

## **Influence of Informal Solid Waste Management on Livelihoods of Urban Solid Waste Collectors: A Case Study of Nakuru Municipality, Kenya**

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### **Abstract**

*The study focused on how the urban waste collectors in Nakuru Municipality earn their livelihood through turning waste into wealth by deriving income from solid waste. The objective of this study was to examine how solid waste management contributes to the livelihoods of the waste collectors using the sustainable livelihoods approach. In the study, 192 respondents were interviewed using purposive and snowball sampling techniques. Data was analysed using the descriptive and inferential statistics computed by the Statistical Package for the Social Scientists (SPSS). The study found that the waste collectors earn an income from waste management and these livelihoods are earned in occupational conditions that are unsafe and injurious to them. The study recommends that the informal sector be recognised as stakeholders within the municipality in solid waste management and since the sector is concerned with attainment of livelihoods, the occupational health hazards should be minimised by adhering to safety precautions.*

**Key Words:** Solid waste, livelihoods, safety precautions, occupational hazards, income

### **1.0. Introduction**

Nakuru town has experienced a rapid population growth in the last decade with a population of 350,000 people (Mwangi, 2001) which has resulted from natural growth, rural urban migration, especially after the tribal clashes in the neighbouring areas like Molo, Likia and Njoro; and lastly as a result of extension of municipal boundaries. Solid waste management in developing countries has received less attention from policy makers and academicians than that given to other urban environment problems such as air pollution and waste water treatment (Medina, 1997). Therefore the government of Kenya has prioritised solid waste management as a pressing issue and recognises the value and importance of integrating environment and development objectives into decision-making process (UNEP 2005).

Waste management is one major area in urban environment which has a major impact on urban livelihoods and people's health with disastrous consequences as exemplified by the rise of Malaria which is responsible for the loss of about 1% Gross Domestic Product (GDP) in Africa (Obirih-opareh, 2002).

Urban waste management has continued to create a lot of attention to scholars as they observe that too much garbage is lying uncollected in the streets becoming a health risk, environmental pollutant and public nuisance. In Nakuru the problem of solid waste has been recognized now as a big threat to the quality of the environment (Mwangi, 2002). However the Municipal authorities charged with the responsibility of providing solid waste management and other services have found it increasingly difficult to play the role of collecting, transporting and disposing waste from their municipal boundaries (UNEP, 2005).

Doan (1998) observes that throughout history cities and towns have struggled with how to collect and dispose off, the refuse generated by their population. While Obirih-Opareh (2002) states that solid waste management has poor cost recovery and most urban authorities in developing countries have failed to devise effective response mechanisms to mitigate the problem of low cost recovery. In these light Mwangi (2002) notes that in Nakuru Municipality the local authority has not efficiently and effectively provided solid waste management services because of an increase in urban population and an influx of informal settlements.

Therefore the task of solid waste collection and disposal is far beyond the cost of Municipal governments and the problem is likely to intensify unless alternative means to solving the problem are developed. Solid waste management is a complex task which depends upon, organisation and cooperation between households, communities, private enterprises and government authorities in providing technical solutions for waste collection, transfer, recycling and disposal. According to Allison, *et al*, (1998) and Kundu, (2002) effective waste management, even when carried out informally can be an important facet of environmental protection and conservation.

Like most cities, Nakuru is a huge consumer of resources, and a phenomenal producer of waste. According to Flamingonnet.com (2009), each day the town generates an estimated 240 tonnes of domestic solid waste, while the commercial sector generates 2400 tonnes/day. Only about 60% of this is collected and disposed off to designated waste management sites, the rest accumulates in the environment and is eventually deposited into the lake by storm water and wind. Karanja (2009) and Mwangi (2000), reports that Lack of effective solid waste management has made Nakuru lose its erstwhile accolade of the 'cleanest town' in East Africa. The town, once reputed as a model in garbage collection, is reeling in filth. Garbage collection has largely been left to youth groups. With residents paying between Sh200 to Sh300 a month for garbage collection, but residents claims that these services are unreliable. The residents accuse the Nakuru Municipal Council of failing to monitor how the private organisations carry out their duty since most garbage usually ends back on the streets because the groups do not have facilities to carry out the waste management activities.

The Council has a few ageing refuse collection trucks, which can no longer be relied upon to manage collection. Ironically, though it is supposed to ensure the town is clean, the Council is said to be a major polluter of Lake Nakuru through its waste. Hundreds of tonnes of solid waste at the council's Gioto dumping site on the foot of Menengai Hills are washed by flood during rains, ending up in the lake.

### **1.1. Research Objectives**

The objectives of the study were to:

1. To ascertain the possible income generated from solid waste management and how it has been used to improve on the livelihoods of the individual actors.
2. To assess the occupational health hazards and risks associated with solid waste management.
3. To highlight the strategies used in SWM in Nakuru Municipality and what they are doing to reduce municipal waste.

### **1.2. Theoretical Framework**

This study proposes a livelihood approach as a theoretical perspective in understanding the livelihoods of the urban poor in general and those involved in solid waste management in particular. The livelihood approaches refocuses development efforts on the elimination of poverty and encouragement of economic growth which benefits the poor through sustainable development which targets policies that create sustainable livelihoods for the poor by promoting human development and conserving the environment (Solesbury, 2003).

### **1.3. Livelihoods Approaches**

A livelihood is defined by Carney (1998) as comprising the capabilities, assets, including both material and social resources and activities required for a means of living. It is sustainable when it can cope with and recover from stresses and shocks and maintain the assets both now and in the future without undermining the natural resource base. The sustainability of livelihoods become a function of how men and women utilise assets portfolios on both short and long term basis to be able to cope with and recover from shocks and stresses through adaptive coping strategies they should be economically sound, ensuring that livelihoods activities do not irreversibly degrade natural resources within a given ecosystem. Solid waste management and urban poverty can best be understood from the point of view of the Livelihoods Approaches. Due to urbanisation and globalisation the urban poor have lacked access to basic necessities of life. Solid waste management as a source of income has provided livelihoods for the urban poor. The Livelihoods Approaches are best suited as they stress on utilising and building on the best existing tools for the circumstances at hand which may include recycling, composting, reuse and even incineration and also an analysis of how they will affect the environment by incorporating the sustainability context.

These approaches stress the need for livelihoods approaches to be underpinned by a pro-poor bias and to be informed by prior social analysis to ensure that vulnerable groups are not neglected.

### **1.4. Conceptual Framework**

This study deals with solid waste management and its effectiveness on reduction of urban poverty and how one can apply the Sustainable livelihood conceptual framework in urban areas to reduce poverty. The conceptual framework (figure1) comprises of five key elements:

- a) Shock context, which are the source of insecurity to which the poor and their assets are exposed.
- b) Livelihood assets, which comprises all assets that individual households and institutions, use to maintain their livelihoods.
- c) Assets to and use of the capitals is influenced by policies and structures that govern individual and institutions
- d) Livelihood strategies, which in solid waste management include, reuse, recycling, composting, scavenging, informal collection of waste and even incineration.
- e) sustainable livelihood outcomes like improved income, improved housing, and education for children and quality environment among many other positive outcomes

## **2.0. Methodology**

The study used the case study research design which employed a purposive and snowball sampling technique which was used to track down informal actors and guided the researcher to the next respondent because there were no formal records for most individual actors in the informal sector. The 192 sample size (table1) was proportionately obtained using the Cochran (1977) formulae for populations that are large to obtain a representative sample in the four locations. The data was collected using both the qualitative and quantitative techniques to obtain the primary data which was also supplemented by the secondary data. The Data collected was analysed using both the descriptive and the inferential statistics. The crammer's V was applied in the study to examine the various relationships and associations that informed the research. The Data was analysed using the Statistical Package for Social Science (SPSS).

## **3.0. Results and Discussion**

### **3.1. Results**

The following results were obtained

#### **3.1.1. Demographic Characteristics of the Respondents**

##### **a )Age**

Age is a very important socio-economic factor in terms of how it influences the demographic characteristics of the respondent. It also influences the level of participation and decision making towards the attainment of sustainable livelihoods.

Table 2 shows the cumulative percent of 93.8% of the respondents being aged below 45 years which portrays a population that was still fairly young, brisk and productive. These are the years when one is considered to be very active in life and when one is considered to be most industrious.

### **b) Gender**

Gender also influences participation and involvement in solid waste management and therefore plays an important role in determining who benefits from solid waste management. The figure 2 indicates that 21.9% of the respondents were female while 78.1% were male. The gender disparity can be explained in terms of the role expectations the society has assigned to the different genders. This can also be attributed to the role of women as mothers and men as the *de jure* providers for their families. Lastly searching and collecting of solid waste involves walking for long distances in search of waste materials and therefore men are more mobile than women.

### **c) Education**

Education improves the ability of a person to critically reason and understand issues. In solid waste management. It is an important asset since the goods collected are sometimes harmful, unsafe and risky and the way to handle them requires an understanding of how hazardous they are as shown in table 3 only 33.3% had acquired post primary education.

#### **3.1.2. Types of Waste**

The livelihood of the urban individual actors and the income derived from waste management is partly determined by the type of waste that the individual actors are engaged in. This is because the type of waste that is collected by the waste workers has an attached economic and social value and therefore will determine the profitability of the end product.

There were mainly four categories of the types of wastes collected by individual actors in this study as shown in table 4 which included plastics 37.5%, scrap metals 28.6%, decomposing garbage 17.7% and papers 16.1%. Plastics were greatly preferred by the individual actors partly because they are readily available and secondly because they have immediate use which makes them easy to sell. Scrap metals was also preferred by over a quarter of the respondents because they are also readily available especially at the industrial area and the garages. Scrap metals also fetch a higher price compared to the rest based on the quality and quantity of the scrap. Only a few respondents were involved in collecting decomposing garbage, this is because of its limited usage which does not translate to earning income, however a few of the respondents used it for composting while the majority of the respondents earned income by transporting the waste to dumpsites. Though the availability of waste papers in the municipality is high only a few of the respondents in this study were involved in waste paper collection. This is partly because of the bulkiness of the papers and lack of immediate pre- processing use.

#### **3.1.3. Income Generation from Solid Waste Management**

Income influences the socio-economic status of individual actors in the society and also determines the sustainability of livelihoods in the community. The study established that the urban individual actors were earning some income from solid waste management in the municipality. Table 5 shows that majority of the respondents (65.1%) were earning an income of less than Ksh.5000 per month, 13.0% were earning an income of between Ksh. 5001-10000 while 21.9% were earning an income of above Ksh. 10000. In order to establish whether there was a relationship between the type of waste collected and the income generated a cross tabulation was carried out. A Cramer's V value of 0.373 was obtained showing that there was a statistically significant relationship between income generated and the type of waste collected.

#### **3.1.4. Occupational Health Hazards and Associated Risks**

The study identified several effects which are common to most waste management processes. Though all are not strictly health effects, they are none the less important, especially when health is seen as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. Odour is unlikely to present a health hazard; but it may influence the local community's perception of the risks and lead to stress which is an occupational hazard. Dust particles are known to exacerbate various respiratory symptom including asthma and various allergies. Gaseous emissions or smoke fumes are known to have putative effects on human beings and may lead to congenital malformations at birth.

Table 6 shows the respondents perceptions on whether they interact with hazardous waste materials in the process of solid waste management. The table shows that 80.7% of the respondents perceive themselves to be interacting with hazardous solid wastes while 19.3% do not think that they come into contact with hazardous materials. This can be explained by the perceptions of the people that health hazardous materials lead to diseases and infirmities and therefore those who have not encountered any disease do not think that they came into contact with hazardous material. In order to establish whether the respondents working in solid waste management were working in health risk environments, a set of the possible health effects of working in the sector were listed and the respondents were requested to list the ones that affected them. The following are the results as shown in Table 7. The study established from the responses that 68.2% of the individual actors had received some cuts from waste while 91.7% were complaining of dust related ailments.

Sixty four percent complained of foul smell in their work environment and 77.1% complained of backaches and headaches. Lastly 69.8% stated that they had experienced some effects of smoke fumes in their solid waste management practises. Table 7 shows that dust effects was the highest cause of health hazardous identified by the respondents this is partly because dust cuts across all the solid waste materials that were under investigation in this study mainly scrap metals, plastics, garbage and papers. Both backaches and headaches had a high response because of the environment that the respondents undertake their work. It is important to note that in all the categories the responses were very high and therefore it is evident that the individual actors in solid waste management work in risky environment.

The study established that in almost all the categories over 50% of the respondents complained of the effects of the various indicators of hazardous waste materials that were detrimental to their health which is a human asset of paramount importance. Garbage collectors had the highest complains in aches, foul smell and smoke while the paper collectors were high in dust emission and the scrap metal collectors complained the most about cuts. Most of the emissions can induce odor sensations. Health complaints associated with odorous emissions from dumpsites include eye, nose and throat irritation, headache, nausea, diarrhoea, sore throat, cough, chest tightness, nasal congestion, heart palpitations, shortness of breath, stress, drowsiness and alterations in mood. However further studies are necessary to quantify the specific levels of components in complex mixtures odours that induce specific health symptoms.

### **3.1.5. Safety Precaution**

Empowerment means enhancing an individual's capacity to make choices and translate these choices into preferred actions and outcomes. The transformation of these choices into the desired actions is influenced by the factors and the opportunities available. The study has established that the solid waste management process exposes the individual actors to risky and hazardous environment. Therefore the actors in the sector need to be empowered to make rational decisions and take precautionary measures. However Table 8 shows that majority of those working in the sector do not use any protective garments or equipment. Gloves are envisaged as a safety precaution meant to protect the hands from cuts and other hazardous materials like lead from leaking batteries. Overalls are seen to protect the body from injuries and spillovers from waste materials because of its hard garment compared to the normal clothing. Safety boots are envisioned to protect the feet from cuts emanating from broken glasses, timber, metals and other harmful substance and lastly inhaler masks prevent the body from inhaling poisonous substances in the air that might have some negative effect to the body metabolism. It is worth noting that there are many precautionary measures that can be undertaken in this sector however this study only enquired on these listed basic precautionary measures. Table 8 show the respondents adherence to safety measures based on the type of waste they collect.

The table shows that 67.2% of the respondents did not use any gloves to protect their hands from the waste. Fifty percent of those dealing with garbage collection stated that they were using the gloves to protect their hands, followed by 40% of the scrap metal collectors, 29% of the waste paper collectors and 21% of the plastic collectors. This shows why most of the respondents were complaining of having been cut in their search for saleable item. Majority (68.7%) of the respondents stated that they have not used any overalls in their work. In the scrap metal category only 34.5% of the respondents had used overall as a safety measure, 26.4% of the plastic metal collectors, 35.3% of the garbage collectors and 32.3% of the paper collectors stated that they were using overalls as protective clothing in their work. This shows that the solid waste workers are not enlightened on their safety and there is a need to change their attitudes toward overalls as safety precautions.

In the analysis of interview schedules it was established that 79.7% of the respondents were not using gumboots or safety boots as safety measures, 88.9% of the plastic collectors, 87.1% of the paper collectors, 76.4% of the scrap metal collectors and 58.8% of the garbage collector stated that they were not using any protective boots for their feet. Due to the nature of the materials involved adoption of using safety boots is perceived in this study as very high in the garbage category followed by scrap metals which are very risky. The papers and plastics are less risky and therefore usage of safety boots is very limited. The table also shows that 70.3% of the respondents stated that they did not use the inhaler masks in their duties as a safety precaution, 81.9% of the plastic collector, 69.1% of scrap metal collectors, 64.5% of paper collectors and 52.9% of the garbage collectors did not use the inhaler mask in their work. Lack of adequate knowledge and the cost implication of the inhaler masks can be cited as the reason for low usage of the mask.

### ***3.1.6. Strategies of SWM used in Nakuru Municipality by the Urban Poor***

The strategies used by the individual workers in solid waste management have an outcome on their livelihoods. The strategy used is dependent on the availability of the waste materials and the value attached to the waste end-product. Reuse of waste has great recovery potential and reduces substantially the amount of waste to be disposed. Recycling as a strategy provides employment opportunities and cheap products while composting has some environmental benefits. Generally all the three strategies reduce substantial amounts of waste to be disposed from the municipality. However it is important to note that the respondents collected the recyclables and reusable materials and sold them to other individuals who had use for them. Those engaged in composting sold their compost product or were paid to do the composting. Some individuals were involved in more than one strategy in an effort to maximize on their income. Table 9 show the three strategies commonly used in Nakuru municipality by the individual actor in solid waste management.

The table shows that recycling was the most preferred strategy of solid waste management by the individual actors at 81.8% followed by reuse and composting at 29.2% and 5.7% respectively. Refuse disposal (12%) and or burning as a strategy that was used by individuals who collected waste from households and disposed the waste to designated dumpsites within their neighbourhoods. A lot of ascription to recycling can be attributed to the fact that there are a number of individuals who have established themselves within the municipality and are able to collate the waste materials and transport them to Nairobi for recycling. Therefore the individual actors are assured of ready market for their products.

## ***3.2. Discussion***

This study established that the respondents collected wastes as they had no alternative but to do so as it was their only source of livelihood. This is well explained by the increased population growth rate which has resulted from the In-migration from the other parts of the country because of the town's relative centrality and accessibility from all parts of the country. It's cosmopolitan character, good climate, relatively low cost of living and availability of various services among other attractions has also played a role. In the recent past, the town has experienced increased population growth due to the infamous tribal clashes in Molo, Likia and Njoro areas between April 1992, and March 1998.

### ***3.2.1. Income Generation from Solid Waste Management***

In this study majority of the informal waste collectors earn less than 5000 Kenyan shilling per month, this can be explained by the fact that as a source of livelihood and due to lack of alternative employment, a lot of the urban poor have ventured into the sector and therefore scavenging for saleable items is competitive. The findings of this study compares to a study conducted in Delhi where an adult waste pickers earn a meager Rupees 45 to 80 per day (Sarkar, 2003) which translates to about Ksh.4000/= per month. The study established that there is a relationship between income and type of waste collected. Scrap metal and plastic dealers were earning more income because this kind of wastes are easily available, tend to have a ready market and are easily reused and recycled.

The findings of this study further suggest that there is a lot of exploitation by the few individuals who can afford to buy the materials in large quantities and dictate the market prices. In fact Baud and Post (2003) assert that in Nairobi there is one large-scale company that buys any given material, thus gaining a monopoly which leads to large fluctuations in prices. Since most of the urban poor do not have a legal framework they therefore lack labour rights and cannot arbitrate for better terms of service.

Though Solid Waste Management by the urban poor supports livelihoods through subsistence, education and property acquirement it is evident from this study that majority of the actors are susceptible to exploitation by the few wealthy individuals acting in the same field

In this study majority of the respondents who earn less than Ksh 5000 were below the age of 35 years this implies that age factor is important in income generation in that the actors are in the process of developing networks of reciprocity which would guide them in their business endeavours and which will connect them to one another and benefit from this associations and hence as age increases so does the income. This can also be understood from the point of limited capital base as these informal actors are in their formative stages in their entrepreneurial skills and have therefore not been able to lay strategies of reciprocal income earning.

This is emphasized by the fact that most of the young people have chosen Nakuru due to its low living standard or have been driven to the town by the ethnic clashes; therefore it would be the ideal place to settle. In this study only 38% of the respondents had gone beyond primary education; it is important to note that even after several years of waste picking they do not acquire any special skills and are hence unable to move into any other occupation. Trapped in the vicious cycle of poverty and debt they are forced to continue with waste picking as a source of livelihood (Sarkar, 2003) and as a survival strategy (Slater and Chasca, 2003).

The study established that there were more men than women in this sector which contradicts Huysman (1994) who argues that women are greatly disadvantaged in the labour market and tend to predominate the waste picking sector, he justifies that women have low education levels compared to men and their child rearing and domestic responsibilities are reasons that decimate them in the formal sector. However in this study that might not be the case since, of all the respondents interviewed only a few were women, this can be attributed to their child rearing and domestic chores. Men are more mobile than women and can therefore be able to cover a bigger distance compared to women who in most of the time had children cuddling in their backs.

### **3.2.2. Occupational Health Hazards and Associated Risks**

It is evident from this study that majority of the individual actors in solid waste management in Nakuru Municipality in an attempt to attain a livelihood work in conditions that subject them to high risks which are detrimental to their health. This study concurs with Zamberia, (2006) when he asserts that most of them do not take any health precaution while undertaking their duties which constitute real safety hazards, the urban poor cannot afford adequate protective clothing or equipment and often, for purposes of speed, do not want to use them. The deposits at the landfill regularly comprise a mix of municipal as well as hospital and industrial waste which pose the greatest risks to the actors in Solid Waste Management. The study also found out that most of the hospital wastes are dumped in the Municipal dumping site in their raw form, that is they have not been incinerated as it is required by the Law; this therefore increases the chances of contaminating the waste pickers and therefore jeopardizing their health.

Improper handling of solid waste and indiscriminate disposal in open spaces, road margins, and many other areas, give rise to numerous potential risks to the environment and to human health. Direct health risks mainly concern those working in the field without using proper gloves, uniforms, and safety boots. According to the Solid Waste Management Manual (2000) a high percentage of waste workers and individuals who live near or on disposal sites are infected with gastrointestinal parasites, worms, and related organisms. For the public, the main risks to health are indirect and related to poor water, land, and air quality. In addition, infrequent collection of waste provides an attractive breeding ground for flies and rats. The findings of this study are that the occupational health hazards of waste pickers arise from two aspects – poverty and their occupation itself. Since they belong to the poorest and most deprived section of the urban population, Sarkar, (2003) asserts that under nutrition, growth retardation, anaemia, tuberculosis and other bacterial and parasitic diseases are very common amongst waste pickers. These make them more susceptible to occupational health hazards.

In anticipation of discovering some saleable item the waste pickers rummage through putrefying waste heaps including toxic medical waste using their bare hands and feet and hence come in direct contact with waste material. Infections and infestations results due to such contact with human and animal excreta, sputum, dead animals and potentially infectious hospital waste dumped in refuse dumps. This makes them highly susceptible to a number of health hazards especially in the Municipal dumping site located in London as was found in this study.

The findings of this study that solid waste workers work in inhumane conditions and once in a while receive cutting from broken metals and glasses concurs with a study conducted by Sarkar, (2003) and Furedy (1992). Most of the materials that find their way for disposal are not selected at the source and they comprise of broken glasses, pieces of metals, woods and many others. The scavengers in their effort of eking a living rummage through waste and therefore end up being cut as was found in this study. Poverty is a factor that has hindered the actors in this sector from undertaking safety precautions. The meager income earned by waste pickers offers them a means of survival and cannot afford them the “luxury” of wearing protective clothing’s like overalls, safety boots and hand gloves, as it is assumed that it will be taking another “plate of food off their table”. However this can be blamed on the lack of proper education by the respondents because the costs incurred in treating the ailments is far much above the cost of buying this materials which are in fact a onetime venture not forgetting the working hours lost during the process of seeking treatment.

This phenomenon is also augmented by the fact that there is a lot of competition by the actors in this sector in order to accumulate enough load of waste since the heavier the load the bigger the income and therefore their health becomes secondary to the income. Fire is a constant hazard at the dumpsites with numerous spots that experience spontaneous combustion. While the respondents are conscious of the risks presented by these 'boilers', they can only try to avoid them (Zamberia 2006). However, the scavengers light fires to cook, warm up or burn old garbage to recover metals, further contributing to the risk and the smog that constantly overhangs the area which exposes them more, to higher risks. This result concurs with Baud and Post (2003) who in their research between Nairobi and Hyderabad concluded that the working conditions off solid waste collectors are unsafe and unhealthy, as they do not take any protective measure. This results replicate the study conducted by the Japan International Cooperation Agency (JICA) in a dumping site in Dandora (JICA 1998) whereby there were complains about, smoke, smell and broken glasses which are also the findings of this study.

Most of the respondents in this study confirmed that they suffer from serious headaches and backaches. The headaches can be attributed to the fact that most of them work under direct sunlight as they scavenge for items to sell, their working conditions in the dumpsite also exposes them to smoke fumes which not only results to headaches but also to respiratory truck diseases. In search for saleable items the waste pickers walk for long distance with loads on their backs and a few carry them using hand carts. Because of the distance between points of collection and the points of selling most of them complain of serious backache problems. The waste picker’s health in this study is conceptualized as a very important asset that will enable them to earn a sustainable livelihood. Their income generation is largely dependent on their health unfortunately only an insignificant effort is being made by the waste pickers as a safety precaution towards their very important asset. There is need to enforce rules to ensure that health facilities within the Municipality should treat and incinerate their wastes before final disposal.

It is therefore evident from the findings of this study that most of the individual waste workers are prone to suffer from ‘stick injuries’ since most of them do not wear the Personal Protective Equipment’s (PPE). Though the study did not delve into the real ailments suffered by the urban poor in solid waste management, literature review reveals that dust and foul smell from waste may contain miniscule particles that are lethal to human beings, for instance smell from dead animal’s releases methane into the air and has been proved to cause cancer

### ***3.2.3. Strategies for SWM***

With the increasing cost of raw materials, recycling provides a cheaper source of raw materials for manufacturing industries. Sorting and separation of municipal solid waste is gaining importance in various sectors. This study has found out that at the dumpsite there is intense scavenging for recyclables in the disposed waste. Search for saleable items has always been driven by poverty and inspiration to earn a living, but the emergence of recycling industries has enhanced the search for recyclable materials in the dumpsites as a ready market for the materials exists making it a popular solid waste Management strategy for the urban poor.

This study has established that Recycling and Reuse remains the most commonly used strategies for Solid Waste Management in Nakuru Municipality. Incineration as a strategy of solid waste management is not utilized in the municipal area apart from the municipal dumping site and in which case not actual incineration is done but burning of waste and therefore this study concurs with UNEP-IETC (1996) that the strategy remains a low option for Africa.

The low educational levels, lack of basic technical skills and limited ability to learn new composting techniques among the actors in solid waste management impact negatively on their ability to produce for economic gains and hence the reluctance to venture into the field. The sale of compost does not have a sufficient income and the process of composting is labour intensive cumbersome and emits a lot of foul smell which in turn discourages the actors from pursuing it. Further more because of lack of separation from the source Compost products made from wastes have been of poor quality because they are contaminated with glass pieces, sharp objects, plastics and industrial and medical contaminants making them not easy to sell and hence unattractive to actors in Solid Waste Management (Furedy, 2004).

#### **4.0. Summary, Conclusions and Recommendations**

##### **4.1. Summary of Findings**

1. The study revealed that the urban poor earn their livelihoods from solid waste management though the income varies depending on age, education and the type of waste collected.
2. The study also found out that the urban poor have been working in conditions that put their health, which is an important asset for them at risk for not undertaking any precaution.
3. The research has established that poverty constrains the poor to work in such inhumane conditions without the basic protective items.
4. This research has also established that the popular strategy for solid waste management in Nakuru Municipality is recycling where the urban poor scavenge for saleable items and sell them to recyclers.
5. Though composting might have some environmental gains not many actors wanted to practice it since the compost manure from solid waste does not fetch good market prices and the process itself is laborious.
6. The type of strategy adopted by the urban poor is also dependent on the type of waste to be disposed.

##### **4.2. Conclusions**

1. The problems facing developing countries in handling of municipal solid are not impossible to solve but they need concerted effort from all sectors of society. MSW management is the responsibility of every resident. An all inclusive approach should be adopted in order to achieve any meaningful and lasting solution and eliminate the exploitation of the informal waste collectors.
2. The marketing of compost products within the urban and peri-urban areas is not developed and the farmers are not well enlightened on the importance of compost manure compared to the organic fertilizers which are expensive both in cash and kind to the farmers in the way that they wear out the soils after continuously using them.
3. This study also concludes that in spite of scavenging providing a means of livelihoods to the urban poor it also substantially reduces the final waste that needs disposal in the municipal dumping site which according to Ouano (1991) has both financial and environmental benefits.
4. It is evident from the study that the actors in solid waste management oblivious of their working conditions and in search of livelihood end up working in deleterious conditions which are characterized by cuts, smoke fumes, bad odour, backaches and headaches. Therefore the sector needs to be regulated by the Municipal Authorities to ensure a conducive working environment.
5. The strategies employed by the solid waste actors in Nakuru Municipality to earn a living which include and not limited to recycling, reuse and composting contributes significantly to reducing the waste that is scattered all over the suburbs.
6. The study also concludes that the Municipality and the health facilities do not meet environmentally safe MSW disposal levels because of a lack of sanitary landfills and incinerators therefore posing great health risks to the individual actors as they scavenge for some saleable items.

##### **4.3. Recommendations for Policy and Further Research**

This study would like to make the following recommendations:-

###### **4.3.1. Policy Recommendations**

1. The study found out that the poor are not too poor to manage solid waste within the municipality. With a pro-poor solid waste management approach in policy-making, including structural subsidies to informal initiatives, recognition of the individual waste workers; and life among the urban poor need not be a life of deprivation. The urban poor should be empowered through the public private partnership to ensure livelihood sustainability.
2. There should be a participatory approach in the management of Municipal Solid Waste by involving all stakeholders who include the civil society, NGOS, CBOs and the informal sector so as to facilitate the planning process, mobilization of resources and the maintenance of economic, social and environmental infrastructure.
3. The study found out that a lot of waste is left lying in undesignated dumpsites and therefore the local authorities should undertake management reforms to bring an end to unsightly areas of uncollected or illegally dumped solid wastes by adopting the 3Rs approach of Reducing, Reusing and Recycling waste which will result in the minimization of waste reaching the drop off points.
4. The study established that solid waste management poses health risks and efforts should be made to minimize the occupational health hazards for the urban poor in solid waste management by advocating for the use and application of safety precautionary measures since solid waste management forms part of the brown agenda. That the brown agenda focuses more on the immediate localized and health related effects while the green agenda deals on the delayed, dispersed and ecological effects of the environment.
5. The study found out that some solid waste strategies are not suitable to the individual actors due to their unpredictable income and therefore suitable technologies as dictated by the composition of the waste generated needs to be explored and encouraged with emphasis on the fact that the solid waste workforce needs to be assured of employment which will provide a living wage and a certain level of job security.
6. The study established that there is a ready market for reusable and recyclable solid waste materials in the “Jua Kali” sector. Therefore there is need for the Ministry of Local Government to consider offering a tax concession to industries involved in developing reusable products that will reduce solid wastes intended for disposal. The local artisan groups (Jua Kali) should be trained on marketing their products as they ultimately provide a ready market and an avenue for reuse of old and disposable waste.

#### ***4.3.2. Areas for Further Research and Action***

- 1 The study found out that open dumping is practised in the municipal dumpsite and therefore an investigation into the extent of pollution of groundwater urgently needs to be carried out within the vicinities of the MSW dumpsites to safe guard the lives of the residents of the Municipality and especially those who live within the vicinities of the dumpsites.
- 2 The study established that composting is not a popular strategy in the municipality because of the difficulty in selling the end product. A study should therefore be conducted on composting as a SWM strategy that can be economically viable to the individual actor, the farmer and the environment in general. Marketing of the end product as an alternative to the organic fertilizers should be encouraged by learning the usefulness of the composted products
- 3 Further research on the impact of SWM on the health of urban workers should be conducted as a case study to establish its effect on the healthy life of an individual worker. The study concentrated on the occupational hazards encountered by the urban poor in SWM and therefore an in-depth study should be conducted to establish the major ailments encountered by the individual actors as a result of solid waste management.

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Figures and Tables

Figure 1: Conceptual Framework

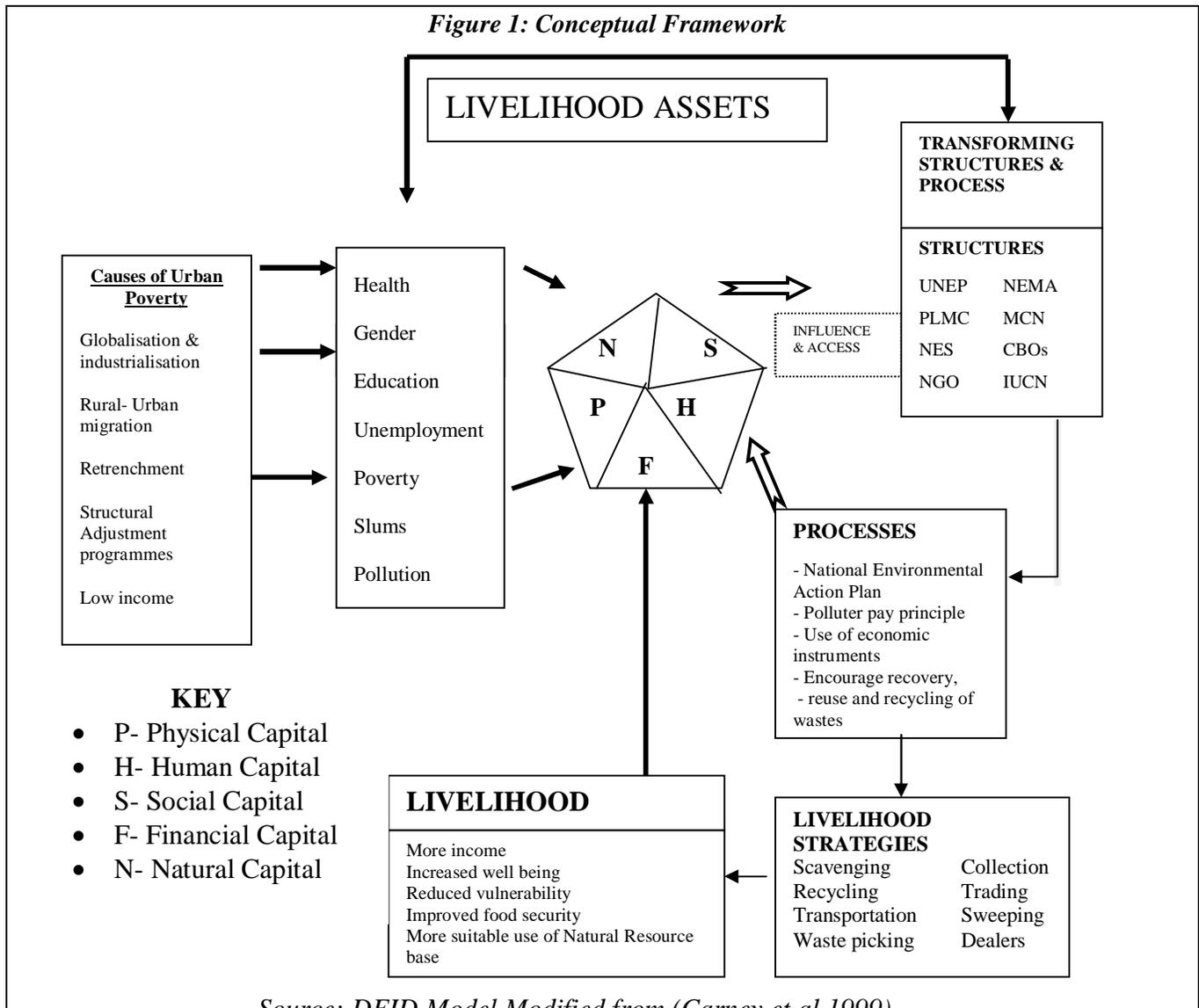
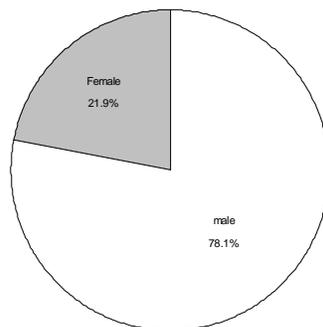


Figure 2: Gender Distribution of the Respondents



**Table 1: Sample Size**

Locations	Total Population (RoK, 2001)	Individual actors from each Location
1 Lanet	36,428	32
2 Kaptembwo	108,234	93
3 Baharini	49,521	43
4 Afraha	27,574	24
<b>TOTAL</b>	<b>221,757</b>	<b>192</b>

**Table 2: Distribution of the Respondents by their Age Categories**

Age Categories	Frequency	Percent
below 25	38	19.8
26-35	98	51.0
36-45	44	22.9
Above 46	12	6.3
<b>TOTAL</b>	<b>192</b>	<b>100.0</b>

**Table 3: Education Level of the Respondents**

Education Level	Frequency	Percent
Did not Attend School	9	4.7
Primary School	119	62.0
Secondary School	59	30.7
Tertiary Institutions	5	2.6
<b>TOTALS</b>	<b>192</b>	<b>100.0</b>

**Table 4: Income Generation and Waste Type**

Income	Waste Types				Total
	Scrap Metals	Plastics	Garbage	Papers	
Below 5000	30 (15.6%)	58(30.2%)	16(8.3%)	22(11.5%)	126(65.6%)
5001 - 10000	7(3.6%)	2(1.0%)	15(7.8%)	0(0%)	24(12.5%)
Above 10000	18(9.4%)	12(6.3%)	3(1.6%)	9(4.7%)	42(21.9%)
Total	55(28.6%)	72(37.5%)	34(17.7%)	31(16.2%)	192(100%)

Cramer's V Value of 0.373 at 0.000 significant level

**Table 5: Income Generation from SW**

Respondents Income Per Month	Frequency	Percentages%
Below 5000	125	65.1
5001 - 10000	25	13.0
Above 10000	42	21.9
Total	192	100

**Table 6: Interaction with Hazardous Waste Materials**

Interaction with Hazardous Material	Frequency	Percentage %
Yes	155	80.7
No	37	19.3
Total	192	100

**Table 7: Health Risks associated with SWM**

	Cuts	Dusts	Oduor	Back/Head Aches	Smoke Fumes
	Frequency	Frequency	Frequency	Frequency	Frequency
Yes	131 (68.2%)	176 (91.7%)	123 (64.1%)	148 (77.1%)	134 (69.8%)
No	61 (31.8%)	16 (8.3%)	69 (35.9%)	44 (22.9%)	58 (30.2%)
Total	192 (100%)	192 (100%)	192 (100%)	192 (100%)	192 (100%)

**Table 8: Respondents frequency on adherence to Safety Precaution Measures**

Safety Precautions	Gloves %		Overalls %		Safety Boots %		Inhaler Masks %	
	Yes	No	Yes	No	Yes	No	Yes	No
Waste Types								
Scrap Metals	40	60	34.5	65.5	23.6	76.4	30.9	69.1
Plastics	20.8	79.2	26.4	73.6	11.1	88.9	18.1	81.9
Garbage	50	50	35.3	64.7	41.2	58.8	47.1	52.9
Papers	29	71	32.3	67.7	12.9	87.1	35.5	64.5
<b>Total %</b>	<b>32.8</b>	<b>67.2</b>	<b>31.3</b>	<b>68.7</b>	<b>20.3</b>	<b>79.7</b>	<b>29.7</b>	<b>70.3</b>

**Table 9: Nakuru Municipality SWM Strategies**

Strategies of SWM	Recycling	Reuse	Composting	Disposal/Burning
	Frequency	Frequency	Frequency	Frequency
Yes	157 (81.8%)	56 (29.2%)	11 (5.7%)	23 (12%)
No	35 (8.2%)	136 (70.8%)	181 (94.3 %)	169 (88%)