conference, United National Centre for Human Settlements, Nairobi.

International Labour Organisation (ILO) (2001). *Employment Creation Through Privatized Waste Collection, Kenya*. ILO. Geneva

Kenya Alliance of Resident Associations (KARA), Sustainable Aid in Africa (SANA) International, and Ilishe Trust, (2007). *Citizens' Report Card on Urban Water, Sanitation and Solid Waste Services in Kenya: Summary of Results from Nairobi, Kisumu and Mombasa*. Nairobi. Nairobi.

Mireri C., Letema S. and Majale C. (2007). *Water and Sanitation Service Delivery in Kenya in Environment & Sustainable Development: A guide for Higher Education in Kenya Vol II*. (Eds.) Waswa F., Otor S., Olukoye D., and Mugendi D., Downtown Printing Works: Nairobi. pp 275 – 295.

Munala G (2009). A Viable Pro-poor Public-Private Partnership Management Model for Water Supply Services: Co-sharing Option for Kisumu, Kenya. TUG, Austria.

Municipal Council of Kisumu (MCK), (2008). Solid Waste Management By-laws, 2008.

Obera B. and Oyier M. (2002). *Sustainable Solid Waste Management for Kisumu, Kenya* in: 28th WEDC Conference Kolkata (Calcutta), India.

Rotich K., Zhao Y. and Dong J. (2005). *Municipal Solid Waste Management Challenges in Developing Countries – Kenyan case study*. Available online at [www.sciencedirect.com](http://www.sciencedirect.com) (March. 04, 2009)

United Nations Human Settlements Programme (UN-HABITAT) /United Nations Environmental Programme (UNEP), (2005). *The Kisumu City Environmental Profile on Sustainable Urban Mobility*. UNON. Nairobi.

United Nations Human Settlements Programme (UN-HABITAT), (2004). *Kisumu City Development Strategies (2004 – 2009)*. UNON. Nairobi

United Nations Human Settlements Programme (UN-HABITAT), (2006). *Kisumu Urban Sector Profile*. UNON. Nairobi

World Bank, (1995). *Lake Victoria Environmental Management Programme Proposal*.

## SUSTAINABLE SOLID WASTE MANAGEMENT STRATEGIES IN JUJA, KENYA

**W. Kaluli, H. M. Mwangi and F. N. Sira**

*Department of Biomechanical and Environmental Engineering, Jomo Kenyatta University of Agriculture and Technology, Nairobi*

*E-mail: wambuak@gmail.com*

### **Abstract**

Integrated solid waste management includes source reduction, source separation, recycling and reuse as well as materials recovery. The waste materials that remain should be safely disposed into a sanitary landfill. Up to 2010 when this study was done, no Kenyan city had a sanitary landfill and solid waste piles along inner city streets was a common sight in Nairobi. This study found that the solid waste in Juja consisted of 80% food and other organic wastes, 10% plastics, 2% metal and glass, and 3% mixed refuse. The waste had a very low level of toxic substances. The majority of the households produced less than 3 kg per day, which translated to less than 0.5 kg/person/day. JKUAT-SWMM, a solid waste management model developed in this study, suggested that if 25% of the population would do composting using household compost digesters of 288 L, the area of a disposal site required for 1 million people would be 16 ha. The identified site was on fallow land that received an annual rainfall of 600-800 mm. A waste disposal facility in Juja Farm could cater for most of the towns in the area of interest, including Juja, Mangu, Kimunyu, Gatundu, Thika, Ruiru and Kahawa. The landfill would be accessible to institutions such as Jomo Kenyatta University of Agriculture and Technology in Juja, Mount Kenya University in Thika, Kilimambogo Teachers' College in Kilimambogo, and numerous secondary schools in the area.

**Key words:** Sustainable, solid waste management, Juja