ROLE OF PUBLIC PARTICIPATION IN SOLID WASTE MANAGEMENT IN MLOLONGO TOWN

BY

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ABSTRACT

Rapid economic growth and industrialization of the developing countries has created serious problems of solid waste disposal due to uncontrolled and unmonitored urbanization, inadequate inclusion of the waste generators (the public) and financial and human resources. This research is culmination of a study carried out to investigate the role public participation in solid waste management. The main problem of concern is the lack of public inclusion in provision of basic services and infrastructure such as solid waste management. The study was carried out in Mlolongo Town which is located on the fringes of Nairobi City within Machakos County. The objectives of the study were to establish how solid waste is organized, the current and potential role the public play to achieve effective SWM, the major challenges of involving the public SMW and exploring ways of improving the same in Mlolongo. The study used a descriptive research design. A total of 196 households' randomly sampled respondents were interviewed. Three focus group discussions were held and three key informants interviewed. The collected data was analyzed using Statistical Package for Social Sciences (SPSS). The study found that, SWM was carried out by private solid waste collectors, cart pushers, resource merchants, public, estate and neighbourhood associations and the County Government who collect and transport waste to a dumping site. The public played roles of waste collection, financing, sorting, transportation and recycling. Potential roles include composting, waste separation, involvement of children in SWM, introduction of solid waste containers and reuse of waste. Identified challenges of involving the public in SWM were inadequate resources, poor attitudes, averseness to participation and SWM knowledge gaps. The study recommends active public participation in SWM, sensitization of the public, social networking with good-willed individuals, prioritization of SWM during annual budgets and plans to cover knowledge gaps of the people with an ultimate aim of empowering, motivating and provoking them to constantly think of effective and efficient ways of SWM. Further research is required to explore the potential for enormous solid waste reduction at household level, potential for waste recycling and the possibilities of complete privatization of Solid Waste Management in Mlolongo and other similar towns.

DECLARATION

I declare that this thesis is my original work, and to the best of my knowledge has not been presented in any university for examination or any other purpose. The research does not contain any content previously published except in cases where due reference has been acknowledged.

Signature: _____ Date _____

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This thesis is hereby submitted as part of the requirement for the award of the degree of Master of Arts in Urban and Regional Planning, University of Nairobi.

Signature: _____ Date _____

Dr. Fridah W. Mugo

(Supervisor)

DEDICATION

This thesis is dedicated to my family, my wife, Mary Kitavi, and children Ryan, Reu and Rieley

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I acknowledge all those who made the completion of this research possible. I thank my supervisor, Dr. Fridah W. Mugo who made it possible to carry the study through constant supervision and insightful guidance on what I needed. I also thank my family for their support during the period I was preparing the paper.

LIST OF ABBREVIATIONS AND ACRONYMS

USEPA	-	United States Environmental Protection Agency
SWM	-	Solid Waste Management
SPSS	-	Statistical Package for Social Sciences
NGOs	-	Non-Governmental Organizations
PSSP	-	Purpose, Structure, State and Performance
KBS	-	Kenya Bureau of Statistics
UNEP	-	United Nations Environmental Programme
USA	-	United States of America
4Rs	-	Reduce, Reuse, Recycle and Recover
CBO	-	Community Based Organization
NEMA	-	National Environmental Management Authority
WHO	-	World Health Organization

CHAPTER 1: INTRODUCTION

1.1 Background

Solid Waste Management (SWM) is an integral part of the urban environment and planning of the urban infrastructure to ensure a safe and healthy human environment while considering the promotion of sustainable economic growth. Rapid economic growth by industrialization of the developing countries has created serious problems of waste disposal due to uncontrolled and unmonitored urbanization (UNEP, 2002). The problem is further aggravated by inadequate inclusion of the waste generators (the public) coupled with inadequate financial resources, human resources trained in SWM practices in the sphere of collection, transportation, processing and final disposal. Thus the responsible persons or agencies concerned with the public health and environment protection face the crisis of ineffective SWM.

In many cities, development of basic services and infrastructure has not kept pace with the population increase and town authorities function under pressure due to the increased rural urban migration and the resultant increase in volumes of the solid waste generated. This makes solid waste management an important facet of sustainable development for any nation. Thus prioritization of solid waste management has been greatly supported by global initiatives. In Kenya, cities and towns have not been spared from this experience. In Nairobi and other Kenyan towns, a whole range of environmental problems are evident and include, problems arising from overcrowding, lack of clean water supply, proper sanitation facilities and solid waste management.

Public participation is an essential element of any development milestone in the public domain. However, in many parts of the world, communities continue to be looked at as passive recipients of government services, and are very often disregarded even in local decision-making processes (Tadesse, 2006). Ultimately, this approach results in the people failing to know the role they can play in the development process. Therefore, in the midst of several waste management and disposal methods, participation could be a missing link/component in a possible recipe for better solid waste management. Considerable research efforts have been directed to public participation even in the aspects of recycling behavior (Barr, 2004). Such studies have had interesting findings emerge in support of public

participation in solid waste management. Research findings show that landfill space is now scarce and yet the communities also are less likely to accept landfills to be sited near their habitation for environmental, health and aesthetic reasons (Barr, 2004). Because it may no longer be viable to use waste management methods of an autocratic nature, participation of the people in solid waste management decisions and practices is inevitable.
However, of critical importance, are problems resulting from and facing the management of solid wastes in towns. The World Health Organization defines waste as being something which the owner no longer wants at a given place and time, and which has no current perceived market value (Suess & Huisman, 1983). Solid waste is composed of wastes generated by household, shops, manufacturing and service industries, markets and offices. Van Tassel (1970) observes that because waste by definition is of little or no value to the generator, there is little financial incentive to handle it in a careful manner and on the whole, there is a temptation to relinquish responsibility for it at the earliest opportunity.

This definition cannot hold water today. Waste is a resource that can create wealth and employment. It's a million - dollar industry and what is needed is a change of mindset or paradigm shift about how we look at waste. For example, organic waste generated from town's ubiquitous garbage can be used or sold as manure. Far from the nuisance that most urban dwellers consider refuse to be, it can be transformed into wealth. The inputs needed are skill, strategy, partnership and financial injections. Public Participation on the other hand may be broadly defined as the involvement of citizens in governmental decision-making processes. This ranges from being given notice of public hearings to being actively included in decisions that affect communities. It is generally a process of engaging stakeholders so that those most likely to be impacted by a particular activity can influence the outcome.

This study offers a critical analysis of the concept of public participation in solid waste management using the case study of Mlolongo town in Machakos County, Kenya. This study was limited to Mlolongo town, a sprawling up-coming township area known as a weighbridge and heavy commercial trucks stopover point. It is sited some 14 kilometers from Nairobi, on Nairobi – Mombasa Highway, in Mavoko area of Machakos County

1.2 Statement of the Problem

Solid waste disposal and management is both an urban and rural problem. Every person is a potential generator of waste and thus a contributor to this problem. To generate waste is one thing, the type of waste generated is another and yet also the way the generated waste is managed or disposed off is quite a different issue. It has more often than not turned out that the rate at which solid waste is generated is far higher than the capacity to responsibly manage this waste. Waste is generated by, and from different sectors that include domestic, commercial, industry and others. In many instances, the waste management responsibility has been left to the government or administrative authorities (Pongrácz, 2009).

Poor household solid waste management is a concern for town authorities, since vector-borne diseases associated with solid waste, like *leptospirosis*, are a serious threat as well as an increase in rodent related complaints in towns due to primarily the result of poor solid waste management in the area, namely infrequent solid waste collection, indiscriminant dumping, and illegal solid waste dump sites (Barr, 2004). Urban areas such as Mlolongo town are under intense pressure to meet infrastructural and service demands as a result of rapid urbanization and high population growth in cities. This has led to poor urban service delivery such as poor solid waste management. Towns such as Mlolongo and their outskirts have become areas that generate tremendous amounts of solid waste, and those amounts are increasing as income increases. Mlolongo Township as an urban centre is no exception and it has been experiencing this problem of poor solid waste management. The problem is further compounded by the lack of participation by the residents (UNEP, 2007).

The County Government of Machakos is now faced with the challenge of managing solid waste in Mlolongo town that has resulted to poor urban aesthetics in the town (Ostrom, 1996). Among the many sources of solid waste in the area are open air market and settlements around Mlolongo areas which generate the highest amount of solid waste. The existing dumpsites cannot accommodate the solid waste from the area and there is also a further need to involve people in the management of the waste as a strategy to improve the efficacy of the process. Solid waste management remains one of the cardinal priorities in the world. It was even identified as part of the world Agenda 21 of the Rio Declaration on Environment and Development in 1992. Therefore, it is essential to address the problem of

solid waste management in Mlolongo town as one of the strategies to achieving a sound environment and promoting sustainable development (UNEP, 2002).

Thus an investigation is warranted to determine if public participation may be the missing link in effective solid waste management in Mlolongo town. The greatest potential for initiating public participation in solid waste management strategies exists at the household level where solid waste reduction strategies based on local need for long lasting solutions and support of waste reuse methods for effective solid waste management can be applied. It is for this reason that the study seeks an in depth examination of this issue with a view of coming up with important insights that may be used to facilitate meaningful implementation of public participation. The study mainly examines the current public participation in solid waste management in Mlolongo Town as well as exploring untapped potential of public participation in solid waste management.

Public participation works towards changing the town authority's behaviour and attitude from dominating to facilitating, gaining rapport, harnessing the skills of local people as well as empowering and enabling them to become a part of the solid waste management system. This can enhance commitment to solid waste management practices with improved results. Many of the studies done on solid waste management have mostly been directed towards major municipalities leaving out the small towns. This study comes in to fill this gap. The research findings will contribute to planning knowledge that can be replicated elsewhere in addressing the monumental challenges of solid waste management experienced in towns throughout the country.

1.3 Research Questions

This study was guided by the following research questions:

a) How is solid waste management organized in Mlolongo Town?
b) What role does the public currently play in solid waste management in Mlolongo Town?
c) What other roles can the public play in achieving effective solid waste management in Mlolongo Town?
d) What are the major challenges of involving the public in solid waste management in Mlolongo Town?

e) How can solid waste management be improved in Mlolongo town?

1.4 Research Objectives

The following were the specific objectives of the study:

a) To determine how solid waste management is organized in Mlolongo Town
b) To establish the role played currently by the public in solid waste management in Mlolongo Town.
c) To identify other potential roles that the public can play in achieving effective solid waste management in Mlolongo Town.
d) To identify the major challenges of involving the public in solid waste management in Mlolongo Town.
e) To determine how to improve solid waste management in Mlolongo town

1.5 Study Assumptions

The study is based on the following assumptions:

a) The current institutional framework of government managed solid waste management is no longer tenable.
b) That there is enormous potential for public participation to improve solid waste management in Kenya's towns.

1.6 Scope of the study area

This study was limited to Mlolongo town, a sprawling up-coming township area known as a weighbridge and a heavy commercial trucks stopover point. It is sited some 14 kilometers from Nairobi, on Nairobi – Mombasa Highway, in Mavoko area of Machakos County. Mlolongo town extends to about 37.3 square kilometers and has a population of 42,154 people. The number of households in the study area is about 7,025. The study confines itself mainly to the role of public participation in solid waste management in Mlolongo Town.

CONTEXT OF STUDY AREA

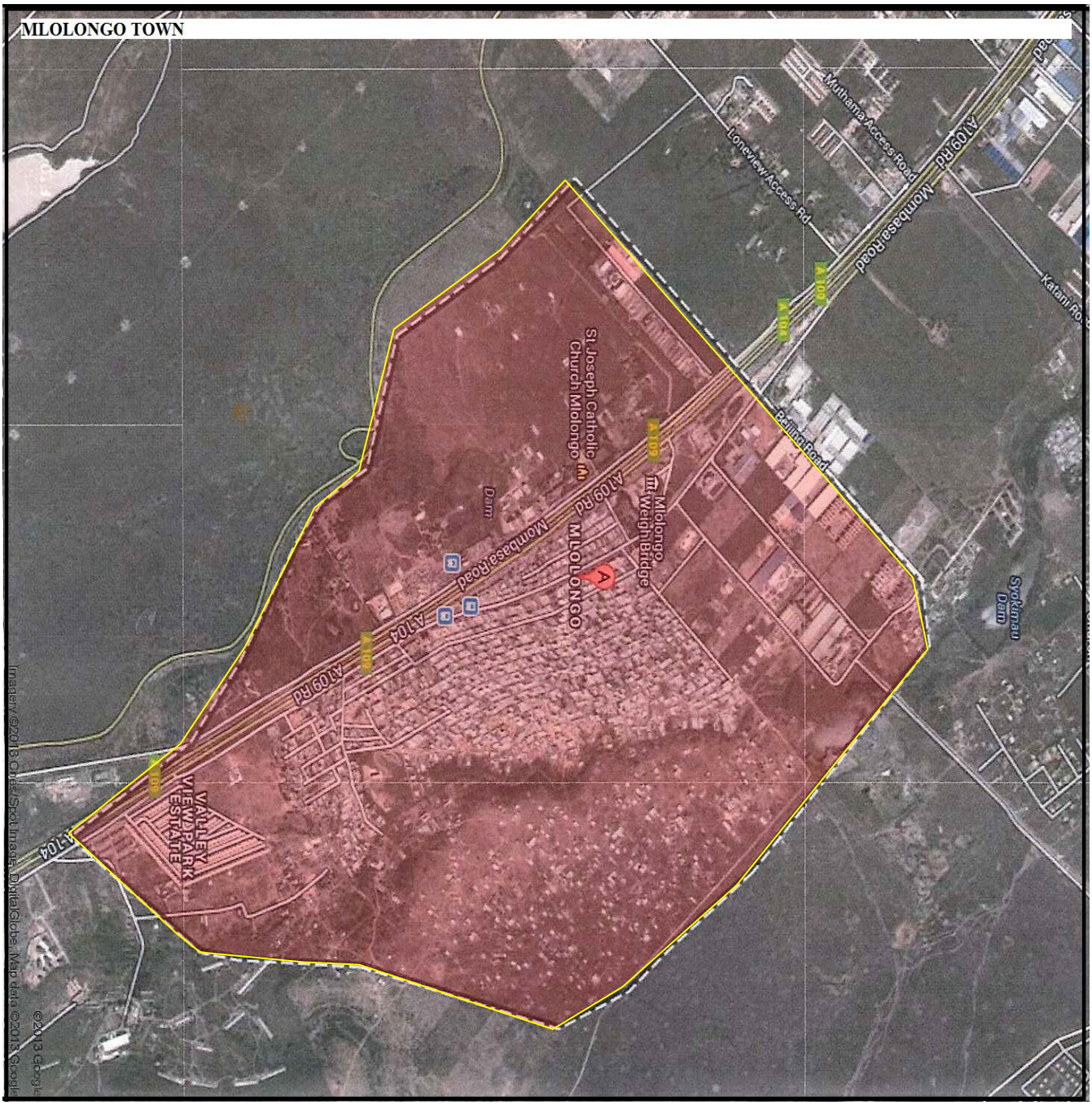
KENYA

MACHAKOS COUNTY

MLOLONGO

Source: Author, 2014

MLOLONGO TOWN



MAP 1.1: Area of Study, Mlolongo Township

Source: Google Maps, 2014

1.7 Justification of the Study

Solid Waste Management is an area that has been taken for granted in our urban centres for a long time. However, it's increasingly obvious that the current practice of public financed and operated solid waste management is becoming inadequate for today's needs especially in the light of the growing urban populations. Although legislation to control waste disposal exists, it's rarely enforced. Poor SWM is negatively impacting public health, the environment and the national economy and thus the need for close attention. Enhanced waste management is possible and affordable; it can simultaneously address national objectives for sustainable development, public health, environmental quality and ultimately meet the MDGS. All citizens are indiscriminately and negatively affected by poor SWM.

1.8 Limitations of the Study

Two major limitations to this study were envisaged. This may have an implication on the process of data collection although they did not compromise the quality of findings.

1.8.1 Resources

Carrying out of this study required financial resources to settle costs such as travelling, printing, photocopying, research assistants and mobilization of participants in the focus groups among other costs. The limited availability of resources was a constraint but this did not compromise the quality of data collection and research findings.

1.8.2 Time

Time is another factor that could have affected the process of this study. Securing permission from government offices can sometimes take a long time delaying the commencement date for data collection and consequently, the study may not be completed within the stipulated time as planned. The time available for the study was limited as it had to be completed within the university calendar. Therefore, extraction and organization of data was quite challenging but the researcher invested the best possibly efforts to ensure that quality of the output is not compromised.

1.9 Key Concepts and Terminologies

A number of concepts and terminologies are explained in this section. These include: waste and municipal waste, solid waste, management, solid waste management and public participation.

1.9.1 Waste

Waste: an item or a substance that is either damaged beyond repair or can no longer be put to its intended use and is therefore to be discarded or parted with (KENAO, 2006/2007). The word *waste* also refers to *refuse* (resources that are to be discarded that are perceived as useless). The World Health Organization defines waste as being something which the owner no longer wants at a given place and time and which has no perceived market value (Suess & Huissman:1993). UNEP defined wastes as substances or objects, which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law. Waste is a dynamic concept which can be defined in different ways (Pongrácz, 2009:93). Pongrácz introduces an innovative description of waste in what she refers to as "object-oriented modeling language, PSSP. PSSP stands for purpose, structure, state and performance, which are object attributes" (Pongrácz, 2009:93). In most cases, the definition of waste depends on the type or category of waste under consideration. Some of the dominant types of waste include; municipal waste, solid waste, hazardous waste and, electronic waste. Municipal and solid waste, which are relevant to this study are defined.

1.9.2 Municipal Waste

Schulbeller (1996) defines municipal waste to include refuse from households, waste from industrial, commercial and institutional establishments, market waste, yard waste and street sweepings. Cointreau-Levine and Coad (2000:4) take municipal waste to refer "to wastes from domestic, commercial, institutional, municipal and industrial sources, but excluding excreta, except when it is mixed with solid waste". It is however necessary to note that in developing countries, many a times, it becomes difficult or even impractical to put a line between excreta and solid waste. In many instances, solid waste mixes with excreta to the extent of being potentially hazardous to human health.

1.9.3 Solid Waste

Solid waste is defined as any item or material that is discarded by its owner and that is not discharged in gaseous form to the atmosphere, to a pit latrine or via a pipe or channel. Solid

waste may include gases and liquids in containers (UN HABITAT, 2010). Any useless, unwanted, or discarded material that is not a liquid or gas is classified as solid waste. Solid waste is also known as garbage and is not very different from municipal waste. Solid waste is also defined as "organic and inorganic waste materials produced by households, commercial, institutional and industrial activities that have lost value in the sight of the initial user.

1.9.4 Management

Management is a cyclical process of setting objectives, establishing long term plans, programming, budgeting, implementation, operation and maintenance, monitoring and evaluation, cost control, revision of objectives and plans. Management of urban infrastructure services is a basic responsibility of the municipal government. It is usually advantageous to execute service provision tasks in partnership with private enterprises (privatization) and/or with the users of services (participation), but the final responsibility remains that of the government.

1.9.5 Solid Waste Management

Solid waste management is a discipline associated with the control of generation, storage, collection, transport and disposal of solid wastes. It includes all the necessary operations to remove solid wastes from the sources of generation to the disposal sites and the activities performed at the landfill to ensure environmental safety (UN HABITAT, 2010).

1.9.6 Public Participation

According to the Oxford English Dictionary, participation is "the action or fact of partaking, having or forming a part of an action. It is primarily about the people and development of their communities or regions. It's a process where the subjects or the target communities and stakeholders participate in particular way, on the implicit assumption that their participation is a means to some further action, on their part, to bring about specific change. Participation as a concept came to the lime light as a result of rising advocacy for the end of the top-down strategies to development action, in favor of greater inclusion of the subjects of the development programs. Oakley and Marsden (1984) agree that participation is a process and

not just a solid product; however, they are also quick to note that it is very difficult to establish a universal definition for participation. This indicates that different scholars, authors and organizations define and understand participation differently. Their definitions and understanding is often guided by the orientation and intent of the individual or organization defining participation, given the circumstances. Although participation is widely known to be a free process, in some instances it practically requires that people are dragged into getting involved in operations that are of no interest to them, but they are coerced in the name of participation. Oakley and Marsden (1984), look at participation as a concept that is closely linked to rural development. They also explain that very often, participation is seen as some kind of ingredient that can be added to the recipe for rural development so that the results from the development project are palatable (Oakley and Marsden, 1984:17). The conception that participation is an important ingredient in development presents a temptation to force participation at any cost. However, it is perhaps helpful to note that there is what Oakley and Marsden refer to as authentic participation, which is described as a result of a bottom-up process of development.

The concept of participation requires clear interpretation and careful comprehension before it is adopted for any given purpose. Oakley and Marsden (1984) try to explain the different interpretations of the concept of participation by use of four "terms", that is; collaboration-input-sponsorship, community development, organization, and empowering. These terms are used to explain the different orientations in the participation discourse, and the different terms represent different intentions or purposes for which participation is adopted by the implementers. According to Oakley and Marsden (1984), participation can be looked at as a means as much as it can be looked at as an end in itself. Participation can be perceived as a means if it is adopted as a method of achieving success in a development program. It can also be an end in itself if it is seen as "a process whose outcome is meaningful" (Oakley and Marsden, 1984:27). Participation is adopted as a catalyst to success of a beneficial undertaking in a community (Barnes, 2005), advises that there is no need to look for a model of participation that is a one-size fits-all; thus this study takes on the perspective of participation as a means.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

This chapter contains sections which consist of information from previous studies on different solid waste management systems, major challenges of solid waste management, public participation in solid waste management and the conceptual frame work.

2.1 Sustainable Development

Nowadays concern about sustainable development is at the helm of most contemporary development debates/discussions and project undertakings. Most conventionally, sustainable development is understood as that development that is mindful of the future generations' needs while resources are used to meet the needs of the present generation (Brundtland, 1987). Several issues arise when we start talking about sustainable development. Most of these issues relate to the "how" of sustainable development. Sustainable development has continuously become a prominent phrase in the development discourse and has been impactful in changing the orientation and practice of development (Adams, 2001). Its prominence, however, has also bred varying meanings and definitions of the concept.

I personally conceive sustainable development as a concept with two faces, on one hand as a means and on the other as an end in itself. Sustainable development as a means in this case refers to the orientation behind the different ways in which interventions or undertakings of any nature (for development purposes) are made. In this, sustainable development presents an ideology upon which development-related activities are initiated and implemented. Such activities would include but not limited to, education provision, health provision, natural resource allocation, land use and waste management.

Sustainable development as an end, on the other hand can only be tested and proved by the future generations, whether those generations can meet their needs conveniently and yet carry on the sustainable development legacy left behind by the preceding generations. Taking a

closer look at the list under sustainable development as a means, brings out the fact that most, if not all such activities are dictates of either the state or at least a privileged group that possesses the power to do so in any given society. I strongly feel that without a proper scrutiny of how such as these activities are done, sustainable development may become only an ideal fantasy that may never be attained. As I have noted, in most cases the state or any other mandated structure of authority singly takes the responsibility of determining how, how much, and to whom these activities/services, are provided. This unilateral nature of responsibility definitely has an effect on sustainability.

Waste management is one of the services that are usually left to the authorities to take care of, and is particularly of concern in the debate on sustainable development. Particular attention has to be paid to the practices of waste management because if not well done, may have far reaching effects on the environment and thereby affecting sustainable development.

Objective 1: To determine How Solid Waste Management is organized

2.2 Waste Management Practice

There are several factors that have facilitated increase in the volume of solid waste generated. One of the factors that have led to increased solid waste generation is rapid urbanization (UNEP, 2007). Urbanization comes with expansion of towns which manifests through the growth of social and economic infrastructure/services and industrialization. The growth in such services warrants the increase in population in such areas. An increased population automatically means increased demand for not only social services but also consumables which potentially present a larger base for waste generation-in most cases solid waste.

The increase in the volumes of waste generated has also been proved to be synonymous with the "new lifestyles associated with greater affluence" which convert into higher consumption levels, thus generating more waste amidst changes in waste composition (UNEP, 2007:224). Affluence influences people to adopt superfluous demand and purchase patterns making people acquire more of what is not very necessary for their wellbeing. When people possess more than what they actually need, failure to consume all that they affluently have, eventually leads them to get rid of the useless excess which turns into solid waste. In most cases more purchases also mean more packaging material- which readily translates into solid waste especially for the manufactured products. The manufactured products contain materials

which are very difficult to decompose, for example plastics, thus increasing waste volumes uncontrollably (Bournay, 2006). In a capitalistic world, the ultimate aim of the manufacturers is to make as much profit as the market can permit. Because of this line of thought, the manufacturers are more concerned about suiting the product to the consumer. Little or even no effort is made to package the products in an environmentally sensitive way and those that make an effort, are still very few. Usually, the burden is left to the consumer to dispose of the waste packaging material by their own means. In doing so, the manufacturers actually externalize the costs of solid waste management by extending it to the consumers. The problem here is that in most cases the manufacturers do not even bother to give any instructions to the end user on how to manage the waste appropriately. This complicates the solid waste management process as those who "manufacture" the solid waste have not considered internalization of the cost of solid waste management, say as a way of doing Corporate Social Responsibility.

Generally, there is a tendency for development to come with increased waste generation. Data from Asia confirms that the more developed countries like Japan, Laos and Thailand, have more municipal waste generated per capita. Interestingly also, there have not been signs of abating the increasing amounts of waste generated (UNEP, 2007:224). The rapid increase in waste generation has therefore made effective waste management in many countries, challenging. Consequently, it has put human life and the environment at stake. Some countries in Asia have taken on eco- labeling as a market-based tool/strategy to deal with the waste problem (UNEP, 2007:225). On top of eco-labeling, the 3-R approach: (reduce, reuse and recycle) is also becoming popular in Asia and other parts of the world.

There is an indication that the ways in which solid waste is managed, are as diverse as the human race itself. Some methods of waste management are proper and environmentally sound, while some are not. Conventionally, solid waste (in most cases referred to as garbage) is usually collected as a bundle of trash by local authorities or by private firms to be taken to a transfer station and then to a landfill (sometimes collected and taken straight to the landfill). However, considering the fact that there are not always enough resources and infrastructure for waste management, especially in developing countries, this scenario ultimately implies that some waste will not be collected, or will be improperly disposed of (UNEP 2002). As a result, landfills, burning waste, rodents and odours which are very common in developing countries have made residential areas susceptible to health hazards (UNEP, 2007). In

agreement, the United States Environmental Protection Agency (USEPA) affirms that improper disposal of solid waste exposes the environment and human life to danger by way of emission of greenhouse gasses and contamination of ground water, respectively (2002).At landfills, the Kansas State University (KSU, n.d:6) reports that: "Containers break open and spill their contents. Liquids put in the landfill combine with rainwater and soak through the garbage. Soluble hazardous materials may be washed with them, producing leachate. Leachate will flow downhill over surface land, or will percolate through the soil until it reaches an impermeable layer. Leachate can contaminate groundwater and surface water.
Therefore solid waste, if not well managed, can cumulatively have long-lasting and difficult-to reverse negative effects on the environment. There have been efforts to improve on the management of solid waste. One of the suggestions has been the application of an integrated waste management strategy.

2.3 An Integrated Strategy to Solid Waste Management

The United States Environmental Protection Agency (USEPA) (1993a, 1994) outlines and explains three main components in an integrated municipal waste management strategy- that is; waste prevention, recycling including composting and, combustion. In a review of these components, USEPA (2002:4), categorically introduces and defines five main activities (in a hierarchy) classified under integrated solid waste management (waste prevention, recycling, composting, combustion and landfilling), and the similarity is noticeable between the former components and the later activities classified.

2.4 Waste Prevention

This is also referred to as *source reduction* in the design, manufacture, purchase, or use of materials and products to reduce the amount and/or toxicity of discarded waste. Waste prevention also means, in simple terms, "reducing waste by not producing it"(USEPA, 2002:4). USEPA asserts that since it reduces the amount of waste that a community must manage, waste prevention is the preferred municipal solid waste management technique. According to USEPA (1998:2), source reduction involves reuse activities and "has come to be recognized as a commonsense approach with significant potential to use resources efficiently, save money, and reduce waste" and because of the various advantages it presents, many states in the United States of America (USA) have increasingly engaged in innovative ventures towards solid waste prevention. Grass cycling and backyard composting are taken to

be “forms of source reduction or waste prevention because the materials are completely diverted from the disposal facilities and require no municipal management or transportation” (USEPA, 2005:7-9).

2.4.1 Recycling

Recycling involves the reuse of materials that are potential waste but are rather turned into valuable resources. The most important advantage with recycling is that it reduces the production of greenhouse gases since there is diversion of the waste from the landfills. Recycling also reduces the use of new resources, in a way contributing to sustainable development. Materials like paper, glass, steel, plastic, and aluminum can be recycled such that instead of disposing them of, they can be regained and thereby reused.

2.4.2 Composting

Biodegradable solid waste form slaughter houses, food-processing industries and kitchens can be mixed with soil and decomposed by aerobic bacteria to produce material known as compost which can be used as a soil conditioner and fertilizer. The compost is then bagged and sold. Compositing refers to “The controlled aerobic biological decomposition of organic matter, such as food scraps and plant matter, into humus- a soil-like material. Compost acts as a natural fertilizer by providing nutrients to the soil, increasing beneficial soil organisms, and suppressing certain plant diseases” (USEPA, 2002:4).This implies that the need for chemical fertilizers will be reduced and at the same time, composting helps in reduction of greenhouse emissions from solid waste.

Compositing however has some drawbacks. It is not economically feasible with mixed urban waste because sorting out the glass, metals and plastics is too expensive. It thus requires consumers and plants separate food and yard waste for collection.

2.4.3 Combustion

Another way to deal with solid waste is to burn combustible materials and melts down certain non-combustible materials in municipal incinerators. The ash or residue left after incineration can then be deposited in landfills. Combustion refers to the controlled burning of waste in a bid to reduce the volume that has to go to landfills, and in some cases to generate electricity.

Combustion can be employed for waste that cannot be prevented or recycled. There is also an element here of providing safer disposal methods for example through "improving the design and management of incinerators and landfills" (USEPA, 1993b:2). Although "the combustion process can generate toxic air emissions, these can be controlled by installing control equipment such as acid gas scrubbers and fabric filters in combustors" (USEPA, 2002:4)

Incineration kills disease - carrying organisms and reduces the volume of solid waste by 80% to 90%. Salvaged metals and glass can generate income and the waste energy can be used to generate electricity or heat for nearby buildings. They do not pollute underground water and add very little air pollution if equipped with adequate air pollution control devices which are required by the present environmental laws. However, construction, maintenance and operating costs are much higher than for the landfills except in areas where land prices are high or waste has to be hauled long distances to the landfills. As urban areas run out of acceptable land fill areas, incineration will become more economically attractive.

2.4.4. Sanitary Landfills

A landfill is a land waste disposal site that eliminates most of the problems associated with open dumps by spreading the waste in thin layers, compacting it and covering it with a fresh layer of soil each day. No open burning is allowed, Oduor is seldom a problem and rodents and insects cannot thrive. Landfills are supposed to be situated to so as to minimize water pollution from runoff and leaching. A land fill can be put to operation fairly quickly, has low operating costs and can handle a massive amount of solid waste. This presents a safer alternative to uncontrolled dumping of solid waste. It is very clear that poor waste disposal can be dangerous to human life as well as the environment; therefore establishment of designated places (landfills) where waste that can neither be recycled nor composted can be managed, becomes necessary. A standard landfill is designed in a way that it can protect ground water from contamination, and also avoids fires that would break out as a result of methane emission.

Landfills can be created by digging out an area and then filling it with successive layers of trash and earth. Others involve filling in natural valleys, canyons, or abandoned mining pits and stone quarries. Once a land fill is filled it can be re-graded and used as a site for park, golf course, athletic field, a wildlife area or other recreational area. Large landfills can also be

used to produce methane gas which can be used as fuel. Landfills do have some draw backs. Wind can scatter litter and dust during the day before each day's load of trash is covered with soil. There is a danger that explosive methane gas and toxic hydrogen sulfide gas, produced by anaerobic decomposition, can seep into nearby buildings and cause explosions. Contamination of groundwater is a potential problem without proper siting, construction and monitoring. To reduce this hazard it's required that landfills have synthetic liner, a cap of clay or plastic and a leachate system to collect water that seeps through the system.

2.5 How can the Strategy Work?

Although solid waste is quite challenging to manage and dispose of, it is not always totally useless. Innovative ways of dealing with solid waste can be devised to make solid waste useful. The Centre for Ecological Technology (CET) which supports sustainable technologies in New England undertook such a venture, turning waste compositing into a "way of doing business" (Majercak, 2002:1). Through collaboration with commercial haulers, commercial waste generators and, farmers, the project took off with the farmers being the composting agents who would then send the products to the market.

Engaging in such a complex of collaboration, in itself presents an opportunity for constructing a synergy that would beneficially take advantage of solid waste to make it productive. This would result into a double gain since composting can fit very well in the marketplace dynamics as it provides an opportunity for benefits both economically (income to farmers) and environmentally(reducing greenhouse gasses and reduction on leachate production), from organic waste. Farmers also get empowered to manage their own waste by using it as fertilizers, thereby minimizing on the use of synthetics or petroleum-based fertilizers (Majercak, 2002). Such an undertaking may not necessarily be simple to start and maintain, but it could definitely turn out to be worthwhile.

In Africa, a very small volume of the generated solid waste is recycled or recovered as there is little "economic incentive and market for recycled materials (UNEP, 2002:249). On one hand, Bournay, (2006) notes that rich countries continue to send waste to Asia and Africa which turns out to increase the burden in those continents. This waste is in form of obsolete items that no longer meet the consumer preferences and standards in the rich countries, and or

unnecessarily extravagant packaging of manufactured products for export. The defence of the rich countries is that the waste they send can be "recycled anyway" (Bournay, 2006:24).
On the other hand, many European countries have recycling schemes for glass and paper, but the success of such schemes has also been reduced by the increased generation of waste paper and glass and thus making the solid waste problem just yet to be mitigated (UNEP, 2002). It also some what sounds impractical to assume that there will be effective and efficient recycling of waste in Africa, when actually the main method of waste management and disposal is landfilling.

Landfilling has become the immediate most possible way of managing solid waste in most African countries because of the high prevalence of indiscriminate waste dumping. The authorities that primarily bear the responsibility to clean up the cities, towns and residential areas find it easier and time saving to collect the waste and carry it to a landfill other than sorting the waste for recycling and less still for composting.

The solid waste management challenge is therefore world-wide albeit at different levels in the different parts of the world. The magnitude of the challenge is driven by the amount of effort put in by different countries to contain the solid waste problem. In the developed countries, solid waste is not as alarming a problem as it is in developing countries. The disparity can be explained by the fact that in developing countries, the rate at which solid waste is generated is not inconsonance with the capacity to properly manage it (UNEP, 2007). The public seems to be leaving the burden of solid waste (which they generate) to the administrative units/authorities. There is little and in some instances no indication of public concern in containing the problem and yet closer involvement/participation by the public is very important if solid waste is to be well managed.

Objective 2 and 3: To establish the role played by public and other potential roles in solid waste management

2.6 Significance of Public Participation in Solid Waste Management

This subsection details the different relevant literature on public participation in solid waste management including; whether public participation could be the missing link or ingredient, the role of public participation in solid waste reduction, social capital and participation in

solid waste management, the role of the public in solid waste management, the challenge of involving the public in solid waste management and, the strategies for public participation.

2.7 Public Participation-Could this be the Missing Ingredient?

In many parts of the world, communities continue to be looked at as passive recipients of government services, and are very often disregarded even in local decision-making processes (Tadesse, 2006). Ultimately, this approach results in the people failing to know the role they can play in the process. Therefore, in the midst of several waste management and disposal methods, participation could be a missing link in a possible recipe for better solid waste management. Considerable research efforts have been directed to public participation even in the aspects of recycling behaviour (like Barr, 2004). Such researches have had interesting findings emerge in support of public participation in solid waste management. Research findings show that landfill space is now scarce and yet the communities also are less likely to accept landfills to be sited near their habitation for environmental, health and aesthetic reasons (Barr, 2004). Because it may no longer be viable to use waste management methods of an autocratic nature, the participation of the people in solid waste management decisions and practices becomes inevitable. In the study on *Residential Solid Waste Management in India*, (Sauro, 2000) found out some gaps in the solid waste management practices that would easily point to public participation as the most possible solution. It was found out that systematic sorting of waste at the different stages right from the source to the disposal sites was lacking (Joardar, 2000:322). It was also a major finding that in India, incineration has not shown success due to the diverse composition of the waste since it is not sorted. Basic sorting should ideally be a role played by the public, at the source (of waste generation). Without waste sorting, it practically becomes difficult to manage the solid waste in a sustainable way.

Besides, the manner in which waste is disposed of especially in the developing world may only suit participation of the public in order to reverse the effects of poor solid waste disposal. Joardar (2000:322), found out that "the most widely practiced municipal disposal method has been uncontrolled dumping, concentrated in low-lying fringe locations and leading to leacheate percolation and pollution runoff and contamination of soil, ground water, canals, and river ways". Uncontrolled dumping when practiced indiscriminately by the public, it imposes far-reaching effects as Sauro points out. However, in itself, dumping is not a sustainable way of management of waste, it would actually be a qualified destructive

method, yet it can be controlled and the effects reversed if the public were involved in the waste management and disposal structure. The process of public participation may sometimes be long and not cheap in terms of time. To some people, it may not even be meaningful. However, it is almost impossible to talk about sustainable development and at the same time evade the need to have the people involved. This is because in contemporary development practice, growing awareness of the importance of people's non-expert experiences and knowledge has continuously led to a dire need for shared decision making in various contexts (Barnes, 2005). The input of the public is not ignorable in any given sector because of their exerted influence on the direction of development. At face value, it may be difficult to see the importance of public participation in solid waste management. However, it is imperative to look at some of the methods in solid waste management and locate the place for public participation in the success and effectiveness of such methods in managing solid waste.

The most popular method, which has notably attracted a lot of research in the field of waste management, is recycling. Although the contribution of recycling to solid waste management has been heralded (Tsai, (2007), Bekin et al. (2007)) argue that there are other environmentally friendly ways that can be adopted to manage waste. They do not wholesomely buy the idea that recycling is an environmentally sound way of managing waste because of the shortcomings levelled against it. Recycling consumes energy and thus imposing costs on the environment (Mackaness 2005 cited in Bekin et al., 2007:274). Read et al., (1998:79) also note that though it is common for even developed countries to deal with solid waste by recycling and, disposal after treatment, it is not the best way to manage solid waste. The scale of public participation in solid waste management is noticeably different between the developed and developing countries. In developed countries, public participation in solid waste management may go as far as sorting of the waste generated.

The private firms then collect the already sorted waste at a fee. The fees paid cover up for the processes in which the public should have participated in the waste management line. In other words, the burden is passed on to the private waste collectors at a fee. In developing countries, the picture is different. In the first place, the majority of the population is too poor to regularly afford fees for waste collection. Secondly, many of the people ignorantly albeit innocently, dispose of waste carelessly with little concern about the imminent effects their careless disposal will ultimately cause. Thirdly, in some instances the people just do not think out the complexity of the waste problem and on whom the effect will finally rest. The public

seems to think that it is completely the concern of the local administration to ensure proper waste management at no extra charge on the public.

2.8 Role of Participation in Solid Waste Reduction

Read et al., found that Local Governments were increasingly encouraging waste reduction as a better way of managing solid waste (1998:82). In their study on waste reduction, Bekin, Carriganand Szmigin argues for waste reduction as a more environmentally viable and yet involving way of mitigating the solid waste problem. They found that in communities that engaged in production of some consumption items (vegetables and fruits), there was reduced solid waste generation (Bekin et al., 2007:277). In these communities however, they found that there were structures that had ensured an understanding of the need for deliberate measures to deal with waste from a sustainable development point of view. The community members were actively involved in the appreciation of the need for collective effort and thus agreement on such undertakings. It is not out of context therefore that Read et al., recommended that despite financial constraints, the private and public sectors need to embrace waste minimization as an important venture to invest in, for waste management (Read et al., 1998:88).

For a community to register the kind of successes that is reported by Bekin et al., (2007), an amount of social cohesion is essential. This is further affirmed by Tsai (2007) that "households living in a region with a higher degree of social capital are more likely to work against opportunism and participate in waste management". The implication of this is that there is potential in strategizing for solid waste management from the public angle. If the members of the public are supported to build and concretize their social capital, their constructive participation in solid waste management can easily be harnessed. The members of the community are capable of thinking of more tailor-made, viable and sustainable ways of managing solid waste, when availed the opportunity.

Tsai believes that waste recycling is a perfect method of managing waste and that it fits very well in sustainable development practices. However, his discussion of the findings from his study on the impact of social capital on regional waste recycling, gives a link to the effect that recycling is "a function of community involvement" (Tsai, 2007). Public participation in all activities related to waste management is pivotal and un-ignorable.

2.9 Social Capital and Participation in Solid Waste Management

Barr, (2004) argues that it is not the role of the product producers alone, to reduce waste but also a duty of the general public to manage waste in a sustainable manner. This argument is valid because the will for involvement of the public needs to be guaranteed so that the roles of the producers and the consumers in waste reduction can reinforce each other. It should be appreciated that success of participation relies strongly on collective action by group, community or society members. Implicitly, the members in the group need to have cohesion as a basis for their collective operation in solid waste management. Tsai, (2007:45), emphasizes the importance of social capital in waste management. Social capital in this case offers an opportunity to the people to collectively construct meaning and vision, consequently reducing probability of divergence in belief and ideology. They instead are most likely to share a common vision and thus able to work together to attain it.

Community institutional structures are also of importance in managing solid waste. In their study, Bekin et al., note that in the absence of appropriate institutional structures, it becomes difficult to ensure solid waste reduction at an individual level. They continue to emphasize that waste reduction may only be viable in a community with some control over production and consumption of some items (Bekin et al, 2007:279). This kind of arrangement is bound to give power to the existing structure to operate in a manner within their own choice of means. Waste reduction begins at the stage of production when there is deliberate effort to prevent production of waste material, but this can be very difficult if the structure within which production is made does not deliberately support the prevention of such materials at production stage. When this is ensured by the structure, it simplifies the solid waste management system at the next level- of consumption.

It is very clear that without community support and involvement at least at sorting stage (which has to be done at the source before waste collection), even recycling may be very costly to undertake. Here, the community manifests as a very important stakeholder in solid waste management and the level of their participation counts on the success of recycling in particular and solid waste management in general. Notably, the costs of collection, transportation and land for landfills, are high; however engaging the community serves to reduce such costs. In a way, this proves to be a sustainable mode of waste management. For

example: in Dhaka where community-based solid waste management and composting projects have been implemented, a lot of such costs have been reduced (UNEP, 2007:225). The projects have been able to save the municipalities from the costs of collection while at the same time reducing the need for landfills (UNEP, 2007). Diversion of costs from the municipalities allows them to invest in other services that benefit the community.

Apart from cutting costs of management and disposal, since waste collection, sorting and processing is in most cases labour intensive, it serves to employ a substantial number of people. It is revealed that in India, over one million people are employed in the waste sector (Gupta, 2001, in UNEP, 2007:225). Potentially, a number of otherwise would-be unemployed people can gainfully engage in the process of sorting and collecting especially recyclable waste materials either on a private individual (informal) basis or at (formal) company level. In so doing, financial gains would permeate to those who engage in sustainable waste management practices, and thus encouraging sustained participation.

2.10 Role of the Public in Solid Waste Management

The role of the public in waste management and in solid waste management in particular, has become indispensable and, can be through various ways. According to Tsai (2007:54), a society that is willing to work together presents an opportunity for "creativity and innovation" in dealing with the waste problem. Tsai's observation brings out the importance of the will of the people/public to work together on matters of waste. Mutual understanding and agreement is vital in having the members of the public to work together. When solidarity is achieved, it presents fertile ground for the germination of creative ways of handling waste in a sustainably agreeable manner. It therefore becomes a responsibility of the public to be willing to work together in solid waste management, among other things.

Bekin et al., (2007:280) recommended that purchasing second-hand items as a way of waste reduction is important before people can resort to recycling and composting. This can go a long way in having potential waste kept at the minimum. It is a form of re-use of items which implies that less new items on top of the already under-use items will be purchased. The developing countries have been operating within this kind of arrangement, however with different push factors like inability to afford first-hand, new items.

When the waste aspect of these items is put into perspective, one could easily arrive at the conclusion that to a larger extent, the importation and use of second-hand items has actually accelerated the solid waste burden. Despite the emphasis on waste reduction and recycling as compared to disposal, avoiding or even reducing disposal is easier said than done specifically in developing countries (Chung and Poon, 2001). The developing countries especially in Asia and Africa usually import second-hand items from Europe and America, though a number of affluent Asian countries also export some of their send-hand items to Africa for reuse. A large volume of these second-hand items are either obsolete thereby ending up as waste sooner than expected, or they just have a very short lifespan remaining and thus becoming out of use. This scenario is not very different from the argument that rich countries negatively contribute to the waste burden in the developing countries by exporting second-hand items (Bournay, 2006). The appropriateness of this suggestion as a way of waste reduction is brought under check, especially in the poor countries which may not have adopted effective and efficient recycling systems.

Objective 4: To identify the major challenges of involving the public in SWM

2.11 Challenges involving the Public in Solid Waste Management

Governments, whether central, federal or decentralized, have been a bit obstinate to public involvement in development projects and social service planning and implementation. From a political point of view, it is expected that the authorities possess the mandate to think and take decisions on behalf of the electorate, besides; it may save time to technically exclude the public in such processes. It is not uncommon, however, to find many of such projects that neglect public participation, failing to yield the planned gains. Provision of solid waste management and disposal services is no exception. The process of public participation in solid waste management is challenged by several factors, depending on the method chosen for this purpose as well as the characteristics of the public in a particular location.

Tsai (2007:45) notes for example that "attitudes towards recycling are influenced by appropriate opportunities, facilities, knowledge and convenience". People are diverse in terms of the knowledge base they possess as well as in what they feel is convenient for them. This automatically makes their attitudes to differ. Reaching consensus on the most convenient system of managing solid waste around a particular facility becomes challenging. Goulet, a development scholar argued that "development is not a cluster of benefits given to

people in need, but rather a process by which a populace acquires a greater mastery over its own destiny". His argument emphasizes the importance of people's participation in development ventures and projects that concern them. This does not go without caution, though. It is dangerous to leave the people with the power to decide for themselves what they want and how they want it, without any guarantees that the people possess the basic requisite knowledge for analysis and subsequent informed decision-making. The information, knowledge and awareness gaps among the members of the public make their involvement a challenging option.

In their study on waste minimization in Local Governments in the United Kingdom, Read et al., (1998) found out that there was low awareness about the best practices in waste minimization across different administrative areas/Local Governments. For public participation to yield optimum benefit, prior arrangements to close or at least narrow the knowledge and awareness gaps ought to have been made. Involving the public with their knowledge gaps, may only lead to a challenging process of participation in solid waste management. Solid waste management is a matter influenced by policy. Ideally, policy acts as an engine that gives direction and impetus to the solid waste management system. Sauro's analysis, however, shows that due to the absence of clear public policies as well as the economic in viability of investments in municipal waste segregation and recycling, such activities have not thrived in most parts of the developing world (Joardar, 2000:322). To effectively involve the public in solid waste management within a structure that does not provide clear public policies becomes very cumbersome. There has also been a tendency to localise the nature of the waste concern and thus looking at it as a mere "nuisance rather than a health and environmental hazard" (Joardar, 2000:329). This has translated into low political will and the reluctance of the public to respond to the problem. The participation of the public as individuals is still virgin and provides a lot of potential for doing more about solid waste management. This therefore calls for strategies that will help to enlist the participation of the entire public for their attention to sustainable solid waste management practices.

Objective 5: To determine how to improve solid waste management

2.12 Strategies for Public Participation

Participation of people in any kind of project needs careful planning by way of laying down strategies to encourage it. Tsai recommends that in order to encourage households to participate in waste recycling, there needs to be "a well-informed waste collection regime, good quality of environmental education and attitudes, an effective enforcement scheme from social norms, proper economic incentives and promotion from local communities" (Tsai, 2007:44-45). This is what many authorities have not been able to do especially in the developing world. Waste collection regimes do not seem to receive enough attention and environmental education has almost not been taken seriously. For the public to be interested to be associated with a project, and put in their efforts, they need to be assured that their efforts will yield success and progress, and the best way to do this is by presentation of a clear and easy-to-understand system of operation. These efforts notwithstanding, there is need for consideration of some other factors. The social and economic status of the people also has a connotation on whether or, and how the people will participate in solid waste management. The authorities need to keep such factors at the back of their mind as they plan strategies for ensuring quality participation of the public. Tsai (2007) gives evidence that higher incomes and higher education levels elicit the will to participate in waste management programmes like recycling in order to protect the environment. However, he does not show whether the influence of the income and education level goes only as far as recycling is concerned. Recycling is different from other activities in solid waste management.

The authorities could easily take advantage of such factors to begin recycling programmes in areas where high income earners reside and or work and the successes that may be registered in such areas may form a basis for rolling it out to other areas. It could be a resource-cutting measure to start with such a group as it is believed that the rich and middle-class households organize themselves to privately collect and transfer their waste to centres where the authorities can pick it from. This assumption is premised on the belief that it is very rare that the municipal or city authorities will engage in door-to-door collection of the waste, especially in the developing world (Joardar, 2000). The limited resources within which the authorities in developing countries operate make it hard to do waste collection at a door-to-door basis. If the households can collect their waste to a centre where the authorities can in turn pick it from, it may make the work easier.

In India, Non-governmental Organisations (NGOs) have helped in civic campaigning, arranging for door-to-door collection of waste as well as assisting in the establishment of

cooperatives for "rag pickers" (Joardar, 2000:329). NGOs, especially those that have an environment orientation need to be supported to mobilise the community to participate in solid waste management as a sustainability measure. NGOs have been instrumental in promoting popular participation in the developing world. The people believe in them, and the voluntary nature of their work, gives authenticity and virtue to their programs. Besides, their membership is widely civic and thus qualifying their interventions as self-help, with a higher chance for success and sustainability.

To Joardar, introduction of a "user charge based on door-to-door collection" can support waste sorting and recycling (Joardar, 2000:327). The user charge can also work as a stimulus for item reuse thus reducing on the rate of waste generation at the source. The charges can be levied on both residential and commercial establishments but with consideration of household size and with "built-in cross-subsidization in favour of slum dwellers and petty traders" (Joardar, 2000:327).

This arrangement may not necessarily be implementable without clashes between the authorities and the low-income households, but it may be worth the efforts because a financial instrument is more flexible than a legal one since the financial instrument provides a choice for the consumers and at the same time makes the polluter incur the cost of environmental management (Joardar, 2000). The effectiveness of such a program is determined by the form of governance in a particular area whether it is centralized or decentralized. Where taxation is centralized activity, it may be tricky to have the taxes specifically form waste charges to be remitted in order to meet the costs at the local level.

Chung and Poon, (2001) agree that having a clear structure of charges for waste collection and disposal in place, may even work as an incentive for waste reduction. They believe that there is need to change the approach for waste reduction from the "command-and-control" to the use of economic incentives and "polluter-pays" (Chung and Poon, 2001:102). This can be a step in involving the public in solid waste management and also forms an impetus for innovative thinking to devise cheaper and more convenient ways of managing solid waste. On the part of government, employing the waste management hierarchy may be a viable strategy.

Production of materials that are less likely to become waste can be emphasized. Before the products are disposed of, consideration for reuse, recycling, compositing and energy recovery

can be encouraged before materials are finally disposed of (Barr, 2004:33). It can be seen that the public has a big stake in most of these processes or activities in solid waste management. It is the public that can decide or not, to buy products that produce less waste. They are the ones who have to play the basic waste sorting role at household level, before the waste can be conveniently collected for recycling or compositing purposes. Therefore, in order to cultivate sustainable waste management, there is need to do more than just creating awareness and disseminating knowledge (Barr, 2004). There is a dire need to strategically involve the public in solid waste management.

2.13 Conceptual Framework

The amount of solid waste generated in an area usually rises with increase in population. The increase in population amidst economic and social development that comes with the demand for a higher and affluent standard of living creates the need for more production as there will be more demand for consumption (UNEP, 2007). By human nature, people have different and in some instances distinct ways of doing things. It is no wonder that people will dispose of waste in different ways including indiscriminate dumping. Such environmentally unconscious ways of disposal contribute to the growth of the solid waste problem in the world and particularly in developing countries. The view held by Cointreau-Levine and Coad (2000) that government has the responsibility to provide services to the citizens, including solid waste management, may be contestable. There may be questions like, to what extent does this responsibility go, and what is the implication of the extent of the magnitude of responsibility held by the government, on effectiveness of the service provision? Besides, the government may not be in position to shoulder the whole responsibility on its own.

In Kenya, it has been noted that the responsibility for provision of solid waste management services has been in the hands of the local governments .The local governments have continued to struggle with this responsibility and in many instances failed to meet it adequately. There is need to appreciate that it is the citizens, the individuals and the public that generate the waste, in the homes and commercial areas. Yes, the citizens pay taxes to the government and local governments on the understanding that these will provide the necessary services including solid waste management to the public. In the ideal situation, there would be no problem with that, but depending on the good will of the people to protect the

environment may not always work. Besides, this good-will needs to be cultivated and harvested through other means which are not laissez faire.

A closer link between government and local governments on one side and the citizens/public on the other is highly recommended - need for collaboration between the authorities and the public. Whether in the meaning given by Oakley and Marsden (1984) where people participate by being informed, after the basic decisions have been taken by the authorities; or in the meaning given by Black, et al (2002) linking collaboration to trust and knowledge among the different parties, collaboration (between the authorities and the public) is an important ingredient in the implementation of any development activity/program.

People may have different options which may work for them, but turn out to be detrimental to the way the authorities carry out their responsibilities. Participation is capable of bringing the contradictions together so that Participation through collaboration presents an opportunity to both the authorities and the public to create a synergy for successfully dealing with such problems as solid waste management. However, like Evans, (1996a) notes, the authorities will not always be trusted when it draws closer to the social organizations. There may be suspicion that the admission of the state will lead to the demise of the community especially in terms of their values and freedom. Therefore, it is the responsibility of the authorities to put up strategies to have the public un suspiciously get involved in solid waste management and also appreciate that a collaborative relationship between them and the citizenry would make life better but not worse. For this to thrive, however, willingness and acceptance on the side of the public should precede.

People may have different options which may work for them, but turn out to be detrimental to the way the authorities carry out their responsibilities. Participation is capable of bringing the contradictions together so that they can be understood and lessons drawn from them. It could start with just face-value collaboration and it turns out to be complementarity, into embeddedness (Evans, 1996b) and could end up into a co productive structure (Ostrom, 1996). What matters is at what level the collaboration has reached and the direction it is taking and it is usually the public that determine this. Good public participation programs are inclusive; they avoid a monologue and emphasize dialogue which becomes instrumental in contributing to success (USEPA, 1996). Fig. 1 summarizes these ideas in the simplest way possible.

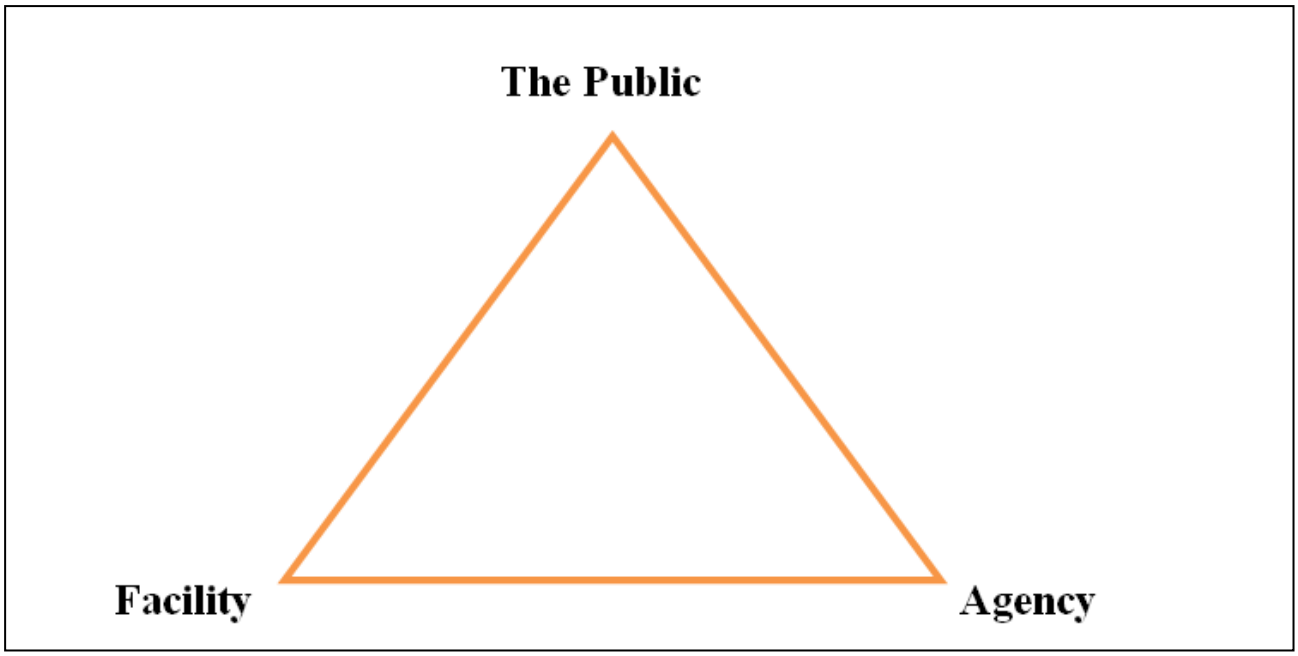


Figure 2.1: The Public Participation Triangle

Source: USEP, 1996

From the above public participation triangle, solid waste management is a service represented as *the facility*. Government/Local Government (*the agency*) is a stake holder with responsibilities, and *the public* are the beneficiaries as well as stakeholders who have a role to play in the facility. This interactive link is desirable for success. SWM is often considered to be a mainly a technical issue. However, numerous cases are known nowadays of technologies that have appeared to be unsustainable in a given society, economy and environment because the approach taken was too much focused on the technical aspects. For example political motives have often coloured technology choices. Equipment have been provided by foreign donor countries under a 'tied aid' that is not most appropriate for waste mangement in many developing countries. According to UNDP (2004), effective SWM is a complex task which must go beyond purely technical, institutional, political, financial, economic considerations to also cover social aspects such as public participation. Based on literature review, empirical studies and personal observations the conceptual framework of the study is formulated.

CONCEPTUAL FRAME WORK

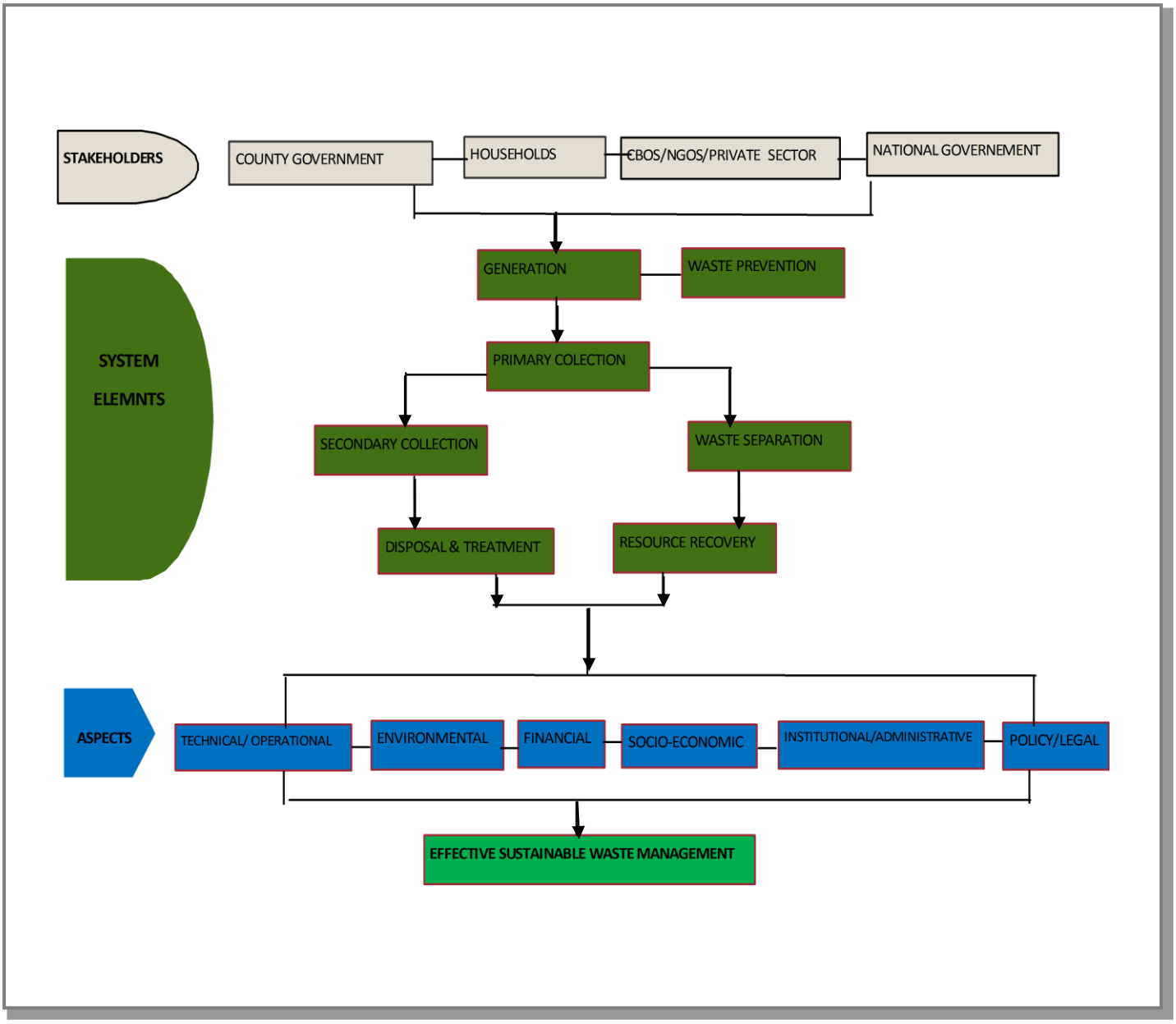


Figure 2.2: Conceptual Framework

Source: Author, 2013

CHAPTER 3: RESEARCH METHODOLOGY

3.0 Introduction

This chapter explains the research design, the data collection methods and sampling, data processing and analysis methods that are to be used in this study. This study will draw on the advantages of using both qualitative and quantitative methods as explained below.

Quantitative methods include design techniques and measures that produce discreet numerical or quantifiable data. Random sampling is done to ensure representativeness of the sample. Quantitative research is applauded for the fact that "the findings are generalizable and the data are objective" (Blanche et al., 2006). It is hoped that the findings from this study would help in reflecting what is happening in the whole of Mlolongo Town as well as other small towns in the Machakos County. At the same time, it is important to have an amount of objectivity to dispel the concerns to the effect that qualitative research may be biased. Quantitative data and statistical analysis would increase on the validity of the findings from this study.

Qualitative on the other hand include designs, techniques and measures that do not produce discrete numerical data. More often, the data are in the form of words rather than numbers. This is done for example through direct observation where the required behaviour is observed in a particular setting or through interview method using an interview schedule. Human behaviour such as attitude is best explained by qualitative research. There is need to get a complete understanding of the situation from the perspective of the stakeholders in the solid waste management sector (Blancheet al., 2006). Making statistical conclusions only will not suffice in unveiling the true picture of solid waste management in Mlolongo Town from different perspectives. The perspective of the people could only be appreciated with the collection and analysis of qualitative data. Qualitative research permits "understanding in context" (Blanche et al., 2006). In this study, I will seek to understand whether there is any kind of collaborative relationship between the public and the local administration (Town Council) in managing solid waste. The collaboration the study is interested in is the public participation in solid waste management alongside the Town Authority. Special focus will be put on the challenges of involving the public in solid waste management.

3.1 Research Design

The purpose of research design is to provide a framework that guides the investigation of the study. Research design is a set of procedures the researcher applies to solve the identified problem. This research was organized in a logical manner. The researcher used a descriptive research design.

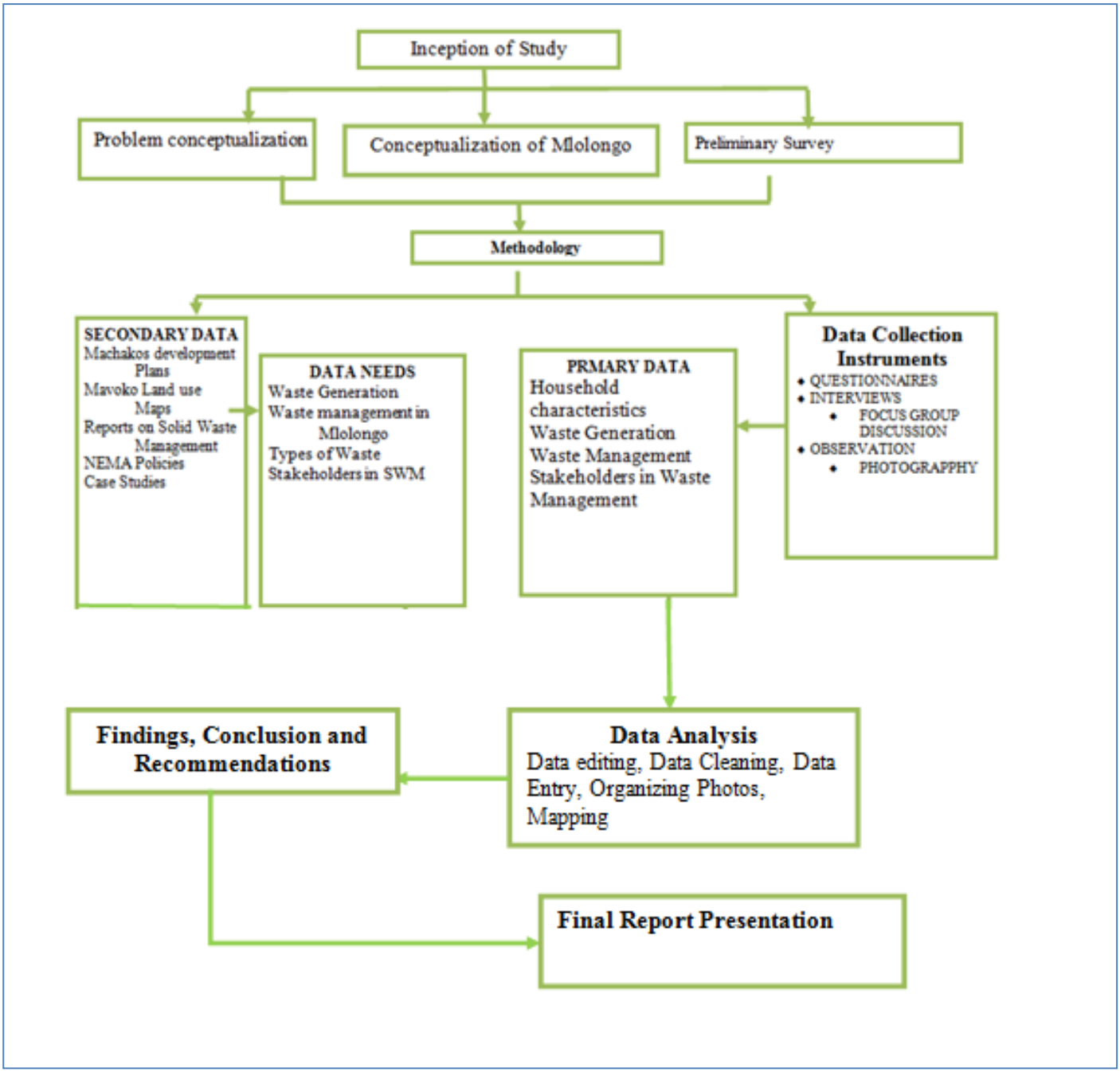


Figure 3.1 Summary of Research Design (Author, 2014)

3.1.1 Study Inception

The study started through conceptualization of the problem of solid waste management in Mlolongo. This involved visiting the site, literature review to understand the context of the problem, and review of case studies.

3.1.2 Building Methodology

The second phase was the outline on the methodology which summarized the type of survey to be done and the methods that would be used for data collection in the field. This was a descriptive research.

3.1.3 Actual Field Inventory

The third phase entailed the actual field survey. Comprehensive field inventory on solid waste management in Mlolongo town were conducted with assistance from the authorities especially the Mavoko Sub-County. Data was collected, analyzed and findings presented. Primary and secondary data was collected.

Primary Data

Primary data refers to data that is obtained directly from the field. This involved an actual site inventory of Mlolongo town and collection of data to help in achieving the research objectives. It entailed aspects like; the solid waste levels in the town, activities that generate waste, presence of dumping sites in Mlolongo town, accessibility routes, and the actual participation of people in solid waste management. The primary data was mainly collected by administering questionnaires, an observation check-list, and interviewing key informants.

Secondary Data

This refers to information that has been documented about the study town from secondary sources like books, journals and newspapers. Secondary materials regarding solid waste management, secondary data collected entailed reviewing literature about solid waste management, review of the role of public in solid waste management, review the history of Mlolongo town, and obtaining maps and aerial images of Mlolongo town. The Sources of the secondary data included Newspapers, Journals, books, the County Government of Machakos and Survey of Kenya.

Data Collection Tools

Different data collection tools were used to gather information for this research including; Administering questionnaires to households and business, Interview schedules for key informants, observation checklist and mapping and photography

3.1.4 Report Compilation

The fourth phase involved compilation and presentation of the research report inclusive of drawn conclusions and recommendations.

3.2 Target Population

The research was conducted in Mlolongo town with a study target population of 137,211 as per the National Population and Housing Census of 2009. There are about 7,015 households. The study targeted population within the Mlolongo Township. The sample frame comprised a list of shopkeepers, market vendors, apartment households, council cleaners and officers, private garbage collectors, officers from NEMA and County Government.

3.2.1 Sampling

Cohen, Manion & Morrison (2000:93) argue that a sample size is in a way "determined by the style of the research". In a survey study, there would be need for a representative sample of the population for generalizability of the study findings. Sampling procedure will be guided by the general rule in most social research that suggests that the use of a large sample will facilitate generalization (Kline, 1980). The procedure of reaching the individual respondents to make up the sample for this study was based on random sampling. However, effort was made to have the sample drawn from a dispersed area, to avoid getting the sample from one place. Mlolongo was selected through purposive sampling. Key informants were purposefully selected while households and business community were selected through random sampling.

3.2.2 Sample size

The study used the formula below to establish a sample size that could be representative of the population of Mlolongo Township. The formula applies Slovene's equation for establishment of research sample.

$$n = \frac{N}{1 + Ne^2}$$

Where: n= the sample size, N = population, e= margin of error

The number of households in Mlolongo Township is 7015. However, there are only 52% of these households that fall within the urban frame where the problem of solid waste management is highly manifested. Therefore, the study took the number of households to be 52% of 7015 that is 3648 households. This area is enclosed by the main Mombasa Road and other feeder roads. Household typologies comprise of flats, informal structures, row housing, bungalow and mansionates. The study assumed the margin of error for this research to be 5%. This would ensure that the confidence level of the research is within the scientifically accepted 95%.

Therefore; in application of the formula;

$n= (7015/1+3648x0.05^2)$

n=3648/18.5375

n=196

Therefore, the study administered 196 questionnaires across the households and businesses to find out the context of the problem of solid waste management in Mlolongo. The breakdown of the sample was according to housing typologies. Table 3.1 below shows the breakdown:

Table 3.1: Breakdown of the Sample Size

Typology	**Percentage (%)**	**Sample**
Commercial	40	78
Residential	40	78
Mixed-Use Developments	20	40
Total	**100**	**196**

3.3 Data Collection Methods

Methods for data collection were dependent on the required data for each specific research question. However, considering that this research adopted a combination of both qualitative and quantitative methodology, the research used document review, observation, interviews - structured and semi-structured, Focus Group Discussions and administration of instruments such as questionnaires in data collection.

3.3.1 Examination of Documents, Materials and Artifacts

It's a data collection method in which a person examines documents, materials or physical artifacts and records the data on previously prepared instruments. Document review is widely used because many variables of interest are regularly recorded. Its data collection method which is non-reactive since documents cannot be influenced by the fact that they are being used (Robson, 2002). Organizations as well as government, produce many documents. For example annual reports, survey reports, planning documents and Development plans. These documents can potentially be used to acquire both quantitative and qualitative data. Some of the data from these document scan form a precursor to the interviews with Town Officers.

3.3.2 Observation

This is a data collection method in which a person observes phenomena and records information about the phenomena. Sometimes instruments such as videos and audiotapes are, used. A structured observation is "very systematic and enables the researcher to generate numerical data from the observations" (Cohen, Manion & Morrison, 2000:306). This being a study that is dependent on survey framework, it is deemed that the behaviour of the respondents would most likely be inferred; direct observation of people's behaviour with regard to their responses were therefore done to check the accuracy of their responses (Bryman, 2004). Observation was particularly used with the help of an observation schedule as a data collection tool (Bryman, 2004). Notably also, observation is non-participatory in the interest of being non-reactive and can be done in an informal way (Robson, 2002; Leedy and Ormrod, 2005), and was used alongside the other methods. Residents, traders and market vendors were observed, to gather data for this study.

3.3.3 Interviewing

A method where the interviewer questions people to elicit self-reports of their opinions, attitudes or behaviour via telephone, by use of on-line computers or face to face situation. I adopted a combination of qualitative and quantitative research techniques in this study because the research questions required different types of data. Some of these data was

appropriately collected by use of interviewing method. Interviews were used because of the ease at which they allow the collection of information regarding, facts, people's beliefs, feelings, motives, present and past behaviour as well as standards of behaviour. This method allows opportunity for probing and clarification of information.

3.3.4 Instrument Administration

This is a data collection method in which the subjects respond to questionnaires or scales or other devices used to measure variables. These are excellent measures of variables. In this study, primary data was collected through self-administered questionnaires. A semi structured questionnaire was used to collect data from respondents because of the need to provide a means of expressing their views more openly and clearly. The semi structured questionnaire consisted of open ended and closed ended questions designed to elicit specific responses for qualitative and quantitative analysis respectively. The questionnaires were randomly administered to respondents.

3.6 Data Processing and Analysis

The quantitative data from the interviews were cleaned and coded for purposes of entry into the Statistical Package for Social Sciences (SPSS) and analysis. The package helped in entry of the data and analysis to produce frequency tables, graphs and charts for presentation. The output derived from SPSS was used to discuss the findings of this study. On the other hand, qualitative data from interviews and focus groups was edited every break of day to get the clear transcriptions of the interviewees' accounts. The notes were then typed to the computer, where after, emerging themes was identified and classification of the emerging themes done. Classification is to be continuously edited in light of the emerging data from interviews, so that the most relevant themes could be constructed. When the final classification of the themes is constructed, discussion of the findings was done with regard to the literature review and the data from documents reviewed. Spatial data was analyzed through the use of ArcGIS.

3.7 Data Presentation

Spatial data was presented in form of maps, and graphics, qualitative data was presented in form of descriptive notes while quantitative information was presented in form of charts, graphs and tables.

3.8 Data Limitation

The following were some of the limitations of this study:

i. Time constraints: the research was conducted within a limited period framework to present the deliverables.
ii. Financial constraints: money resources was also be a limiting factor as the research requires maps, fieldwork assistance, printing and information materials which required substantial amount of funds.
iii. Data inadequacies: the research depended on availability of the required data and willingness of respondents to forward the information.
iv. Authority bureaucracies: the authorities had lengthy bureaucratic structures for obtaining information. It was not be easy to obtain certain information they may consider sensitive and such bureaucracies consumed a lot of time.

3.9 Ethical Issues

The ethical considerations were considered at all stages of the research process- from planning, implementation and dissemination of results. The researcher gave assurances that no coercion was involved in recruitment or selection. Participants were undertaken to sign subject information sheets and informed consent and the researcher ensured that no adverse effects would result from the study or any psychological or emotional distress. Participants were assured of confidentiality of information shared with the researcher. This is because violation of confidentiality amounts to disrespect of the dignity of the participants and invasion of their privacy. So based on fidelity the researcher informed the participants of the fact that confidentiality is assured to eliminate the probability of compromising on beneficence and non-maleficence in the research process.

Data collected was stored securely and research findings disseminated appropriately. The research observed all professional principles of conduct of acting to enhance respondents' well-being (beneficence), respecting the rights of the respondent (autonomy), and take responsibility such that participants consent to being involved and disclosure of the purpose of the study. Fair and just treatment of respondents (justice), observe fidelity by being genuine and faithfully honouring the commitment to respondents confidentiality without invasion of their privacy and ensuring that the researcher avoids doing harm to respondents (non-maleficence) by choosing appropriate designs of tools that won't harm or stir up painful feelings or memories, threats to one's self-image and embarrassment.

Table 3.2: Data Needs Matrix

Objective	Data Needs	Source
To determine how solid waste is organized in Mlolongo town	Stakeholders in Solid Waste Management Role of Public in Solid waste management Location of Dumpsite Logistics of the process Stages of the process of Solid waste management	County Government of Machakos Mlolongo Town Residents
To establish the role played by the public in solid waste management	Role of public in solid waste management Stages where the public is involved	County Government of Machakos Mlolongo Residents
To identify the potential roles that the public can play in achieving effective solid waste management in Mlolongo town	Potential role of the public in Solid waste management	Mlolongo Residents County Government of Machakos
To identify the major challenges involving the public in solid waste management in Mlolongo town	Challenges of waste managements in Mlolongo town Missing links in the solid waste management process	Residents County Government Stakeholders in SWM
To determine how to improve solid waste management in Mlolongo town	Value addition strategies in Solid waste management	Residents

CHAPTER FOUR: RESEARCH FINDINGS

4.1 Introduction

This Chapter presents the data analysis, presentation of findings of the study, discussion and interpretation of the findings on the role of public participation in solid waste management in Mlolongo town, Machakos County. The chapter presents the data on the respondents' background information on social characteristics, the process of solid waste management, the level of participation and attitudes relating to the participation process in solid waste management. The study also presents information on households' types of waste and methods of disposal. The study also outlines the different strategies of improving the efficacy of solid waste management and challenges facing the process in Mlolongo town. It also presents respondent suggestions on how to increase the role of public in solid waste management and how to improve the efficacy of the process.

4.2 Response Rates on Questionnaire and Interview Guide

The study had a high response rate from the respondents. There was a 100% return of the questionnaires from the respondents. The research assistants were essential in helping the residents and households in Mlolongo to fill the questionnaires. There was a high response rate from the respondents in the questions. Almost 90% of the questions were answered and only cases of non-applicability were questions not addressed. There was also a positive response rate from the key stakeholders in Solid Waste management in Mlolongo town.

4.3 Respondents' Background

4.3.1 Gender and Age Bracket

Among the respondents of the study, 60% were male and 40% female. About 7% of these respondents were less than 18 years, 43% were between the ages of 18-25 years, and 23% were 26-35 years and another 23% between 36-55 years. The research also indicated that there were about 4% of the respondents who were above 56 years. This indicated that majority of the respondents fall in the youth age bracket. It is an indicator that majority of the households in Mlolongo are within the age bracket where they have capacity to play essential roles in the process of solid waste management in the town.

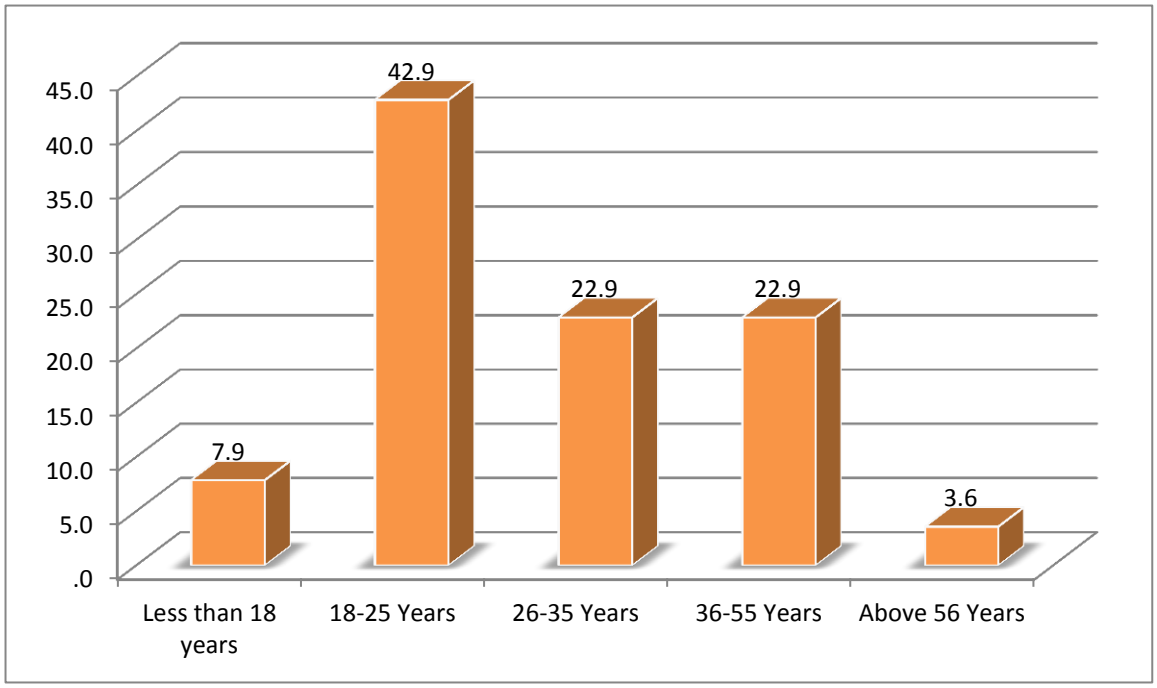


Figure 4.1: Respondents Age Distribution (Field Survey, 2014)

4.3.2 Marital Status and Education Level

The research indicated that there were 70% respondents who were single, 28% married and 2% have divorced. This is a social indicator that most respondents to the study were single household members. The study indicated that 33% were of primary education, 37% secondary education, 14% had college education and 5% with university education while 11% had no formal education.

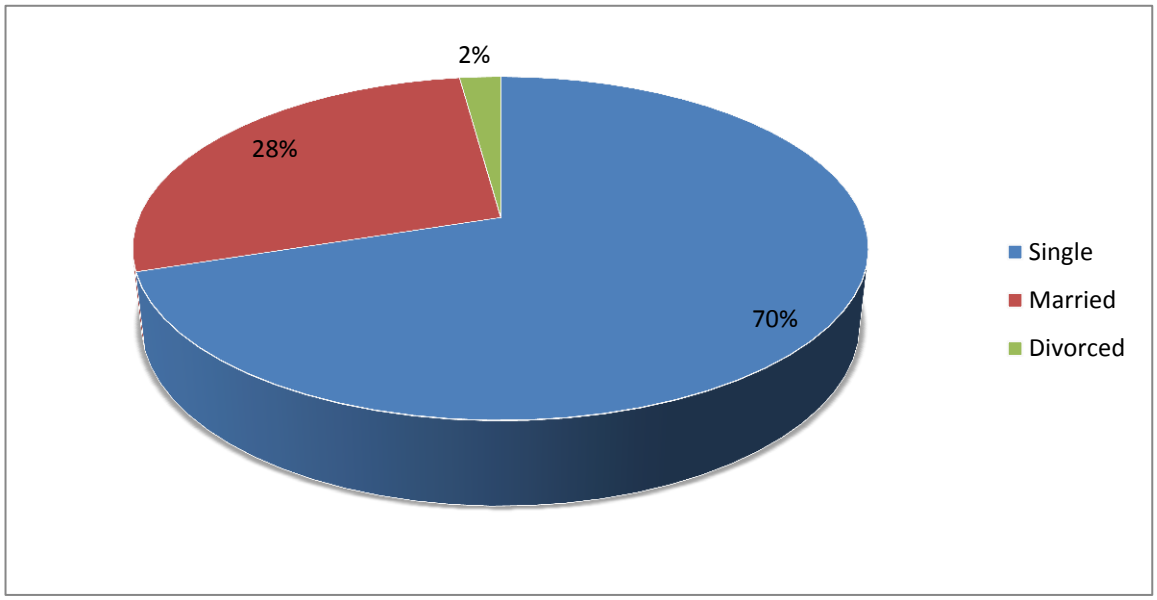


Figure 4.2 Respondents' Marital Status (Field Survey, 2014)

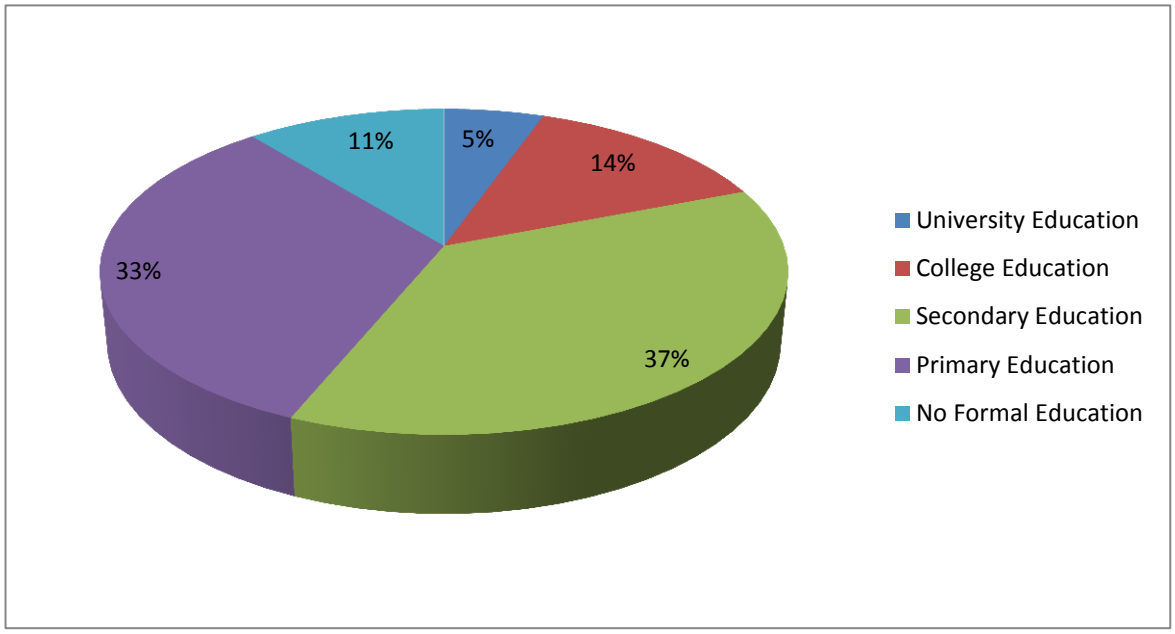


Figure 4.3: Level of Education (Field Survey, 2014)

4.3.3 Average Household Size

The study also revealed that 51% of respondents were households of less than 3 members, 31% households with 3-5 members while 15% were from households of more than 10 members and only 3% households of between 6 and 10 members. This indicated that most households were medium sized, an implication that there was considerable amount of waste generation in Mlolongo town.

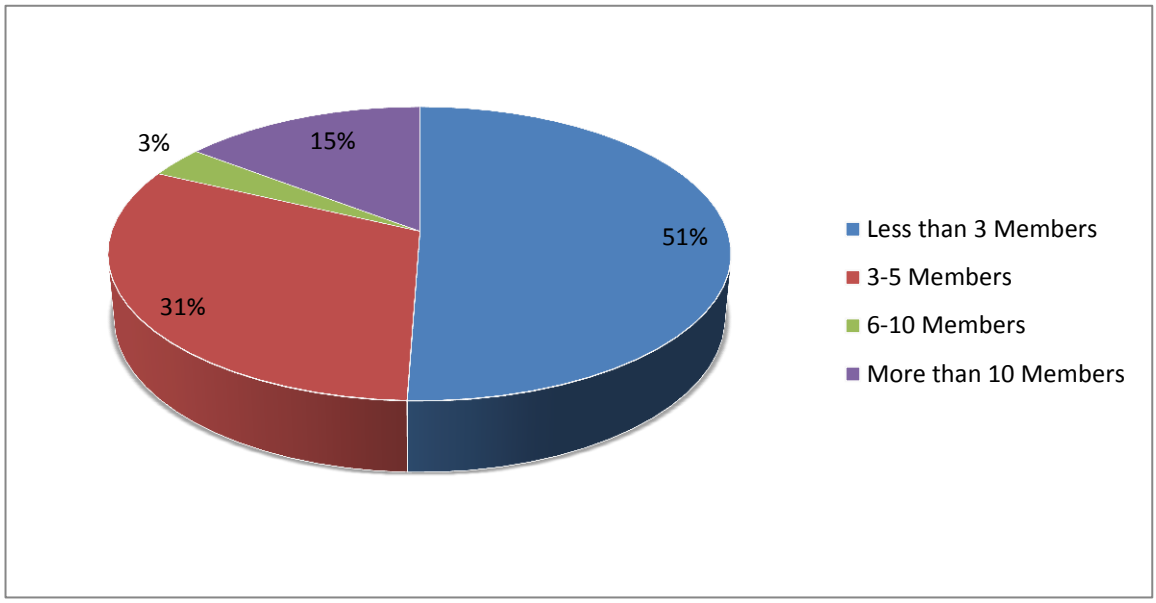


Figure 4.4: Average Household Size (Field Survey, 2014)

4.3.4 Means of Livelihood

About 39% of the respondents were in formal employment, 41% undertook business or entrepreneurship activities as a means of livelihood and 5% were in informal/casual employment. There were 15% of respondents who were not in any form of employment.

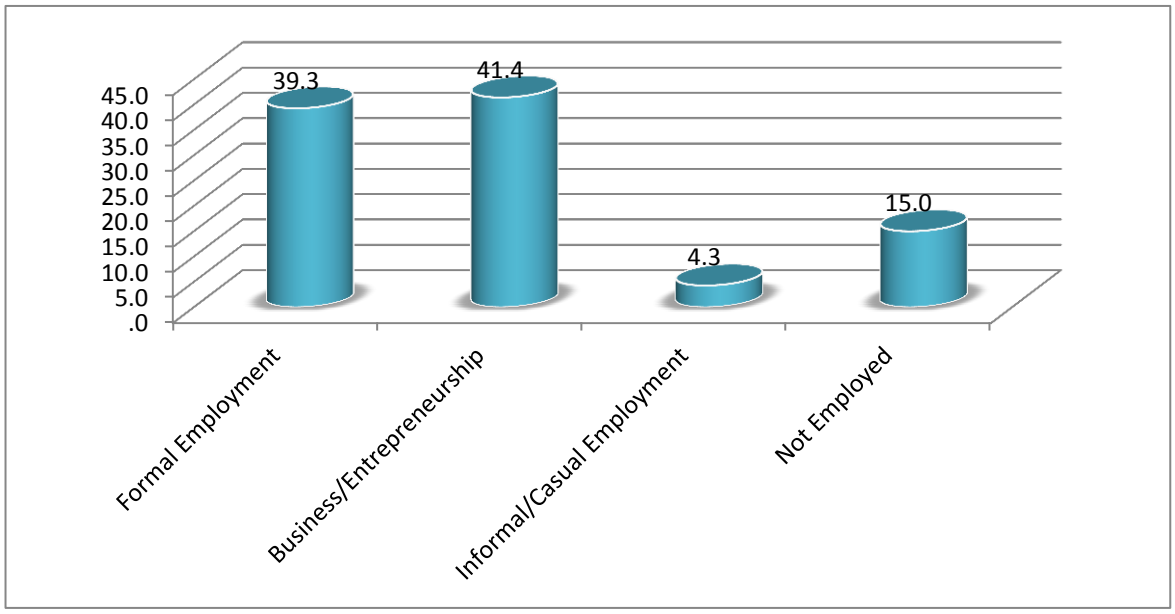


Figure 4.4: Respondents' Means of Livelihood

4.3.5 Level of Income

The level of income of a person is closely related to the quality of the services he or she is able to pay for or the neighbourhood one can live. Therefore, the research also conducted an assessment of the level of income for various respondents to the study. The results indicated that 40% of respondents earned between Kshs 10001 and 20000. About 28% earned between Kshs 5001 and 10000, 13% between Kshs 1 and 5000, 14% between Kshs 20001 and 30000 and 5% more than Kshs 50000.

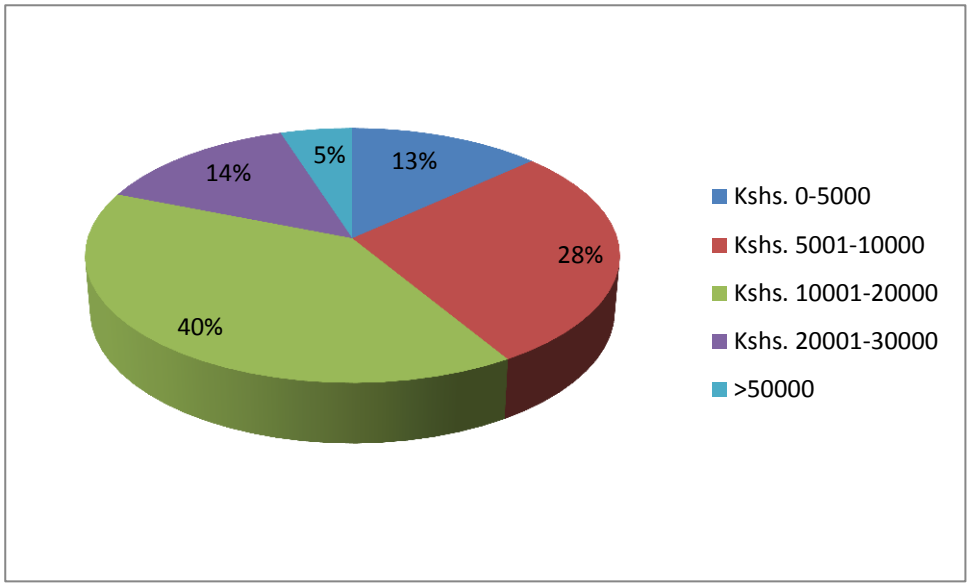


Figure 4.5: Respondents' Level of Income

(Field Survey, 2014)

4.4 Household Characteristics

The research also presents information on the household characteristics of the respondents and the type of waste generated and modes of disposals. The household characteristics refer to nature of operation if it's a business and type of household residential structure.

4.4.1 Housing Typologies

There were different kinds of house typologies in Mlolongo. These included flats/apartments; bungalows, row housing, and semi-detached houses. The housing typologies affected the method of waste disposal and general level of solid waste management.

An Apartment/Flat Housing near a solid waste disposal site in Mlolongo town.
Flats are the most common housing typology and house most of the residents who generate tonnes of solid waste.
The solid waste is dumped in adjacent proximity to the building and this causes unhygienic environment in the surrounding
The temporary dumping sites can be taken as part of the causal problem for health concerns, crime and lost sense of aesthetics of the environment.

Plate 4.1: An Apartment near a dumping Site

(Field Survey, 2014)

The study indicated that 90% of the respondents were residents in different housing typologies, 6% were traders in premises such as kiosks and makeshift structures and 4% were market vendors such as hawkers, e.g. sugarcane vendors. The nature of operations of these respondents also affected the mode of solid waste management.

The waste is kept under the stair case of the flat as a temporary site while awaiting collection. These spaces also act as storage points for children playing materials such as a bicycle as indicated in the picture.
This poses a high health risk especially for children when they come to pick their playing toys.
Keeping of solid waste under the stair case is not suitable locality for the settlement and inhabitants.

Plate 4.2: Waste Disposal within an Apartment (Field Survey, 2014)

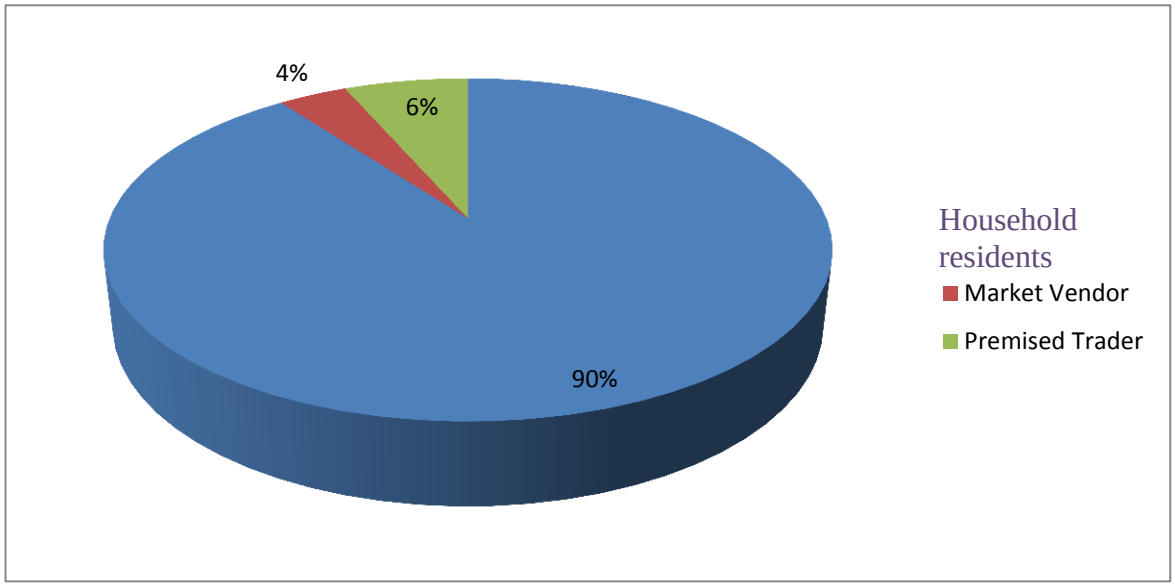


Figure 4.6: Type of Respondents

(Field Survey, 2014)

4.4.2 Type of Premise Ownership

The research indicated that 90% of the resident respondents were tenants and only 10% owned the premises. This can affect management of solid waste as the responsibility of solid waste management comes up as an arrangement between the landlord and the tenant.

Research Objective One: To determine how solid waste management is organized in Mlolongo

4.5 Waste Production and Disposal

4.5.1 Type of Waste

The research indicated that there were different types of waste generated by the respondents. About 47% of the respondents generated organic waste, 32% inorganic waste and 13% specifically generated paper as waste, 4% glass and textile and another 4% generated metallic appliances as waste.

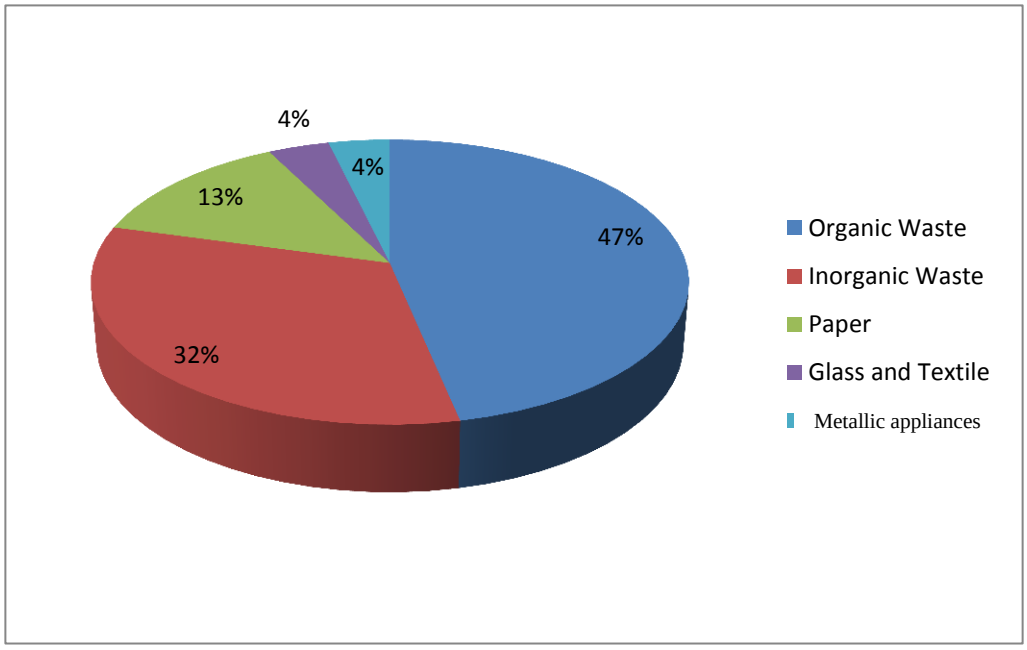


Figure 4.7: Type of Waste

Plate 2.3: Mixed Waste in Disposal Pit (Field Survey, 2014)

Different Types of Waste in a disposal point. The major waste generated in Mlolongo is organic waste such as food remains and inorganic waste such as polythene. Paper and metallic appliances are also common types of waste.

Plate 4.4: Different Types of Solid Waste

(Field Survey, 2014)

Solid waste in one of the dumping sites in Mlolongo town

4.5.2 Mode of Disposal

The main mode of disposal of the waste generated was through waste collectors and was used by about 40% of the respondents, 28% used burning to dispose off waste, 24% used dumping while 8% used burying .

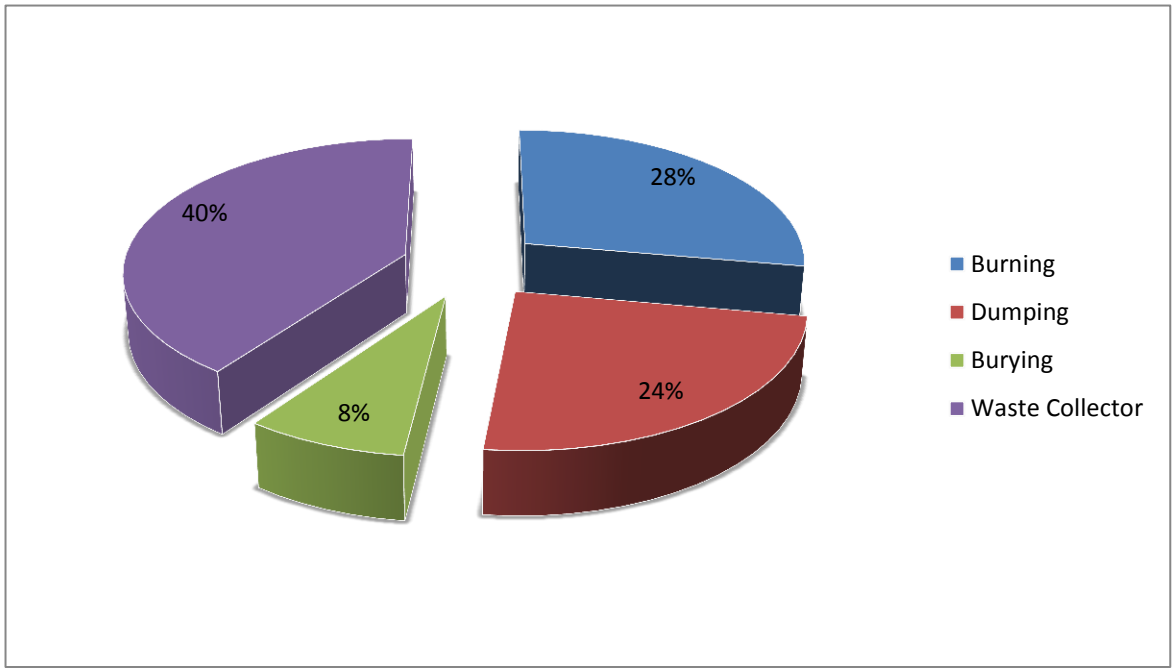


Figure 4.8: Mode of Disposal

(Field Survey, 2014)

PLATE 4.5: Solid Waste Containers in a Garage

Field Survey, 2014)

Solid Waste in Containers ready for Collection in one of the Garages in Mlolongo town

Plate 4.6: Modes of solid waste disposal

(Field Survey, 2014)

Waste being burnt in an open field in Mlolongo: Burning and throwing solid waste to open space is a common form of disposal in the town.

4.5.3 Waste Collection Responsibility

The research indicated that the County Government of Machakos takes the main responsibility of waste collection in the town. There were 38% of respondents who depended on the County government for waste collection, 32% took the responsibility of waste collection as tenants while 22% were landlords, 6% depended on neighbourhood associations and 2% on Estate Management.

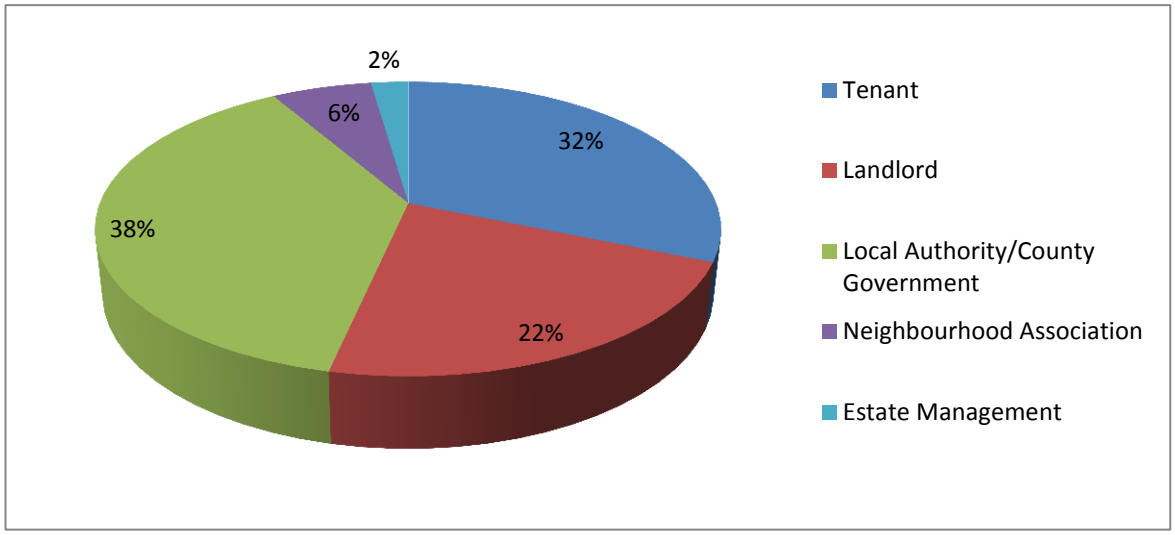


Figure 4.9: Waste Collection Responsibility

(Field Survey, 2014)

Plate 4.7: Solid Waste Collection Vehicle

(Field Survey, 2014)

County Government of Machakos Solid Waste Collection Vehicle on road to the dumping site in Quarry, the County takes the responsibility of Waste Collection yet has inadequate vehicles to undertake the responsibility. The main dumpsite is also far off the town.

4.5.4 Knowledge of Dumping Sites

There was varied knowledge among the respondents regarding the legal dumping sites in Mlolongo town. There were 60% who were aware of the presence of only 1 dump site in Mlolongo, 36% were aware of 2 dump sites, 2% knew of more than 2 dumping sites and another 2% indicated that they did not think Mlolongo has any dumping site. These varied indications among the respondents was indicative of the nature of different illegal dumping sites cutting across the town, whereas the County Government indicated that there was actually no dumping site in Mlolongo but one waste collection centre.

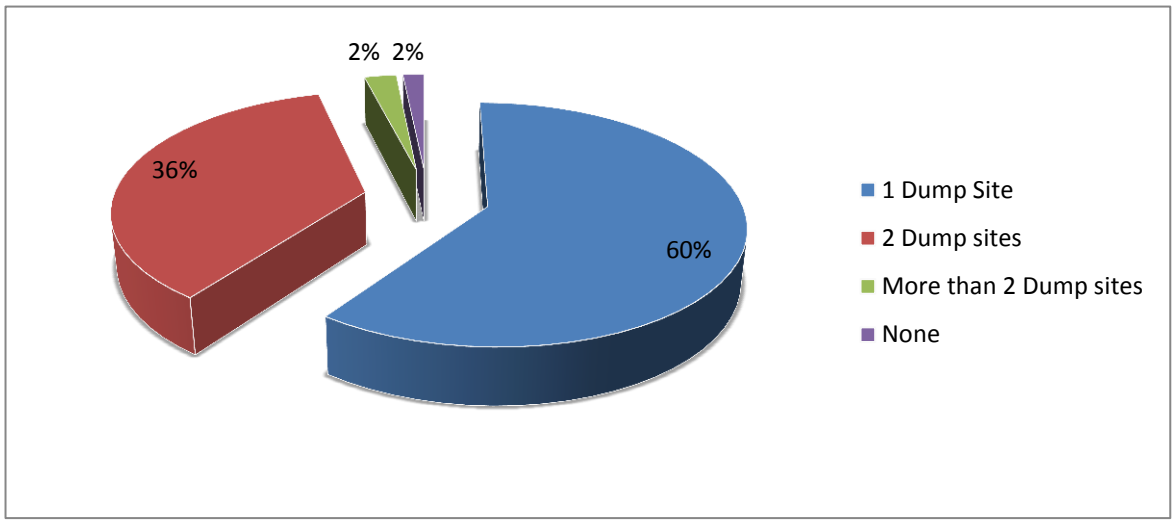


Figure 4.10: Dumping Site Knowledge (Field Survey, 2014)

PLATE 4.8: The Dumping Site (Field Survey, 2014)

Process of Solid Waste Management in Mlolongo

Figure 4.11 Process of Solid Waste Management in Mlolongo Town (Author, 2014)

Research Objective Two: To establish the role played currently by the public in solid waste management in Mlolongo Town

4.6 Role of Public in Solid Waste Management

The role of the public in solid waste management forms the cardinal point of this research. It was one of the cardinal parameters of investigation in the research. The results revealed that about 58% of the respondents participated through engaging in actual collection of solid waste, 19% participated through financing collection, 6% engaged in sorting and about 6% supported transportation of the waste. There were around 11% of respondents who played the role of recycling of solid waste.

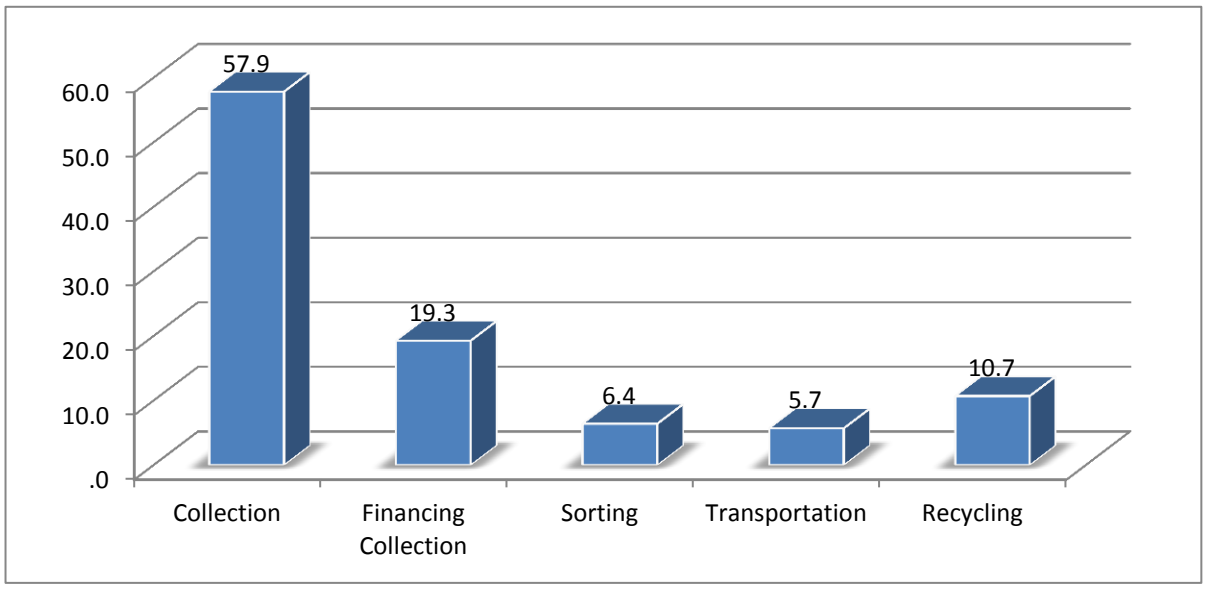


Figure 4.12: Role of Public Participation in Solid Waste Management

(Field Survey, 2014)

4.6.1 What Residents do with Solid Waste?

The research also undertook to find out what the residents do with their solid waste. The study indicated that about 74% of the respondents had their waste collected by the County Government, 11% threw waste to open spaces, 13% burned their waste and about 2% had the waste collected by the estate management through private collectors.

Some residents throw waste into open space as a lady in this plate seen throwing waste in open space near living apartments

Plate 4.9: Resident Throwing Waste to Open Space

(Field Survey, 2014)

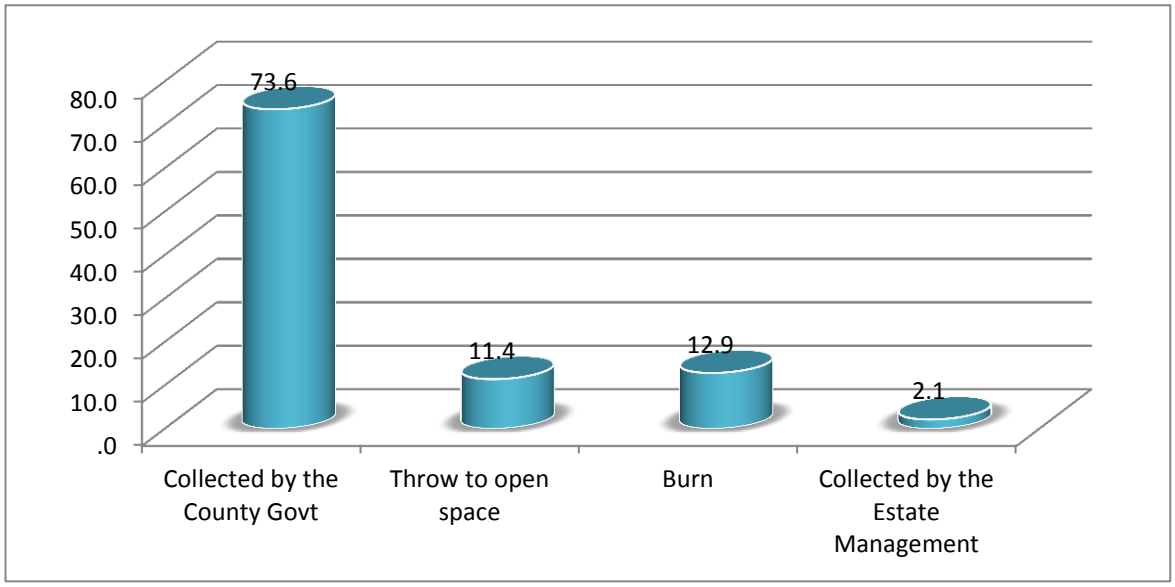


Figure 4.13: Solid Waste Collection

(Field Survey, 2014)

4.6.2 Awareness on what happens to Waste after Disposal

Findings also indicated that there was little awareness on part of the public on what happens to the waste after they disposed it. The study indicated that only 24% were aware of what happened to the waste after disposal while 76% lacked such awareness.

4.6.3 Recycling

The study indicated that there were only 45% of respondents who undertook recycling of solid waste they generated and 55% did not engage in recycling. However, it is notable that there was no single recycling plant or firm in Mlolongo town.

4.6.4 Solid Waste Scavenging

The research also conducted an assessment on the level of solid waste scavenging in Mlolongo town. It inquired whether there were other people who collected waste from the respondents. Findings indicated that 53% of respondents received scavengers who wanted to collect waste while 47% did not have any other people collecting waste from their premises.

Children and an adult scavenging for valuables in solid waste

Plate 4.10: Solid Waste Scavengers

(Field Survey, 2014)

4.7 Solid Waste Problem in Mlolongo

4.7.1 Solid Waste Problem

A large majority of the respondents acknowledged that solid waste was a problem in Mlolongo town. There were 92% of the respondents who agreed that solid waste was a problem while only 8% did not view it as a problem for the town. In addition, 81% of the respondents related the solid waste management with the presence of different health issues. There were only 19% of respondents who did not associate solid waste with health issues.

Plate 4.4: Solid Waste mixed with Waste Water in Mlolongo: An indicator that it is a problem in the town and even a hazard to public health hazard.

(Field Survey, 2014)

Research Objective Three: To identify other potential roles that the public can play in achieving effective solid waste management in Mlolongo Town

4.7.2 Changes of Existing Solid Waste Collection System

There were 68% of respondents who acknowledged that there was a need to change the existing solid waste collection system because of its inefficiencies. However, 32% did not indicate any need for changes to the system. There were many suggested changes to the existing solid waste collection system. A total of 30% of the respondents proposed a change to increase waste collection personnel and vehicles. Mlolongo had 3 field supervisors, and 18 workers responsible for waste collection. There was also one waste collection vehicle that was also shared with Athi River town. Therefore, it is a big challenge for them to collect

waste across the vast settlements of the town. There were 22% of respondents who suggested that the town should have strategic waste collection containers across the town for dumping, 16% suggested for the improvement in the management of dumping sites, and another 16% also suggested that all stakeholders should be incorporated in the process of solid waste management to improve its efficacy. There were 6% of respondents who suggested for privatization of the process of solid waste management in the town and another 6% for the County Government of Machakos to take a full responsibility for solid waste management in Mlolongo. Only 4% suggested for the introduction of sorting and recycling as one of the changes necessary to the current solid waste management system.

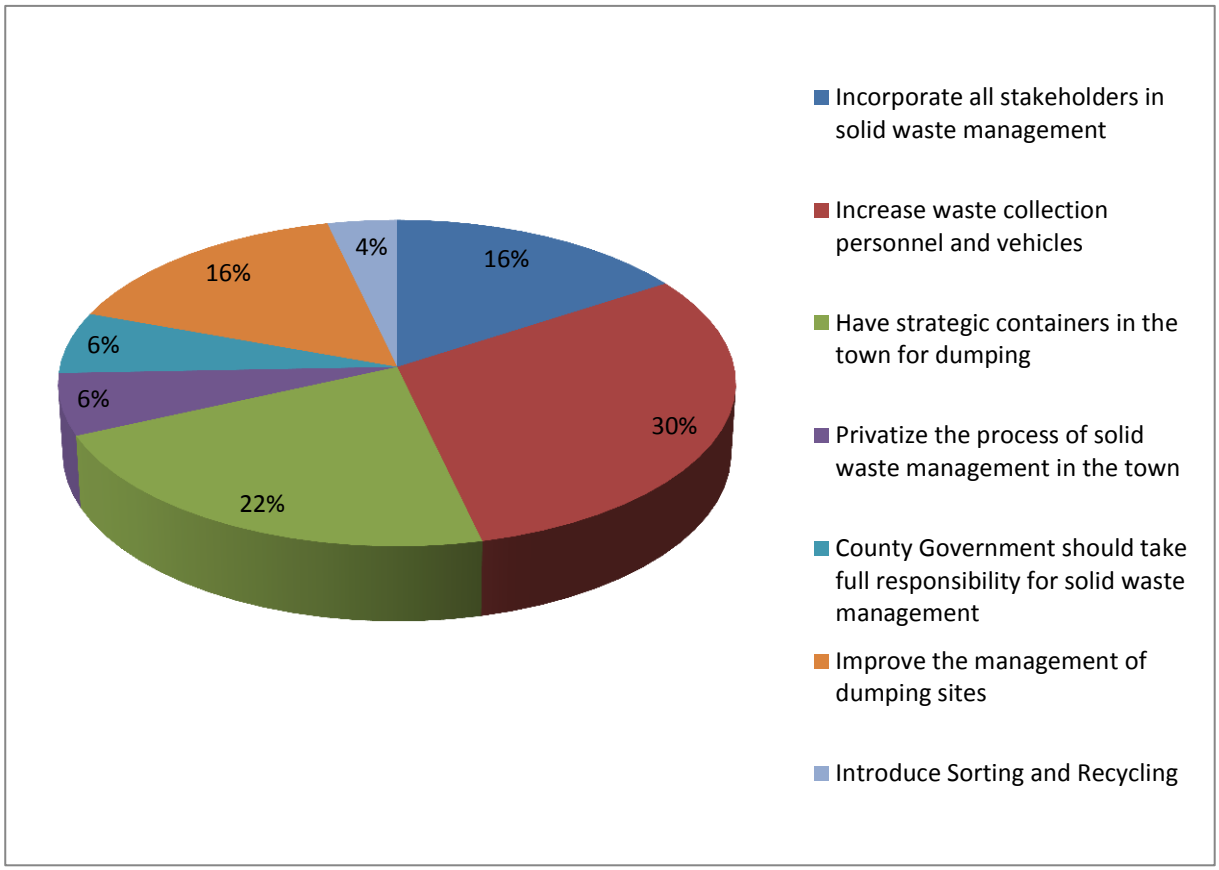


Figure 4.14: Suggested Changes to current SWM

(Field Survey, 2014)

4.7.3 Reasons for Suggesting the Changes to Solid Waste Management

There were varied reasons why the respondents suggested changes to the existing solid waste management system. The major reason as outlined by 36% of the respondents was to improve the deteriorating state of the environment in Mlolongo town and minimize the associated hazards. There were 27% of respondents who noted that the reason for changing the system

was to improve the efficiency of solid waste management that is was not working well, 22% noted the reason as the need to reduce the accumulation of solid waste in the town and 15% highlighted their reason as the need to improve public health in Mlolongo.

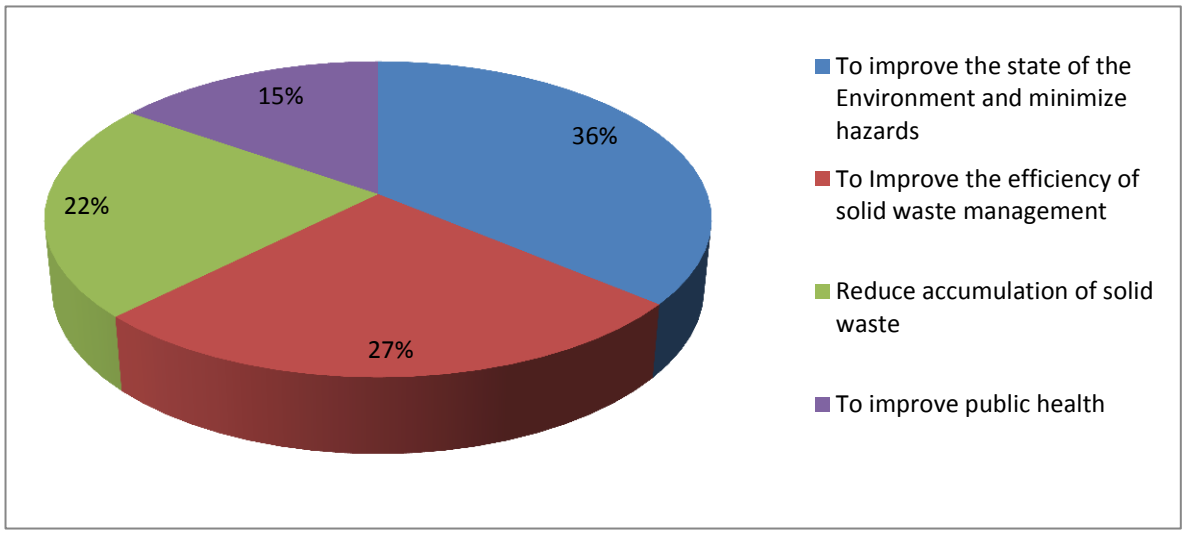


Figure 4.15: Reasons for Change to SWM

(Field Survey, 2014)

Plate 4.3: Accumulated Solid Waste with Human Settlements (Source: Field Survey 2014)

Solid waste has compromised the state of the environment in Mlolongo town necessitating changes to the current system of management

4.7.4 Authority to Implement the Changes

Most respondents of the study (57%) preferred that the changes be implemented by all stakeholders in solid waste management including the households, private sector, neighbourhood associations, estate managements and the County Government of Machakos. There were 36% who suggested that the County Government should take responsibility of implementing the suggested changes, 4% wanted individual households to implement the changes and 3% wanted different authorities apart from the noted ones such as a private contractor.

Plate 4.4: Machakos County SWM Staff at work in Mlolongo (Field Survey, 2014).

The County Government of Machakos should work in cooperation with residents and private sector to implement changes in solid waste management in Mlolongo town

4.8 Compositing

The research also conducted an assessment of how the respondents minimize their solid waste generation in households and business stalls. Compositing is one of the major strategies for regulating solid waste and improving its management level. However, the findings of the research indicated that only 29% of the respondents understood what composting is and the vast majority of 71% did not understand compositing. The research indicated that there were only 18% of respondents who practised compositing while 82% did not. This revealed that

the process was still a rarity within Mlolongo town despite it being an integral part of an efficient solid waste management system.

Those who didn't practice composing cited different reasons for not practising it. About 76% indicated that inadequacy of space was a challenge that prevented them from practising compositing, 13% indicated that the process is time consuming and 11% were unable to find time for practising compositing.

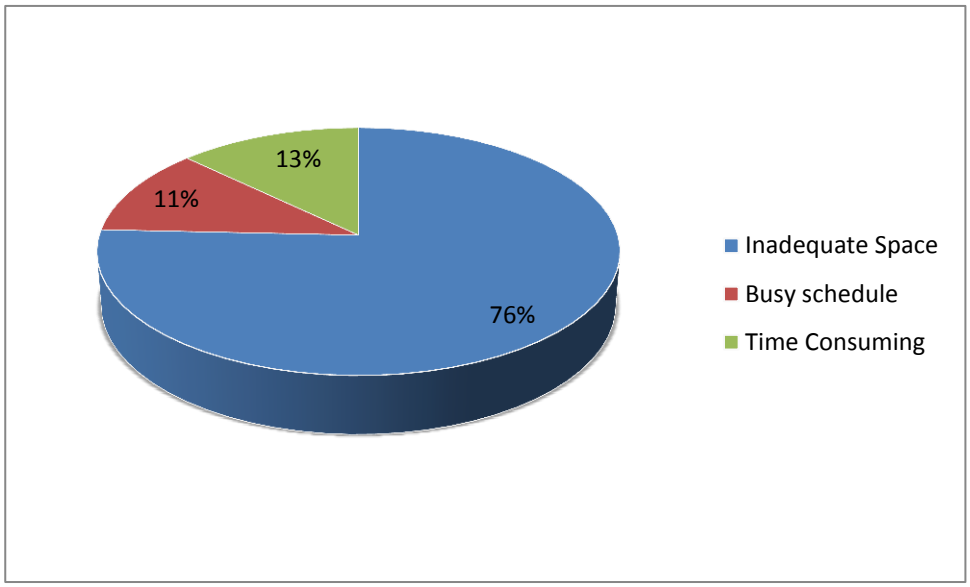


Figure 4.16: Reasons for not Practising Compositing

Source: Field Survey, 2014

Waste Separation at Source

There were 76% of respondents who indicated that they can separate their solid waste while 24% cannot separate waste. Waste separation is essential to promote effective disposal and encourages re-use, scavenging, and recycling.

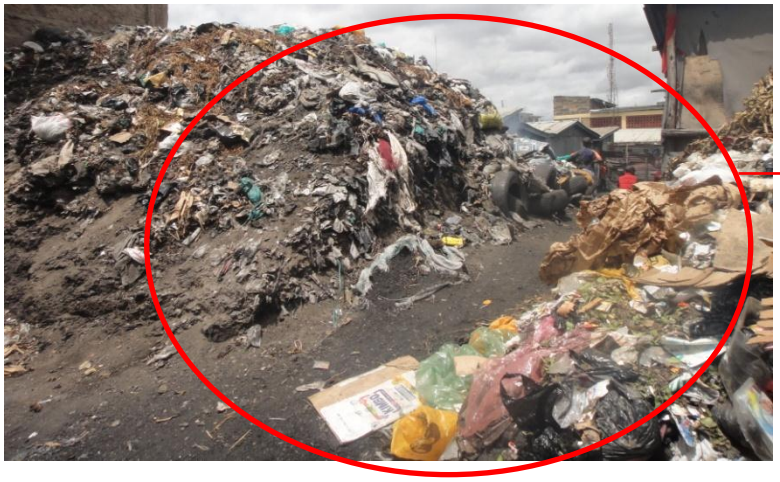


Plate 4.5: Un-separated Waste

Source: Field Survey, 2014

4.8.1 Starting a Household Compositing site

The study indicated that there were only 55% of respondents who would like to start a household compositing site, while 45% were unable to start such a site. This indicated that compositing sites were not a popular initiative in the town. There was a potential to reduce solid waste management through initiation of compositing sites projects among the residents. This can contribute to the overall better management of solid waste.

4.9 Public Participation in Solid Waste Management

The research also conducted an assessment of the different elements of public participation in solid waste management in Mlolongo. There were different forms of participation in solid waste management that the people engaged in as discussed below. The approaches included payment for collection of waste, active participation through collection and dumping of waste, provision of solid waste management education, recycling and re-using of solid waste.

4.9.1 Payment for Solid Waste Collection

The research indicated that there were 76% of respondents who were willing to pay for waste collection while 24% were not willing to pay for the service. This indicates that majority of the respondents are willing to participate in solid waste management through paying for waste collection to ensure quality solid waste management.

4.9.2 Active participation in Solid Waste Collection

The study revealed that 70% of the respondents indicated that it was appropriate for individuals and households to actively participate in solid waste collection. There were only 30% who noted that active participation in solid waste collection was inappropriate.

4.9.3 Solid Waste Management Education

Solid waste management education is essential in promoting the efficiency of the process of solid waste management. It promotes aspects of solid waste reduction, appropriate dumping and increases household responsibility in solid waste issues. The findings of this study indicated that there were only 21% of respondents who provided members of their households with solid waste management education. This meant that a majority of 79% lacked household solid waste management education.

4.9.4 Solid Waste Management Education Lessons

There were two main reasons that were associated with solid waste management as indicated by the study. There were 62% of respondents who taught lessons on reducing solid waste generation and 38% of the respondents who taught on maintenance of proper hygiene through effective solid waste disposal.

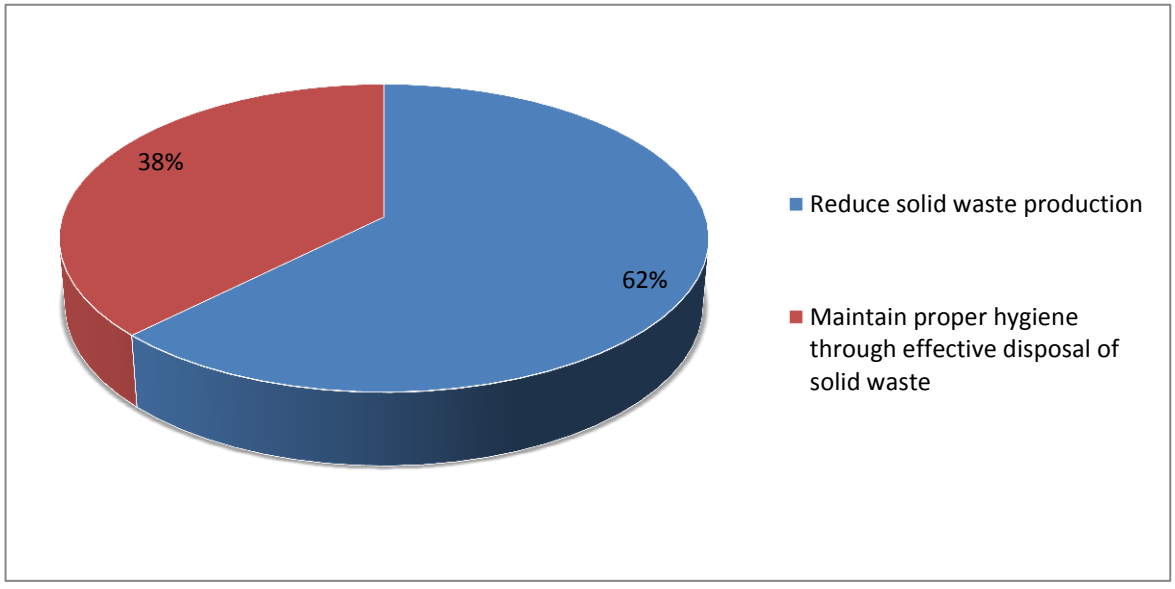


Figure 4.17: Solid Waste Management Education Lessons

Source: Field Survey, 2014

4.9.5 Involvement of Children of Less than 10 years in SWM

There were 40% of respondents who involved children of less than 10 years in solid waste management. There were 60% who did not engage children of that age bracket in solid waste management. This meant that majority of young children missed on valuable lessons and education in solid waste management. This decreased their capacity of participation in the process when they are adults.

4.9.6 Household Solid Waste Containers

The research indicated that all the respondents have household containers where they dump their waste. This reflects a high level of household responsibility in solid waste management at household level.

Plate 4.6: Household Solid Waste Containers

A solid waste collection container used in Valley View Estate Mlolongo and a sugarcane vendor uses sack to collect waste from his business in Mlolongo town

Source: Field Survey, 2014

4.9.7 Re-using of Waste

The study results revealed that 73% of the respondents re-use some of the waste they generate while 37% do not re-use any waste they generate. Some of the areas for re-using include waste becoming feed for animals and manure for urban agriculture.

Plate 4.7: Urban Agriculture

Source: Field Survey, 2014

Urban Agriculture in Mlolongo town, Organic waste can be re-used as manure in these farms

Plate 4.8: Re-using of Solid Waste for Animal Feed (Field Survey, 2014)

Some waste is also re-used as animal feed for dogs, goats, cows and pigs in Mlolongo town

4.10 Household Waste Collection

Waste collection is an essential component of solid waste management. The research conducted an assessment of solid waste collection among households and businesses in Mlolongo. There were different elements of solid waste collection. These elements include household waste collection, affordability of the collection, knowledge of dumping sites, frequency of collection and waste generation reduction. This elements are discussed below:

4.10.1 Household/Shop/Stall Waste Collectors

The study indicated that 26% of the respondents get their waste collected from household level by a private collector, 42% collect it as tenants and 16% have landlords collecting it. There were 14% who get waste collected from their households by the County Government and 2% by the Estate Management. There were 82% of the respondents who paid to get their waste collected and 18% did not pay for the service.

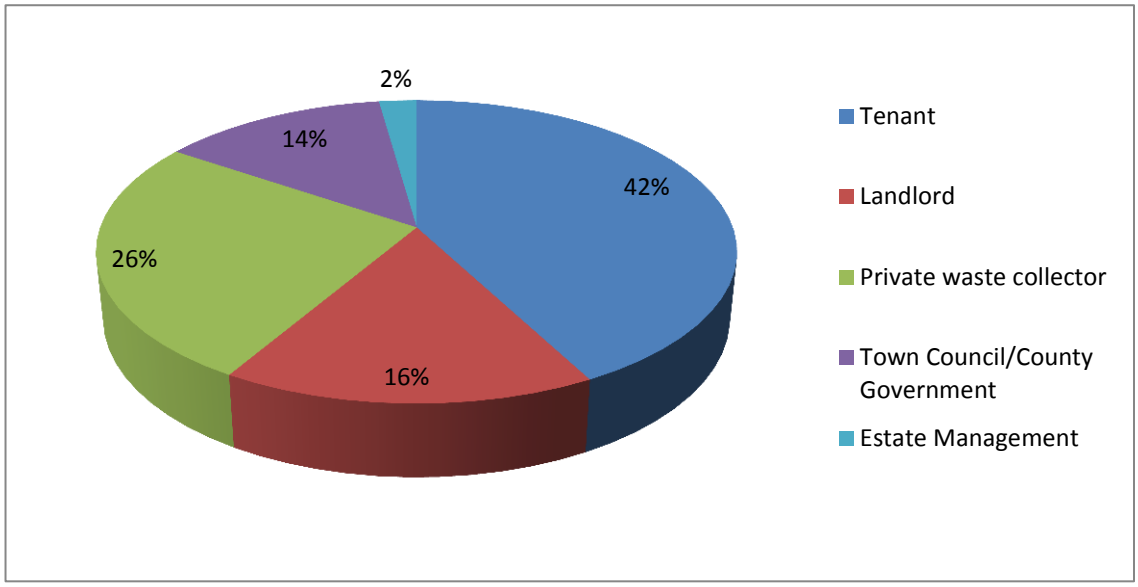


Figure 4.18: Household Waste Collectors

Source: Field Survey, 2014

4.10.2 Affordability of Solid Waste Collection Fee

Among the 82% who paid for solid waste collection, there were only 49% who thought that the fee they paid for the service is affordable and 51% thought that it was not affordable. Solid waste management still remains unaffordable to the poor or lower middle class households. Solid waste management should be a free Government service to the people, rendered as part of tax payment.

4.10.3 Knowledge of where Waste is taken

The findings indicated varied responses on where the solid waste is taken after collection from the households. There were 45% who know that their waste is taken to a collecting centre in Mlolongo, 14% said their waste is taken to landfills and 13% said it is taken to pits for burning. However, 28% of respondents did not know where their waste is taken after collection from the household.

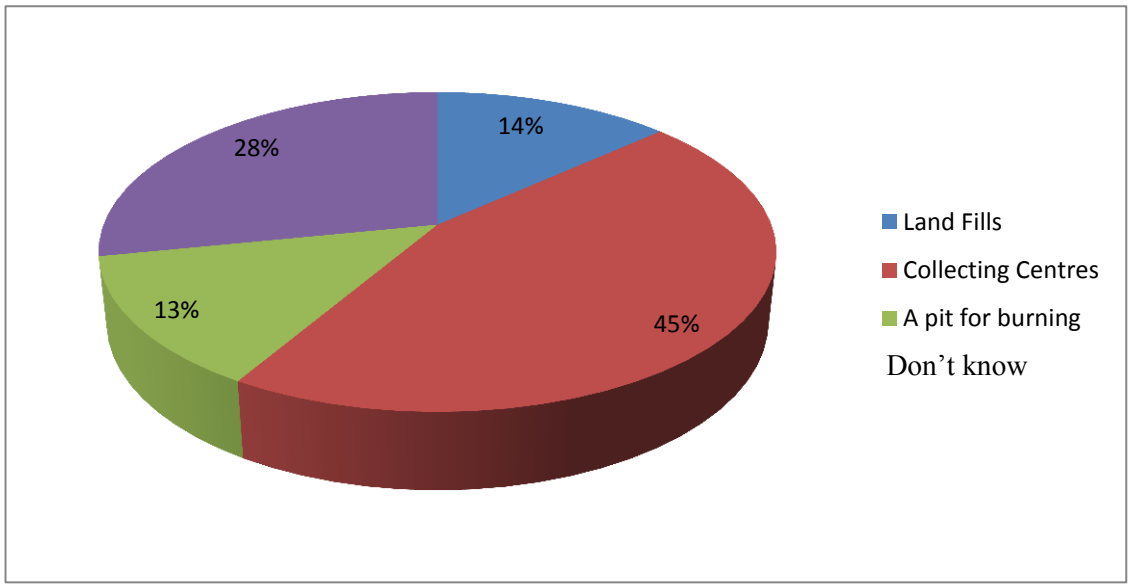


Figure 4.19: Knowledge of where waste is taken

Source: Field Survey, 2014

4.10.4 Number of times Solid Waste is collected per Week

There were 49% of respondents who indicated that their solid waste is collected 2-6 times per week, 35% get waste collected only once per week and 8% get it collected twice per week. There were 4% who got it collected on a daily basis and another 4% have irregular collections and did not know the frequency of collection.

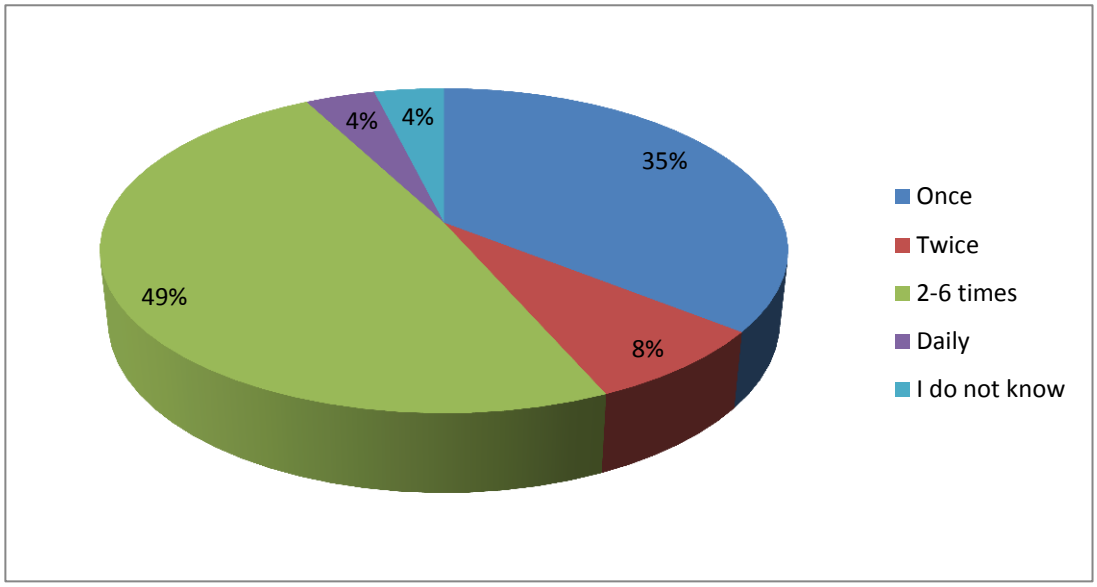


Figure 4.20: Frequency of Solid Waste Collection

Source: Field Survey, 2014

4.10.5 Waste found near premises

The research indicated that most respondents (71%) pick and put waste they found near their premise in a container while 29% moved on with their activities. This revealed that the level of solid waste responsibility and general awareness was still low in the town. There were few residents who took responsibility on solid waste collection.

4.10.6 Waste Generation Reduction

The study indicated that only 27% of the respondents thought that they can reduce the waste they generated while a total of 73% did not think they can reduce the solid waste they generated. Additionally, the research indicated that 78% of the respondents suggested that they can reduce the waste they disposed through recycling and burning and 22% suggested reducing waste through practicing appropriate waste disposal methods. In addition, there were 58% of respondents who thought that there are items that can be re-used in the waste they generated while 42% did not think that there were any items for re-use in their waste.

4.11 Sorting of Solid Waste

The research findings indicated that 93% of the respondents thought that sorting helps in the process of solid waste management while there were only 7% who think that the process did not help. The study further indicated different items that should rank in high priority in sorting to promote recycling. About 51% of the respondents indicated that hard plastics

should be sorted from the rest of the solid waste, about 24% want sorting of polythene, 11% want glass, 7% want sorting of paper and about 8% want sorting of metals to promote recycling.

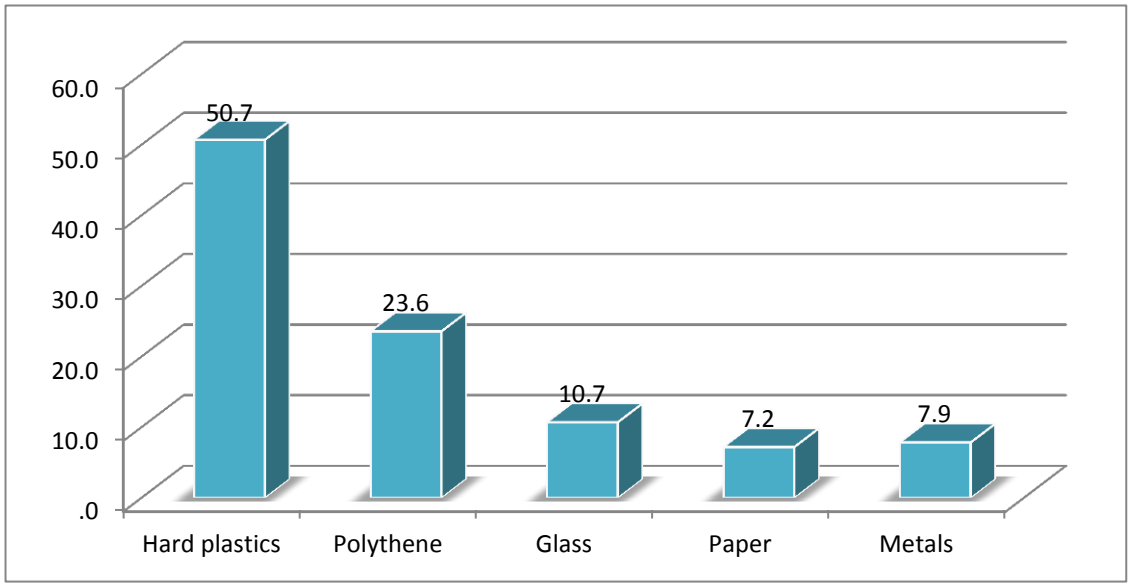


Figure 2.21: Waste that should be sorted

Source: Field Survey, 2014

4.12 Cooperation in Solid Waste Management

4.12.1 Working together as Residents

The research indicated that there were 79% of respondents who thought that it was necessary to work together among residents of Mlolongo town to promote solid waste management while only 21% did not think that it was necessary to have such cooperation among residents.

4.12.2 Necessity to work with the County Government

The research indicated that 89% of the respondents deemed it necessary for the residents to work with the County Government of Machakos to promote solid waste management in Mlolongo town. Further, 34% of the respondents thought that they are not capable of managing solid waste in Mlolongo without the support of the County Government while only 66% supported the idea that residents have the capacity to manage solid waste without working with the County Government.

Research Objective Four: To identify the major challenges of involving the public in solid waste management in Mlolongo Town.

4.13 Challenges of Solid Waste Management in Mlolongo

There are different challenges of solid waste management and public participation in Mlolongo town. The main challenge as noted by 36% of the respondents is undesignated dumping of solid waste. There are many dumping points across Mlolongo town. There were 25% of respondents who cited lack of efficient solid waste management systems for some households and businesses as the major challenge in Mlolongo.

Plate 4.9: Children in illegal Dumping Site

An illegal dumping site in Mlolongo town

Solid Waste also poses a threat to public health especially to children playing in the dumpsites.

Source: Field Survey, 2014

Plate 4.10: The Low number of SWM Staff at work in Mlolongo

The County Government has inadequate personnel, containers and vehicles for solid waste collection

Source: Field Survey, 2014

The findings also revealed that 16% of the respondents noted lack of public cooperation and participation in solid waste management as a challenge in Mlolongo town, 7% noted that difficulties in solid waste transportation in the town is a major drawback to effective solid waste management. There were 6% of respondents who cited few dumping sites around the town, another 6% also noted lack of clear and specified schedule for solid waste collection and 4% also indicated poor level of infrastructure especially feeder roads hinders solid waste collection in the interior settlements of Mlolongo that are off the main spine of Mombasa-Nairobi Highway.

Plate 4.11: One of the Undesignated Dumping Site in Mlolongo

Undesignated Dumping Site in Mlolongo Town is one of the Challenges facing Solid waste management

Source: Field Survey, 2014

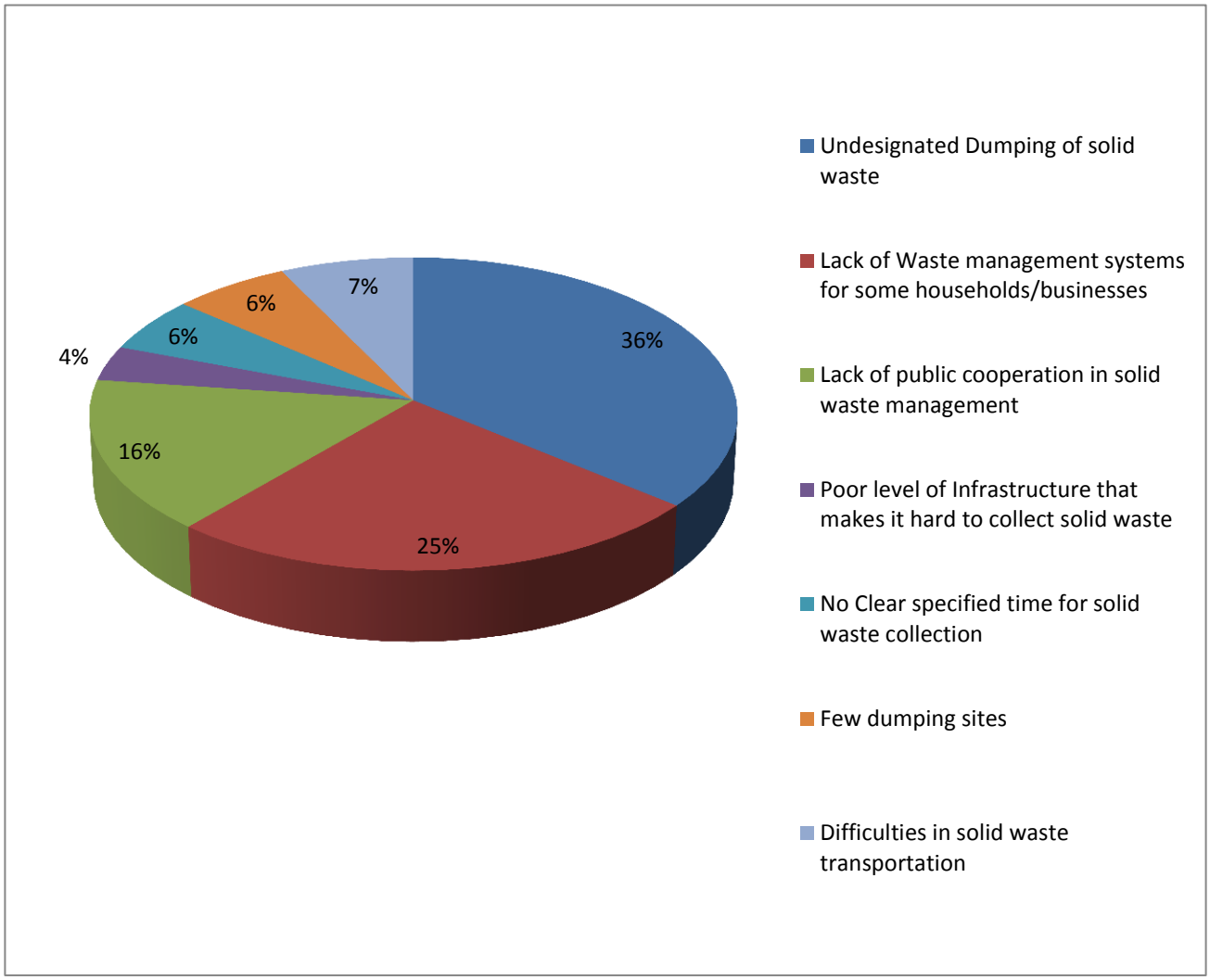


Figure 4.22: Solid Waste Management Challenges in Mlolongo

Source: Field Survey, 2014

Plate 4.12: Poor State of Feeder Roads

Impassable feeder roads in the interior settlements of Mlolongo make Solid waste collection difficult

Source: Field Survey, 2014

Research Objective Five: To determine how to improve solid waste management in Mlolongo town

4.14 Suggestions to Promote Effective SWM and public participation

There were different suggestions from the respondents on strategies of promoting effective Solid Waste Management and public participation. Majority of the respondents (30%) suggested sensitization of the people on the need for effective solid waste management as a method of promoting effective SWM and public participation.

There were 20% who suggested for increment of solid waste collection personnel, 15% suggested for increment of waste collection vehicles and waste collection containers across Mlolongo town while 8% suggested the incorporation of neighbourhood associations and estate management in solid waste management. The results further indicated that 6% of the respondents suggested for the enactment of by-laws in the County that can promote environmental cleanliness and citizen participation in solid waste management.

There were 4% of respondents who suggested for the neighbourhood associations to oversee the process of solid waste management in collaboration with the County Government, another 4% suggested improvement of infrastructure and a similar percentage suggested for designation of a schedule for lorries to collect solid waste instead of having a makeshift and irregular time-table for collection. Additionally, another 4% suggested for increment of the level of public participation in solid waste management through public environmental days and public barazas as a method of improving solid waste management in Mlolongo.

Increasing solid waste collection containers across the town and strategic waste collection points can improve waste management in Mlolongo

Plate 4.13: County Government Solid Waste Collection Containers

Source: Field Survey, 2014

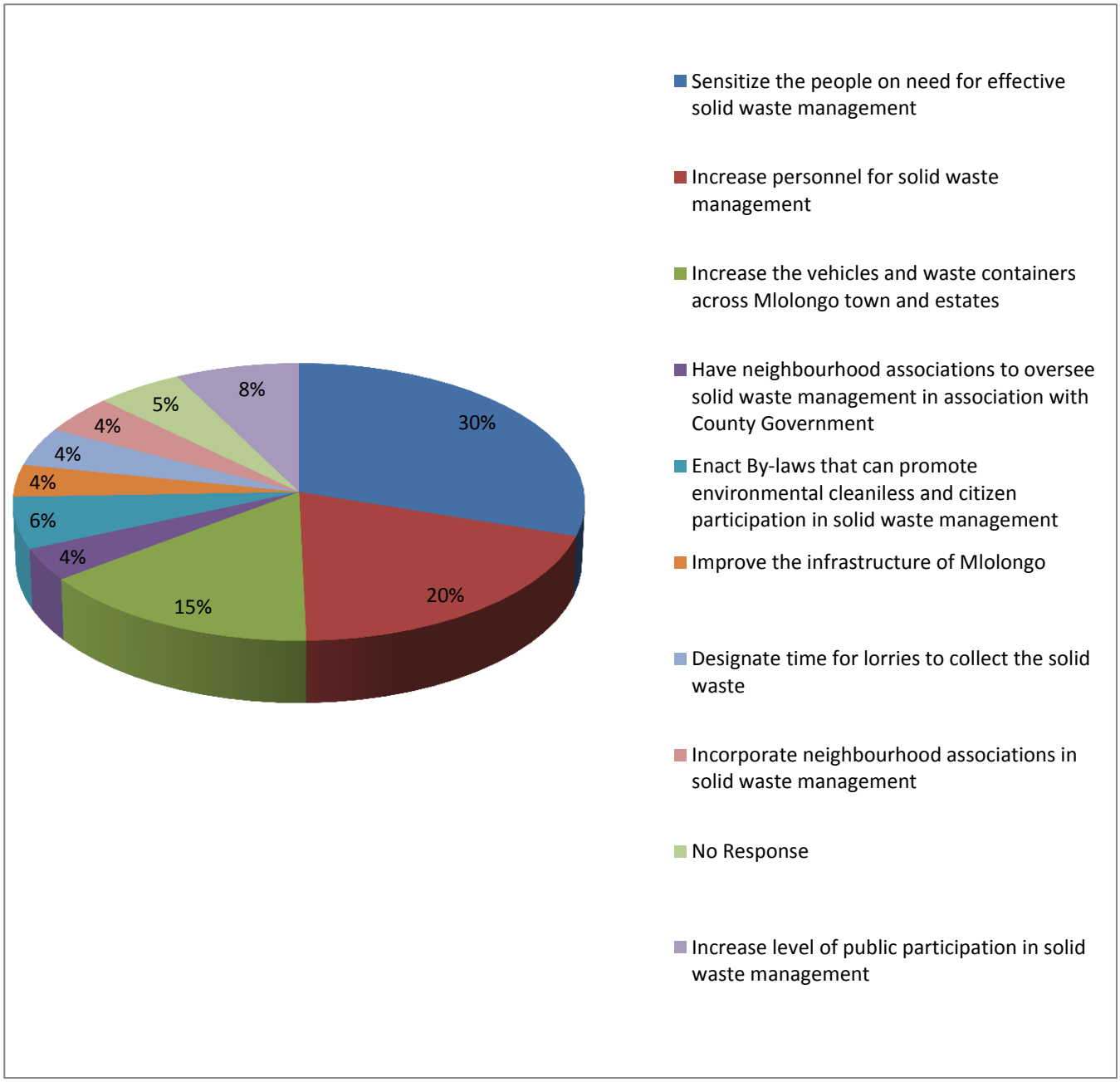


Figure 4.23: Suggested Improvements to SWM and Public Participation

Source: Field Survey, 2014

4.15 Stakeholders in Solid Waste Management in Mlolongo Town

There were different stakeholders in the process of solid waste management in Mlolongo town. These stakeholders played different roles to ensure the efficacy of the process and to promote the development of the town. The stakeholders included the public, private waste collectors, waste scavengers, cart pushers, resource merchants, real estate managers and neighbourhood associations.

4.15.1 Public

The public was the main stakeholder of solid waste management in Mlolongo town. It comprised of the residents, business operators, and people on transit. The major role of the public was solid waste generation and management at the household or shop/stall level. They then helped in financing the solid waste collection, actual collection, sorting, recycling, re-using and other personnel provision related to solid waste management.

Plate 4.14: The Public as Principal Waste Generators

The public: Major Solid waste generators in Mlolongo town

Source: Field Survey, 2014

The general public who are the waste generators were the first casualty of irregular and epileptic services of the County Government responsible for waste management in Mlolongo. When the waste they generated was not evacuated for a very long time, it left the various neighbourhoods with huge mounds of garbage and trash. The negative spill overs caused by the accumulated solid waste within the communities led to the public themselves seeking for

alternative waste disposal system, hence the entrance of the private sector into solid waste management stream in Mlolongo town.

4.15.2 Private Waste Collectors

There were different private solid waste collection firms in Mlolongo town. They collected solid waste from the household level and took it to the waste collecting centre in the town where the County Government of Machakos vehicle collected it for dumping in a Quarry.

The activities of informal private sector in solid waste management streams in Mlolongo town were vital and overwhelmingly significant in the overall integrated solid waste management practice in the town and Machakos County at large. The sector, which encompassed all aspects of, integrated solid waste management practice vis-à-vis collection, transportation, recovery, recycling and merchandise of both recovered and recycled materials was an institution in its own right. They have established a very high network of operation and distribution of their valuables both within and outside Mlolongo town.

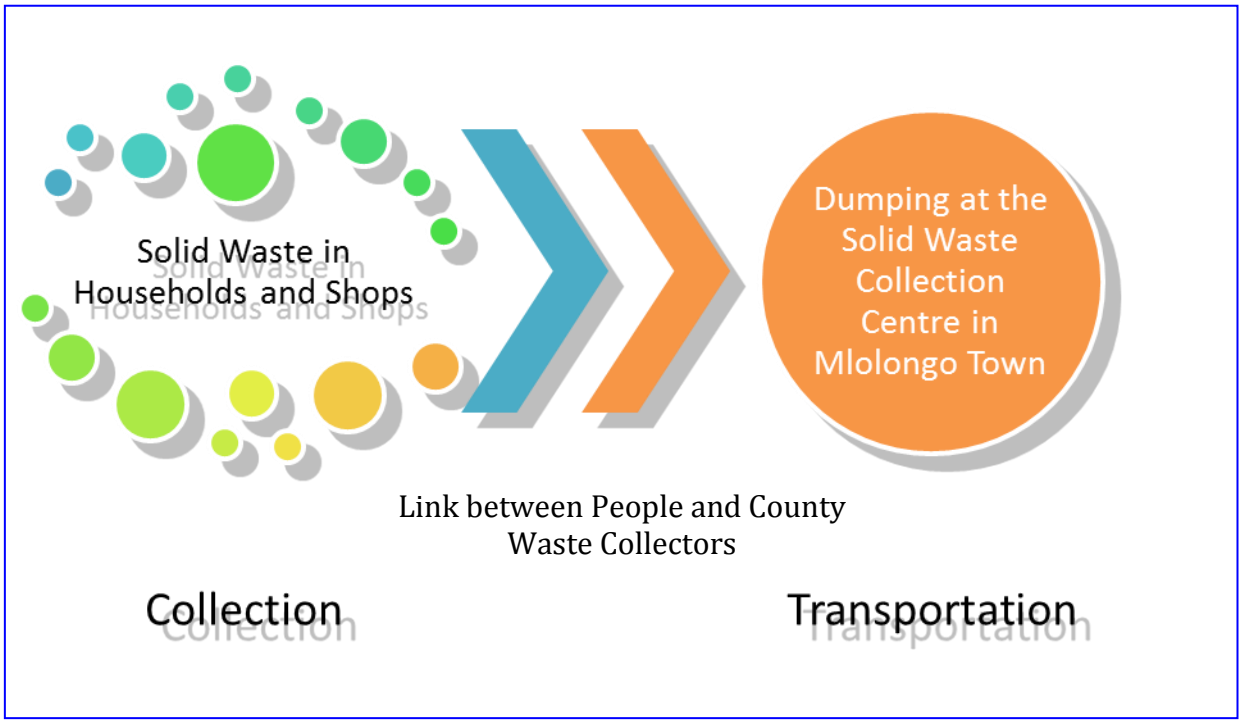


Figure 4.24: Operation Organization of Private Waste Collectors in Mlolongo

Source: Author, 2014

Challenges of the Private Solid Waste Management Sector

There were different challenges that hindered the efficiency of the private sector in Solid Waste Management in Mlolongo town. Some of the challenges included non-formalization of all the activities of the informal private sector, which resulted into non-regulation and coordination by the County Government and its agencies. There was also no good linkage system between the private firms and the County Government of Machakos to work in as a cohesive unit and support solid waste management. There was exposure to several hazards and health risks, due to their mode of operation, which was more of manual than mechanical. They collected the waste using hand pushed carts which is not efficient.

4.15.3 Waste Scavengers

Waste Scavengers operated at their own motives and their role was to find re-usable or recyclable waste that was of value to them or was of economic benefit. They collected waste from households, the waste collecting centres at Mlolongo town and the main dumping site at the quarry. This was the only group /organization so far identified in Mlolongo town that was involved in both on-site and off-site waste/ resource recovery. They recovered re-usable and recyclable materials like plastics, aluminium, glass, paper, scrap metal and animal waste like horn, bones etc. Some of them went from door-to- door to recover re-usable and recyclable materials, while majority limited their operation to the waste brought to the disposal sites. In some cases, the scavengers also processed some of the recovered waste before selling either to the resource merchants or directly to the recycling industries. The processes included washing, and burning. Majority of the scavengers lived in and around the disposal sites.

A Waste Scavenger looking for Re-usable/Recyclable waste in Mlolongo town

Plate 4.15: A waste scavenger at work

Source: Field Survey, 2014

4.15.4 The Cart Pushers

These are the group of informal private sector involved in the house to house waste collection at a fee using built carts. They were brought into the industry by the ineffectiveness of the County Government of Machakos for collection, transportation, and the disposal of waste. The County Government vehicle was not able to collect solid waste from the interior sections of Mlolongo settlements due to poor feeder roads and inadequacy of staff to undertake the work. The role of the cart pushers was to collect solid waste from houses and transport it to the collecting centre near the main Mombasa-Nairobi Highway. This group was also involved in waste recovery. As they went from house-to-house collecting waste at an agreed fee, some of them also sorted and recovered reusable and recyclable materials from the waste before disposing the residue. However, the non-formalization of the activities of the group made it almost impossible to have accurate data/records of their activities within the waste

management sector in Mlolongo town. However, they carted away several hundred tons of waste per day.

Plate 4.16: Hand Carts with Waste

Cart Pushers: Responsible for Waste Collection from house to house in Mlolongo town

Source: Field Survey, 2014

4.15.5: The Resource Merchants

This group was made up of traders (merchants) involved in the purchase of all recovered recyclable and re-usable materials from the scavengers. Some members of this group were retired scavengers who could not scout for materials on the site again due to either age or advancement in financial capability. They were so wealthy that some of them are involved in the exportation of some of the recovered resources to other countries thereby earning foreign exchange. They were also influential that they got orders from companies to supply recovered materials.

4.15.6: Real Estate Management and Neighbourhood Associations

The Real Estate Management took the responsibility of solid waste management in gated neighbourhoods such as Valley View Estate in Mlolongo. They managed solid waste on behalf of the estate residents. This was similar to some neighbourhood or community associations such as business and market groups that are responsible for waste management on behalf of residents and business operators at a given cost.

Plate 4.17: Gated Communities in Mlolongo

Gated Communities Mlolongo: They have an efficient solid waste collection Model

Plate 4.18: Valley View Estate where SWM is efficient

Source: Field Survey, 2014

4.15.7 County Government of Machakos

The County Government of Machakos managed solid waste through its Department of Environment. The County had an Environmental Officer based in Machakos and another Assistant Officer in charge of supervision based in the Mavoko Sub-County. There were 3

field supervisors responsible for managing solid waste collection around the town. There were only eighteen employees who collected waste from the collecting centre to one collection vehicle. In addition, there were about three solid waste collection tankers/containers for Mlolongo town.

PLATE 4.19.1: County SWM Staff

Source: Field Survey, 2014

Plate 4.20.2: County SWM Staff

County Government of Machakos waste collection staff at Work in Mlolongo town

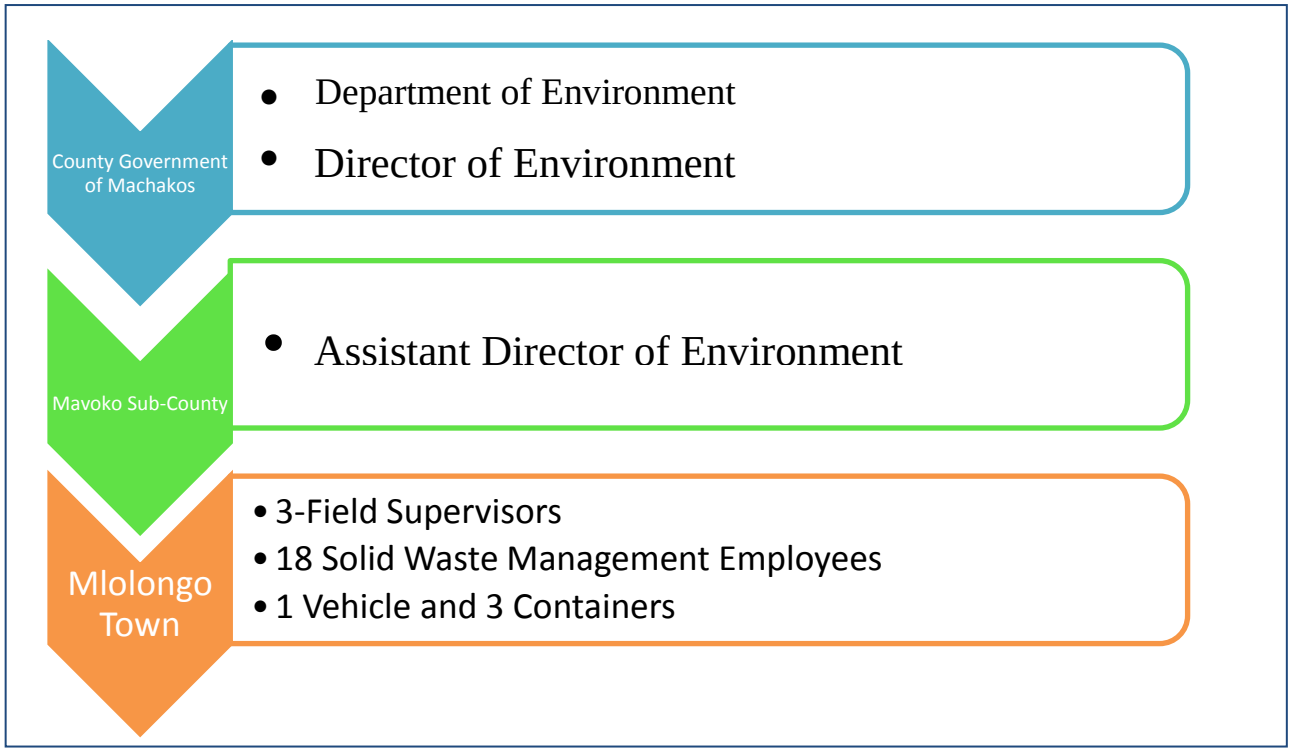


Figure 4.25: Organization of County Government SWM (Author, 2014)

The County Government of Machakos was also directly involved in the policy implementation relating to solid waste management in Mlolongo town. However, solid waste management was oscillating among private firms and individual household members because of the lack of capacity in the ministry of environment in the County to meet the needs of the vast settlements in Mlolongo. Some of the challenges faced by the County Government of Machakos in addressing the problem of solid waste management in Mlolongo town included incessant political interference, operational and institutional instability, inadequate funding and equipment, inadequate staff and waste generators (public) not willing to pay for the services, especially when services became epileptic.

4.15.8 The Missing Links in Solid Waste Management in Mlolongo

There were missing stakeholders in the process of solid waste management in Mlolongo town. This tended to hinder and affect the efficacy of the process leaving the town with heaps of solid waste and public health hazards. Recyclers were one of the missing links in solid waste management in Mlolongo town. There was no single recycling company or firm in the town. The presence of both the micro and the small scale recycling companies that convert recovered waste materials like paper, aluminum, animal by-products, plastics, scrap metals etc., to valuable materials and raw materials for the consumption of the industrial sector can be essential in transforming the solid waste management sector in Mlolongo town. The recycling sector is an essential investment, where some specialized equipment and machines are used for the conversion of the recovered items to finished products or raw materials that are also used in several other applications. Some of these recycled products and raw materials are exportable products through which foreign exchange is obtained. These industries can also provide job opportunities for residents of Mlolongo town and increase public participation levels in solid waste management.

Solid Waste Management Stakeholders and the Missing Link

Figure 4.26: Stakeholders in SWM in Mlolongo

Source: Author, 2014

CHAPTER FIVE: SUMMARY OF FINDINGS AND RECOMMENDATIONS

5.1 Introduction

This chapter is a discussion of the critical findings of the study on public participation in solid waste management in Mlolongo town. The chapter provides a review of the findings and recommendations and draws essential conclusions. The recommendations detail out various alternative approaches that can be adopted to mitigate the problem of solid waste management in Mlolongo.

5.2 Synthesis of the Study

The level of participation of the public in solid waste management in Mlolongo Town Council was low and most of the residents have not actively been involved in the process of solid waste management. Though low, it is useful for future planning and anticipation for more meaningful participation of the public in solid waste management in Mlolongo Town. A larger proportion of the public in Mlolongo Town exhibited concern and an amount of sensitivity about solid waste. The findings showed that majority of the respondents, possessed waste containers for their solid waste save for the market vendors in Mlolongo. It was established that particularly in Mlolongo, there was a private arrangement within the main market areas in such a way that it did not necessitate everyone to have a solid waste container. Mlolongo markets had an arrangement where every vendor contributed Kenya shillings ten per day for cleaning including: sweeping, collection and disposal of solid waste from the market. Several vendors therefore, did not find it necessary to use waste containers yet they paid for cleaning of their premises. While elsewhere in Mlolongo, most of the residents practiced "pit-burning" of the solid waste. This could explain why most of them did not have waste containers because waste was taken straight to the pit other than first kept in a container. The use of different materials also displayed the innovativeness of the people in keeping the solid waste in one place before disposal.

Across the different wards in Mlolongo Town, sorting of solid waste was less adopted. The findings revealed that even those who said they sorted their waste, many of them had already declared that they did not possess waste containers. It is not clear and quite unrealistic for one to sort waste without having it in a container. The participation of the public in as far as waste sorting was concerned seemed to be low . There seemed to be little appreciation of the benefits of solid waste sorting. The people

seemed to know that it helped to sort waste but few were practicing it. When there is no motivation for sorting of the waste, it is only taken to be time-wasting to the people. Those who took time to do some sorting were mainly sorting out materials that could either be used as feed for animals or for manure. Those who had a motivation in terms of economic benefits were seriously sorting the waste either for sale or for exchange with items that would otherwise be bought like milk. The knowledge base for recyclable items was also low. There were even people who had no idea of any item that can be recycled. All the items on the list that was presented to the respondents during the interview were recyclable. Amazingly, people were more aware of plastics as a recyclable item. Only few people thought of other items like polythene, glass, paper and metals as recyclable items.

It becomes difficult for people who lack information to fully participate in solid waste management. The Town Environmental Office plans to persuade the people to think of waste management related business ventures, but this would not even have been necessary if the people had the information about the benefits. The lack of information could be the constraint to public participation in solid waste management. The level of item reuse is similarly low in Mlolongo Town. Few people acknowledged that they have items they reuse before they think of disposal. The stimulus for this however was not really the consciousness to reduce the volume of waste generated. The people did not deliberately reuse items in order to reduce the solid waste volume but were rather pushed to reuse because they did not have much choice. They were constrained by the inability to afford acquisition of new items, so they took on reuse as a survival alternative. This may be a good place to start with a change of attitude so that even in the midst of greater affluence which according to UNEP (2007) places demand impulse for more consumption. From the items that were mentioned, there is an impression that there may be many other items that can be reused and thereby reducing on the volumes of new solid waste generated.

The current level of voluntary responsibility for proper solid waste management was low but not negligible. Majority of the people did not seem to assume responsibility voluntarily for solid waste that was not generated by them. When waste was found outside their premises, people were not concerned about such solid waste. It seemed they took the Town authority to have responsibility over such solid waste in areas as road sides, trenches and public open areas, play grounds and land reserved for the local government. Much as these areas belong to the public, because they are to be used for public interest, people do not show interest in voluntary care by way of picking up such waste and putting it in the rightful place. Even for

those who may have the will, may be limited by the facilities that can make such responsibility attainable. It may work well if and when there are waste bins for example within reach. People may feel that is so burdensome to carry waste for very long distances for the sake of being voluntarily responsible. It may only be realistic and easier if a waste bin is nearby so that it is not inconveniencing for someone to voluntarily engage in proper solid waste management.

The process of public participation may sometimes be long and not cheap in terms of time. To some people, it may not even be meaningful. However, it is almost impossible to talk about sustainable development and at the same time evade the need to have the people involved. This is because in contemporary development practice, growing awareness of the importance of people's non-expert experiences and knowledge has continuously led to a dire need for shared decision making in various contexts (Barnes, 2005). The input of the public is not ignorable in any given sector because of their exerted influence on the direction of development.

At face value, it may be difficult to see the importance of public participation in solid waste management. However, it is imperative to look at some of the methods in solid waste management and locate the place for public participation in the success and effectiveness of such methods in managing solid waste. The most popular method, which has notably attracted a lot of research in the field of waste management, is recycling. Although the contribution of recycling to solid waste management has been heralded (Tsai, (2007), Bekin et al. (2007)) argue that there are other environmentally friendly ways that can be adopted to manage waste. They do not wholesomely buy the idea that recycling is an environmentally sound way of managing waste because of the shortcomings leveled against it. Recycling consumes energy and thus imposing costs on the environment.

The scale of public participation in solid waste management is noticeably different between the developed and developing countries. In developed countries, public participation in solid waste management may go as far as sorting of the waste generated. The private firms then collect the already sorted waste at a fee. The fees paid cover up for the processes in which the public should have participated in the waste management line. In other words, the burden is passed on to the private waste collectors at a fee.

In developing countries, the picture is different. In the first place, majority of the population is too poor to regularly afford fees for waste collection. Secondly, many of the people ignorantly albeit innocently, dispose of waste carelessly with little concern about the imminent effects their careless disposal will ultimately cause. Thirdly, in some instances the people just do not think out the complexity of the waste problem and on whom the effect will finally rest. The public seems to think that it is completely the concern of the town authority to ensure proper waste management at no extra charge on the public.

For a community to register the kind of successes that is reported by Bekin et al., (2007), an amount of social cohesion is essential. This is further affirmed by Tsai (2007:45) that "households living in a region with a higher degree of social capital are more likely to work against opportunism and participate in waste management". The implication of this is that there is potential in strategizing for solid waste management from the community/public angle. If the members of the public are supported to build and concretize their social capital, their constructive participation in solid waste management can easily be harnessed. Members of the community are capable of thinking of more tailor-made, viable and sustainable ways of managing solid waste, when availed the opportunity.

Social capital and participation in solid waste management Barr, (2004) argues that it is not the role of the product producers alone, to reduce waste but also a duty of the general public to manage waste in a sustainable manner. This argument is valid because the will for involvement of the public needs to be guaranteed so that the roles of the producers and the consumers in waste reduction can reinforce each other. It should be appreciated that success of participation relies strongly on collective action by group/community/society members. Implicitly, the members in the group need to have cohesion as a basis for their collective operation in solid waste management. Tsai, (2007:45), emphasises the importance of social capital in waste management. Social capital in this case offers an opportunity to the people to collectively construct meaning and vision, consequently reducing probability of divergence in belief and ideology. They instead are most likely to share a common vision and thus able to work together to attain it.

Community institutional structures are also of importance in managing solid waste. In their study, Bekin et al., note that in the absence of appropriate institutional structures, it becomes difficult to ensure solid waste reduction at an individual level. They continue to emphasize

that waste reduction may only be viable in a community with some control over production and consumption of some items (Bekin et al, 2007:279). This kind of arrangement is bound to give power to the existing structure to operate in a manner within their own choice of means. Waste reduction begins at the stage of production when there is deliberate effort to prevent production of waste material, but this can be very difficult if the structure within which production is made does not deliberately support the prevention of such materials at production stage. When this is ensured by the structure, it simplifies the solid waste management system at the next level- of consumption.

It is very clear that without community support and involvement at least at sorting stage (which has to be done at the source before waste collection), even recycling may be very costly to undertake. Here, the community manifests as a very important stakeholder in solid waste management and the level of their participation counts on the success of recycling in particular and solid waste management in general. Notably, the costs of collection, transportation and land for landfills, are high; however engaging the community serves to reduce such costs. In a way, this proves to be a sustainable mode of waste management. For example: in Dhaka where community-based solid waste management and composting projects have been implemented, a lot of such costs have been reduced (UNEP, 2007). The projects have been able to save the municipalities from the costs of collection while at the same time reducing the need for landfills (UNEP, 2007). Diversion of costs from the municipalities allows them to invest in other services that benefit the community.

Apart from cutting costs of management and disposal, since waste collection, sorting and processing is in most cases labour intensive, it serves to employ a substantial number of people. It is revealed that in India, over one million people are employed in the waste sector (Gupta, 2001, in UNEP, 2007). Potentially, a number of otherwise would-be unemployed people can gainfully engage in the process of sorting and collecting especially recyclable waste materials either on a private individual (informal) basis or at (formal) company level. In so doing, financial gains would permeate to those who engage in sustainable waste management practices, and thus encouraging sustained participation.

The role of the public in waste management and in solid waste management in particular, has become indispensable and, can be through various ways. According to Tsai

(2007), a society that is willing to work together presents an opportunity for "creativity and innovation" in dealing with the waste problem. Tsai's observation brings out the importance of the will of the people/public to work together on matters of waste. Mutual understanding and agreement is vital in having the members of the public to work together. When solidarity is achieved, it presents fertile ground for the germination of creative ways of handling waste in a sustainably agreeable manner. It therefore becomes a responsibility of the public to be willing to work together in solid waste management, among other things.

Bekin et al., (2007) recommended that purchasing second-hand items as a way of waste reduction is important before people can resort to recycling and composting. This can go a long way in having potential waste kept at the minimum. It is a form of re-use of items which implies that less new items on top of the already under-used items will be purchased. The developing countries have been operating within this kind of arrangement, however with different push factors like inability to afford first-hand, new items.

When the waste aspect of these items is put into perspective, one could easily arrive at the conclusion that to a larger extent, the importation and use of second-hand items has actually accelerated the solid waste burden. Despite the emphasis on waste reduction and recycling as compared to disposal, avoiding or even reducing disposal is easier said than done specifically in developing countries (Chung and Poon, 2001). The developing countries especially in Asia and Africa usually import second-hand items from Europe and America, though a number of affluent Asian countries also export some of their send-hand items to Africa for reuse. A large volume of these second-hand items are either obsolete thereby ending up as waste sooner than expected, or they just have a very short lifespan remaining and thus becoming out of use. This scenario is not very different from the argument that rich countries negatively contribute to the waste burden in the developing countries by exporting second-hand items (Bournay, 2006). The appropriateness of this suggestion as a way of waste reduction is brought under check, especially in the poor countries which may not have adopted effective and efficient recycling systems.

Governments, whether central, federal or decentralized, have been a bit obstinate to public involvement in development projects and social service planning and implementation. From a political point of view, it is expected that the authorities possess the mandate to think and take decisions on behalf of the electorate, besides, it may

save time to technically exclude the public in such processes. It is not uncommon, however, to find many of such projects that neglect public participation, failing to yield the planned gains. Provision of solid waste management and disposal services is no exception. The process of public participation in solid waste management is challenged by several factors, depending on the method chosen for this purpose as well as the characteristics of the public in a particular location.

Tsai (2007) notes for example that "attitudes towards recycling are influenced by appropriate opportunities, facilities, knowledge and convenience". People are diverse in terms of the knowledge base they possess as well as in what they feel is convenient for them. This automatically makes their attitudes to differ. Reaching consensus on the most convenient system of managing solid waste around a particular facility becomes challenging. Goulet, a development scholar argued that "development is not a cluster of benefits given to people in need, but rather a process by which a populace acquires a greater mastery over its own destiny". His argument emphasizes the importance of people's participation in development ventures and projects that concern them. This does not go without caution, though. It is dangerous to leave the people with the power to decide for themselves what they want and how they want it, without any guarantees that the people possess the basic requisite knowledge for analysis and subsequent informed decision-making. The information, knowledge and awareness gaps among the members of the public make their involvement a challenging option. In their study on waste minimization in Local Governments in the United Kingdom, Read et al., (1998) found out that there was low awareness about the best practices in waste minimization across different administrative areas/Local Governments. For public participation to yield optimum benefit, prior arrangements to close or at least narrow the knowledge and awareness gaps ought to have been made. Involving the public with their knowledge gaps, may only lead to a challenging process of participation in solid waste management.

Solid waste management is a matter influenced by policy. Ideally, policy acts as an engine that gives direction and impetus to the solid waste management system. Sauro's analysis, however, shows that due to the absence of clear public policies as well as the economic in viability of investments in municipal waste segregation and recycling, such activities have not thrived in most parts of the developing world (Joardar, 2000). To effectively involve the public in solid waste management within a structure that does not

provide clear public policies becomes very cumbersome. There has also been a tendency to localize the nature of the waste concern and thus looking at it as a mere "nuisance rather than a health and environmental hazard" (Joardar, 2000). This has translated into low political will and the reluctance of the public to respond to the problem.

The absence of clear and specifically outlined legislation and mandate makes it difficult to achieve quality solid waste management practices. This is because it "deprives local bodies of transparent tools to regulate activities of individuals, firms, or organizations towards effective solid waste management" (Joardar, 2000:323). The participation of the private sector in solid waste management also most often than not concentrates on municipal "contracting-out" of secondary waste collectors in form of transferring the waste to disposal sites (Joardar, 2000).

The participation of the public as individuals is still virgin and provides a lot of potential for doing more about solid waste management. This therefore calls for strategies that will help to enlist the participation of the entire public for their attention to sustainable solid waste management practices. Participation of people in any kind of project needs careful planning by way of laying down strategies to encourage it. Tsai recommends that in order to encourage households to participate in waste recycling, there needs to be "a well-informed waste collection regime, good quality of environmental education and attitudes, an effective enforcement scheme from social norms, proper economic incentives and promotion from local communities" (Tsai, 2007). This is what many authorities have not been able to do especially in the developing world. Waste collection regimes do not seem to receive enough attention and environmental education has almost not been taken seriously. For the public to be interested to be associated with a project, and put in their efforts, they need to be assured that their efforts will yield success and progress, and the best way to do this is by presentation of a clear and easy-to-understand system of operation.

These efforts notwithstanding, there is need for consideration of some other factors. The social and economic status of the people also has a connotation on whether or, and how the people will participate in solid waste management. The authorities need to keep such factors at the back of their mind as they plan strategies for ensuring quality participation of the public. Tsai (2007) gives evidence that higher incomes and higher education levels elicit the

will to participate in waste management programmes like recycling in order to protect the environment. However, he does not show whether the influence of the income and education level goes only as far as recycling is concerned. Recycling is different from other activities in solid waste management. The authorities could easily take advantage of such factors to begin recycling programmes in areas where high income earners reside and or work and the successes that may be registered in such areas may form a basis for rolling it out to other areas. It could be a resource-cutting measure to start with such a group as it is believed that the rich and middle-class households organize themselves to privately collect and transfer their waste to centres where the authorities can pick it from. This assumption is premised on the belief that it is very rare that the municipal or city authorities will engage in door-to-door collection of the waste, especially in the developing world (Joardar, 2000). The limited resources within which the authorities in developing countries operate make it hard to do waste collection at a door-to-door basis. If the households can collect their waste to a centre where the authorities can in turn pick it from, it may make the work easier.

5.3 Summary of findings

This involves a preview of the findings of the study on the state of solid waste management and public participation in the process. Some of key the findings of the study indicated that:

i) The average household size was about 3 members. The study revealed that there were 51% of respondents who came from households of less than 3 members, 31% were from households with 3-5 members, 15% had more than 10 members and only 3% had households of between 6 and 10 members. This indicated that most households were medium sized, an implication that there was considerable amount of waste generation in Mlolongo town.

ii) About 39% of the respondents were in formal employment, 41% undertook business or entrepreneurship activities as a means of livelihood and 5% were in informal/casual employment. There were 15% of respondents who were not in any form of employment.

iii) There were different kinds of house typologies in Mlolongo. These included flats/ apartments; bungalows, row housing, and semi-detached houses. The housing typologies also affected the method of waste disposal and general level of solid waste management.

iv) Findings revealed that there were different types of waste generated by the respondents. About 47% of the respondents generated organic waste, 32% inorganic waste and 13% specifically generated paper as waste, 4% glass and textile and another 4% generated metallic appliances as waste.

v) The main mode of disposal of the waste generated was through waste collectors and it was used by about 40% of the respondents, 28% used burning to dispose waste, 24% used dumping, and 8% used burying as the mode of disposal.

vi) The research indicated that the County Government of Machakos took the main responsibility of waste collection in the town. There were 38% of respondents who depended on the County government for waste collection, 32% took the responsibility of waste collection as tenants, 22% were landlords, 6% depended on neighbourhood associations and 2% on Estate Management.

vii) The results revealed that about 58% of the respondents participate through engaging in actual collection of solid waste, 19% participate through financing collection, 6% engage in sorting and about 6% support transportation of the waste. There were around 11% of respondents who played the role of recycling of solid waste.

viii) There were 68% of respondents who acknowledged that there was a need to change the existing solid waste collection system because of its inefficiencies. However, 32% had not indicated any need for changes to the system. There were many suggested changes to the existing solid waste collection system. A majority of 30% suggested for increase of waste collection personnel and vehicles. Mlolongo had a staff of 3 field supervisors, and 18 workers responsible for waste collection. There was also one waste collection vehicle that was also shared with Athi River town. Therefore, it was a big challenge for them to collect waste across the vast settlements of the town.

ix) There were 49% of respondents who indicated that their solid waste was collected 2-6 times per week, 35% get waste collection only once per week and 8% get it collected twice per week. There were 4% who get it collected on a daily basis and another 4% had irregular collections and didn't know the frequency of collection.

x) The main challenge as noted by 36% of the respondents was undesignated dumping of solid waste. There are many dumping points across Mlolongo town. There were 25% of respondents who cited lack of efficient solid waste

management systems for some households and business as the major challenge in Mlolongo.

xi) There were different suggestions from the respondents on strategies of promoting effective Solid Waste Management and public participation in the process. Majority of the respondents (30%) suggested sensitization of the people on the need for effective solid waste management as a method of promoting effective SWM and public participation.

xii) There were 20%, who suggested the increment of personnel of solid waste collection, 15% suggested for the increase of waste collection vehicles and waste collection containers across Mlolongo town and 8% suggested for the incorporation of neighbourhood associations and estate managements in solid waste management. The results further indicated that 6% of the respondents suggested for enactment of by-laws in the County that can promote environmental cleanliness and citizen participation in solid waste management.

xiii) The study also had an assessment of the stakeholders and missing links in solid waste management in Mlolongo town especially the role of the public, scavengers, cart pushers, resource merchants and neighbourhood associations.

5.4 Recommendations

The study findings indicated the current solid waste management system in Mlolongo was not working efficiently. There were several undesignated dumping sites, mixed solid waste and waste water, lack of waste sorting and recycling and inadequate personnel for solid waste management. Therefore, there is a need to have an integrated solid waste management framework that encompasses a public participatory approach. This will improve the current system of solid waste management in Mlolongo.

Public participation in solid waste management will support a significant reduction in the waste discharge amount in Mlolongo, it will reduce the tonnes of litter across the town, and it will reduce the frequency of solid waste collection and improve the overall performance of solid waste management. Public participation will also ensure proper landfill operation through public monitoring.

5.4.1 Waste Reduction Strategies

There is a need to review the solid waste streams in Mlolongo town. The review should aim to reduce the amount of solid waste generated from the household/business level. This will encompass a high level of participation from the public. The study recommends the segregation of waste at generation sources to promote waste recovery. There should be home compositing or common residential units' compositing for e.g. an apartment to composite biodegradable waste, and a centralized compositing site for Mlolongo town that can be managed by the County Government of Machakos or a private sector firm. The Ministry of Environment in Machakos should strengthen the capacity of Mlolongo town to recycle solid waste. Additionally, the County Government should adopt a policy of reducing, re-using, and recycling of solid waste.

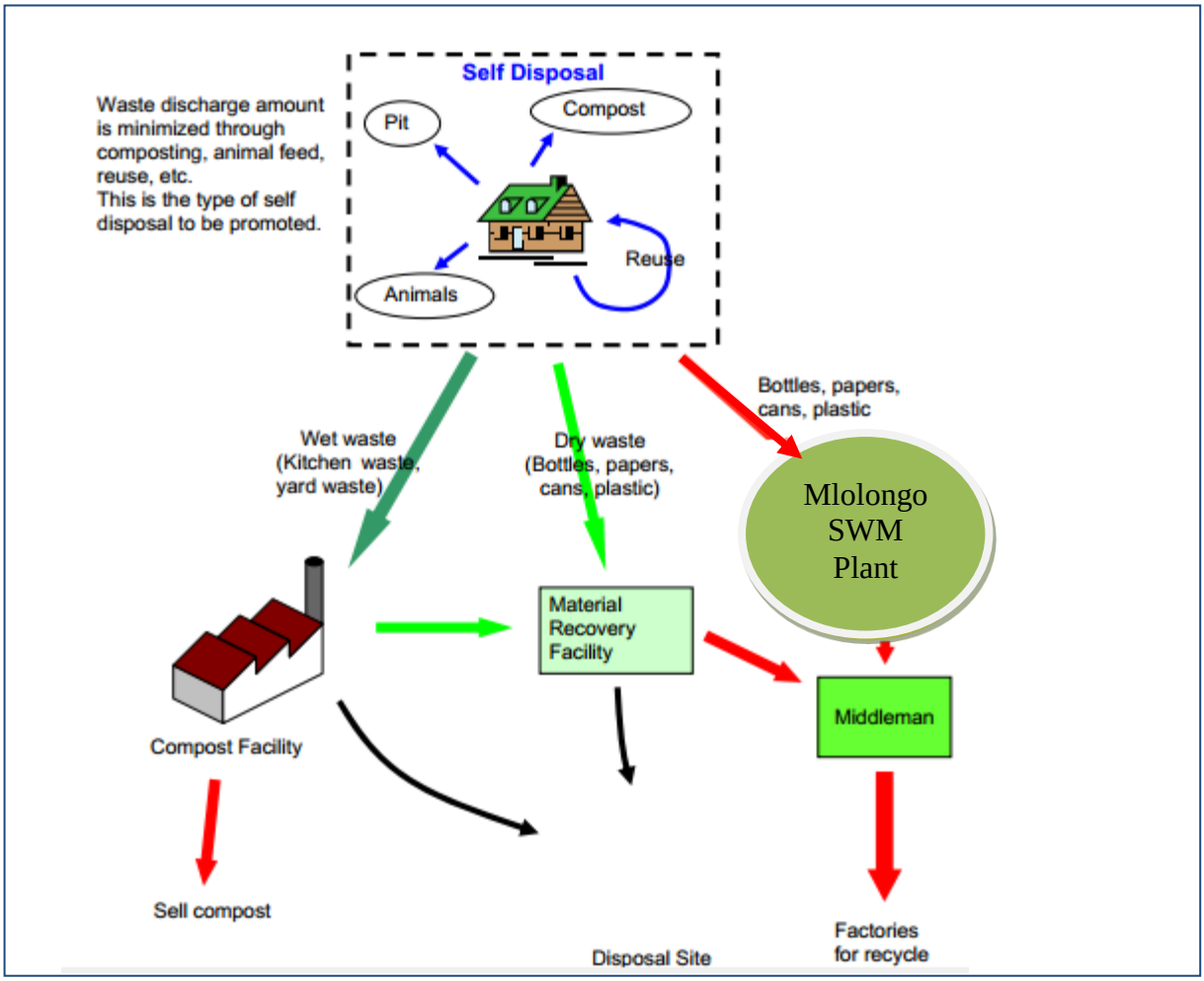


Figure 5.1: Proposed Models of SWM

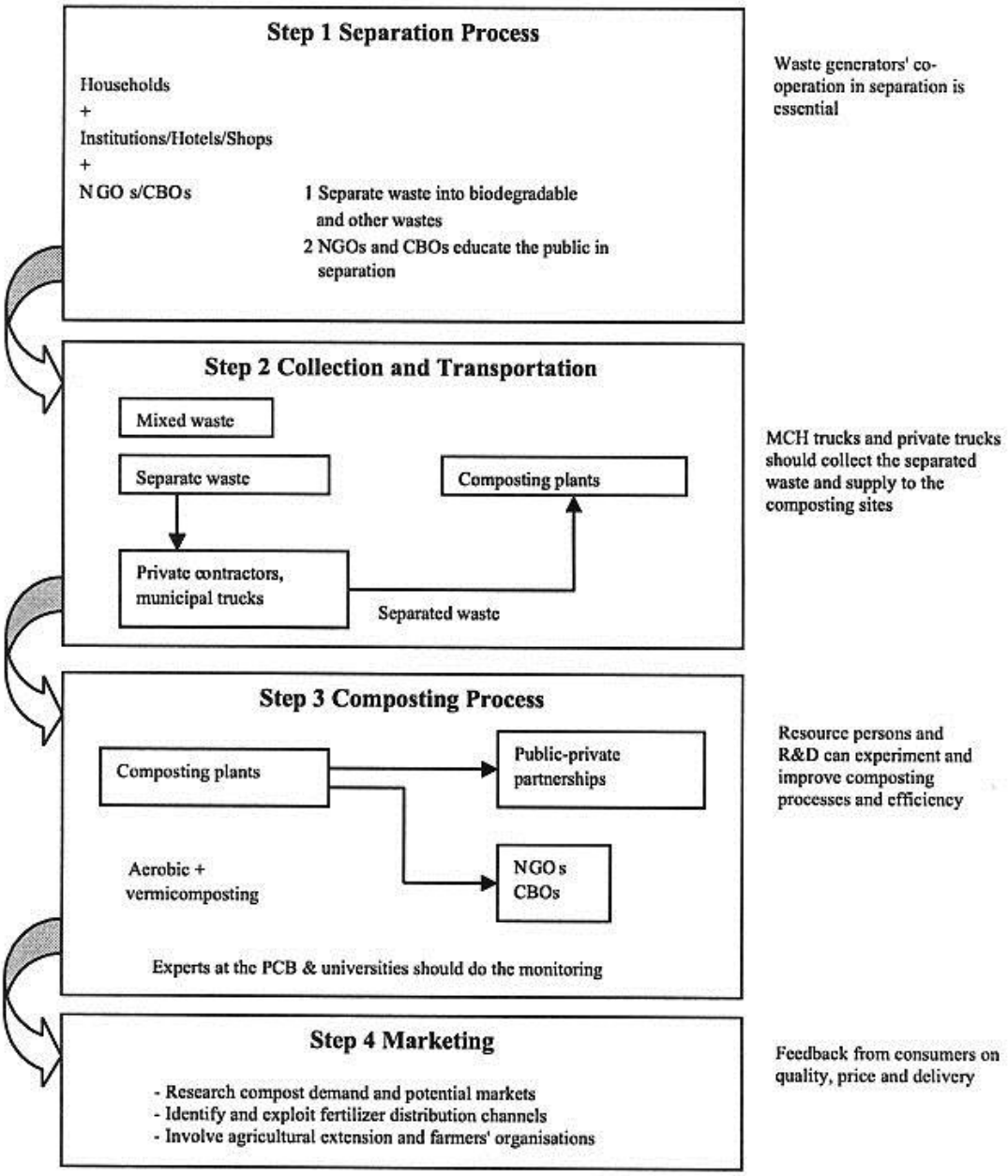


Figure 5.2: Proposed Models of SWM

Source: Author, 2014

The research recommends the use of home composters as a cardinal strategy for solid waste reduction. A home composter can make compost from organic waste. People can put leftover food scraps into the home composter every day, producing compost after a few months. A home composter is better than a compost pit system in terms of preventing pests and easier in terms of handling waste and compost.

5.4.2 Environmental education

Information technology has become a powerful tool for environmental information dissemination. Environmental education among the Machakos population is critical for active involvement in conservation and solid waste management. Formal and informal education is helpful in changing people's attitudes and behaviour. It imparts skills and knowledge that enable people to strive for sustainable development through effective public participation in decision-making processes. The study recommends for the inclusion of environmental education for the citizenry in Mlolongo town. This can be through having environmental days for the town, public barazas, and workshops, distributions of notices, brochures, radio and Television messages encouraging on responsible solid waste management in the town.

The components of solid waste management education in Mlolongo should comprise of:

i) Actions to support the routines of solid waste collection as currently practised, including the self-help efforts of groups not adequately served by public institutions;
ii) General public education useful for creating understanding of issues and problems in solid waste management, including personal health education, environmental health, waste problems for the society, and attitudes to wastes and waste workers;
iii) Attempts to integrate attention to solid wastes into community development;
iv) Special campaigns, competitions and drives by County Government of Machakos to raise profile of solid waste management or serve purposes of general public awareness of solid waste issues;
v) Suggestions for developing more integrated and comprehensive approaches to solid waste management at metropolitan and national levels.

5.4.3: Enact an Integrated Solid Waste Management Plan for Mlolongo

The study recommends the enactment of an integrated solid waste management plan for Mlolongo town, where citizen participation will be at the core of operations. Integrated Solid Waste Management (ISWM) is simply a planning process used to optimize waste management practices. The process consists of five primary steps: establish waste management goals and objectives, identify alternatives that may achieve the goals and objectives, conduct a detailed analysis and comparison of the alternatives, select appropriate programs, and implement the programs selected.

5.4.4: Improve approaches of public participation in solid waste management

The study recommends the improvement of strategies of improving public participation in solid waste management in Mlolongo. The stakeholders can review the current approaches and apply contemporary strategies of citizen participation. Although citizen participation is seen as the cornerstone in developing an effective SWM program, there is no common agreement on citizen participation and education embraced by the public. However, the study identifies three approaches that can work for an effective solid waste management system in Mlolongo town.

i) The public institutional approach

This approach is based on the views of solid waste management departments routinely doing their work, and is thus the best represented view. It accepts the current institutional structures and procedures in SWM and looks for ways of inducing the public to cooperate with them. (In the main, this means urging people to put wastes in particular places at certain times). It accepts the social status quo, namely that there will not be fundamental changes in service priorities or financing, so that if those who are currently unserved are to have clean environs, they are expected to do more of the initial work of waste collection for themselves (or pay private "sweepers" to do it). This labour contribution is presented as "self-help," or payment in kind. Community organizations may be asked to mobilize citizens for the necessary cooperation. Enforcement of regulations against littering and illegal dumping is stressed in policy statements (although experienced administrators in some cities are sceptical of how effective enforcement drives would be in most cities) . Citizens are not expected to object to decisions about disposal sites or methods. It is assumed that the school system will be able to deliver appropriate health education to children.

ii) The community-oriented approach

This approach envisages SWM improving with education, people's participation in planning decisions, and greater understanding and responsiveness on the part of urban authorities to the needs of residents, particularly the poor. Providing the facilities to permit neighbourhood cleanliness and maintaining advertised pick-up schedules are seen as prerequisites to enforcement of regulations against unacceptable practices. Community voluntary organizations, -supported by local government improvement funds or charitable donations, are seen as the most effective vehicles for developing awareness and articulating needs, as well as organizing clean up drives. (But resources have to be sufficient to allow intensive

work in the community for health education). The community approach does not accept that poor people should necessarily have to contribute labour in lieu of public services; putting pressure on city officials and politicians to consider equity in services is supported by proponents of this view, who argue for regular channels of feedback by which people can inform city departments of service failures or other problems.

Since numbers of families in poor urban communities depend on waste recovery for employment and household needs, the community-oriented approach wishes to improve informal waste recovery to generate employment, improve health and contribute to environmental improvement. Planning of solid waste services guided by this approach requires research into people's needs, attitudes, and behaviours. A new approach to understanding people's attitudes to wastes, and to explaining the hazards of poor waste management is considered essential for progress in public education.

iii) The environmental movement approach

A third point of view envisages improvements in people's awareness and proactivity for improvement coming from social movements that are propelled by coalitions of environmental interest groups supported by media engagement in solid waste issues. Proponents of this approach emphasize the need to change values and behaviour throughout the society. For instance, they want to see waste reduction and waste recycling accepted as aspects of daily living and national planning through consumer awareness and the cooperation of production industries. This approach rejects the characterization of solid waste problems as resulting largely from the lack of education of disadvantaged people. Instead, it emphasizes the root causes in the styles of production, the nature of products, consumerism, and the commercial competition that have arisen with modernization. The proponents of this view expect that the public will be more accepting of decisions on landfill siting if they are confident of the safety of the disposal system and the genuine efforts of the authorities and businesses to reduce toxic materials and unnecessary packaging.

5.4.5: Mainstreaming and Up-streaming of Public Participation

The County Government of Machakos should adopt appropriate Governance Strategies and Policies to guide Public Sector Investment Programmes. This should allow for transparency and involvement and empowerment of people, development of EIA and SIA guidelines and of the public participation process. This will require that: A participatory approach is adopted

in which all stakeholders have the opportunity to participate in decision making; there is two-way communication in which information and ideas are exchanged between government and the community of stakeholders at the national and local levels. Public awareness programmes communicate SWM issues and initiatives and communication with target audience using tools appropriate to that audience.

5.4.6: Improve cooperation between the public and other solid waste stakeholders

The basis of any effective large-scale system for managing solid wastes is the cooperation of waste generators in interfacing with the waste collection, transportation and disposal system. What town stakeholders desire above all else is that people should routinely "put waste in its place," that is, put out wastes at approved times, in approved places, contained, and sometimes sorted in appropriate ways. The failure of many people to follow apparently simple rules in this regard is the most often voiced complaint of solid waste managers. They are at times mystified, annoyed and frustrated by repeated lapses that are extremely costly for the municipality and that create a general impression of uncleanliness which makes it hard to create or sustain a sense of civic pride. There are two common suggestions to deal with the general public's non-cooperation: first to inform the public by notices that wastes should be put in the proper place, that people should not litter, nor dump wastes in illegal spots; and then, to enforce regulations. Usually the enforcing mechanism is a fine. On spot fines extracted by law enforcers and even members of the public are often cited with approval.

5.4.7 Encouraging separation at the source

The aspect of solid waste management that has not yet been integrated into routine services at the household and neighbourhood level is waste separation and recovery. A great deal of separation of recyclables is carried out by households, shops, offices and institutions already in resource-scarce cities. The materials are bartered, bought and traded by private enterprise. No city has yet discussed how to support the door-to-door collectors on whom this source separation and trading depends and who are often in bond to the middlemen who supply their vehicles. What cities have to watch out for in making innovations in resource recovery is that they do not undercut the existing systems if these are working quite well. Solid waste departments should not promote waste collection systems that inhibit source or near-to-source separation and thus enhance waste problems. A case in point is the distribution of

plastic bags to households for waste disposal in Colombo. The bags are convenient for householders, shopkeepers, and restaurants, and also for collection crews, but problematic at disposal sites, especially if compost-making is practised. Furthermore, they conceal recyclables so that waste pickers in some cities set plastic bags alight in order to recover cans hidden inside. Roll-on roll-off containers are convenient for collection, but they inhibit waste recovery in poor cities.

5.4.8 Outreach to the Community

The study recommends the need to improving in reaching out to the community and enhancing efforts to improve solid waste management in Mlolongo. This can be initiated by the County Ministry of Environment through environmental days and public cleaning days. This can improve the state of solid waste management in Mlolongo. For instance, having cleaning drives can improve the state of the environment in Mlolongo. Clean-up drives can be undertaken by the County Government authorities through creating a desire to create an impression of good city management. In these, schoolchildren and general public are often mobilized to provide the basic labour for picking up litter. The solid waste departments sometimes represent these drives as educational, and some children must surely be impressed at the amounts of wastes to be found lying around parks, sports grounds and streets.

5.4.9 Special Areas Designation for Solid Waste Dumping

The County Government should designate special areas for dumping and waste collection in Mlolongo town to avoid the proliferation of illegal dumpsites across the town. The County should also improve the capacity of the Ministry of Environment to manage solid waste and improve the state of the environment through sufficient budgetary allocations. The County Government can also consider the option of complete privatization of solid waste management as a way of improving efficiency. They can privatize the process through public tendering where the best bidder will be given the task to manage solid waste in the town.

5.4.10 Public Institutions and Private Firms Partnership

The County Government should improve and embrace some partnership with private solid waste collection firms as one of the strategies of improving solid waste management in Mlolongo. There should be regulation of the role of scavengers in solid waste management

and recognition of other makeshift operators in the sector. This can bring order and sanity in solid waste management. The partnership should promote clearing of the current scattered solid waste across the town. All stakeholders responsible for solid waste management at Mlolongo town should take an immediate action of clearing of scattered solid waste that has destroyed the aesthetics of the town and its outskirts. The stakeholders include: County Government of Machakos, NEMA, Real Estate Management Groups, CBOs in Mlolongo, Solid Waste Scavengers, Private Solid Waste Collection Firms and other organisations that provide solid waste management services. If the situation remains the way it is, then Mlolongo town's appearance would be unattractive for investors.

5.4.11 Repairing or upgrading of the existing infrastructure

The study recommends the improvement of support infrastructure that ensures effective solid waste management in Mlolongo such as gravelling all feeder roads and securing waste collection points. The current solid waste collection points are left open and there is need to create a buffer zone to differentiate them from residential and commercial areas. This will ensure that there is no spill over of waste from designated points to undesignated zones. Securing of solid waste dumping sites is also essential to ensure that recyclers and resource merchants are free to operate in adding value and recycling of waste. This will increase the efficiency of solid waste in the town.

5.4.12 Housing Units Specific Recommendations

Single Unit Housing

The research recommends that single unit housing should have their own compositing pits to produce manure for flower beds. The single units can have a waste separation at solid waste source level

Flats/Apartments and Multi Units Dwellings

The research recommends that flats and apartment should have a common collection point for waste for all the households rather than different collection points for each household.

Property developers should provide sufficient containers for garbage, recycling and organics materials for residents

The multi-unit dwellings should have material recovery units for simple recycling.

5.5 Stakeholder Responsibilities

5.5.1 The County Government of Machakos

The County Government of Machakos should formulate the specific regulations that are necessary to implement effective public participation in solid waste management in Mlolongo town. The County Government should implement effective solid waste management in Mlolongo. It should prepare an integrated solid waste management plan for the County and Mlolongo. The County Government should provide the personnel and infrastructure for solid waste management. It should ensure effective implementation of the formulated Integrated Solid Waste Management Plan and other related activities.

5.5.2 Private Sector

The private sector should supplement the efforts of the County Government in improving solid waste management in Mlolongo town. They should play the role of primary collectors of waste from household level. The Private Sector should play the role of waste re-using and recycling. It should also be a bridge between the household and secondary waste collection by the County Government.

5.5.3 Local Community

The local community in Mlolongo should participate in the planning process of an integrated solid waste management plan for the town. They should play the role of reducing waste generation in the town through re-using, reducing usage and recycling. They should also participate actively in the management of solid waste in the town through voluntary services like waste collection, landscaping the site to provide good aesthetics for the town.

5.5.4 NEMA

The National Environmental Authority should play the role of providing approvals for environmental plans, formulating the necessary regulations for solid waste management and coordinating with pertinent local and national entities to implement effective proposals for improving citizen participation in solid waste management. It should also be an oversight body monitoring and supervising the process of solid waste management in Mlolongo. It should also provide extension services to the County Government like technical and environmental experts.

5.6 Areas of Further Research

The study focussed on the role of public participation in solid waste management. However, there is potential for further research on the impact of complete privatization of Solid Waste Management on the efficiency of the practice. This could be done by examining SWM case studies of the gated communities.

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APPENDICES

Appendix 1: Structured questionnaire for Residents/Traders and market vendors

UNIVERSITY OF NAIROBI
DEPARTMENT OF URBAN AND REGIONAL PLANNING
MASTER OF ARTS IN PLANNING
HOUSEHOLD QUESTIONNAIRE

OBJECTIVE: TO EXAMINE THE ROLE OF PUBLIC PARTICIPATION IN SOLID WASTE MANAGEMENT IN MLOLONGO TOWN

Disclaimer: The information collected during this survey is purely for academic purposes and will not be divulged to any other person in whatever circumstance.

Researcher's Name _____ Date of interview_____

SECTION A: RESPONDENTS PROFILE

1.Name of the respondent
(Optional).....

i). Gender:

Male ☐ Female ☐

ii). Age:

Less than 18	[ ]
18-25	[ ]
26-35	[ ]
36-55	[ ]
Above 56	[ ]

iii). Educational background.

a. No formal education ☐

b. Primary education ☐

c. Secondary School ☐

d. Diploma Level ☐

e.University Level ☐

iv) **What is your Marital Status?**

Single	[ ]
Married	[ ]
Divorced	[ ]
Widow	[ ]
Widower	[ ]

v) Household Characteristics

Size of the Family

1-3 [ ]

4-6 [ ]

7-10 [ ]

More than 10 [ ]

vi) What is your Occupation?

Formal Employment [ ]

Business/Entrepreneurship [ ]

Informal/Casual Employment [ ]

Not Employed [ ]

Vii) Level of Income (Per Month in Kshs)

0-5000 [ ] 5001-10000 [ ] 10001-20000 [ ] 20001-30000 [ ] 30001-50000 [ ] >50000 [ ]

2. Type of respondent.

a) Resident ☐

b) Market Vendor ☐

c) Premised Trader ☐

d) Other (specify)……

3. Premises Ownership.

a) Private owner ☐

b) Tenant ☐

SECTION B: PUBLIC AWARENESS, PARTICIPATION, PERCEPTIONS AND ATTITUDES ON SOLID WASTE MANAGEMENT

Types of Waste and Methods of Disposal (Indicate method of disposal)

4. What are the common waste products that you produce and what is the mode of disposal?

WASTE		MODE OF DISPOSAL [1. Burning 2. Dumping 3. Burying 4 Recycling 5 Waste collector]
Organic Waste		
Inorganic Waste	Plastic Bags and Containers	
	Metal Cans	
Other Forms of Waste		
Metals (aluminum cans, old vehicles, appliances, equipment's etc.)		
Paper (newspaper, writing paper, magazines, books, cardboard boxes, food & drink wrappers etc.)		
Cosmetics (cement,ceramics,tiles)		
Glass (bottles, jars, windows, mirrors)		
Textiles (torn rags/clothes, curtains, carpets etc.)		

5. i) Who is responsible for waste collection?

Tenant [ ] Landlord [ ] Local Authority/County Gov [ ] Neighborhood Association [ ]
Other (Specify)_____

ii) How many dumping sites are in Mlolongo?

None [ ] 1 [ ] 2 [ ] More than 2 [ ]

iii) What are the roles of the Public in Solid Waste Management?

Collection [ ]
Financing Collection [ ]
Sorting [ ]
Transportation [ ]
Recycling [ ]
Other (Specify) [ ]

---

6. What do you do with your garbage?

Collected by council ☐ Throw to open space ☐ Burn ☐
others……..

8. Do you know what happens to your garbage after disposal?

Yes ☐ No ☐

9. Do you recycle things yourself?

Yes ☐ No ☐

10. Do any other people collect waste from your premise for recycling?

Yes ☐ No ☐

11. Do you think solid waste is a problem in Mlolongo area?

Yes ☐ No ☐

12. Are you aware of any health issues relating to solid waste?

Yes ☐ No ☐

13. a) Do you think that there is a need to change the existing refuse collection system?

Yes ☐ No ☐

b) What Changes do you propose?

c). Why do you propose these changes?

d). Who do you think needs to make these changes?

Council ☐ Households ☐ All ☐ None ☐

14. a) Do you understand composting?

Yes ☐ No ☐

b) Do you practice any compositing?

Yes ☐ No ☐

c) If no, Why

_____

15. Do you think that you can separate waste?

Yes ☐ No ☐

16. Do you like to start a household composting site?

Yes ☐ No ☐

17. Are you willing to pay for waste collection?

Yes ☐ No ☐

18. Do you think it is appropriate for individuals to actively participate in garbage collection?

Yes ☐ No ☐

19. Do you often take the chance to educate your household on the need to participate in solid waste management?

Yes ☐ No ☐

20. If yes, what are some of the lessons you teach them?

……
…

21. Do you involve children less than ten years in the household solid waste disposal?

Yes ☐ No ☐

22. Do you have any waste containers in your home/shop/stall?

Yes ☐ NO ☐

23. Do you sort the waste generated in your home/shop/stall?

a) Yes ☐

b) No ☐

24. Are there any items from your waste that you reuse?

Yes ☐

No ☐

25. Who takes the waste from your home/shop/stall for disposal?

a) Tenant ☐

b) Landlord ☐

c) Private waste collector ☐

d) Town council ☐

e) Others (please specify)……

26. If yes, in your view, is the fee affordable?

a) Yes ☐

b) No ☐

27. Where is the waste taken for disposal?

a) Land fills ☐

b) Collecting center ☐

c) A pit for burning ☐
d) I do not know ☐
e) Other (Please specify)……

28. How many times in a week is waste taken from your home/shop/stall for disposal?

a) Once ☐
b) Twice ☐
c) More than twice but not daily ☐
d) Daily ☐
e) I do not know ☐
f) None ☐

29. What do you do about waste you find outside your home/shop/stall?

a) Pick it and put it in a nearby waste container ☐
b) Move on ☐

30. Do you think you can reduce on the amount of waste you generate in your home/shop/stall?

a) Yes ☐
b) No ☐

31. If yes, how? .....

32. Do you think there are some waste items which can be reused but you are not reusing? ☐

a) Yes
b) No ☐

Please Specify……

33. Do you think it helps to sort waste before disposing it off?

a) Yes ☐
b) No ☐

34. Which waste items do you think should be sorted for recycling?

a) Hard plastics ☐
b) Polythene ☐
c) Glass ☐
d) Paper ☐
e) Metals ☐
f) I do not know ☐

35. In future, are you willing to pay for collection of the waste that you generate in your home/shop/stall?

a) Yes ☐
b) No ☐

36. Do you think it is necessary for you to work together with other residents, traders, market vendors for better waste management?

a) Yes ☐
b) No ☐

37. Do you think it is necessary for you residents/traders/market vendors to work together with the Town Council in managing waste?

a) Yes ☐

b) No ☐

38. Do you think the residents/traders/market vendors are capable of managing the waste they generate without help from the Town Council?

a) Yes ☐

b) No ☐

39. What are the major challenges of involving the public in solid waste management in Mlolongo Town?

……

……

……

40. In your opinion, what are the measures that can be taken to ensure proper solid waste management and participation of residents in the process?

……

……

Thank you very much for your time.

Appendix 2: Observation Check List

UNIVERSITY OF NAIROBI
DEPARTMENT OF URBAN AND REGIONAL PLANNING
MASTER OF ARTS IN PLANNING
OBSERVATION GUIDE

OBJECTIVE: TO EXAMINE THE ROLE OF PUBLIC PARTICIPATION IN SOLID WASTE MANAGEMENT IN MLOLONGO TOWN

Disclaimer; the information collected during this survey is purely for academic purposes and will not be divulged to any other person in whatever circumstance.

Researcher's Name _____ Date of observation_____

1. Type of Respondent
a) Resident ☐
b) Market Vender ☐
c) Trader ☐

2. Presence of Dumping site/ waste containers
_____
_____
_____

3. Type of containers
_____
_____
_____

4. Neatness of environment (All waste in containers/on the pit)
_____
_____
_____

5. Evidence of sorting
_____
_____
_____

6. Evidence of Waste Management (sorting, collection, transportation, recycling etc.)
Challenges
_____
_____
_____

Appendix 3: Focus Group guiding questions

UNIVERSITY OF NAIROBI
DEPARTMENT OF URBAN AND REGIONAL PLANNING
MASTER OF ARTS IN PLANNING
FOCUSSED GROUP DISCUSSION GUIDE

OBJECTIVE: TO EXAMINE THE ROLE OF PUBLIC PARTICIPATION IN SOLID WASTE MANAGEMENT IN MLOLONGO TOWN

Disclaimer; the information collected during this survey is purely for academic purposes and will not be divulged to any other person in whatever circumstance.

Researcher's Name _____ Date of Discussion_____

ISSUES FOR DISCUSSION IN FOCUS GROUPS

1. Where is the waste got from (what kind of places and why the specific type of waste?)
2. How is the solid waste packaged, what is done about it before collection (how much volume)
3. How is the willingness of people to pay for solid waste collection?
4. Where is the waste taken (is it disposed of at acceptable places?
5. How is the solid waste treated at the disposal sites-burned? composited?)
5. What has been the role of the Town Council in solid waste management?
6. What is the role of the public ((household residents, business operators, people on transit) in solid waste management?
7. What are the major challenges involving the public in solid waste collection?
8. Who are the major stakeholders in solid waste collection?
6. What more should be done to promote effective solid waste management and public (household residents, business operators, and people on transit) participation in the process?

Appendix 4: Key Informant Questions

UNIVERSITY OF NAIROBI
DEPARTMENT OF URBAN AND REGIONAL PLANNING
MASTER OF ARTS IN PLANNING
KEY INFORMANT QUESTIONNAIRE

OBJECTIVE: TO EXAMINE THE ROLE OF PUBLIC PARTICIPATION IN SOLID WASTE MANAGEMENT IN MLOLONGO TOWN

Disclaimer; the information collected during this survey is purely for academic purposes and will not be divulged to any other person in whatever circumstance.

Name of Key Informant_____
Organisation_____Position_____Date_____
_

1. Who are the key stakeholders in Solid Waste Management in Mlolongo town?
_____
_____
_____
_____

2. What is your role in solid waste management in Mlolongo town?
_____
_____
_____
_____
_____

3. How is Solid Waste Management organized in Mlolongo Town?
_____
_____
_____
_____
_____
_____

4. What is the level of public (household residents, business operators, and people on transit) participation in Solid Waste Management?
_____
_____
_____
_____

5. At what stages are the public (household residents, business operators, and people on transit) involved in waste management?

_____
_____
_____
_____
_____

6. How can the efficiency of Solid Waste Management be improved?

_____
_____
_____
_____
_____

7. How can the public (household residents, business operators, and people on transit) be involved more in the process of solid waste management?

_____
_____
_____
_____
_____

Thank You.