The Contribution of Household Waste Management and Recycling in Kenya to Environmental Conservation; A case of Residents in Kisii town

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ABSTRACT

Waste management process involves the collection, transportation, processing or disposal, managing and monitoring of waste materials. waste management relates to materials produced by human activity and the process is generally undertaken to reduce their upshot to the environment and the human health. Waste management is a distinct performance from recovery which focuses on delaying the rate of consumption of natural resources. Recycling involves the gathering and reuse of waste materials, The materials from which the items are made can be reprocessed into new products. Recycling may be collected separately from general waste using dedicated bins and collection vehicles, or sorted directly from mixed waste streams. Solid wastes are a by-product of a broad spectrum of industrial, service and manufacturing processes. Primary products used by households that can be recycled include the metals, wood, paper, leather, textile among many also recoverable materials that are organic in nature, such as plant material, food scraps, and paper products, can be recovered through composting and digestion processes to decompose the organic matter. The resulting organic material is then recycled as mulch or compost as for agricultural or landscaping purposes. This study will explore boulevards which are used by resident of Kisii town to be able to recycle their refuse and sustain proper environmental conditions which in turn reduce the diseases associated with the environment.

Introduction

In the global context the developed countries have various legislations and guidelines on waste management. Their generated waste currently accounts for 1% of total solid waste generation and is expected to grow to 3% by 2015. In the USA it accounts for 1% to 3% of total municipal waste generation. According to UNEP, (2005), biodegradable waste is growing three times faster than average annual municipal solid waste generation. It is estimated that the total amount of waste generated in the EU ranges from 5 to 7 million tones per annum or about 14 to 15 kg per capita and is expected to grow at a rate of 3% to 5% per year. In developing countries, it ranges from 0.01% to 1% of the total municipal solid waste generation. In China and India however the annual generation per capita is less than 1 kg, it is growing at an exponential pace. In this countries waste collection methods vary widely among different countries and regions, domestic waste collection services are often provided by local government authorities, or by private companies in the household Some areas, especially those in less developed countries, do not have a formal waste-collection system (Peters, T. J. 1984)

Rio de Jeneiro (1992) observed that the solid waste management is a major problem world-over and it offers several challenges from clogged drainage and sewers, waterborne diseases like typhoid, cholera and diarrhea, increased upper respiratory diseases from open burning of the garbage to malaria. Sustainable solid waste management is a new concept of dealing with waste which is gaining coinage. (Magutu, O. P, 2010) Waste management has been the responsibility of local authorities but the scenario is changing with the realization that local authorities on their own are not capable of managing

waste. Solid waste management is an expensive venture gobbling up to 30 to 50% of revenues. Waste management is the prevention of waste material being created and waste reduction. Methods of avoidance include reuse of second-hand products, repairing broken items instead of buying new, designing products to be refillable or reusable such as cotton instead of plastic shopping bags, encouraging consumers to avoid using disposable products such as disposable cutlery, removing any food/liquid remains from cans, packaging, and designing products that use less material to achieve the same purpose

Waste management in African context majorly cover the Sub-Saharan Africa region where the accumulation of solid waste is increasing day in day out warranting an intervention to manage the refuse through recycling of the waste which is actively occurring now, especially after the 1980s economic crisis which resulted in increased hardship for most of the region's poor. The serious problems which confront African cities as a result of the 1980s' economic crisis have been well documented (Hayes, R. H. 1985). One enduring consequence is the inability of African governments to sustain adequate levels of urban services. As continuing economic hardship forces a growing number of migrants to urban areas in search of employment, an even greater strain is placed on urban pressure points like solid waste management. Both financially and physically, a Town may be unable to provide waste collection, especially to the urban poor occupying urban areas or other geographically inaccessible areas. The urban poor are left to contend with waste disposal on their own. The lack of support given to the urban poor in this area has serious consequences on their health and on the urban environment. Thus, in cities of the developing world, the management of solid wastes is now an

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issue of vital importance to urban sustainability.

In the Kenyan context Kenya is a signatory to many agreements and conventions on environmental management, these include support for the provisions of Agenda 21 amongst other declarations and statements of principle, such as the Rio Declaration in 1992 on Environment and Development. Kenya is also part to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. Kenya also supported the Nairobi Declaration on the Environmentally Sound Management of Electrical and Electronic Waste at the Conference of the Parties (CoP 8) meeting in Nairobi, 2007. The declaration sought to develop a work plan for the environmentally sound management of electrical and electronic waste (e-waste), focusing on the needs of developing countries and countries with economies in transition. In 1999 the Government of Kenya produced the Sesssional Paper No 6 on Environment and Development. The overall goal of the policy was to integrate environmental concerns into the national planning and management processes and provide guidelines for environmentally sustainable development. The policy paper identified areas requiring action which included development of comprehensive waste management policy, guidelines, and standards (UNEP, 2005)

The Environment Management and Coordination Act of 1999 is an ACT of Parliament that provides for the establishment of an appropriate legal and institutional framework for the management of the environment. The act allows the minister in charge of environment to gazette standards, regulations and guidelines for the proper management, conservation and protection of the environment. The Environmental Management and Co-ordination (Waste Management) Regulations 2006, is the government's legal instrument that deals with waste management in Kenya. Although there is no direct provision for e-waste, the Waste Management Regulations 2006 apply to electronic waste by virtue of their composition which includes several of the substances listed as hazardous waste (Al Salem S.M & Lettieri, 2009)

As urban environmental problems worsen in developing countries, non-conventional approaches to urban pressure points like waste management will have to be adopted. The recycling of solid and organic waste is one approach which has positive ramifications in creating informal employment and offering an environmentally sound solution to waste management problems. One alternative waste management technique is the urban poor's re-use of refuse. Waste recycling is often undertaken as a survival strategy when the urban poor are unable to obtain formal employment, and when non-waste resources are scarce or unaffordable. Waste re-use also plays a role in improving the urban physical environment. By reducing the total amount of solid waste headed for the landfill (or left lying to rot in the streets), recycling and composting are land-saving and pollution-reducing strategies (Al Salem S.M & Lettieri, 2009) Waste re-use also plays a valuable resource conserving role: by recycling materials, further exploitation of scarce natural resources is minimized, thus containing the spreading ecological footprint of the Town. Despite these environmentally and socially beneficial aspects of waste recycling, it is not without its negative impacts, which include exploitation by waste buyers and poor health and living conditions for the urban poor who deal in waste picking (Kenya Gazette Supplement, 68, 2006). Waste management is identified as one of Kisii municipality's key environmental issues and is therefore the focus of this study. Local residents fondly recall the days when Kisii municipality

was a clean, efficient Town. Researchers in Kenya and abroad discuss the externalities of structural adjustment; how the ability of local authorities to deliver services to urban residents has been hindered by deficit reduction, civil service streamlining. Local residents and researchers alike show concern for the impact that the lack of adequate waste management has on low-income urban residents. Both local residents and researchers are also looking for solutions which not only mitigate the environmental problems of waste, but also enhance informal waste management and disposal enterprises development efforts by generating income, sharing information and labour, and uniting informal waste management and disposal enterprises members in collective action.

Table 4.0 Respondents on whether they recycle the waste in the homes

	Frequency	Percentage
Yes	20	66.6
No	10	33.4
Total	30	100

The lack of well paying formal sector employment opportunities due to slow economic growth, SAPs and the accelerated pace of urbanization has resulted in a growing jua kali sector in Kisii municipality. This sector has become an important alternative to employment in the formal sector and is estimated to employ approximately one half of the urban labour force, contributing twenty to thirty percent of total urban income (Hayes, R. H. 1985). For 1981-84, the growth rate of the informal sector (8.1%) was estimated to be twice that of the modern sector (4.1%). The sector caters for low-income consumers with the affordable goods and services the sector provides. Informal activities in Kisii municipality include street vendors, maize roasters, shoe shiners, auto-repairers, cart pullers, kiosk owners, street barbers, and water vendors, building contractors, charcoal sellers and furniture makers.

Organic wastes are not usually scavenged by waste pickers, but are important to street children who often pick through bins to find their next meal. Some of the larger restaurants and hotels also sell their scraps to farmers to be used as pig feed. Organic wastes are also important to the urban agriculture sector as all sorts of livestock, including goats, chickens and the occasional cow, feed on top of waste heaps. Responsibility for the provision of most urban services is allocated to the level of local government as a result of the British colonial heritage of the country. Because the westernized approach to service provision is failing, alternatives must be explored. In order to identify appropriate alternatives, the reasons for the failure of urban service provision must be established. (Kenya Gazette Supplement, no. 57, 2007) Administration of urban areas in Kenya is the responsibility of local authorities and the Ministry of Local Government. Services provided by municipal governments in large urban areas include: primary education, health services, road construction and maintenance, water supply, sewerage, housing, solid waste management, drainage, markets, and social services.

Purpose of the study

The waste management and disposal can be traced to both local and central levels of government. Staff at both levels suffers from a lack of decision-making authority, a lack of experience, a lack of accountability and heavy volumes of work due to under-staffing. There is also a lack of inter-local government cooperation in projects where coordination in planning and construction of infrastructure projects result in significant cost savings and several financial problems that plague local authority: out-dated land rates, neglect in the

collection of taxes, dishonesty of revenue collectors, inadequate enforcement authority, political pressure on officers to be less aggressive in revenue collection, and payment delinquency on the part of many government agencies and parastatals. Moreover, user fees for some urban services may be heavily subsidized to the point that the service is operated at a net loss (Magutu, O.P, 2010).

These problems for waste management by the local government are exacerbated by political difficulties. Councilors are more concerned with the private accumulation of wealth than with the efficient management of urban services (UNEP, 2005). There are also poor relations between the politicians and chief officers. These organizational, fiscal and political problems faced by central and local government in Kenya have resulted in an inability to cope with the staggering rates of population growth and rural to urban migration. There is excessive strain on existing facilities and under-investment in new ones. Education, health facilities, and urban services including waste management are especially affected.

Uncollected solid waste is one of the most visible environmental problems, the municipal service which seems to fail most strikingly is garbage collection and disposal because it causes littering and untidiness which has an immediate adverse psychological impact. The lack of adequate garbage disposal in an area often results in negative attitudes that contribute to a general deterioration of the ecology; this has led to resident trying to manage their waste by having proper disposal and recycling the waste to make sure they are not affected by the environmental changes caused by the improper disposal of waste.

Literature Review
Solid waste management

Rapid urbanization and the associated growth of industries and services is an essential feature of economic and demographic development in most developing countries. Cities are currently absorbing two-thirds of the total population increase throughout the developing world (Erick Nyakundi Onsongo, 2013). Another striking growth is the steady growth in size of cities. One of the most important environmental consequences of urbanization is the amount of solid waste that is generated. These wastes have fast outstripped the ability of natural environment to assimilate them and municipal authorities to dispose of them in a safe and efficient manner. The resulting contamination affects all environmental media and has a direct negative effect on human health and the quality of urban life. In Dar es Salaam in Tanzania, the government made a bold step in 1994 to privatize the waste collection and transportation aspects where the city was zoned and different private companies were given areas of operation while collecting waste management charges approved by the various municipalities. Different municipalities enacted their own by-laws to govern and guide the operations of the private sector. The City only manages the disposal site but this again, the city of Dar-es-salaam has partnered with a strategic investor from

Germany to develop a sanitary landfill site as for a long time the city has operated with a controlled disposal site. The private companies collect waste management charges from the citizens and only approved rates by the council are applied. The city has a department for solid waste disposal, which only develops policies, rules governing the private sector operation, supervision and the management of the disposal site. The private companies contracted are locals and sometimes they get a back-up from the city council whenever they cannot deliver. In this case, the council has to have what to fall back to and therefore

the council cannot afford at any time to have no fleet of vehicles (Rio de Janeiro, 1992).

In Cairo Egypt, the Government decided to invite international bidders for the solid waste management services when the council failed to provide the required services and the city was dirty while the residents were not agreeable to pay for services, which were hardly there in 2002. The Giza region in Cairo, which has a population of 6.5 million was divided into three zones and contracted to three different companies. Jacorossi Impresse is one of the companies managing cleansing services from a population of about 1.2 million under a 15 yr period contract (Rio de Janeiro, 1992).

UNEP, (2005) points out that Solid waste management solid waste management varies widely among different countries and regions. Most of the management services are often provided by local government authorities, or by private companies in the industry. This can be done through the application of waste hierarchy which refers to the "3 Rs" reduce, reuse and recycle. This hierarchy classifies waste management strategies according to their desirability in terms of waste minimization aimed at extracting the maximum practical benefits from products and to generate the minimum amount of waste. The Extended Producer Responsibility is a strategy designed to promote the integration of all costs associated with products throughout their life cycle including end-of-life disposal costs into the market price of the product. The other strategy is Polluter Pays Principle, where the polluting party pays for the impact caused to the environment, which implies that a waste generator pays for appropriate disposal of the waste (UNEP, 2005)

Sustainable waste management

Sustainable waste management is using material resources efficiently to cut down on the amount of waste produced and where waste is generated, dealing with it in a way that actively contributes to the economic, social and environmental goals of sustainable development key principles underlying sustainable waste management is to ensure that waste is dealt with as high up the waste hierarchy as possible. Since all waste disposal options have some impact on the environment, the only way to avoid impact is not to produce waste in the first place, and waste prevention is therefore at the top of the hierarchy. Re-use, followed by recovery techniques (recycling, composting and generating energy from waste) follow, while disposal to landfill or by incineration, the worst options, and are at the bottom of the hierarchy (Rio de Janeiro, 1992)

In deciding what the most appropriate disposal route is, both environmental and economic costs and benefits need to be considered. This decision should be reached taking into account all the costs and impacts associated with waste disposal, including those associated with the movement of waste. Wherever possible the proximity principle should be applied. This recognizes that transporting waste has environmental, social and economic costs so, as a general rule, waste should be dealt with as near to the place of production as possible (Al Salem S.M & Lettieri, 2009) The birth of the waste management hierarchy can be traced to the 1970s, when the environment movement started to criticize the practice of disposal-based waste management. Rubbish was at that time regarded as a homogenous mass that should be buried; the environmental movements argued that rubbish was made of different materials that should be treated differently – some should be reused, some should be recycled or composted, some should be burnt and others buried. The hierarchy in a way echoes ideals that are widespread in human health and medicine, i.e. prevention is

better than cure. It is difficult not to agree that it is more effective to try preventing the problems of waste, than to invest in reactive solutions once the problem has presented. The idea of preventing the creation of waste instead of managing [and disposing] waste after it is created is a very radical position, and to successfully apply it a substantial changes in how products, services and associated materials are consumed

Magutu, O.P (2010) argues that although many government programs are concentrated on recycling at home, a large portion of waste is generated by industry. The focus of many recycling programs done by industry is the cost-effectiveness of recycling. The ubiquitous nature of cardboard packaging makes cardboard a commonly recycled waste product by companies that deal heavily in packaged goods, like retail stores, warehouse and distributors of goods. Other industries deal in niche or specialized products, depending on the nature of the waste materials that are present A number of different systems have been implemented to collect recyclates from the general waste stream. These systems lie along the spectrum of trade-off between public convenience and government ease and expense. The three main categories of collection are "drop-off centers," "buy-back centers," and "curbside collection Drop-off centers. Drop-off centers require the waste producer to carry the recyclates to a central location, either an installed or mobile collection station or the reprocessing plant itself. They are the easiest type of collection to establish, but suffer from low and unpredictable throughput Buy-back centers (Erick Nyakundi Onsongo, 2013) Buy-back centers differ in that the cleaned recyclates are purchased, thus providing a clear incentive for use and creating a stable supply. The post-processed material can then be sold on, hopefully creating a profit. Unfortunately, government subsidies are necessary to make buy-back centers a viable enterprise, Curbside collection encompasses many subtly different systems, which differ mostly on where in the process the recyclates are sorted and cleaned. The main categories are mixed waste collection, commingled recyclables and source separation (Magutu, O.P, 2010)

Research Methodology

The study adopted a cross-sectional survey that covered the estates in Kisii town; the estates were selected because they were characterized by a high volume of garbage. Data collection was done from a sample of 30 residents in Kisii Town and the respondents were selected using systematic random sampling technique, data entry and analysis was done using EpiData and STATA respectively, a binary logistic regression model was used during analysis of the waste management and recycling methods based on independent factors, unlike the linear regression model, estimation of coefficients of the logistic model was by the maximum likelihood method with the odds of the dependent variable predicted from the values of the independent being used to make inferences about the effects. A test of goodness of fit of the model was carried out using the Hosmer- Lemeshow Chi-square static and wald test statistics for marginal effect of estimated parameters. Stepwise regression to obtain a parsimonious model was performed during analysis at 10% level of significance.

Results and Discussion

The results from the table 4.1 above indicate that 66.6% of the residents interviewed indicated that they recycle the garbage and 33.4% of the respondents indicated that they do not recycle the garbage. Waste recycling Methods include reuse of second-hand products, repairing broken items instead of buying new, designing products to be refillable or reusable such as cotton instead of plastic shopping bags, encouraging consumers to avoid using non biodegradable products such as disposable cutlery, removing any food/liquid remains from cans, packaging, and designing products that use less material to achieve the same purpose.

The correlation analysis revealed a significant but moderate relationship between proper waste management and disposal practices by using products that use less materials help enhance and preserve the environmental ($r=-0.448**$, $p<0.01$). This implies that when residents manages waste disposal by recycling they conserve the environment. Removing any food that remains in the cans and plastics was found to be associated with increased environmental conservation ($r=0.326**$, $p<0.01$) while avoiding to use non biodegradable products is moderately correlated with environmental conservation levels ($r=0.215**$, $p<0.01$).

The Logistic Regression model output

LR chi2 (7)   = 36.22
Prob>Chi2   =0.000
Pseudo R2   =0.336
Long likelihood   =-36.699

The study tested the fit of the model using the Hosmer-Lemeshow chi square and the results revealed a significant fit ($p<0.01$) with a predictive power of up to 33% (R= 0.336). Results from the unconditional multiple logistic model show that residents who recycled their waste as a waste management practice were less likely to pollute the environment that those who did not recycle their wastes (OR= 0.137, 95% CI: 0.39 to 0.480; P<0.01). This could be because those who recycle their wastes are concern with the environmental conservation.

The contribution of household waste recycling to environmental conservation

Figure 1: The contribution of household waste recycling to environmental conservation.
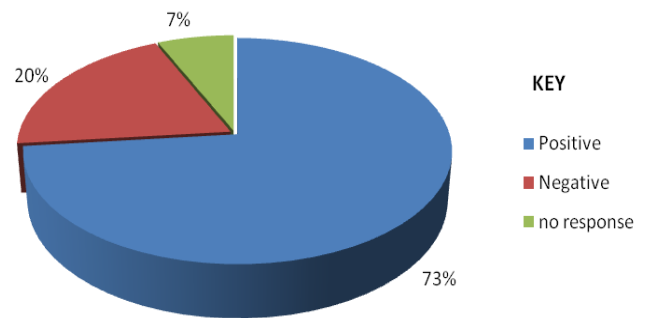
Source: Researcher, 2012.

Out of the sampled respondents, 73.3% said household waste recycling activities affected the environmental conservation positively, 20% of the respondents indicated that activities affect the environmental conservation negatively but 6.7% did not respond. The households who are directly involved in the household waste recycling benefit in terms of reducing the environmental related diseases, and providing a conducive living environment. The negative effect included unplanned recycling, plundering the waste management among others. Those who did not respond have no idea of household waste recycling and did not benefit directly from it.

Means of household waste recycling on Environmental conservation in Kisii Town Impact Cronbach's Alpha composite Realibility   Average Variance extracted

Re-use of products	0.744	0.763	0.420
Clearing food cans	0.917	0.853	0.500
Avoid non biodegradable	0.898	0.639	0.775

Source; Researcher, 2012

Table 4.1 Pair wise correlations between the dependant outcome and independent

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Re-use of second- hand products	(1)	1.00						
Repairing broken items not of buying news	(2)	0.224*	1.00					
Designing products to be refillable	(3)	0.183*	0.130	1.00				
Avoid using non biodegradable products	(4)	0.081	0.159	0.215*	1.00			
Removing any food remains from cans	(5)	0.051	0.326**	0.247**	0.331**	1.00		
Products that use less materials	(6)	0.448**	0.114	0.013	-0.155	0.292**	1.00	

*Correlations Significant at 5% level,
**Correlations significant at 1% level

Table 4.2. The waste management practices on environmental conservation

	Odds Ratio	Std. Error	p>|z|	(95% conf.	Interval)
Re-use of second- hand products	7.265	5.637	0.011	1.587	33.246
Repairing broken items not of buying news	5.604	4.191	0.021	1.294	24.270
Designing products to be refillable	.115	.091	0.007	0.0N M0000000000K24	0.547
Avoid using non biodegradable products	5.870	5.052	0.040	1.086	31.715
Removing any food remains from cans	1.259	.165	0.080	0.973	1.629
Products that use less materials	.974	.276	0.928	0.559	1.699

The average variance extracted indicates what percentage of variance was explained by every individual item. In this study all variables demonstrated average variance extracted between 0.420 and 0.775, easy access was higher than the benchmark of 0.5. All the variables displayed a higher composite reliability that 0.60. The internal consistency of the measuring model was assessed by computing the composite reliability; the coefficients ranged from 0.639 to 0.853 and are displayed in each variable. These indicators suggest that the data exhibit internal reliability. The composite reliability extracted from the benefits indicate a satisfactory reliability and validity hence the household waste recycling has an impact on the environmental conservation in Kisii town.

Conclusion

Solid wastes have a lion's share among total pollution mainly it is composed of resident solid waste, hazardous waste, plastic waste and E-waste trash or garbage which is mainly composed of everyday items that are discarded by the public, biodegradable or recyclable and non biodegradable. The non biodegradable is more harmful in nature as it can't be degraded. Hazardous wastes always pose a great threat to an environment, hazardous wastes are classified into 4 categories viz. ignitability, reactivity, corrosively and toxicity. Plastic wastes always pose a great threat to the environment. Due to its non degradable nature it always tops the chart in pollution, Waste has been a global concern and all effort is being made to minimize it.

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