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Towards safe waste disposal sites: Examining the siting processes and social - environmental impacts of dumpsites in Dar es Salaam city, Tanzania

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Dedication

This work is dedicated to the memory of my uncle (Baba Mkubwa) the late William Jakob Mapunda.

To my wife Agripina Alfred Lyapa, your love and constant prayers and support helped me to be strong through the entire period of my studies.

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In expressing my gratitude, I would also like to state that, I am solely responsible for any errors or omissions of facts, which may be found in this thesis. All such errors are a reflection of my human limitations.

Executive summary

Historically, landfills have been the dominant alternative for final disposal of municipal solid waste. The method has been regarded as the most economically and environmentally acceptable option for solid waste disposal in both developed and developing countries. However, rapid urbanisation coupled with uncontrolled urban expansion for the countries in the south, presents a tremendous challenge to urban managers and planners to contain an enormous increase of solid waste generated within the urban setting given limited available land.

The increasing awareness on the adverse impacts that are caused by unsanitary landfills has raised the quest for urban authorities to ensure that waste disposal facilities are sited in areas, which are environmentally and socially acceptable and yet cost effective. This has become an increasing concern of various stakeholders in the waste management system on one hand and the general public on the other. Dar es Salaam, like any other cities in the developing world, has been adopting open dumping as the main waste disposal option. Despite the implementation of the Sustainable Dar es Salaam Project for which solid waste management has been the major theme, unsanitary waste disposal practices is predominant. Most of the dumpsites have been sited in areas that are in proximity to human settlements and water bodies, which is environmentally and socially not acceptable.

The study therefore aimed at examining how solid waste disposal facilities are sited in the city with special attention on the processes and procedures followed and environmental and social-economic criteria adopted on one hand and the assessment of levels of public awareness, perceptions and attitudes on problems that are manifested due to unsanitary waste disposal practices, on the other.

A case studies survey has been employed to draw information from a broad range of institutions consisting national and local government authorities. Included here are the Vice president's Office –Environment, Ministry of Lands, National Environmental Management Council, Urban Authorities Support Unit, Sustainable Dar es Salaam Project, the Dar es Salaam City Council, Ilala, Kinondoni and Temeke municipalities, and Non Governmental Organisations. A household survey was also carried out in two settlements where dumpsites are located.

The main finding from the study shows that, despite the presence of policies and legislations guiding sanitary waste disposal practices, most of the dumpsites in Dar es Salaam city are sited without compliancy to physical, socio-economic and environmental criteria, coupled with minimum public and stakeholders' participation in the siting process. It is also realised that a significant percentage of the local residents living close to dumpsites do not know about various long term adverse impacts caused by unsanitary landfills. 32.4% of the sample population ranked bad odour as the most serious impacts of dumpsites within their living environment followed by health hazards 29.7%.

This study recommends that, NEMC in collaboration with local government authorities should set technical guidelines and specifications to be used as minimum requirements for the siting, development and operation of landfills, and enforce the compliancy in respect of the local government authorities whenever a new landfill is required. Nevertheless, the central government and NGOs should introduce a continuous awareness and sensitization campaign to educate local communities on impacts that are caused by unsanitary landfills on their health and wellbeing.

Abbreviations

CBOs	Community Based Organisations
DCC	Dar es Salaam City Council
ESAs	External Support Agencies
EIA	Environmental Impact Assessment
ENVIROCARE	Environmental, Human Rights Care and Gender Organization
GIS	Geographical Information System
IHS	Institute for Housing and Urban Development Studies
ISWM	Integrated Sustainable Waste Management
LEAT	Lawyers Environmental Action Team
LFG	Landfill Gas
LGAs	Local Government Authorities
MLHSD	Ministry of Lands and Human Settlement Development
MSWM	Municipal Solid Waste Management
NEMC	National Environmental Management Council
NIMBY	Not in my backyard
NGOs	Non Governmental Organisations
PMO-RALG	Prime Minister's Office Regional Administration and Local Government
UASU	Urban Authorities Support Unit
UCLAS	University Collage of Lands and Architectural Studies
UNCHS	United Nations Centre for Human Settlement
UNEP	United Nations Environmental Programme
SDP	Sustainable Dar es Salaam Project
SCP	Sustainable Cities Program
SWD	Solid Waste Disposal
SWM	Solid Waste Management
URT	United Republic of Tanzania
USA	Unite States of America
VPO	Vice Presidents' Office
WDC	Ward Development Committee

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CHAPTER ONE: INTRODUCTION AND METHODOLOGY

1.1 Background to the study

Landfilling is one of the most common waste disposal methods in solid waste management system. Historically it has been the most economically and environmentally acceptable methods for waste disposal in both developed and developing countries (Rushbrook, 1999). However the site where to develop and establish a sanitary Landfill is a challenging process, as it requires taking into account the social, environmental and technical aspects. An appropriate landfill siting process aims to minimize hazards[1] to the public health and to the natural environment and requires continuous government and public interactions. Developed countries like North America and Europe, the siting of landfills are one of the important stages in a solid waste management system.

The success of waste disposal siting is subjected to several linked factors such as landfill design, operation and management, its impacts and community values and support (Al-Yaqout et al., 2001). However in countries such as Japan, it is becoming increasingly difficult to obtain public acceptance during the siting of incinerators and landfills due to public concern over negative environmental impacts, health protection and awareness on dioxins[2] issues (Ishizaka and Tanaka, 2003). This reflects that the siting of waste disposal facility is not an easy task, it requires to seek public compromise and is subject to inter-displinary and full community involvement in the decision making process.

On the contrary, in most of the countries in the South, waste disposal facilities do not receive the attention it deserves in waste management system. According to Johansen and Boyer (1999), argues that the crude open dumping approach coupled with indiscriminate disposal of waste with limited measures to control pollution and hazards to public health and natural environment has remained a predominant waste disposal option. In many cities in the developing countries like Tanzania, the only changes and improvement that can be observed in the waste management system are the ways of collection and transportation of solid waste to the disposal sites for which there is increased private, NGOs, and CBOs involvement based on public private partnership arrangement. The waste disposal facility on the contrary, continues to be unabated.

The selection of the site for a landfill is considered as important decision to be made by the municipalities for the development and implementation of councils' waste management plan (Rushbrook, 1999). In developed countries, proper landfills siting receives a high priority due to the fact that a poorly chosen site may require unnecessary expenditures on transport, site development, environmental protection, and protection of public health from hazards which can be developed by landfill (Tchobanoglous and Kreith 2002). However, this is not the case in developing countries.

Dar es salaam the largest city in Tanzania. It is a coastal city located along the Indian Ocean and it is described as one of the fastest growing cities in sub Saharan Africa (Mato, 2000). The Dar es Salaam city population count more than 2.5 million people with annual growth rate of 4.3%[3] with a population density of 1700 – 1800 people per

[1] Hazard is the characteristics that cause a substances or a combination of substance to qualify as hazardous material

[2] Dioxins are strong toxic substances like PCDDs, PCDFs, and PCBs which are generated during incineration process and emitted to the atmosphere through flue gases. Also when the ashes from incinerator are landfilled there is danger of emitting the dioxins to into soil and underground water.

[3] 2002 National population and housing census

sq Km. The city plays a major role in the countries' economic growth as it is the major industrial, commercial, and government centre of the United Republic of Tanzania.

For the last 20 years, Dar es Salaam city has been experiencing rapid urbanisation coupled with uncontrolled city growth. Urban rural migration has been the main course for city growth and consequently leading to proliferation of unplanned settlements, which has brought environmental degradation. More than 70% of the Dar es Salaam residents are housed in informal settlements.(Mgweno, 1979), (Mosha, 1989). It has also been noted that the rapid growth of the city takes place while the economic and administrative performance of the Local Government authorities in the city has been diminishing (Kironde 2003). As such the municipal authorities are viewed as incapable of dealing with emerging urban challenges such as the growing demand for services to city residents including water supply, sanitation, development and maintenance of roads and waste management (Misigaro, 2001).

Like any other services in the city, solid waste management has been a critical problem for Dar es Salaam city council for the last two decades. Before 1992, less than 3% of the daily-generated waste was collected and properly disposed to the dumpsites. The city has been able to meet only a fraction of its resident's collection needs (Kaseva and Mbuligwe, 2000). Common feature for the city was stinking heaps of uncollected waste, haphazardly disposed waste by roadsides, valleys, open spaces, open drains and public lands. Inadequate service delivery compelled the central government to resolve the then Dar es Salaam city council in 1996 and appointed a City commission to deal with the day-to-day activities including services delivery.

Solid waste management acquired attention from various stakeholders since 1992 when the Sustainable Dar es Salaam Project (SDP) was introduced. The city environmental profile which was the first step in the institutionalisation of Sustainable Cities Programme (SCP) highlighted inadequate solid waste management as the first among five environmental issues facing Dar es Salaam city and earmarked it as serious problem that needed an immediate attention (Nnkya, 2004). The city consultation identified nine environmental issues acquiring priority attentions.

The implementation of the sustainable Dar es Salaam project brought about a series of interventions directed towards solid waste management. To the contrary, the SDP expended much effort towards improvement of solid waste collection. The implementation of SDP expended little effort on how and where the collected wastes are disposed, a situation, which has lead to subsequent negative impacts to environment and public health (Mato, 1998). Currently Dar es Salaam city council is about to discard Mtoni dump site and has set aside 70 Ha of land for the construction of sanitary landfill in Buyuni Chanika ward under the ongoing project of Urban Sector Rehabilitation Programme. The study is focused to investigate and assess site selection process using the previous dumpsites.

1.2 Statement of the problem

Waste disposal is the final functional element in the waste management system that involves disposing of discarded items. The disposed waste mainly comprises residue, which are remnant after processing or cannot be recycled. In many cities both developed and developing countries have adopted sanitary landfilling as solid waste disposal techniques. According to Tchobanaglous (1993) Landfills have been the most economical and environmentally acceptable method for the disposal of solid waste in the United Sates and through out the world". However, the adoption of sanitary landfill depends on the city's compliancy on social, economic and environmental standards and financial and technical capacities.

Like any other developing countries, municipal solid waste disposal facilities have become an increasing problem in Tanzania's towns and cities. Overwhelmed by an overabundance of social economic problems, Dar es Salaam city councils are generally seen as incapable of delivering services to its citizens. One major area in which city authorities appear to have failed to fulfil their duties is waste management for which only a fraction of the wastes generated daily by city population are collected and safely disposed of by the authorities (Kironde, 2003).

The rapid population growth that has significantly increased solid waste generation is considered to impede the capacity of Dar es Salaam municipal councils to effectively deliver solid waste management services. It has been noted that, solid waste generation in the city doubled from 1090 tonnes/day in1988 to 2000 tonnes/day in 1995. (Kasseva and Gupta, 1996). A study by the University of Dar Es Salaam in 1993 indicates that waste generation in Dar es Salaam differed according to income groups. The high-income households generated 0.45 kg/person/day; medium income households 0.38 kg/person/day and low-income households 0.34 kg/person/day. Recently data by (DCC, 2004) shows that the currently the city generates 3000 tonnes of solid waste per day . The trend reveals increase of waste generation, which does not match with the existing waste management system.

Likewise waste disposal facilities have been the worst in waste management system. The practices of City Council on waste disposal for the last two decades has been through crude open dumping often in selected natural depression, or abandoned quarry sites (Yhdego, 1995, Baya, at el. 1996). Industrial solid waste containing hazardous components together with medical wastes are also disposed in these dumpsites (Mato and Kaseva, 1997). As such a large number of scavengers who extract valuable materials from waste heaps are exposed to health and physical hazards due to contamination and contracting of these wastes (Mato and Kaseva, 1997) This method has led to environmental pollution and has been a source of tension, especially in densely populated areas. There have been several court injunctions against city authorities on poor siting of dumpsites. For example operational activities of a dumpsite at Vingunguti informal settlement were forced to an end by high court with case number 316 of the year 2000 due to non-adherence to health and environmental standards.

Nevertheless the practice of Dar es Salaam city council on identifying and selecting possible areas eligible for siting waste disposal facilities has continued to be malfunctioned. Municipal authorities have been directing much efforts in making city streets clean at the expense of the peripheral settlements (Kironde, 2003). With more forethought it is no longer realistic to simply remove the health risk posed by refuse from city streets and accumulate them in a nearby suburb or rural area (World Bank 1997). This has compelled three quarter of dumpsites n the city to be operational with life span of less than ten years due to hazards posed to neighbouring settlement and environment**.**

The implementation of Sustainable Dar es Salaam Project (SDP) assumed among others to address solid waste management problems. Despite its implementation the areas in which dumpsite are located in the city raises the question whether the landfill siting process in Dar es Salaam in specific and Tanzania in general complies with the sustainability concept and the required environmental and social standards and whether the general public are aware of the environmental and health impacts posed by unsanitary landfills. The study is therefore focused on investigating and analysing procedures and processes undertaken by the municipal councils in the siting of dumpsites in Dar es Salaam city and examine whether communities living close to the

dumps are aware of the hazards posed by unsanitary landfills to the environment and individual health using the previous Mtoni and the present Kigogo dumpsites as a case study.

1.3 Research objectives

1. To examine the sustainability of the siting process, criteria and procedures for urban solid waste disposal facilities in Dar es Salaam city;
2. To assess levels of public awareness, perception and attitudes on the problems related to unsanitary solid waste disposal facilities and;
3. To provide recommendations for making siting processes and procedures more sustainable in the future

1.4 Research questions

1. How sustainable are siting processes, procedures and criteria for solid waste disposal facilities in Dar es Salaam city?
   - What processes, procedures and criteria are used by the Dar es Salaam city council for siting solid waste disposal facilities?
   - Who are the key actors involved and what are their roles and responsibilities in the implementation of the siting process of solid waste disposal sites?
   - In what ways does the Dar es Salaam City Councils (DCC) integrate environmental and socio economic impact consideration in the Siting of solid waste disposal facilities?
   - What roles and rights does the public have in such processes?

2. How aware are the selected communities about the problems of unsanitary disposal of waste in Dar es Salaam city?
   - What are the views and perceptions of selected communities living near dumpsites on environmental / health impacts of unsanitary disposal facilities?
   - What does this community know about their rights with regard to siting of disposal facilities?

1.5 Hypothesis (Assumptions)

1. The siting of solid waste disposal facilities in Dar es salaam city is conducted without proper planning, adherence to environmental standards and involvement of other stakeholders;

2. Low levels of public awareness on the problems related to unsanitary landfills leads to improper siting of solid waste disposal facilities

Table 1: Variables and indicators

Hypothesis(Assumption	Criteria	Variables	Indicators
Siting of solid waste disposal facility in Dar es salaam city is conducted without proper planning, adherence to physical, economic and environmental acceptable standards	Sustainable physical and economic criteria for siting of solid waste disposal sites	Distance and accessibility from waste generation Soil condition and topography Site capacity/available land area Abutting land uses Land availability Quality of on site soil Availability of onsite cover material Water permeability	No. of condition fulfilled
	Sustainable Environmental criteria for siting of solid waste disposal sites	Distance from various sensitive ecosystem Precaution on the LFG emission CO_2, C_4H (green house gases) Precaution on Leachate control measures Distance from water sources, wetlands and flood plains Conduct Environmental Impact Assessment Land cover and topography Depth and type of on site soil Prevailing wind direction Geological and hydrological structure	List of minimum environmental standards fulfilled
Low levels of public awareness on the problems related to unsanitary landfills leads to improper Siting of solid waste disposal facilities	Socio criteria for sustainable siting of waste disposal site (public acceptance)	Involvement of different stakeholders groups Involvement of nearby communities Awareness creation programmes Distance from nearest residential areas Distance from cultural areas Accommodation of scavengers	Number of Stakeholders and type of involvement in the siting process Number and type of awareness creation/advocacy programs conducted List and type of socio factors fulfilled Levels of public awareness on problems of unsanitary landfills

1.6 Scope of the study

The study focused on exploring the practices which the city authority adopts to secure areas that are used as dumpsites. The exploration has been conducted in view of determining the feasibility of site selection process and criteria adopted by the city, minimum standards used with respect to environmental and social-economic impacts and identify gaps on areas for improvement. It further intended to identify main stakeholders involved in the site selection process, type of involvement, their roles and the extent which local communities from the selected dumping sites are involved in the siting process.

The study has also explored views, perception and awareness of local communities on hazards caused by unsanitary landfilling on one hand and their knowledge on rights to participate on the siting of dumpsites on the other. Dar es Salaam city has the history of disposing solid waste in open and uncontrolled dumps since 1935. Six different settlements have had at certain stage been the solid waste dumpsites. However due to time limitation, two dump sites have been selected to represent others and answer the research questions. They include "Mtoni" dumpsite in "Temeke" municipality, which has been operational since 2000-2007, and the present "Kigogo" dumpsite in Kinondoni Municiality that started in February 2007. The selection of two dumpsites is based on their similarities on characteristics. While Mtoni dumpsite is located close to Indian Ocean with nearest houses are on the edge of the dump, "Kigogo" dumpsite is located within "Msimbazi" river valley and the nearest houses are less than 3m. Furthermore, both dumpsites are in close proximity to unplanned settlements characterized by inadequate supply of basic services such as drinking water, storm water drains, access roads and sewerage system. In this case the two dump site poses similar potential impacts to public health and natural environment.

1.7 Motivation for the study

The motive behind this research is based on the following factors

- Continued haphazard siting of dumpsites within the city that contradicts with principles of sustainable development
- Public complaints based on the physical disaster like fire outbreak after the dumpsites has been in operation for about a year or more
- Presence of policies, laws and regulations and standards that provide guidelines for siting and operation of SWD facilities
- Presence of solid waste management strategise with little attention on waste disposal (SDP)
- The continued tendencies of city authority to simply remove health risks posed by solid waste from city streets and accumulate it in suburb areas where it continues to pose risk to public health and natural environment
- Open dumping is neither safe nor hygienic
- Presence of open dumpsite that have been located in proximity of residential area, ocean sides and river bed

1.8 Relevance of the study

Dar es Salaam city, being the social, economical and industrial centre of the United Republic of Tanzania, draws the attention from many researchers. Regarding to its rapid annual population growth, the city is endowed by a wide range of researches that are being conducted by different scholars and professionals. Within the field of waste management, researchers have exclusively covered different aspects of waste

management system and approaches ranging from waste collection, storage, transfer and transportation, disposal, recycling and private involvement in solid waste management. However, the siting of solid waste disposal facilities has received little attention as such few researches have been conducted on this subject.

This study aims to study processes and procedures that are adopted on the evaluation and selection of landfills sites. It will further avail weather the landfill siting process meet the minimum environmental standards, requirements and sound stakeholders participation in the process to ensure the reduction of environmental and public health impacts. It is therefore anticipated that the outcomes of this study will contribute to the existing knowledge on solid waste disposal and particularly the sitting process for the new urban landfills sites. The findings and recommendations will facilitate Dar es Salaam municipal council and other cities to achieve their objective of improving SWM and ensuring environmental sustainability.

1.9 Description of the research area

Dar es Salaam city is the research area. This also includes the three municipalities of Ilala, Kinondoni and Temeke. The city has a population of 2.5 million people for which 70% of them are housed in informal settlements with poor infrastructure and sanitation services including solid waste collection and disposal. Two informal settlements hosting dumpsites have been selected as case study areas. They include “Mtoni Sabasaba” settlement located in “Temeke” Municipal council and “Kigogo Kati” which is located in Kinondoni municipal council.

1.10 Research methodology

This is an exploratory case study research. For carrying out the research more than one technique was employed to capture the required valuable information. Potential stages followed for this study involved taking a number of tasks which included reviewing related literatures, defining the problem, designing the research strategy, deciding on the sample size, clarification of the research objectives, and designing of survey questionnaires for primary data collection. The details are further discussed hereunder;

1.10.1 Sample size

The research used a population sample size of 67 respondents, comprising national policy and law enforcement institutions (VPO, NEMC, MLHSD, PMO-RALG; UASU, SDP), implementing institutions; DCC and the three municipalities (Ilala, Temeke and Kinondoni), civil society and selected communities living close to the dumpsites. The respondents for official interviews were purposively selected based on their expertise and experiences in the field of solid waste management. A total of 24 officials from both local and central government including 2 officials from two different NGOs had been interviewed.

The respondents for households’ interviews were chosen through a stratified random sampling technique and covered 37 households from the two dumpsites consisting; 20 and 17 respondents from Mtoni and Kigogo dumpsites respectively. Nevertheless the interview also involved 6 waste pickers who were randomly selected from the present Kigogo dumpsites. The sample size of 67 respondents may not be representative to generalize the conclusion, however based on the subject under study it was anticipated to provide significant information on how the siting of solid waste disposal sites are carried out, identify weaknesses and recommend improvement options.

1.10.2 Research type and Strategy

The research has adopted single embedded case study as a research strategy and focused on Municipal council as main stakeholder charged with the responsibility of solid waste management including the siting landfills on one hand, and the landfills operation and management on the other. The data collection process was divided into two parts, literature review and primary data collection.

1.10.3 Literature review (secondary data collection)

This stage mainly involved reviewing different theories, data and concepts pertaining to the subject at hand (solid waste disposal) from secondary sources, like text books, Journals, published and unpublished researches, reports and internets sources so that to develop research concept and putting the study under acceptable body of knowledge on waste management and identification of any existing gaps between subject under study and previous research. Attention was directed on reviewing different process discussed by different authors related to siting of landfills and assesses their practicability in the context of Dar es Salaam city. However data gathering through literatures was a continuous process during the entire period of research for the purpose of filling the gapes.

1.10.4 Primary data collection

The primary data collection was administered in Dar es Salaam city for one month from July 2, through August 2, 2007. For effective exploration on the processes of siting urban solid disposal facilities, both qualitative and quantitative approaches on data gathering were considered to be relevant and were adopted. Various techniques employed to gather relevant information are described below;

a) Field Observation and socialisation

This involved walking around the solid waste disposal sites (Mtoni and Kigogo dumpsites) and observes general condition and impression of the dumpsite such as physical features, activities taking place, distance to the nearest settlements and management mechanism in place. It also involved socialisation with community leaders and residents living close to the dumpsites. This facilitated to establish the magnitude of potential environmental impacts to the public health and natural environment. Photos were also taken to demonstrate the extent of unsanitary condition posed by the landfill.

b) Government official interviews

In-depth official interviews were conducted and involved a total of 24 respondents from central and local government authorities. The respondents for official interviews were purposively selected and mainly involved environmental experts working in the field of solid waste management. Semi-structured and yet open-ended questionnaires were used to administer the interviews. There are different government institutions, which are relevant to the context of the study. In this regard Interviewed officials were mainly from Ministry of lands and Human Settlement Development (Urban Development Division), National Environmental Management Council, PMO-RALG- Urban Support Unit, SDP, Vice President's Office-Division of Environment, DCC (Department of waste management), and heads of waste management section from Ilala, Kinondoni and Temeke Municipalities, and Town Planning Officers.

Besides ward executive officers from the two settlements were also interviewed for the purpose of ensuring validity of collected information. The official interviews facilitated to generate qualitative information from national and local government level on the aspect of

waste management practices in general and the siting of solid waste disposal facilities in particular.

c) Household Interviews

In order to gain an insight of the siting process, the role of communities living around the dumpsites in the two selected settlements, household interviews was conducted. This was conducted between July 9th and 22nd 2007. A total of 37 households from both dumpsites were covered that included 20 respondent from Mtoni dumpsite and 17 from Kigogo dumpsite. The interviews were administered using semi-structured yet simple questionnaires and was pre tested and modified to facilitate the collection of data on public opinion on the siting procedures that took place, community role in the entire process and their opinion and perception on the problems caused by dumpsites to their living environment.

d) Waste pickers interviews

This interviews involved individual waste pickers (scavengers) who were sorting disposed material at the present Kigogo dumpsite in Kinondoni municipal council. The interviews involved 6 waste pickers consisting 4 men and 2 women. The interview was administered using semi structured questionnaires which was meant to collect information related to scavenger's opinion and perception on the problems they are facing with regard to waste sorting at dumpsite and suggested measures the local government should take to improve the situation.

e) Questionnaires

This involved handing questionnaires to experts who had no sufficient time for a detail interview. The approach was limited to environmental experts from Non Governmental Organisations particularly INVIROCARE and LEAT. Through self-administering questionnaires focused to draw quantitative data on their perception and the role of different stakeholders in the siting of solid waste disposal facilities in Dar es Salaam city.

The multiple uses of respondents has facilitated to triangulate the information collected from different sources and ensured the consistency and validity of the data. All the above techniques were supplement by collecting relevant information from official reports related to solid waste disposal facilities from the DCC, Ilala, Temeke and Kinondoni Municipalities so as to document actor's initiatives, their future plans and targets related to siting, management and improvements of solid waste disposal facilities.

Table 2: Summary of sources of data collected

S/No	Name of institution to be interviewed	Main role	Data collected
1	Ministry of Lands and Human Settlement Development	Approval of land use schemes both urban and rural areas	Approved areas for locating dumpsites
2	Vice Presidents Office Division of Environment	Environmental management at national level	Laws, policies, programmes, strategies guidelines, standards for waste disposal siting
3	National Environmental Management Council	National environmental executing argent	Actions taken to municipality for non-compliance of environmental standards
4	Sustainable Dar es salaam Project	Implementer of Sustainable Cities program	Advices and action taken towards solid waste management and sustainable location of dump sites
5	PMO-RALG Urban Authorities Support Unit (UASU)	Promoting sustainable development and environmental management in local government urban authorities	Actions taken for unsustainable location of dump site
6	Municipal Town Planning Officer (Ilala &Temeke and Kinondoni)	Municipal land use planning and development control including setting aside land for transfer station and disposal sites	Process for acquiring land for locating dumpsites Guidelines used for selecting land for dumpsite
7	Municipal Health Officer (Ilala & Temeke and Kinondoni)	Plans, evaluate implement all matters related to health and environment including waste removal and disposal	- Process and criteria of locating dump site in certain location -Stakeholders involved in the siting process -Role of community in the siting process -Negative environmental Implication experienced from the dump site
8	University Collage of Lands and Architectural Studies (Environmental engineering Department)	Training and conducting researches related to environmental management issues	Empirical data on pollutions from the dumpsites in the city
9	Ward Executive Officer (Mtoni ward)	Overall Ward development controller	Land acquiring and the siting process Stakeholders involved at ward level Summary of meetings on the siting of dumpsite Official complains raised by residents
10	Envirocare	Environmental management issues and human rights	How stakeholders/the public participate in solid waste management and siting of landfills
11	Ward Environmental Management Committee (Mtoni ward)	Deal with all matters related to environmental management challenges at ward level	Their role in the siting of dumpsite. Awareness on pollution caused by unsanitary dump site
12	Mtoni dump site manager	Management and operation of the dumpsite	Mechanism in place to control pollution and other hazards
13	Mtoni ward residents	Household owners in mtoni ward (affected community)	Awareness on the problems caused by unsanitary dump sites Their attitude and willingness to participate in the siting of dumpsite
13	Waste pickers	Sorting waste at dump site for and sell them to waste dealers their living	Opinion on the location of the dumpsite Awareness on the hazards caused by the dump

Developed by the author July, 2007

1.10.5 Data quality

Data quality is envisaged in its validity, reliability and objectivity as depicted below,

1.10.6 Validity

The validity focuses to determine whether the research measures what was intended to measure (Black, 1993). To achieve the validity of data, the study identified subjects to be measured. It further examined different literatures to determine the conventional and acceptable normative measuring methodologies. This involved the development of questionnaires and outlines to be adopted at different levels comprising a series of questions and checklist that was seeking similar information from different respondents. This assisted the researcher to triangulate data collected from different respondents and hence ensuring the validity of data collected.

1.10.7 Reliability

Reliability of data is mainly concerned with quality measurements for which focuses on minimization of errors and biases in the study. It is also meant to achieve the consistence on two measures of the same thing or "repeatability" of the measurements that are adopted in the research (Black, 1993). To ensure reliability, field data were collected using techniques and existing theories in the field under study. This involved a careful design of the semi- structure questionnaires and guidelines for the interviews so that they do not provide different meaning. This was also supplemented by interviewing different level of institutions for the purpose of triangulating of the collected data. Respondents were also asked different questions yet seeking similar information. This in a way meant to ensure the reliability of data gathered from respondents. This assumes that using those measuring instruments consistence of the study was maintained.

1.10.8 Objectivity

This refers to data gathering in a way that does not allow for subjective interpretation (Black, 1993). This was ensured by preparing questions that are not leading (Neutral) to the respondents. However as the study is based on qualitative and quantitative data analysis, the author's data collection techniques has minimal influence on the quality of data collected, and therefore the results and conclusion drawn from the study are not biased or subjective to the opinion of the author.

1.11 Data analysis

Data analysis technique varies significantly based on the data type collected for specific research(Saunders et al., 2003). The analysis of data for this research adopted both qualitative and quantitative techniques. Stakeholder power analysis was used to analyse qualitative data, which its values cannot be measured numerically and facilitated to determine the authenticity, roles, and influence of each stakeholder involved in the entire process of siting dumpsites in the city. Apparently the techniques facilitated to compare research results based on assessment indicators that have been developed. The techniques further facilitated to determine dynamics for the current practices of siting dumpsites and potential shortcomings that are embedded in the siting process

Quantitative data on the other hand were analysed by using SPSS software. This involved coding the data in numeric form and entered through SPSS. The findings from the analysis have been presented by using tables, graphs, and charts. Specifically used to analyse data collected from the households surveys comprising 37 respondents living close to the two dumpsites. This facilitated to capture information on their roles,

perception and attitude on problems caused by siting of dumpsites within their living environment.

1.12 Research limitations

Dar es Salaam city has several settlements that had been used as the dumpsites and could be interesting to review the process, which took place for siting each dumpsite in these settlements. However due to time limitation as field works was scheduled for five weeks only, two informal settlements where dumpsite are located were selected to represent others in the city. On the basis of the above fact the research also used the sample size of 67 respondents. Financial limitation was also another problem, the amount of money devoted for fieldwork was not sufficient to cover all costs that are associated with data collection.

1.12 Definitions of terms

- **Solid waste disposal sites**

A solid waste disposal site (landfill) refers to physical facilities used for disposal of solid waste in a surface of earth. Historically landfill has been the most economical and environmentally acceptable methods for the disposal of solid waste in both developed and developing countries (Rushbrook, 1999)

- **Siting processes**

The siting process in this research refers to range of chronological stages that are essential to be considered upon selection of potential sites for locating solid waste disposal facilities and conditions necessary to be applied for, which can be used as exclusions or inclusion siting criteria (Tchobanoglous and Kreith, 2002)

- **Minimum requirements**

Minimum requirements are sets of standards established for the purpose of protecting environment and general public from potential impacts caused by poor solid waste disposal practices. Minimum requirement for waste disposal by landfill are essentially criteria that are established for the purpose of ensuring all activities pertaining landfill siting, development and operation are accomplished within prescribed limit
(Langmore and Jarrod, 1998).

- **Environmental Impact Assessment**

This is the process in which the effects of an activity on the environment are predicted and described, it is an activity designed to identify and predict the impacts on bio-geophysical environment and on man's health and well-being on proposals, policies, programs, and projects and indicate ways to minimise potential adverse impacts by formulation of possible alternatives (Brilhante et al. 2002)

- **Stakeholders**

The term stakeholders in this study it refers to person or an organisation that have interest on particular issue in this case solid waste management in general and siting waste disposal facilities in particular (Klundert and Anschuz, 2001). Different stakeholders have different roles, interest and power to influence decision-making. However most of the stakeholders have potentials to cooperate for common interest.

- **Public awareness**

Public awareness refers to degree of public understanding and consciousness on threats and risk posed by certain activities, which has effect on their health and living environment. In this research it is focused to assess their degree of understanding on hazards or risks caused by operations of open dumps within their community

1.14 Thesis structure

The thesis consists of five chapters. Chapter one is an introductory and methodology, it contains study background, research problem, objectives, and questions. Also it discusses the scope within which the study is confined. The chapter ends with discussion on research methodology used and finalise by defining major concept and definition applied in the research.

In the second chapter literature is reviewed on the subject. It first examines related concepts and highlight solid waste disposal options. Then it discusses the role of landfilling in waste management system and related factors leading to the demand for landfills. It further provides an overview of chronological siting process of waste disposal facilities. Practical case studies for landfill siting from European, Asian and African cities are highlighted. The chapter highlights potential adverse impacts caused by unsanitary landfills and is finalised by providing conceptual framework based on the literatures.

The third chapter provides the context of siting waste disposal facilities in Tanzania. It first discusses existing solid waste management in general and the existing waste disposal system in particular. It further discusses the existing policy and regulatory framework and institutional arrangement on landfills. The also describes of plans and strategies for landfills pursued by DCC, and it finally analyse the trend of siting of dumpsites in Dar es Salaam city and reaction from the communities. A short summary from the discussion is provided at the end of the chapter.

In chapter four, the research questions are answered based on the analysis from the collected data. The findings are provided and illustrated by means of tables, charts, figures and pictures.

The final chapter mainly reviews the findings from the research objectives and questions in relation to the theoretical framework as depicted in the second chapter. The reflection from theoretical framework is underlined and final part provides recommendations based on the findings.

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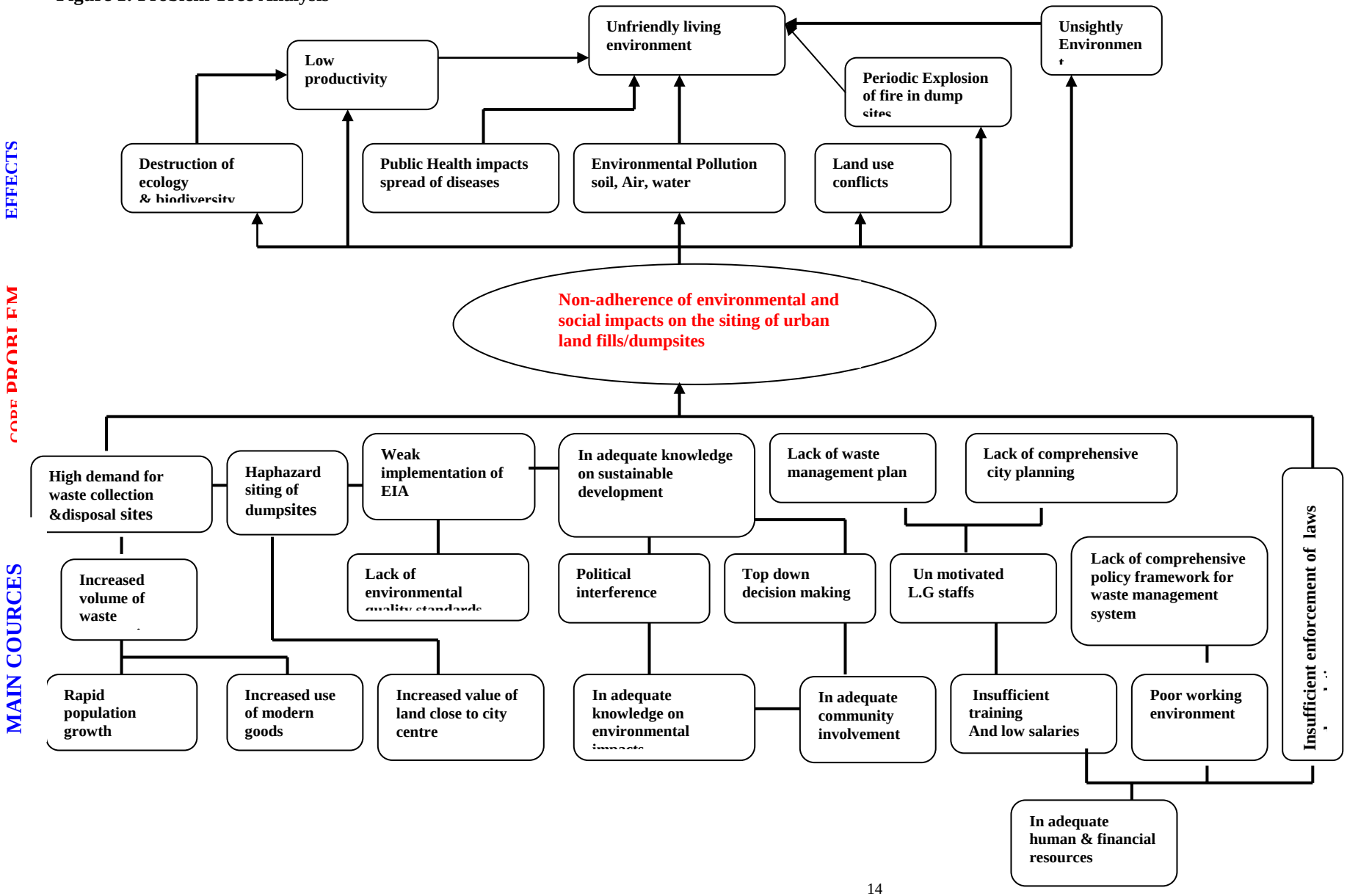
Figure 1: Problem Tree Analysis



CHAPTER TWO: OVERVIEW OF SITING SOLID WASTE DISPOSAL FACILITIES

2.1 Introduction

This chapter reviews different literatures that are related to solid waste management with particular focus on waste disposal sites. It further provides an in-depth analysis of requirements for landfill sites identification and criteria that are required to be adhered to when evaluating and selecting possible areas for the development of landfills. The chapter further highlights essential theories and concepts regarding municipal disposal sites and essential factors for the identification and selection of landfill sites. Above all, the chapter draws practical experiences on municipal waste disposal site selection process and development from both developed and developing countries in order to justify the theories and concepts discussed.

2.2 Concepts and Definitions

There are a wide range of concepts and definitions that are applied in the field of Solid Waste Management. Some of the concepts and definitions that are relevant to this study are described below.

2.2.1 Solid Waste

The term solid waste has a wide range of definitions but within this study is referred as residual materials that are considered to be of no use and must be disposed off typically by landfilling or incineration (Freddy, 1997). Words like “of no use” in the definition conceptually qualify waste as a resource with economic value and depict its potential as a resource for reuse, recycling, or composting. However (Anderson, 1993) defines solid waste as any solid materials which there is no further use and has been rejected or replaced or is considered as materials that the possessor no longer considers of sufficient value to retain. The term can be used interchangeably with the word refuse and garbage.

2.2.2 Municipal Solid waste

Municipal solid waste is defined to include refuse from households, non hazardous solid waste from industrial, commercial, and institutional establishment, market waste, yard waste and street sweeping (Mato, 1999). Semi solid waste like sludge and night soil are considered to be under the responsibility of liquid waste management system where as hazardous industrial and medical waste are by definition not component of municipal solid waste but it becomes difficult to separate it from municipal solid waste particularly when they are generated from scattered sources (Rushbrook, 1999). Apparently this type of waste is also mixed with non-hazardous municipal solid waste.

2.2.3 Solid Waste Management

Solid waste management in its broadest sense refers to the control of generation, storage, collection, transportation, treatment and disposal of waste in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetic, and other environmental consideration.(Tchobanoglous et al., 1993). It entails all activities that are involved in waste management chain that is from waste generation to final disposal. Traditionally solid waste management has evolved mainly as the removal of municipal waste by hauling out of city boundaries and dumping them to suburban.

This is inconformity with the “out of mind” human philosophy (chaggu, 1996). The philosophy also conforms to NIMBY (not-in-my-backyard) sentiment where society resists siting landfill close to their neighbourhood. This sentiment has slowed or even

prevented siting new waste landfill in U.S.A but is not the case in most developing countries (Yaqouit at el, 2001). An effective waste management is considered to be the one, which takes various intervention of all components in waste management system; waste generation, storage, collection, transfer and transportation, treatment and final disposal. The system is regarded as the flow of waste materials from the source to final treatment and disposal (Namwinga, 2006). An effective waste management is therefore considered as a system, which takes proper management interventions on each component in the waste management system.

2.2.4 The concept of Integrated Sustainable Waste Management (ISWM)

Integrated Sustainable Waste Management (ISWM) is defined as waste management system that best suit the society's economy and environment. The concept further emphasise on the appropriate to local conditions based on the existing technology, socio economic, environmental financial, institutional and political perspective which is also capable to maintain itself over time without exhausting resources it needs (Klundert and Anschuz, 2000). On the other hand ISWM is described as the choice and application of acceptable system, technologies and administrative arrangement fostering to achieve the definite goal of solid waste management (Tchobanoglous et al., 1993). The definition shows that ISWM emphasizes the promotion of the development of waste management system that can be appropriate to specific society, environment and technology.

The ISWM hinges on three dimensions that include stakeholders, system elements and aspects. To achieve greater sustainability in solid waste management system, integration of the three dimensions is imperative. According to Anchuz and Klundert (2002) the concept of ISWM can be used as conceptual model in developing waste management plan as well as analytical, assessment tool and as a guide to the decision makers. The concept has also four basic principles, which are essential to be adopted in any waste management system. The principles include:

(a) **Equity**:-Reveals that all citizens are entitled to appropriate waste management system basically for environmental health reasons due to the fact that equity is more than moral imperative due to the fact that;
- Polluting one part of the city affect other parts as well. Always pollution is transmitted from one part to another through wind, water or insects;
- Polluted areas cause poor living conditions which eventually leads to social unrest and ant-governmental activities;
- Unhygienic neighbourhoods have negative impacts on city's economy and development because people with ill health become unproductive.

(b) **Effectiveness:** Measures the extent to which objectives of the service are met and waste management system adopted will lead to safe removal and disposal of all waste. With implementation of ISWM, it is anticipated to lead to safe siting of waste disposal facilities. When the effectiveness is limited to city centre or business districts, the overall waste management system is considered to be ineffective reasons being less visible areas are as important as the visible ones;

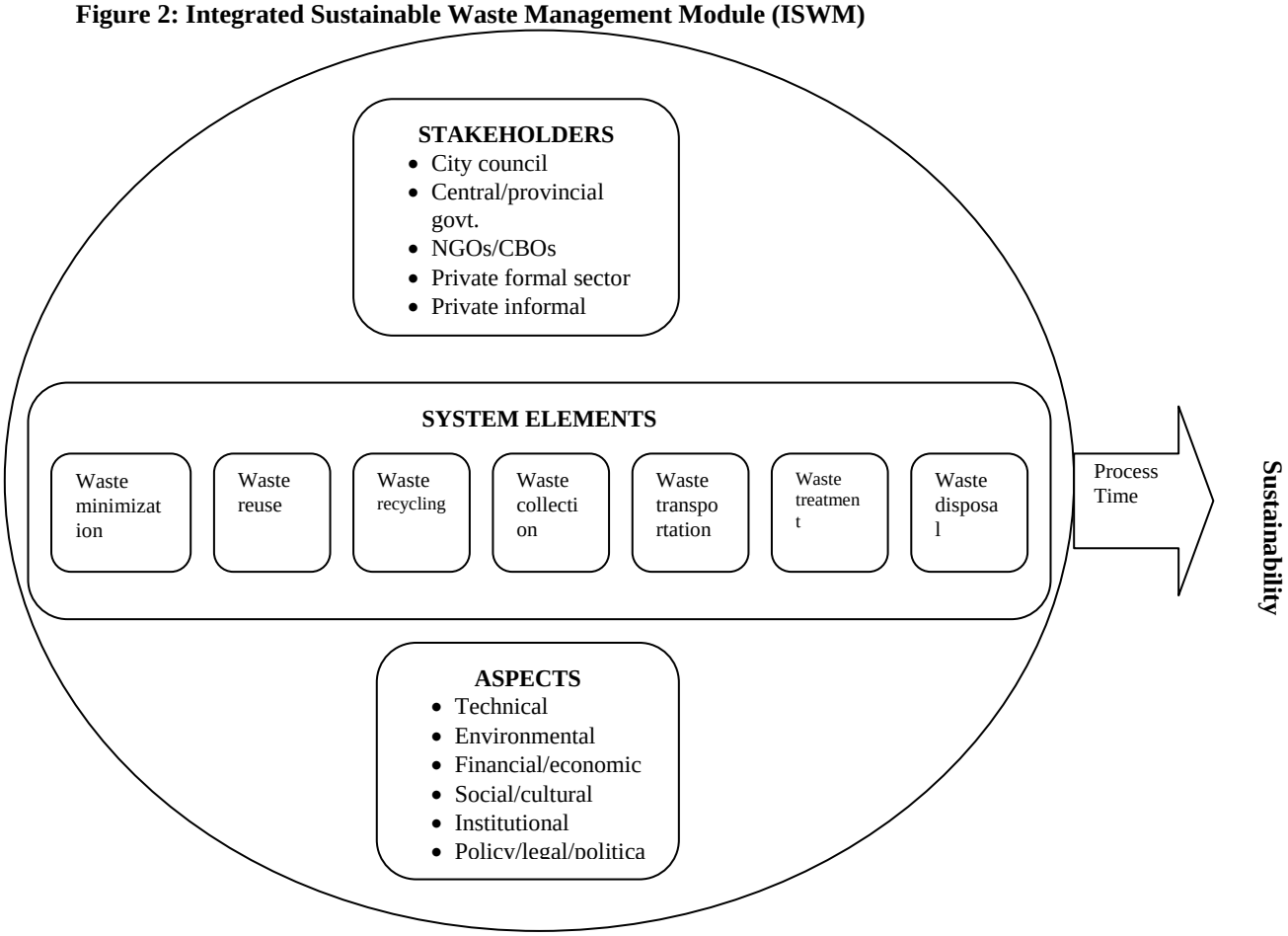
(c) **Efficiency:** In waste management system efficiency entails maximizing benefits, reducing costs, and optimizing use of resources. In the case of siting municipal waste disposal facilities, it is considered efficient if its location does not need extra cost for site development or pollution control;

(d) **Sustainability:** Is tailored on the resource use and how waste management system fits into local context, culture, socio economic, financial, technical, and environmental aspects. It should also have the ability to safeguard itself without exhausting resources it depends on. In this case waste management system is considered to be sustainable if it is appropriate to local conditions

and it can replicate itself without diminishing the likelihood of succeeding generation to meet their needs.

The ISWM concept differs from conventional waste management approach. The concept also emphasizes on full stakeholder participation, and integration of system elements and aspects. The concept depicts how the system can best work and important elements and components that have to be taken into consideration in waste management system. This is illustrated in figure 2 below.

Figure 2: Integrated Sustainable Waste Management Module (ISWM)



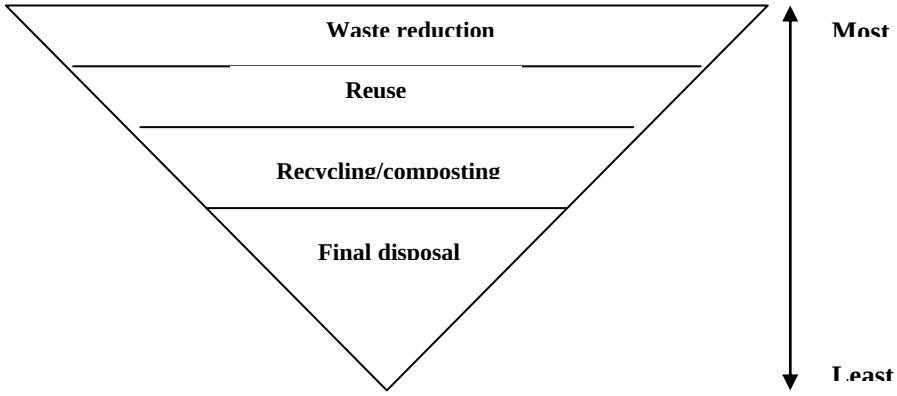
Source: Klundert &Anschuz (2001)

2.2.5 The concept of waste management hierarchy

Waste management hierarchy is the concept, which draws a precautionary principle in waste management system. Waste hierarchy prioritizes first, the prevention and reduction of waste, then its reuse and recycling and the last option is optimization of disposal (Klundert and Anschuz, 2000). The concept is best described by the "3Rs" denoting Reduce, Reuse, Recover and eventually followed by unavoidable its final disposal to the landfill (Gertsakis and Lewis 2005). Based on this concept, the hierarchy is imperative in waste management system. The promotion of reduce, reuse, and recover plays an important role of minimizing huge amount of waste material to be disposed to the landfill, and consequently lower demand for new areas for landfill. Besides, the concept echoes to the approaches that are widespread in human health and medicine, which states that prevention, is better than cure (Wallace and Sutton 2001). This demonstrates that, it is more effective to avoid problems from the outset, than to invest in reactive solutions once the problem has presented. The parallels in human health and environmental protection are similar and supported by considerable scientific evidence and knowledge.

The essence of these approaches is characterized by a need to avoid, eliminate, prevent and significantly reduce the causes of environmental problems, as opposed to managing the impacts, wastes and emissions arising further down of the hierarchy or service life cycle. This suggests a fundamental change in the nature of environmental interventions in terms of rationale, timing and specific approach.
Although the terminology can vary, a simple description of environmental attributes and outcomes of the waste hierarchy is outlined below:

Figure 3: Waste management Hierarchy



Source*: Adopted from Gertsakis and Lewis 2005*

Figure 3 explicitly demonstrates a logical sequence and environmental concern on waste management. The hierarchy reveals that policies, legislations, guidelines and strategies focusing on preventing waste from going further down before exhausting higher options are regarded as good policy (Wallace and Sutton 2001). Inherent in the hierarchy levels is that all stages are linked in a manner of preferences and benefit. In this case, viewing the entire concept as a model for increasing an efficient resource use and minimizing impact associated with consumption pattern is imperative. On the contrary, in most countries in the south less effort is given to the higher levels of hierarchy and therefore is the opposite of the logical sequence of the hierarchy thereby letting huge amount of waste flowing to the final disposal (dumpsites).

2.3 Municipal Solid Waste Disposal

The disposal of solid waste to land is an inevitable to every solid waste management system. No waste can be removed from its point of generation without there being a place for it to be taken to (Schubeler, 1996). Although facilities can be provided for processing waste to recover materials or energy, recycling and reuse, there is always a need for land to dispose a proportion amount of waste originally produced. Proper siting of urban solid waste landfills and appropriate refuse disposal therefore it has become a significant factor to safeguard adverse impacts on the local environment, ecology and public health. The safe and reliable long term waste disposal site is an important factor in waste management system.

Inadequate final solid waste disposal (open dumping) practised in most of developing countries thrives because of the mistaken believe that it is the cheapest disposal method (Rushbrook, 1999). In this regard the provision of waste disposal sites, which meets environmental standards, is a fundamental factor to ensure safety of public health, ecology and local environment. This has become a big challenge to waste managers through out the world.

2.4 Solid waste disposal options

The problem with the disposal of wastes traces back from the time when human first began to congregate in tribes, villages and communities as a result accumulation of waste became the consequence of life (Tchobanoglous et al., 1993). As this is not a new phenomenon for the purposes of improving public health and the living environment several solid waste disposal options has been developed and adopted by human societies (Theins & Vigil 1993). The most common solid waste disposal options currently known and widely used are recycling, incineration, composting, and landfilling.

2.4.1 Waste recycling

Solid waste recycling refers to separating a given waste material from waste stream and processing it so that it may be used again as useful material for a products that may be or may not be similar to original product (Tchonanoglous and Kreith 2002). Additionally, recycling is no longer optional but essential to address the long range of problems associated with solid waste management. Recycling should not be viewed as environmental activism but rather as an integral part of integrated solid waste management because it plays a vital role to address the problem associated with disposal of waste on land as it helps to extend the life of existing landfills and delays the need for siting new ones.

2.4.2 Waste Composting

This is an aerobic process that converts waste into a humus like material through microbial action on organic portion of solid waste, and that if carried out effectively, the final product is stable characterised by odour free, does not attract flies and it used as soil conditioner to increase organic content in the soil (Ali et al., 1999). It is a controlled natural process of decomposing waste material. Principally, composting helps to increase recovery of biodegradable waste materials and hence minimizes the amount of waste for disposal to the landfill (Palczynski and Nova Scotia 2002). Despite its simplicity, suitability and compelling economic and environmental benefits for developing countries, several projects initiated in the past decade have not been successful due to financial, technical and institutional problems. As such it is not a common waste disposal option adopted by most developing countries like Tanzania as it seems to be expensive

2.4.3 Incineration

Incineration is referred to a controlled burning of waste in a purpose built facility or incineration plant (Ali et al., 1999). The process sterilises and stabilises the waste and for most refuse will reduce its volume to less than a quarter of the original. During burning process most of the combustible materials are turned into carbon dioxide.

Ali et al (1999) asserts that ideally incineration plants are designed to recover energy released by combustion; however, it is not feasible for small-scale incineration like health care waste, which is meant to sterilize hazardous hospital waste. Waste incineration is taken as the modern hygienic treatment and disposal option but can be unreliable, polluting and expensive to most of developing countries. The experience drawn from many Municipalities in Tanzania reveals that medical wastes containing hazardous components are mixed with municipal waste and dispose in open dumpsites. (Mato and Kaseva, 1997),

2.4.4 Landfills

The term landfill is defined as the physical facilities used for disposal of solid waste in a surface of earth. Historically landfills has been the most economical and environmentally acceptable method for the disposal of solid waste in both developed

and developing countries (Tchobanoglous et al., 1993). Even with the implementation of waste reduction strategies, recycling and waste transformation technologies, still the disposal of solid waste to land has remained an inevitable practice in waste management system. However, its operation differs between developed and developing country and regions due to financial and technological capabilities.

2.4.5 Classification of landfills

Several studies on waste disposal provide an extensive classification of landfills. Most of the landfill practices are classified based on their characteristics. These characteristics vary between regions and nations. According to (Johannessen and Boyer, 1999) classify land fills into four categories; open dumping, controlled landfills, engineered landfills and sanitary landfills.

a). Open dumping

Open dump is referred to crude dumping of solid waste in natural depression or abandoned quarry or sand sites (Baya et al., 1996). Open dumping practice is also regarded as the primitive stage of landfill development for which there is unrestricted contamination release. It involves indiscriminate disposal of wastes characterised by limited measures to control operations that includes those related environmental effects of landfills (Johannessen and Boyer, 1999). In this case solid wastes are disposed at designated site without taking into account any environmental control measures.

b) Operated/controlled landfills

These are landfills, which operate with some form of inspection and recording of incoming wastes. They also practice extensive compaction of waste and control of tipping. (Johannessen and Boyer, 1999). Controlled landfills however implement limited measures to mitigate environmental impacts. This is reflected on most of the operated landfills which still practices unmanaged contaminants' released and do not take into account environmental cautionary measures such as leachate and land fill gas collection and management.

c). Engineering landfills

These are landfills that involve the adoption of engineering techniques to control and avoid surface water entering the waste. Engineering landfills involves some form of waste containment and levels of leachate collection and treatment (Rushbrook, 1999). The author further stresses that the daily operation in engineering landfill includes spreading soil, removing lagoons compacting waste into smaller layers and they are far better than controlled or operated dumps as it embodies further attempts to minimize environmental impacts. It is considered to be an appropriate for middle and low income countries as a step towards sanitary landfill but most of these countries still find engineering landfill as expensive and can not adopt it due to financial and technical limitations.

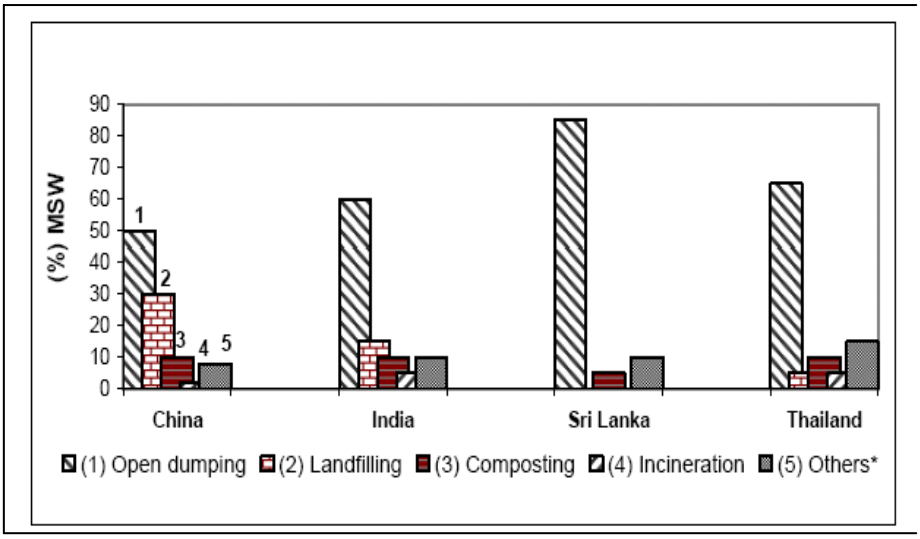
d) Sanitary landfills

Sanitary landfills are defined as the site where waste is isolated from the environment until is safe (Rushbrook, 1999). It is considered to be safe when it is completely degraded biologically, chemically, and physically. This is regarded as fully engineered disposal option which incorporate a full set of measures to control gas, collect and treat leachate, apply soil cover and compaction on waste and implement plan for closure (Ali et al., 1999). Sanitary landfills are considered to be the most appropriate and perhaps the only safe waste disposal option by landfill. However, high capital and technological investment to make it's operational to relinquish low and middle-income countries from adopting it. As a result most of these countries adopt uncontrolled open dumping.

2.5 The role landfilling in solid waste management system

The term landfill in waste management system is referred to as the disposition of refuse on land whether by filling in of excavation or creation of a landfill above the grade (Ali et al., 1999). The disposition of waste to land has been an important method of solid waste disposal ever since the volume of waste generated became sufficiently to warrant specific consideration (Mato, 2006). Historically the disposal of waste on land has become a common phenomenon. Owing to its simplicity and wide spread applicability, the disposal of waste by landfill is the most common recognised disposal technique for municipal refuse and it is estimated that 85% of countries in the world dispose waste by landfilling (Langmore and Jarrod, 1998). However in most developing countries open dumping is the most commonly practice of waste disposal. A study by Visvanathan and Trankler (2002), shows that, most of Asian countries are still adopting open dumping as the main refuse disposal technique.

Figure 4: Different method of refuse disposal in four Asian countries



Source: Visvanathan and Trankler 2002

However, despite the prevailing weaknesses depicted in the figure above for which open dumping is a predominant option in the four Asian countries, the disposal of waste to land is still the most adopted method for refuse disposal. It is also argued that no matter the implementation of waste minimisation technologies, reuse or resource recovery, there will always remain some form of residue which eventually need to be disposed by landfill (Ali et al., 1999). In this case landfill remains to be an important component in solid waste management system

2.6 Factors leading to the demand of land for landfill sites

The demand for waste disposal facilities for countries in the North and south is mainly influenced by the proportion amount of solid waste generated, and the proportion amount of waste that is not avoided or diverted to be disposed in the landfill (Leao et al., 2004). Other factors like economic growth, rapid urban population growth and minimum adoption of the Reduce, Reuse and Recycling, present an enormous amount of waste to be disposed by landfill and therefore demand for more land for landfill sites. It is also articulated that the supply of land for landfill is a function of many linked factors. They include physical characteristics of the particular region including topography, hydrogeology, local environmental policies and regulations and spatial urban growth. The promotion of the Reduce, Reuse, and Recycling is considered the best alternatives for solid waste disposal, however most developing countries like Tanzania very small fraction of recycling scheme is in place a situation which creates pressure on land for the establishment of new landfills.

2.7 Overview of siting process of Solid waste disposal facilities

Solid waste management system is considered incomplete without proper disposal of collected refuse from their intermediate environment. In this regard places where collected wastes are disposed is an important component of SWM system that need to be carefully evaluated and selected. Apparently, SWD sites have become a big challenge to waste managers and planners in many cities due to the fact that city residents are often willing to pay for waste collection from the neighbourhoods but not concerned with its ultimate disposal (Zurbrug, 1999). As such, in most countries in the South the operation of solid waste disposal facilities has remained to be the local government responsibility, although the decision where to locate it requires involvement of all stakeholders.

Based on its important, complexity and sensitivity of landfill operation, several literatures have illustrated essential procedures to consider during identification of eligible areas for SWD facilities. Rushbrook (1999) argues that, the selection of sites to develop a landfill is one of the most important decisions to be made by municipalities in developing and implementing its waste management plan. His argument is based on the fact that a poorly chosen landfill sites is likely to require unnecessary expenditure on activities like transportation, site development, site operation and to a large extent concern of public acceptance.

2.7.1 Solid waste Disposal siting processes and criteria

The location of waste disposal facilities as highlighted before is an important component in waste management system. One of the factors being inappropriate siting of SWD facility may lead to environmental damages, social, political crises and economic inefficiency (Leao et al 2004). It is also admitted that the identification and selection of waste disposal sites requires a detailed analysis that involves consideration of different factors and actors. This is reflected by wide range of authors, who have extensively investigated and discussed different procedures, principles, criteria, stages and models necessary to be taken into account during site identification process and has created a wide range of methods and models for assisting efficient siting process. The waste facility siting models includes; spatial multiple criteria, voluntary model, technical, intelligent method, and landfill siting using Geographical Information System (GIS), to mention a few.

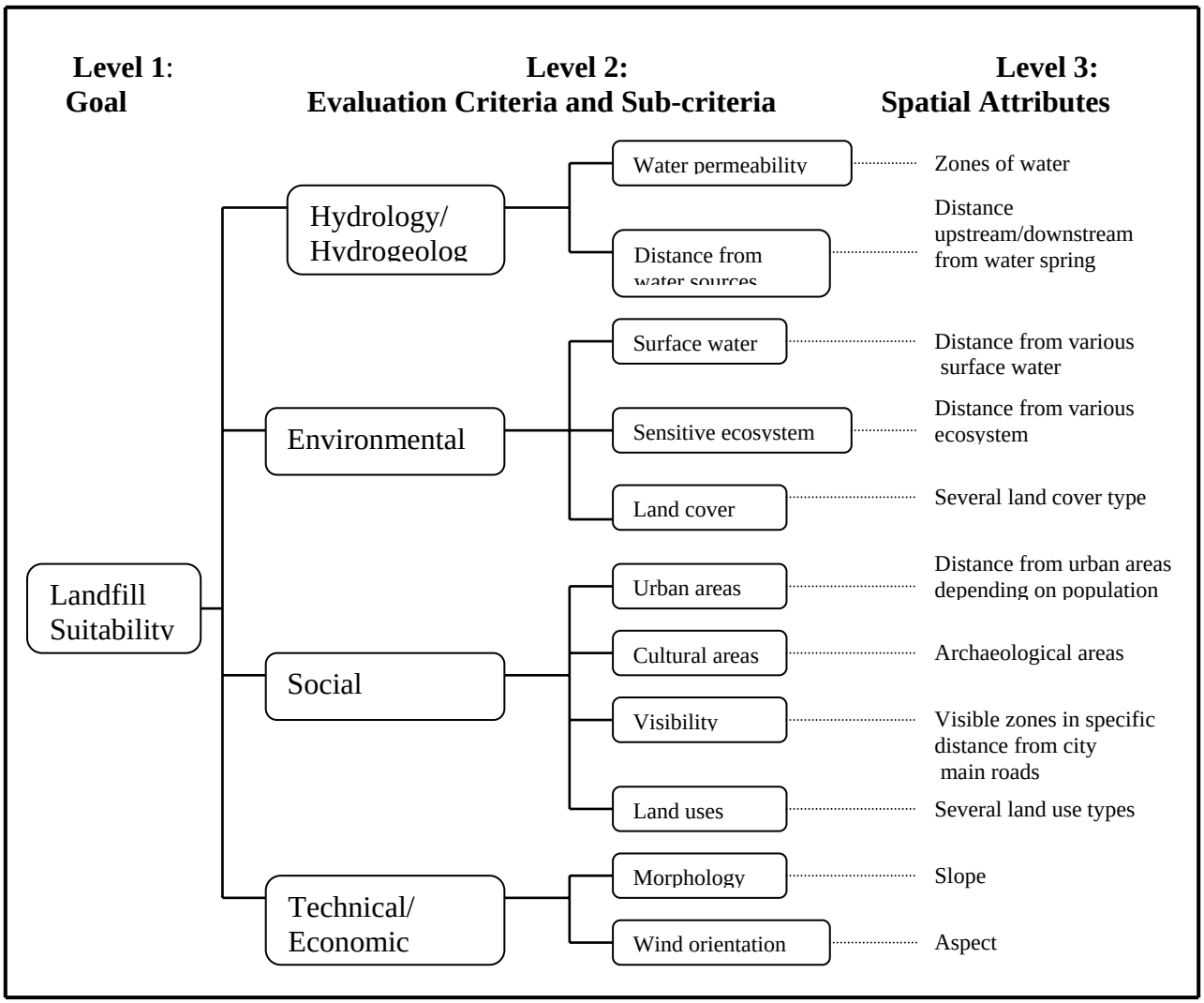
The existing models have been developed over time following socio economic and technological changes. For instance the technical/convectional location model in the 1960s as described by Leao et al (2004), focused on financial optimisation. In this context the assessment of best location for waste disposal facility focused on the available location options, which were then translated into costs based on operational, revenues, and transportation. However the author acknowledges that the growth of awareness on potential pollution from waste disposal facilities in the 1980s and early 1990s particularly in the North, led to the introduction of restrictive environmental regulations for siting, implementation and operation of waste disposal facilities.

On the other hand landfill siting using voluntary model emphasize full involvement of all stakeholder, which includes those who are likely to be affected, and those with various interest. As pointed out by Sloan (1993), the model assumes a broad agreement to be reached by broad range of stakeholders to determine the need of the facility, places to locate it and how it will operate. Usually the process start by informing the public on the objective of the project and proposed methods for siting followed by forum of meetings, initial and detailed investigations, and the ultimate final approval.

There is also substantial discussion raised by (Tchobanoglous et al., 1993) on landfill siting criteria that must be considered in assessing eligible sites for locating municipal SWD facility. The authors highlight ten technical essential criteria on site identification process, that include (i) haul distance, (ii) Location restriction, (iii) available land area, (iv) site access, (v) soil condition, (vi) climatology condition, (vii) surface water hydrology, (viii) geological and hydrological condition, (ix) local environmental condition and (x) potential ultimate uses for he completed site. He also considers public support as an important aspect and emphasizes on the translation of technical criteria to citizens so as to acquire knowledge and encourage them to participate in the entire process.

Likewise (Kontos, 2005) reveal different perspective on siting of landfill. The author considers landfill siting as a complicated process, which needs to combine different aspects such as hydrology, social, environmental, and technical parameters and different actors to assess eligibility of sites for siting solid waste disposal facilities. It is also emphasised that proper siting process should focus to locate landfill to areas that ensures least hazards or risks which may be extended to both public health and natural environment. He further provides considerable description of the selection criteria as described in figure 6.

Figure 5: Hierarchical criteria of decision making for landfill siting



Source: Kontos, 2005

In figure 6 above the author demonstrates that decision on where to locate landfill depends on hydrology, environmental, social and technical components. Each component contains sub elements that need to be carefully assessed before concluding on the suitability of the proposed landfill site. Components like hydrogeology at the second level of assessment should be directed towards water permeability, distance from water sources while third level assessment has to focus on zones of water permeability and upstream, down stream distance from water springs and wells. The author also demonstrate that identification and selection of land suitable for locating SWD facilities requires detailed assessment and analysis of the four components listed above.

Considering the complexity and potential impacts that may arise due to poor siting of landfill, there are seven guiding principles to be adopted for the selection of new landfill sites (Rushbrook, 1999). These are referred to as a step-by-step process, which progressively narrow down to a single preferred site, based on technical, environmental and socio-economic grounds, which has to be adopted by any local government authorities in the selection process of landfill sites. Despite describing all these stages, full public and stakeholders participation is emphasized. The author stresses that, the decision for siting solid waste disposal facilities can not be done by an individual or single organisation in isolation. The municipality should actively involve all interested parties and communities especially those affected in the entire processes from elimination to final approval as described below;

- ***Constraint mapping***

This refers to carrying out preliminary studies candidates' sites. It involves identification of and mapping of areas that are not suitable for the location of landfill based on the excluding criteria.

- ***Listing possible sites***

The task involves preparing a long list of possible areas which SWD site can be located based on constraint mapping. To ensure list of possible sites are well thought of, factors like target land required, expected volume of waste over sites life, and environmental concerns particularly with generation of leachate are incorporated.

- ***Walking survey***

This is a formal inspection of possible sites identified for the location of landfill. It involves physical site investigation that aspires to identify favourable and unfavourable features using established check list points such as transport aspect, natural features land use and public acceptability. A walkover survey seeks to identify sufficient constraints to reduce the number of possible sites to a maximum of three for which it is conducted through involvement of all stakeholders including affected communities.

- ***Preparation of conceptual design***

The stage involves developing a conceptual design for each remaining candidate site. The process facilitates to identify preferred sites, by establishing approximate estimates based on factors like site capacity in m^3 daily volume of waste, and final cover required, resources needed to install and adequate leachate control system. All this has to be established for comparison purposes. This eventually leads to the selection of the best available area to locate landfill.

Table 3: Illustration of site comparison factors

Measure	Site A	Site B	Site C
Incremental cost/m^3 (soil cover materials on site	Low	Medium	High
Incremental cost (soil cover 100% imported)	Medium	Medium	High
Impact on local residents	Medium	Low	Low
Environmental protection required (=risk to environment)	Low	High	Low

Source: Rushbrook, 1999

In table 3 above, the author demonstrates how to compare potential factors between the remaining three identified sites. Based on the above illustration it demonstrates that simple comparison matrix based on different measures can be used to identify the preferred sites for detailed investigation.

- ***Site investigation***

This involves a detailed investigation of the remaining favourable sites (mainly two) for locating landfill. Generally site investigation is conducted to confirm assumptions made during conceptual design focusing on quantity of soil materials available within the sites, permeability, the bearing capacity of the base of landfill, stability of slope, ground water regime, and baseline quality of ground and surface water. Usually site investigation is critical and plays an important role in the successful siting and designing of the landfill.

- ***Feasibility report and Environmental Impact Assessment (EIA)***

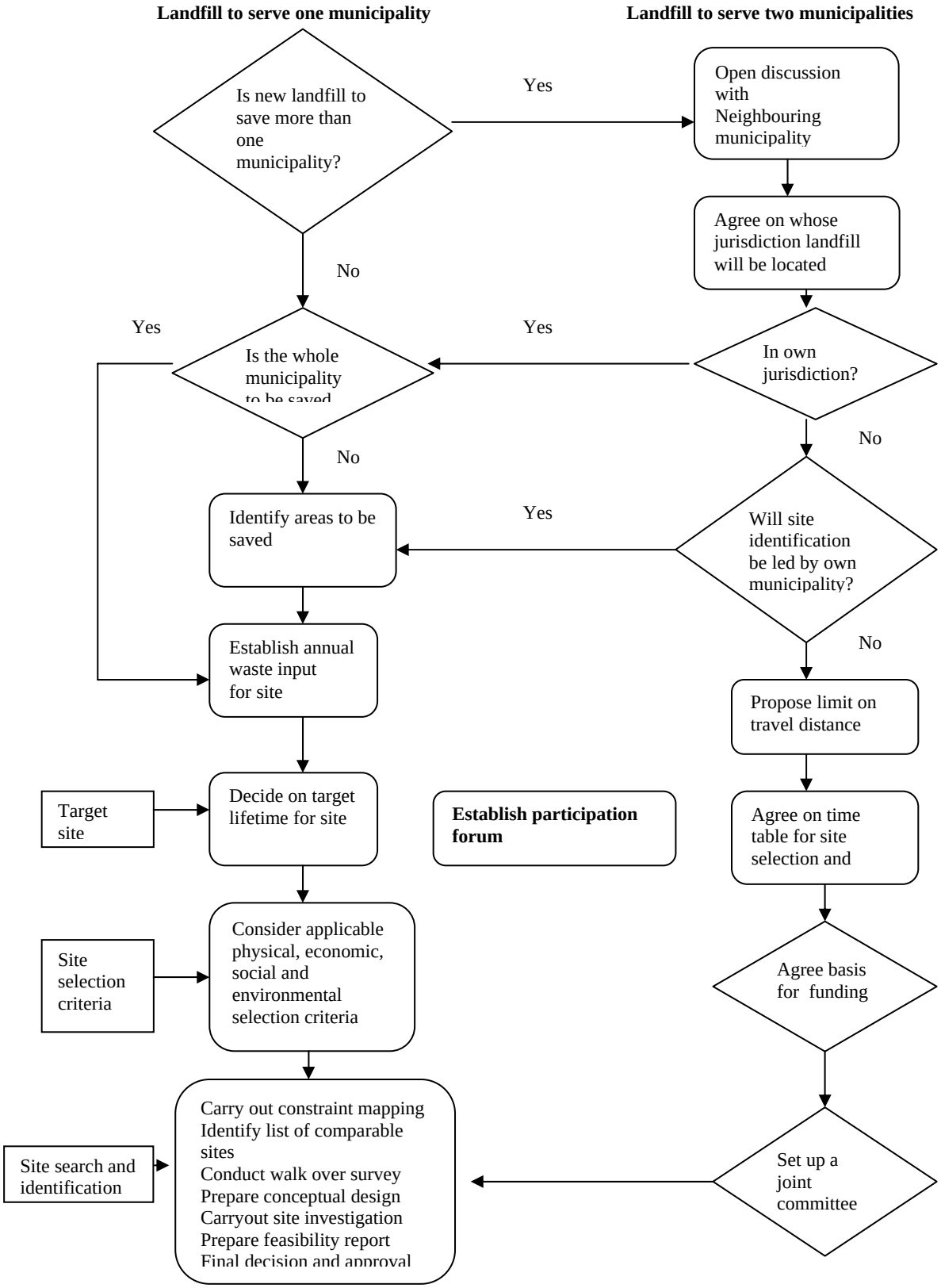
The feasibility report has to be prepared by municipal waste management staffs after the preferred site has been identified. The report is prepared to demonstrate the viability of developing the chosen site based on economic, physical, environmental, technical social cultural and legal aspects. The process also involves conducting Environmental Impact Assessment which is an integral part of site selection to ensure that landfill site development under consideration is environmentally sound and sustainable and that any environmental consequences are recognised early in the project cycle and taken into account in the project design.

- ***Final decision making***

This is the approval process prior to implementation of the project (site development). Appropriate committee of the municipality, regulatory authority or fund provider can do the approval process. The feasibility report in this respect is expected to demonstrate that the chosen site is the best available in the area and will be operated to the satisfactory of environmental standards (Thurgood, 1999).

Similarly (Thurgwood, 1999) argues that it is important to assess the possible environmental impacts of the preferred site, facilitates to spot out which activities if any, and is likely to give rise to significant adverse impacts. The author further expresses that identified impacts may lead to amendment of the design however if the impacts are sufficiently more serious and potential harm can not be reversed the proposed site can be abandoned. Orgenis et al (2002) comments that, EIA process is most effective where there is interactive link between the design of the project and the results of the assessment that can be established. Apparently EIA aims at impact avoidance and fundamental to this is alternative design and location.

Figure 6: Framework for landfill siting



Source: Rushbrook 1999

Figure 6 provides a summarised sequence of activities for landfill siting process. The author demonstrates the required decisions to be made under the situation where the proposed landfill is to serve one or two municipalities. It further depict essential processes and criteria to be taken into account in order to guarantee the selected sites does present potential threats to environment and human welfare.

The selection of site for locating solid waste disposal depends on several factors which includes physical, economic, environmental, technical and public acceptance considerations. Although authors argue differently but they essentially focus on the same line of thoughts. They generally provide exclusive procedures that are required to be fulfilled prior to the siting of landfills. Additionally they stresses the significance of public and stakeholders involvement in the process so that the final selected site should have minimum adverse impacts to natural environment and public health because the main goal of consensus building efforts is to reach agreement on plan of action which is acceptable to all stakeholders and legitimate by the public.

2.7.2 Minimum environmental requirements for landfill siting

The need for environmentally acceptable and yet cost effective waste disposal has become a priority in both developed and developing countries (Langmore and Jarrod, 1998). The rapid population growth and urbanisation hasten the growing of waste generation and subsequently placing pressure on the environment due to rising demand for more space to accommodate disposal facilities.

Minimum requirements are sets of standards established for the purpose of protecting environment and general public from potential impacts caused by poor solid waste disposal practices (Langmore and Jarrod, 1998). They are essentially criteria that have set for the purpose of ensuring all activities pertaining landfill siting, designing, development and operation are accomplished within prescribed limit. The essence of setting up minimum requirements for landfill site selection includes:

- Provision of guidelines for environmentally acceptable waste disposal for a wide spectrum of landfill location, sizes, types and operation;
- To ensure that proposed sites to be developed as landfills are environmentally and socially acceptable and provides for simple cost effective which in turn provides for a good operation of landfill;
- To illustrate the relative suitability of proposed sites for landfilling;
- Improvement of standards of waste disposal;
- To minimise the possibility of public rejection over the proposed site.

The context of setting minimum requirements depends upon several factors. Each country or region may have different minimum requirements but share most common features. In south Africa for example minimum requirements for landfill site selection includes *inter alia* classification of proposed site, elimination of areas with fatal flaws[4], identification of eligible candidates landfill sites, rank the sites and investigate, present the ranked sites to authorities, and conduct feasibility study including EIA for the most eligible sites (Langmore and Jarrod, 1998).

However cities from developing countries like Tanzania, the existence of minimum requirement to guide the siting and operation of landfill is doubtful due to continued adopting crude open dumping of waste for which are haphazardly sited in the midst of residential areas.

2.7.3 Stakeholders involvement in the siting process

The term stakeholders refer to a person or an organisation that have interest on particular issue in this case solid waste management in general and siting waste disposal facilities in particular (Klundert and Anschuz 2001). Different stakeholders have different roles, interest and power to influence decision-making in waste management practices. There is a wide range of individuals, groups and organisations that are concerned with Municipal Solid Waste Management (MSWM). They include service

[4] Fatal Flaw is a factor or situation which prevents the development of an environmentally acceptable waste disposal facility, except at prohibitive cost

users, service providers, intermediaries and regulators (Visvanathan and Trankler, 2001). Stakeholders for municipal solid waste management include but not limited to national and provincial government, municipal council, private sector (formal and informal) NGOs, CBOs, service users and External Support Agencies (ESAs). Also refer to the ISWM model pg 17.

In order to achieve sustainability in landfill siting, the role, interest and power structure prevalent in waste management system is imperative factors. According to Klundert and Anschuz, (2001) assert that experiences from several countries in the North has shown that cooperation and coordination between different stakeholders such as city council, National/provisional government, service users, NGOs, CBOs, Private formal and informal sectors provide a significance improvement to sustainability of waste management system. Nevertheless the author clarifies that ignoring certain groups for instance informal sector that recover huge amount of waste for most countries in the South minimizes the possibility to achieve desired goal of sustainability.

Also Tchobanoglous and Kreith (2002) supplement this by arguing that public concern and opposition usually takes place due to insufficient stakeholders' participation and eventually it leads to long delays and rejections of proposed facility site. Stakeholders' participation is important as it can shape the analysis and if well coordinated the likelihood that members of the community can appropriately negotiate agreements that will eventually give an outcome which each stakeholder may stand behind as the final decision is fair, efficient and wise. This assumes that municipal authorities that are also in charge of the landfill development have to identify relevant stakeholders and encourage them to participate in the siting process of municipal SWD facilities.

2.7.4 Institutional arrangement for MSWM

Institutional arrangement refers to administrative and legal set up with law enforcement machinery for the implementation of SWM program. Improved MSWM capacity requires innovation in the organisation structures, staffing and description of responsibilities among different government bodies. According to Schubeler (1996) the assistance from national or provincial governments should focus on identifying institutional constraints inherent in waste management system. To increase local government efficiency and effectiveness, the central government authorities need to strengthen the capacity of all actors in SWM with education, training, and providing infrastructure support.

2.7.5 Community participation in site selection

Community involvement is an integral part in landfill site identification and selection. Once the decision has been made to seek a suitable site for developing a new landfill, the municipality should actively encourage the involvement of communities and organisation with significant interest in the choice of the site (Rushbrook, 1999), (Thurgood, 1999). Public involvement in the siting process is crucial because it form the basis for the public acceptance. UNEP (1996), describes public restrain as among the principle factors necessary to be considered in landfill site identification and selection process. Public restrain refers to opposition raised by the communities to the siting and operating of SWD site close to their neighbourhood as (NIMBY[5]) syndrome.

Through involvement, residents get opportunity to express their concern on how the presence of landfill may have impacts in their living environment. This is also contributed by (Sloan, 1993) expressing that the qualities of environment as perceived by people who are mostly directly affected often exceed the minimum qualities

[5] NIMBY Not in my backyard

prescribed by government regulations. Many communities are found to have attributes that are far beyond the domain of the government control (Sasao, 2004).

In this regard full public participation in the site selection process facilitates to define condition, which may not be covered in government regulations and standards is imperative. According to Thurgwood (1999), NIMBY syndrome must be addressed not avoided and can only be achieved through full public participation in the siting process. The arguments raised by the authors above are relevant due to the fact that community are aware of the consequences that may have negative implications on their social and economic welfare within their neighbourhood. But under the situation where public are not well informed about the consequences dumpsites especially in the unplanned settlements inhabited by the urban poor needs to be underscored.

2.7.6 Accommodating waste pickers at SWD sites

Waste pickers (scavengers) are individuals or groups of people who sort out valuable materials discarded by its first users. Some scavengers usually patrol streets looking for items that can be reused and commonly known as “itinerants” while others conduct their activities at the disposal site mainly open dumps and they normally limit their sorting activities to one or two items (e.g. metals, plastic bottles, steel) (Polezynsky and NoraScotia, 2002). According to the author, in most developing countries scavenging plays essential role on the economic survival for several industries such as (papers, plastic, steel, pulp).

To most of urban poor scavenging has been taken as free employment opportunity. According to survey conducted by Kaseva and Mbuligwe (2000), in Dar es Salaam, 60% of the interviewed scavengers had been engaged in scavenging for 6-12 years. Likewise in Jarkata, Indonesia, landfill operators have registered 640 waste pickers (Johannessen and Boyer 1999). However the situation reveals presence of conflicting interest between the needs of the urban poor (waste pickers) and efficient management of landfills. Notably excluding waste pickers from landfill is a difficult attempt in developing countries hence they form part of potential stakeholders and therefore need to be integrated in the operation and management system of waste disposal sites.

2.8 Practical experiences in the siting of SWD facilities

2.8.1 The Swiss case

In Aargau Canton city located on the eastern side of Swiss lands had a need to have a new waste disposal facility (landfill). The building department (Baudepartment), which is the state agency, was given the responsibility of preparing design and siting of the canton’s waste disposal plan, which was to be implemented, by the municipality

The process involved preliminary site selection by characterizing different sites then followed by choosing potential areas through mapping elimination process. The elimination process was done in compliancy with the Swiss federal laws and Canton by-laws, which restrict siting, landfill in parks, wetlands, inhabited areas, geological unsound areas, cultural areas, sensitive ecosystem areas, and several others. All these areas were removed from map leaving 32 potential sites. The 32 site were narrowed down by private engineering company to thirteen sites, based on preference criteria developed by the department. However the mapping and elimination process was done without community involvement but the results were made public revealing the selection of the thirteen potential sites. The second stage consisted detailed investigation of the thirteen sites for which cantos involved the local communities through citizens representatives and oversight committee.

The municipal council organized a meeting in January 1993, which was attended by all representatives. Council officials introduced procedures and rule of discourse on how to carry out the task ahead of them. At the end of the meeting four citizen panels consisting two representatives from each community were formed. They were given identical tasks to review the past mapping and elimination process and integrate the technical feasibility analysis undertaken by engineering company, consider social, political, ecological, economic impacts and equity issues and finally make suggestion or priority list of 3-5 eligible sites for further investigation.

The process was successful but, the first three months the team of experts in the panel placed emphasis on educating citizen's panel about potential risks and problems a landfill can cause to public health and environment. Also several other experts were invited to talk about technical and economic issues of landfills including the results of engineering company that made the first survey. After six months of investigation, the panel narrowed down to five (5) eligible sites based on characteristics like impacts to human, nature, society and economic cost. Interestingly each panel recommended the first priority site although they were working differently and they only differed in the order of the remaining priority sites. To address this conflict each panel appointed five representatives for a super panel, which met in September 1993 and articulated a consensus list of five eligible sites.

The list was then forwarded to oversight committee and with no objection the oversight committee approved the list and passed on to the building department for detail investigation. The third stage involved detailed investigation including formal Environmental Impact Assessment (EIA), which also involved citizens' panel. The process came up with two most eligible sites, which were also subjected for public hearing and approval and were then sent to the state parliament for final voting in December 1993. The site development was initiated in January 1994 after the final approval. The site selection process was done for a year. (Renn et al., 2007).
The process is summarized into four different phases as shown in the table 4

Table 4: Summary of landfill siting process the Swiss case

Phase	Activity	Actors/stakeholders	Outcomes
I	Develop a need for solid waste disposal facility Developing preference criteria Identify potential sites through mapping elimination process	Cantos municipal council Building department	32 potential sites identified
	Preliminary investigation of the potential sites	Private engineering company	13 potential sites identified
II	Formulation of community assessment representatives Investigation of the selected sites Approval of high ranking potential sites	Cantos municipal council Building department Citizen panel Oversight committee Private engineering company Affected communities	Oversight committee and citizen panel formulated 5 eligible potential sites selected Eligible sites approved by the oversight committee
III	Detailed site investigation including EIA	Cantos municipal council Building department C Private engineering company Citizen panel Affected communities	Two most eligible sites identified
IV	Final approval of the eligible sites	Municipal council Building department State parliament	One eligible site for developing solid waste disposal facility approved

Developed by: Author 2007

2.8.2 The Metro Manila case – Philippines

Caloocan is one of the re-settlement areas in Metro Manila, which is inhabited by the urban poor communities. The settlement had an open land surrounded by housing units.

According to earlier plan of the municipality, the land was designated as an Area for Priority Development (APD). It later came to be realized that the municipality changed its earlier plan and decided to locate a landfill due to the pressing needs as the former sites was becoming an absolute.

The municipality made the decision despite the fact that, housing estates and medical care institution surrounded the area. Spearheaded by an NGO, citizens started protesting against it because their housing units were bounding the site in question and they realized that disposal facility had to be operated as an open dump. They also became so furious as they learned that the dump had to host the waste from the whole region of Metro Manila. Backed by other government agency, environmental experts and NGOs,

the community filed proceedings against the municipality decision. The court overruled the operation of landfills site in the re-settlement areas. (Passe and Salvador, 1993)

2.8.3 The Ghana case

The government of Ghana in collaboration with the World Bank and other donors initiated efforts for developing engineering landfills in 16 major urban towns in Ghana. The project began in 1994, which aimed at providing improved solid waste disposal facility for 11 medium size towns, and in 1995 the project focused in five largest cities of Ghana.

The Sunyani Town:- The progress was smooth during the preliminary site investigation in 1994, until when the contractor arrived on site in 1996. The contractor faced opposition from the local residents who objected having waste from the nearby "city folk" on their land. Following this objection, the site selection process had to start all over again after wasting two years.

The Ho town: - In this town the contractor had completed about 30% of the work before he was ordered to stop by civil aviation authority due to the fact that the site was alleged to be too close to planned airstrip. After negotiation for about two years it was agreed that the development of landfill could continue on the condition that the site would be closed before airstrip was ready for operation.

The Keta/Anloga town:- The only site could be found was 30km away from urban area. Attempts to use closer sites caused delays and finally it was proved unsuccessful because the residents and department of game and wildlife opposed them.

Source: (Horizonte, 1998)

From the Swiss case important lessons that can be drawn, is that siting of the solid waste disposal facility is not a day or month decision making. Successful waste disposal facility siting has to be linked to many other aspects and considerations so as to have a common consensus. It also reveals that siting agreement can only be reached after extensive public information has been held and ample opportunities have been rendered to the citizens to raise concerns and determine their support for or opposition to the proposal.

The deliberation of landfills siting must cover the institutional arrangement that will assure safe facility construction and management, compensation packages and long term measures to community over facility operation. The process also involves a detailed technical investigation including EIA to determined site suitability (Rabe, 1994). Nevertheless the process also involves community participation. Additionally even in developed country not all people are aware of the hazards, which can be caused by landfills, but local authorities' takes initiative to raise their awareness and getting them involved. But the experience from low-income countries like Tanzania this is not the case. Many projects of similar nature have continued to be executed without public concern especially if it is locally funded.

The lessons drawn from Metro Manila and Ghanaian cities demonstrates how the municipality can take certain decisions without a detailed analysis, involvement of communities and reveals the importance of careful consideration of all factors related to selecting sites for developing landfills. It further illustrates some difficulties that may be encountered in the process if there is insufficient public and stakeholders' participation. This is quite contrary from the developed countries as illustrated by the Swiss case. It further illustrates that if the public are informed about the consequences can play a vital role to influence and alter decision that have been made by higher authorities for siting a landfill in a particular location. However their resistance or demand to full involvement is subjective to their awareness on the forthcoming adverse negative impacts on health and their living environment, which does not seem to be the case in most of Tanzanian cities.

2.9 Negative impacts associated with poor siting of SWD

The disposal of waste to land is considered to be the cheapest and most convenient method of solid waste disposal. However if the siting and operation of landfills are not carried out to a sufficiently high standards and without meeting the minimum requirements, can lead to adverse short and long term impacts to natural environment and public health (Langmore and Jarrod, 1998).

The short term impacts include air pollution, wind blown littering, emission of unpleasant odors (strong pungent smell), noise pollution, risk of fire explosion caused by concentration of methane and asphyxiation[6], diminishing of property value, unsightly view, dusty, direct physical harm arising from the collapse of unstable slopes of waste or contracting sharp items, and attraction of animals, flies and pests.

While long term impacts include:

- Generation of leachate which is produced due to influence of natural agent like microorganisms leading to biological, physical and chemical transformation of waste. Leachate is considered to have high concentration of non conventional and hazardous chemicals such as BOD, COD, Heavy metals which severely pollute the environment (Marzougui and Mammou, 2006)
- Unsanitary landfills are also potential generators of green house gases such as Carbon dioxide (CO_2) and Methane (CH_4). It is estimated that a complete reaction of one tone of MSW generates about 208 standard cubic meter of methane (CH4) biogas or 0.149 tones of Methane gas which has high global warming potential (Nickolas and Priscilla, 2007)
- Unsanitary landfill also causes underground and surface water pollution due to contamination of uncontrolled leachate oozing out from landfills
- Health hazards caused by aquatic food chain through eating contaminated food from crops grown down stream, fish, and meat.
- Presence of bacteriology and pathogens and similar ineffective agents arising from biological and contamination of waste
- The impacts of chemical or microbiological contaminants on human reproductive activities notably still birth, low birth weight or specific birth defects

These problems are associated with poor siting, design and operation of landfills and may persist for long time even after landfill closure. It further illustrates that these impacts may not be confined in one location for example strong pungent smell that arises from dumpsite can spread in a wider area, also chemical and biological contaminants emanating from dumpsites always find their way back to human and eventually affect health and qualities of life. Furthermore leachate generated from dumpsites can migrate to a distant area and affect thousands of people across the city.

[6] Asphyxiation is a landfill gas which is heavier than air and may collect in sewers and manholes

In this case putting the dumpsite in the right position and operating within the acceptable standards is imperative.

2.10 The theoretical framework

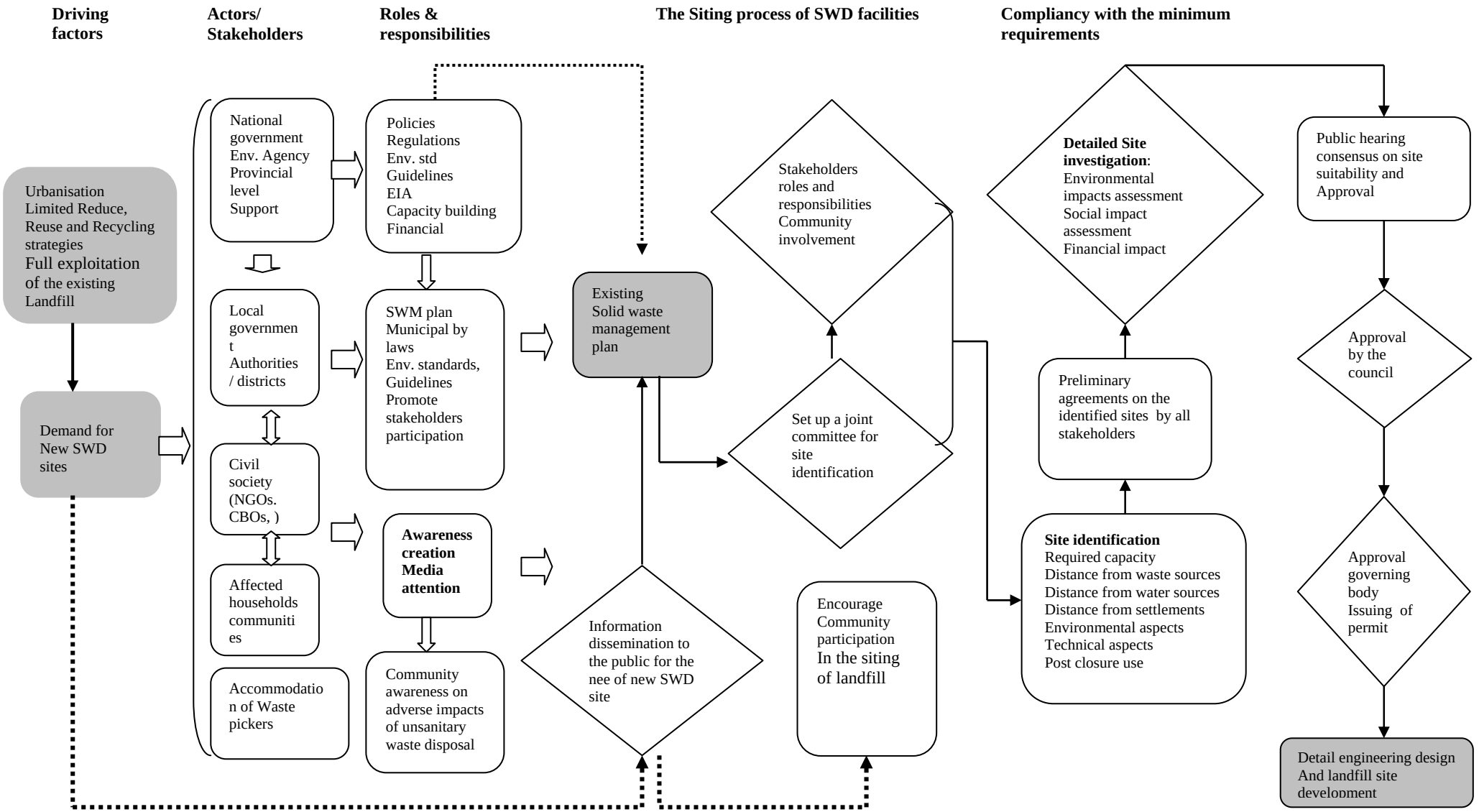
The author has selected ISWM model as the basis for development of theoretical framework. The literature clearly indicates that, good landfill site selection provides for cost effective, design and operation, which ensures social, environmental and physical acceptability. It is further highlighted that the development and operation of SWD facilities is carried out by public sector particularly in developing countries. However, the growing awareness on the potential impacts the landfill can cause has lead to the establishment of strict standards and criteria that has to be complied during site selection process particularly in the North.

Based on ISWM and other waste disposal siting models, the author identified four important aspects for the research.

1. Different levels and actors with a stake in the siting of solid waste disposal facilities
2. Roles and responsibilities of different actors in the siting process
3. The siting processes and procedures of SWD facilities
4. The compliancy of the minimum requirements on socio-economic, physical and environmental criteria

Having identified the four aspects above, the study reviewed how siting of dumpsites in Dar es Salaam city is carried out. Attention has been directed on decision making process between different layers of government, the role of public and other stakeholders in the site selection process, and the compliancy of siting of SWD facilities to the existing environmental and social standards. Figure 7 provides a summary of the conceptual framework.

Figure 7: Conceptual framework: Sustainable siting of urban SWD facilities



Source: Developed by the author based on ISWM & WD siting models

2.11 Summary

Although different authors argue differently but they essentially focus on the same line of thought revealing that it is not an easy task to be undertaken. But generally, all authors provide exclusive procedures on required procedures to be fulfilled prior to the selection of sites for development of landfills. They all agree on the importance of involving the public and other stakeholders in the siting process to ensure the final site present minimum adverse impacts to natural environment and public health. This is due to t5he fact that, the main goal of consensus building efforts is to reach agreement on plan of action which is acceptable by all stakeholders and legitimate by the broader public. They also illustrate that there must be a legal body to approve the plan which may be a locally selected or the municipal council to ensure that all precautionary measures are met. However they don't show how the public concerns can be raised or realised particularly the affected communities in a situation where the public have little or no knowledge on impacts, which may be caused by the landfills.

Another remarkable issue featured by all authors is the concept of Integrated Sustainable solid Waste Management (ISWM). The concept has been the centre for discussion because all the criteria, techniques and essential conditions for the siting process hinges on ISWM model. From the literature, it can be translated that the model is a benchmark, which guides to attain sustainable waste management through the integration of physical, technical, socio-economic and environmental aspects.

Another important lesson drawn from the literature is that properly selected sites for siting SWD facilities provide significant possibility of minimizing investment and operational cost of the landfill, while mitigating adverse effects, which the landfill can cause to natural environment and public health. However this can be achieved if specific policies and regulations governing solid waste management in general and siting of SWD facilities are in places, together with the presence of effective and efficient enforcement mechanism. This is illustrated in the conceptual framework figure 7.

CHAPTER THREE: THE CONTEXT OF SITING WASTE FACILITIES IN TANZANIA

3.1 Introduction

This chapter is composed of two main parts. The first part provides an overview of solid waste management in general and waste disposal system in specific within the context of Tanzania. It also sheds light on some initiatives taken by the government to improve waste management practices based on different programmes. The second part presents the trend of landfill siting in Dar es Salaam city; it highlights the status of land use planning and strategies on landfills. Attention will also be drawn to Public litigations against dumpsites.

3.2 Overview of Solid Waste Management in Tanzania

Tanzania is a relatively a big country in east African region with an area of 945,087km^2 for which 886,037km^2 is land and 59,050km^2 is occupied by water. The country is located between longitude 29^0 and 41^0 East and latitude 1^0 and 12^0 South. According to 2002 National census the country has a total population of 34.569,232 with an annual growth rate of 2.9%. The country's urban population accounts for 35% with a growth rate estimated at 6.8 % per annum compared to an average of 1% per annum in developed countries. This depict that Tanzania is experiencing rapid urbanization processes, which translate into a greater volume of waste, generated**.**

Tanzania like many other developing countries is continuously faced with the need to pursue three challenging goals simultaneously; economic growth, poverty reduction and environmental sustainability. In this regard the government recognizes that waste management is among one of the important elements in the Government's overall strategy for sustainable development, which aims to help decouple economic growth from resource consumption. However, inadequate solid waste management in urban centres has been one of the major challenges in Tanzania.

Most cities and towns in the country are facing problems of collection and treatment of solid waste and in some areas SWM is virtually non-existent. The rapid urbanisation coupled with globalisation has caused a considerably increase of huge amounts of solid waste that are generated in urban areas beyond municipalities' capability of handling them (Mato, 1999). In the light of available data, it is estimated that the quantity of municipal solid waste generated countrywide amounts to more than 5000 tonnes per day (NWMSAP 2006). Mato 2000, reveals that, waste generation rates in Tanzania vary between 0.17 to 0.49 Kg/cap/day. In Dar es Saaalam city for example, solid waste generation doubled from 1090 tonnes/day in 1988 to 2000 tonnes/day and 11 years later (Kasseva and Gupta, 1996). The main factor for the increasing waste generation is mainly rapid urban population growth caused by rural urban migration coupled with other factors such as cultural habits; different consumption pattern and urban life style.

However, on average less than 20% of solid waste generated is collected and disposed by the authorities with minimum recycling activities for particular types of solid waste materials (NWSAP 2006). In many urban centres, collection is still confined to a few areas, usually the Central Business District (CBD) and high-income neighbourhoods. Most parts of the cities do not benefit from public waste collection and disposal services, therefore many residents have opted to bury or burn their waste, or to dispose it haphazardly along the roadsides, on open spaces or in valleys and storm water drains (Mato, 2000).

Additionally many Tanzanian cities town are experiencing uncontrolled proliferation of unplanned settlements. It is estimated that 70% of urban population live in these areas (Mato (2000). These settlements are characterised with limited access to basic infrastructure services such as roads, decent shelter, sanitation, water supply, sewerage system and transportation. This poses a drawback to extend refuse collection services to these settlements leading to pilling up of uncollected waste which causes potential risks to public health and natural environment. The poor state of municipal solid waste management in urban settings is currently viewed as not only an environmental challenge but also a major social handicap.

Table 5: Waste generation rates in some municipalities in Tanzania

Municipality/City	Waste generation rate Kg/capita/day	Average density Kg/m^3
Arusha	0.19(squatter areas) 0.36 (serviced areas)	275
Moshi	0.49	330
Dar es Salaam	0.17 (squatter areas) 0.33 (serviced areas)	550

Source: Mato (2000)

Table 5 shows refuse generation rates and densities in some of the municipalities in Tanzania. It is however should be noticed that, many of the values given in the table are based on the amount of solid waste weighted at disposal sites. The amount of uncollected solid waste may outweighs the data provided as most of the people resort on site waste disposal. But it is taken to give the differences on waste generation between serviced and squatter areas where most probably waste is collected very infrequently.

3.3 Solid waste disposal system in Tanzania

Like in other cities in the developing countries the enormous increase of waste generation in Tanzania has posed big problems for the waste disposal system. In most cities and towns in the country the common method of disposing collected municipal waste is through open dumping often in natural depression, or abandoned quarry or sand sites (Kaseva and Mbuligwe, 2000). Most of these dumps are located at the perimeter of town or cities and the main factor that is considered for site selection is merely its proximity to waste generations' sources than environmental, physical or public health consideration. Along with that most of the dumping sites accommodate all type of waste irrespective of their nature and type. It is common to find a mixture of industrial, hospital, commercial, and domestic waste dumped together, a situation that poses high risk of contracting diseases. (Kaseva 1997)

As the disposal of waste to land is the cheapest and therefore most convenient option in the country, other waste disposal methods such as composting, incineration, reuse and recycling are not prominent. There is also lack of formal recycling schemes in the country although it could significantly reduce the huge amount of waste disposed at the dumping sites. The disposal of waste to land has remained the main option in the country and as it is mostly unsanitary, it has been subjecting enormous impacts to environment and public health although the extent of impacts has not thoroughly being examined yet.

Table 2: Solid waste disposal practices in selected municipalities, 2005

Urban/ Municipality	Estimated Population (2005)	Waste generated tones/day	Waste collected tones/day	% Collected	Methods of disposal
Dodoma	345,872	75	55	73	Open crude dumping
Ilala	637,573	750	450	60	Semi controlled Open dumping
Kinondoni	1,229,836	1064	266	25	Semi controlled open dumping
Temeke	871,911	450	245	55	Semi controlled open dumping
Dar-es Salaam(Total	2,739,320	2264	961	42	Semi controlled open dumping
Iringa	111,601	70	60	86	Semi controlled open dumping
Morogoro	247,330	172	77	45	Semi controlled open dumping
Moshi	156,803	200	128	64	Crude dumping
Tabora	201,632	55	30	55	Semi controlled open dumping
Tanga	259,878	125	80	64	Open crude dumping

***Source*:** Country Environment study (Draft report) 2006

The table 2 above shows different methods of waste disposal adopted by municipalities in the country. Crude dumping refers to disposal of solid waste in undesignated places, open crude dumping, solid waste are disposed in designated areas with no management mechanism in place while semi controlled dumping refers to disposal of waste in designated areas with some form of management. However, the few semi controlled waste disposal sites depicted above have considerable weaknesses since most of them have been sited in a haphazard way and therefore contradict with abutting land uses.

3.3.1 Initiatives taken to improve solid waste management in Tanzania

The local governments' authorities in collaboration with central government initiated public private partnership arrangement in municipal solid waste management since 1997. The adoption of Public Private Partnership principles follows the transformation of government's role from direct service provider to enabler whereby the principle role of service provision is devolved to private sector and the government assumes the regulatory role (Mwihava, 1996).

Recently the local government authorities have also engaged small and medium enterprises, and CBOs, in solid waste collection and a fraction of liquid waste from *primary*[7] to *secondary*[8] *levels* for the purpose of improving cleanliness. This is particularly practised in unplanned settlements in which most of properties are inaccessible. In such areas it is common to find pushcarts and trolleys are used by individuals and/or CBOs to transfer wastes from point of generation to transfer stations, which are then collected by private contractors using big trucks. However, this arrangement coupled with CBOs' efforts covers a fraction of the communities in

[7] Primary level collection entails removal of waste from household sources to transfer stations.
[8] Secondary level entails removal of solid waste from transfer stations to designated disposal sites

unplanned settlements. Huge proportions of the urban population have resorted to dispose uncollected wastes in unauthorized sites.

3.4 Policy and regulatory framework on waste disposal facilities

3.4.1 Relevant National Policies

The need for sustainable urban development and environmental protection from further degradation is increasingly placing pressure to policy makers, particularly in waste management. In recent years, Tanzania has witnessed a steady flow of policies, legislation and programmes focusing on reduction of environmental impacts from solid waste. Some policies that render policy frameworks, to address solid waste management challenges include;

National Environmental Policy, 1997 (NEP) is the core framework policy on environmental planning and management in Tanzania. The policy highlights different general aspects of environmental management in the country. The policy identifies six major environmental problems, which need urgent attention. Among the priority areas is environmental pollution. Solid waste management which is highlighted in paragraph 50 emphasizes, the protection of public health should have a broader focus of promoting human well-being and the provision of the community needs for environmental infrastructure, such as safe and efficient water supplies, sewage treatment and waste collection and disposal services (U.R.T, 1997).

The promotion of health related programmes such as food hygiene, separation of toxic/hazardous wastes and pollution control at the household level are well articulated in the policy. Although the policy's' scope focuses on interventions of environmental problems in its totality, it also directly provides a framework of addressing urban solid waste management issues including disposal sites.

National Health Policy (1990); The policy's overall objective is to improve the health and well being of all Tanzanians (U.R.T, 1990). The policy recognizes that through environmental management particularly, solid waste collection and safe disposal facilitates the control communicable diseases and therefore improvement of public health. Solid wastes management is highlighted under the preventive measures that stresses on streets cleansing and collection of refuse to avoid the spread of diseases and create a healthy living environment. However, little is mentioned on solid waste disposal sites as a priority.

Sustainable industrial development policy (1996); The policy acknowledges the need for effective environmental management in the promotion of sustainable industrial development (U.R.T, 1996). The policy highlights important strategies that are aimed to achieve sustainability through promotion of an integrated preventive environmental strategy to industrial process, products and services. The promotion of efficient use of raw materials and energy; elimination of toxic materials, as well as reduction of emissions and wastes at source are among the issues highlighted by the policy. The policy is directed on the management of waste from industrial processes, particularly emission control and waste minimization. The policy expresses the framework of industrial and municipal waste separation to residues the risk of contamination. However, the siting of solid waste disposal facilities is not underscored.

The Human Settlement Development policy (2000) also underscores solid waste management. The policy thrives to achieve sustainable urban development, and therefore one of its objectives is to ensure that human settlements are kept clean and free from pollution effects of solid and liquid wastes to improve public health and

natural environment (U.R.T, 2002). The policy acknowledges the link between growths of human settlements and increased waste generation and therefore promotes waste management through integrating urban development with mitigation strategies to promote sustainable development. Although the policy focuses on waste collection, it do not directly provide a framework for landfill siting, it does however provide a clear linkages between urban growth and development and the need for planning and implementation of appropriate solid waste management systems.

Some of these policies highlighted do not directly address the solid waste management but they present general framework on waste management system in the country. Policy development has been subjected to increased generation of waste that calls for a more coherent coordinated and well-planned approach to manage the increasing solid waste volumes in urban areas.

3.4.2 Relevant Regulations

Tanzanian government recognises that there is need to internalize the impacts of wastes into the life support system in order to tackle development needs comprehensively. To ensure that this is achieved, the national government passed laws that are aimed at addressing urban environmental challenges including solid waste management. The laws include:

The **Environmental Management Act (2004) (EMA**); this act is the principle legislation for which environmental planning and management at all levels is a central concern. The law recognize the right of every person living in Tanzania to have access to a clean, safe, and healthy environment (U.R.T, 2005). The law provide an exclusive framework of environmental management that includes the provision of strategic environmental assessment, pollution prevention and control, waste management, and environmental restoration. The management of solid waste is stipulated in section 117, which empowers local government authorities to determine waste collection systems. Section 119, provides the framework for choosing the best site and method of a waste disposal system within the areas of municipal jurisdiction. Section 114 (2) also requires local government authorities to conduct an EIA prior to the establishment of all its new major activities including refuse disposal sites.

The law clearly indicates important factors to be considered prior to the selection of solid waste disposal sites. Since its inception in 2004, there is weak enforcement of the act in practice as most local government authorities still practice crude open dumping as the waste disposal option. The selection of dumpsites does not involve feasibility studies or an EIA's. Additionally, there are no specific guidelines to administer location of solid waste disposal facilities. Inadequate coordination within the government system to for the implementation of the act is also a handicap.

The Urban Authority Act No.8 (1982); this act provides general measures to restrain different development and environmental management issues within urban local government authority. The act empowers local government authorities to address sanitation and solid wastes management matters as stipulated in section **55** (U.R.T, 1983). The law charges urban authorities to ensure among others solid and liquid waste

are collected and safely disposed. However, in practice the most practised implementation strategy is waste collection while little is done for its final disposal.

3.5 Institutional arrangement

There are different institutions for solid waste management in general and landfill siting in particular. At central government level the main custodian on solid waste management are the Vice President's Office and National Environmental Management Council.

The Vice president's office is responsible for the articulation of policy and guidelines necessary for the promotion, protection, and sustainable management of the environment in the country. The National Environmental Management Council (NEMC), which is a government agency, undertakes enforcement, compliance, review and monitoring of environmental impact assessment, and exercises supervision and coordination of all matters related to environmental management. At this level final decisions are made. Pertaining to solid waste disposal facilities, the NEMC has also the capacity to influence the decisions and performances of actors at local government level in this field. Other sector ministries including; the Ministry of Lands and Human Settlements Development, the Ministry of Health, and the Urban Authorities Support Unit under PMO-RALG also support the implementation of urban waste management policies[9].

At the local government level, the DCC is responsible for the provision and management of waste disposal facilities (Landfills). The waste management department of the DCC coordinates this task. The department has two sections; the waste disposal facilities management section, which is responsible for the identification, development and management of solid waste disposal sites; and the public education, enforcement and inspection section, with the obligation of raising public awareness on environmental issues and ensure the three municipalities (Ilala, Temeke, Kinondoni) dispose their collected waste in areas specified and developed by the DCC.

The three other municipalities have their own setting. While Ilala municipal council has a full-fledged waste management department, in Temeke and Kinondoni municipalities, their respective health departments supervise solid waste management. The activities of street cleansing and daily operation of solid waste collection and disposal for the same are headed by the waste management sections (Ntakamulenga et al., 2007). The disparity on institutional setup creates lack of coordination on waste disposal management, which has lead to inefficiency improvement of siting and operation of waste disposal sites. The setup from municipalities is not linked with the DCC, which is the main custodian for management of waste disposal facilities.

3.6 The Dar es Salaam city land use plans and strategies on Landfills

3.6.1 The Dar es Salaam master plan of 1979

A city master plan is a document that describes, in narrative and with maps, an overall development concept of a city. It also represents a clear vision and guidance of city development. Master plans provide details about different land uses usually by means of scaled maps indicating commercial, residential and service areas, industrial zones, institutional location and many other city functions. It is a blue print long-term, general

[9] PMO-RALG is the abbreviation of Prime Minister's Office-Regional Administration and Local Government

outline of a project or city with specific period of time span which may range between 15 to 20 years of implementation. The master plan is also used to coordinate the preparation of more detailed plans or may be a collection of detailed plans. The plan may be prepared by a local government to guide private and public development or by a developer on a specific project or area.
http://www.lssu.edu/about/forms/ccpidraft0404.pdf

The Dar es Salaam master plan was prepared in 1979 for the purposes of directing, guiding and controlling the city's development. The plan detailed out different uses and pattern of city growth and was meant for the implementation period of 20 years with a detailed public utilities plan. The plan also indicated the waste management system including the sewerage system, the wastewater treatment ponds, and solid waste disposal sites. In the master plan five different sites were zoned for the development of sanitary landfills with different capacities. The plan was meant to develop these sites in three stages with its full operation in 1999. The following table provides these sites and their staged capacities.

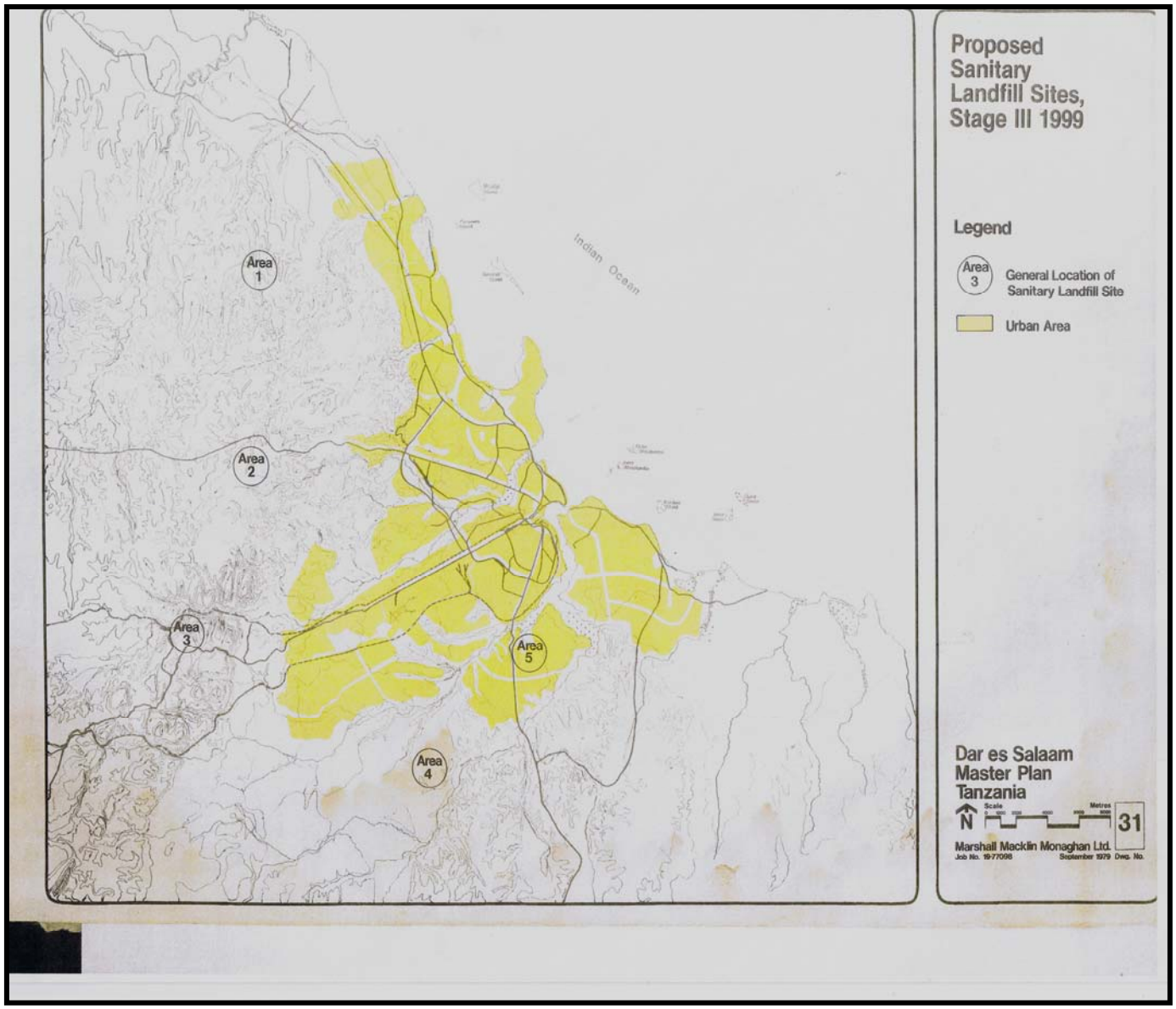
Table 6: Areas designated in the 1979 city master plan for sanitary landfills

Site number	**Location**	**Capacity in m^3**		
		Stage I	Stage II	Stage III
1	Kimara	855,000	1,305,000	3,090,000
2	Mbezi	150,000	225,000	705,000
3	Pugu	90,000	135,000	1,155,000
4	Mbegala	450,000	720,000	1,470,000
5	Kigamboni	0	225,000	870,000

Source: Dar es Salaam Master plan 1979

Despite having waste disposal sites in the master plan, the siting of all waste disposal did not follow the plan. The sites were neither surveyed nor protected from encroachment. As a result zoned areas for landfill development have been informally developed as residential areas. In 2006 the DCC received financial assistance from the World Bank for improvement of waste disposal facilities. In an attempt to seek eligible sites, a survey was conducted in different areas of the city, finally area number three (3) in table 6 was found to be the most appropriate. However as residents now inhabit the site, the DCC acquired it through displacement of people and payment for compensation. The situation would be different if the site was surveyed and protected.

Map 1: Proposed sites for sanitary landfills 1979 Master plan



Source: Dar es Salaam City Council, July 2007

3.6.2 The sustainable Dar es Salaam project (SDP)

The sustainable Dar es Salam Project (SDP) is one of the oldest SCP programme in Tanzania. It was initiated in 1992 and Dar es salaam was among demonstration cities in Africa for which Environmental Planning and Management was reinstated through a joint initiatives of UN Habitat and UNEP, in the implementation of Agenda 21 (Nnkya, 2004). Inadequate solid waste management was highlighted in the city's environmental profile, as the first among five environmental issues facing Dar es Salaam city. The city consultation, which involved key actors and stakeholders from public, private, and popular sector held in August 1992, also highlighted solid waste as the first among nine environmental issues that required priority attentions.

The solid waste management issue was handled by five sub-working groups dealing with respectively; an emergency clean up campaign, privatization of refuse collection,

community management of solid waste, refuse recycling and composting, and management of disposal sites (Nnkya, 2004) .

Each sub-working group had specific issues to address. The sub-working group on disposal site management was charged with the responsibility of finding an alternative solid waste disposal sites following the closure of Tabata dumpsite in 1992.

The sub-working group identified a site bordering Vingunguti informal settlement for the establishment of an interim dumpsite on condition that it would continue to search for new disposal site within Dar es Salaam city. The sub-working group proposed actions for improvement of the vingunguti dumpsite. Some of the improvement proposals include; the installation of a weigh bridge, the construction of tarmac road 1.2 km, construction of dumpsite office, control of leachate to Msimbazi River, and the construction of internal tracks to facilitate smooth movement of trucks. All proposed actions for improvement were promptly implemented by DCC with the assistance of Japanese Government.

However, the DCC did not take any initiatives to identify and develop alternative site for sanitary landfill as it was initially planned. The dumpsite remained operational until 2001. This demonstrates that the good intentions initiated under the Sustainable Dar es Salaam Project did not materialize. Municipal councils have continued adopting semi-controlled open dumping as a disposal option characterised by haphazard siting. This implies that despite launching of the Sustainable Dar es Salaam Project in 1992, the problem of solid waste management particularly waste disposal sites has not been addressed. A lot is still a desired to improve the existing unsanitary practices for SWD.

3.7 Siting dumpsites in Dar es Salaam city

In Dar es Salaam city, like any other city in the country, the disposal of colleted municipal refuse has been through open dumping. According to Chinamo (2006), the practices of dumping waste dates back before countries' independency. Most of the dumpsites were located in open areas within human settlements. Along with that the siting did not consider essential factors like social, economic and environmental aspects. Proximity to waste generation was the main criterion influencing site selection and development.

The city has used six different sites for waste disposal sites since 1935. These areas include

- 1935-1954 "Mchikichini" dumpsite was located in "Mchikichini" settlement within "Ilala" Municipal council. The area has been in use for 19 year and currently the site used as commercial area and is designated to petty traders
- 1954-1964 "Magomeni" dumpsite was located in "Magomeni" settlement in "Kinondoni" Municipal council. The site has been operational for 10 years. The site is now used as Municipal green open space.
- 1964-1991 "Tabata" dumpsite was located in Tabata settlement in "Ilala" Municipal council. The dumpsite has been operational for 27 years. The area is currently used for service industries (garages) designated to private operators.
- 1991-1992 "Kunduchi" dumpsite was located in "Kunduchi Mtongani" unplanned settlement in "Kinondoni" Municipal council. The site has been operational for 2 years. Currently the site is used as residential area
- 1992-2001 "Vingunguti" dumpsite was located in "Vingunguti" an unplanned settlement in "Ilala" municipal council. The site has been operational for 8 years. The DCC is currently conducting a research to examine the extent of gases and leachate at the dumpsite so as to launch mitigation measures.

- 2001-2007 "Mtoni" dumpsite located in "Mtoni Sabasaba" an unplanned settlement in "Temeke" municipal council. The site has been operational for 6 years. The DCC is also conducting a research to examine the extent of gases and leachate collection at dump sites so as to launch mitigation measures.
- February 2007 – to date "Kigogo" dumpsite located in "Kigogo kati" an unplanned settlement, in Kinondoni municipal council. The site was established following the closure of "Mtoni" dumpsite. The three Dar es salaam municipalities are currently disposing their solid waste at this site.

All dumpsites have had similar characteristics in terms of location, physical, geological and hydro geological aspects. All the sites have been located in the midst of residential areas and at least four of them were located in unplanned settlements while the remaining three were located very close to planned areas. Except for "Mchikichini" dumpsite, six dumpsites have been located close near water bodies such as the "Msimbazi" river valley, the "Jangwani" river valley, and the Indian Ocean a situation which is very controversial due to the adverse impacts to environment. Further more,, all the dumpsites were not zoned in the city master plan as waste disposal sites. The following table summarizes different location of dumpsites in the city.

Table 7: Location and lifespan of dumpsites in Dar es Salaam city

Name of dumpsite	Years of operation	Life span In years	Location characteristics
Mchikichini dumpsite	1935-1954	19	Open land in planned residential area
Magomeni dumpsite	1954-1964	10	Open land close to Jangwani river valley
Tabata dumpsite	1964-1991	27	Open land within industrial and residential area close to Msimbazi river valley
Kunduchi dumpsite	1991-1992	2	Open land within unplanned residential area close to Indian Ocean
Vingunguti dumpsite	1992-2001	8	Open land within unplanned residential area close to Msimbazi river valley
Mtoni dumpsite	2001-2007	6	Degraded land within unplanned residential area close to Indian Ocean
Kigogo dumpsite	2007	Still in use	Degraded land within unplanned residential area close to Msimbazi river valley

Source: Developed by author, 2007 also refer to map 2 in page 46

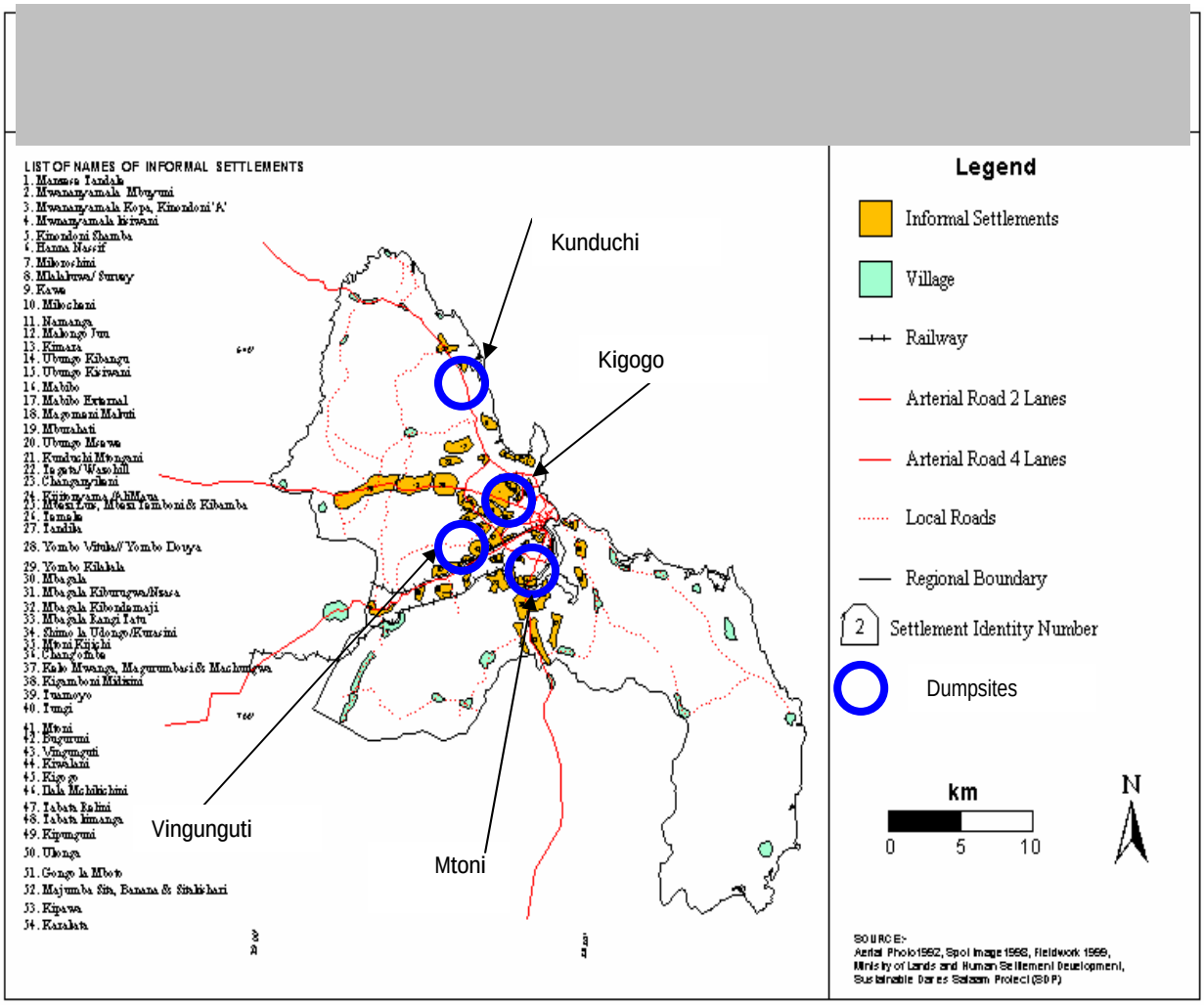
3.7.1 Mtoni and Kigogo dumpsites

a) Mtoni dumpsite is located at "Mtoni Subasaba" unplanned settlement in Temeke Municipal council. The dumpsite is bordered by residential houses in the North, West, and South and on the eastern side by the Indian Ocean. The dumpsite was established in 2001 and all the three municipalities used it to dispose their collected refuse for a period of seven years. According to the 2002 national census, the settlement has a population of 47,952. The dumpsite is surrounded by houses and the closest are at the edge of the dump separated from it by garbage walls. The main access to the dumpsite was through "Kilwa" road. The dumpsite has been closed down since January 2007, following central government appeal. Currently the DCC is conducting research to examine the extent of gases and leachate it has not been collected in order to introduce proper mitigation measures.

b) "**Kigogo" dumpsite** is located at "Kigogo Kati" an unplanned settlement in "Kinondoni" Municipal council. Residential houses in the East, West and North border the area. The dumpsite also borders "Msimbazi" river valley and "SUKITA" farms on the south and is estimated to cover an area of 7-18 hectares. Based on the 2002 census, the settlement close to the dumpsite "Kigogo" had a population of 37,964 people but due to annual growth rate of 4.3% the population has increased significantly. Unlike mtoni dumpsite, the nearest houses at Kigogo dumpsite are 3 meters further from the dump fence. The main access to the area is through "Kigogo" or "Mandela" road.

The dumpsite has been established in February 2007 following the closure of "Mtoni" and is currently used by Ilala, Temeke and Kinondoni municipalities to dispose refuse collected from their respective areas and management activities include refuse covering and compaction, which is done on weekly basis (Ntakamulenga et al., 2007). The unhygienic conditions of the dumpsite pose potential threats to human health and local environment. There are scavenging activities taking place and the area is estimated to have more than 150 waste pickers per day. The eastern side of the present dump consists of water ponds with high leachate concentration while on bordering plots agricultural activities producing crops such as spinach, cabbage and maize.

Map 2: Location of dumpsites in Dar es Salaam city



Source: Dar es salaam City council, July 2007; Modified by author

1

3.7.2 Public litigation against landfill sites

Public involvement during the process of developing landfill sites is an essential criterion for solid waste management system. Public participation primarily persists to ensure that those people concerned or affected get into compromise and therefore pledges for the acceptance of the proposed site (Tchobanoglous and Kreith, 2002). Public involvement in the siting of solid waste disposal facilities in the developed countries is fundamental as the public are deeply concerned and aware of the likely adverse impacts that a landfill can cause to both public health and natural environment (Al-Yaqout et al., 2001). As such this has been a greatest potential to safeguard devastation of the local environment caused by landfill following appropriate siting and protective measures taken by the government to ensure safety and avoid public

The Dar es Salaam city authorities have a long experience with public resistance against the siting of solid waste disposal facilities (dumpsites) too close to residential areas. From 1988 until 2003 there have been five (5) cases of conflicts between communities against the DCC and the three municipalities on issues related to dumpsites. A few individuals voluntarily filed a case to the high court to impede the operation of dump sites within their settlements due to growing concern over the protection of health and their living environment. According to City profile (2004), the proceedings that have been filed against DCC include;

- Case No. 299 of 1988 between Josephy Kyessy and Dar es Salaam City Council over “Tabata” dumpsite. The verdict by judge Lugakingira in September 1991 favored the public and the city council was forced to close the dump with immediate effect.
- Case No. 90 of 1991 between Kunduchi residents against Dar es Salaam City Council over kunduchi dumpsite. The ruling by Judge Yahaya Rubama in January 1992 favored Kunduchi residents and the city council was orderd to close the dumpsite in 1992.
- Case No. 316 of 2000 between “Vingunguti” residents against DCC and “Ilala” municipal council. However Ilala municipal council requested the high court and “vingunguti” residents to settle the matter out of court. There upon the DCC spent Tanzanian shillings 6.5 million as compensations for transport and other court expenses to Vingunguti residents. Nevertheless in 2001 the operation of “Vingunguti” dumpsite was suspended.
- In 2001, the DCC attempted to establish a sanitary landfill at “Kunduchi mtongani” settlement with financial support amounting US$ 4.5 Million from Danish government (Chinamo, 2006). The project was suspended by Judge Muro following a high court appeal raised by “Kunduchi” residents based on case number 90 of 1991 on the same allegations.
- Case No. 1588 of 2003 between Ally Chaurembo against the DCC and Temeke municipal council over “Mtoni sabasaba” dumpsite. Following DCC request to the high court the case has been settled out of court and eventually the dumpsite has been closed in January 2007 following central government appeal.

The verdict presented above portrays a significant increase since the late 1980’s of community awareness and concern over inefficient siting of dumpsites in Dar es Salaam city. However, all litigation was raised after the establishment of dumpsites and feeling of adverse impacts such as bad odor and event of fire explosion. Despite litigations raised by the public, Dar es Salaam city council and the three municipalities have continued to locate dumpsite in areas that environmentally and socially are not acceptable.

Furthermore, the method of disposing refuse to land without adopting any engineering principles to contain and control leachate and gases emission is still in place. The general public is not sufficiently informed on the potential hazards caused by unsanitary landfills. There is also no clear evidence of punitive measures against DCC and the three municipalities taken by Dar es Salaam Regional Government or NEMC in response to poor siting and operation of dumpsites.

3.8 Conclusion

All town and cities in Tanzania experience the problem of solid waste disposal management. Most cities still adopt open dumping as the final solid waste disposal option. Like wise in Dar es Salaam city solid waste disposal problem has persisted before independency and despite of all good intentions strategies taken so far, very little impacts of solid waste disposal improvement can be realised. For example the non-compliancy of 1979 city master planned which zoned five areas for sanitary landfill where none of the sites have been developed.

Moreover the Sustainable Dar es Salaam Project that developed different strategies for solid waste management had little impacts with regards to improvement of solid waste disposal facilities. City authorities have continued to use the same option over a long period despite of emerging conflicts raised by local communities. Nevertheless there is weak regulatory enforcement mechanism. The National Environmental Management Act of 2004 despite of its specification on the siting of SWD facilities has neither been integrated into council by-laws nor enforcement mechanisms are in place.

CHAPTER FOUR: DATA ANALYSIS AND FINDINGS

4.1 Introduction

This chapter presents an analysis of findings from data collected from a sample of 67 respondents composed of 37 households, 24 central and local government officials, and 6 waste pickers. The data present answers to the two main research questions of this study. The first part gives an analysis of policies, legislation, processes, criteria and minimum requirements that are adopted by city authorities for the selection of locations for solid waste disposal facilities (dumpsites), the key actors involved and the extent of community involvement in such processes.

The Second part provides an overview of the perception and views from selected communities living near solid waste dumping sites on impacts caused by unsanitary landfills to natural environment and public health, their consciousness on rights to live in healthy environment and to participate in site selection. The last part of the chapter depicts a general conclusions based on the analysis provided.

4.1.1 The management of solid waste disposal facilities in practice

4.1.2 Policy implementation

The National Environmental policy of 1997 provides a general framework towards management of environmental issues that need urgent attention. Among the priority issues indicated is the control of environmental pollution. The analysis included the response to a question concerning the effectiveness of environmental policy on waste management and whether there is a need to develop a specific policy addressing solid waste management. 24 respondents were involved; 8 from national level 5 from DCC, 9 from the three municipalities and 2 staff from two NGOs were interviewed on this issue

The remarks raised by environmental experts from the division of environment in the Vice President Office argued that, lack of compliance to pollution control requirements by the local government authorities on the siting of solid waste disposal, is not inflicted by lack of policy or guidelines, but rather weaknesses of the council by-laws which has not integrated waste disposal siting as part and parcel of a waste management system. They concluded that this is the main reason for municipal councils in Dar es Salaam city to be reactive in siting dumpsites. The incidents of haphazard siting of solid waste disposal would be minimal if council by-laws integrated sanitary landfill as the essential requirement in solid waste management.

Key persons interviewed from the National Environmental Management Council raised the same issue. On the contrary, key persons from the Prime Minister's Office, the Ministry of Land, the City Council, and the three Municipal councils and NGOs were of different opinion. They argued that there is a need to develop specific policy for waste management, reason being that the current national environmental policy covers a too wide spectrum of environmental issues. They stressed that solid waste management by itself has a lot of challenges, which require special attention. Therefore it is a high time to develop specific policy or strategy addressing waste management. A summary of response is indicated in table 7.

Table 8: Opinion on the need to develop waste management policy

Do you think there is a need to develop specific policy to address waste management?	**Frequency**	**Percentage**
Yes	15	62.5%
No	6	25.0%
Not Important	3	12.5%
Total	**24**	**100%**

Source: Official Interviews, July 2007

4.1.3 Implementation of environmental Legislation

The National Environmental Management Act of 2004 provides a framework for managing the environment in the country. Section 119 of the act provides criteria that are essential to be considered upon the selection of landfill sites. They include; climatic conditions, economic ability, interest of the communities, environmental, hygienic and social benefits and availability of tipping sites. An interview with the head of waste management department of the DCC admitted that the city subsidiary by-law of solid waste treatment, disposal and street littering of 2004, does not provide requirements for solid waste disposal siting, development and operation. He added that according to the environmental act the mtoni dumpsite is considered as unsanitary site which is not economically, environmentally, and socially acceptable area. Refer Appendix 4 but he added that, DCC has realised the weaknesses of by-law and is due to be amended.

The responses from the heads of the waste management section from Ilala, Temeke, and Kinondoni municipalities were very contentious. They argue that administratively waste disposal facilities, including siting and operation have been dispensed to DCC since 2000, following the decentralisation and local government reform programme which divided the city into three municipalities. They further revealed that following this reform, crosscutting issues like securing areas for developing, and operation of landfill is the responsibility of Dar es Salaam city council. That is why their municipal solid waste management by-laws of 2001 do not include siting and operation of landfills. During the interview one of the respondents furiously remarked;

> *"What we have been doing so far is not our fault but is subject to the failure of the Dar es Salaam city council to provide the so called sanitary landfill. Now we are being blamed that we don't excel our duties. All the same politicians are always behind our backs, pushing us to find immediate places where collected waste has to be disposed of".*

4.1.4 Implementation of Dar es Salaam city land use plan

The general land use plan of Dar es Salaam city, the 1979 master plan, zoned areas for the development of sanitary landfill. However during its entire implementation phase, all sites that were designated for landfilling were not developed. In this respect, respondents from central and local government offices were questioned about reasons for the discrepancy on the implementation of the city plan. Respondent from the ministry of lands and human settlement development said that the major factor for the failure of Dar es Salaam master plan implementation is lack of financial resources. She added that most of the city master plans were prepared under the supervision of the ministry of lands with support from foreign countries and then handed to local government authorities for implementation without assisting them with financial resources. In this regard, sanitary landfilling is not the only area suffering from

implementation failure. Several other issues; like the provision of surveyed residential plots, water supply, improvement of roads, and sanitation services. This is also the main reason which has caused the proliferation of unplanned settlements in Dar es Salaam city.

The issues opted by the head of solid the waste management department of the DCC indicate other reasons. The respondent argues that, in the last two decades, solid waste management in general and landfill siting in specific was not a priority of the national government. Efforts were directed to the provision of services like education, health, and water. He also added that the central government directed major resources to these sectors.

> *"What the central government has been emphasizing was also the priority of local governments. Solid waste management was not a priority in most LGA. As a result the little money earmarked for SWM was not even sufficient for refuse collection in all areas. That is why in the late 1980s and early 1990s the situation of the city was critical you could not walk 100m in the city's streets without finding unattended garbage"*

It was revealed that political interference from national and local government leves had significant influence on the drawbacks to the implementation of the plan. There has also been a tendency of diverting the little available resources from waste management to other services that were more government priority. This was also said to be impediment factor for lack of development of sanitary landfills.

> "*Sometimes politicians create problems with regard to the implementation of prepared plans. In 2006/2007 for example, the waste management section was budgeted 175 million Tshs. for the purchase of 3 trailers, 1 tractor, and 1 wheel loader to support waste collection. In the end, these funds were diverted to the construction of secondary school classrooms following the prime ministers appeal. Under such circumstances it is almost impossible to plan for the construction of a landfill, which is even more costly. Therefore we keep the nice plans on the shelf*".

4.2 Landfill siting procedures and adopted criteria

Based on the official interviews, it has been revealed that procedures and criteria to guide the selection of new landfill sites are not in place. This demonstrates that the siting of Mtoni and Kigogo dumping sites complied with neither environmental nor social-economic impacts considerations. The director of environmental compliancy and enforcement and the principle environmental management officer at National Environmental Management Council (NEMC) argued that all solid waste dumping sites in the city has been sited without technical guidelines. They further added that no feasible processes and criteria such as economic, environmental and socio-economic impact consideration have been taken into consideration. It was rather a reckless decision by the three municipal councils for the purpose of getting rid of solid waste from city streets.

This statement was corroborated during an interview with environmental officers from the Vice President's Office Division of Environment which is the ministry responsible for environment. They noted that malpractices on the siting and management of waste disposal facilities within local government authorities is also caused by lack of specific guidelines, laws and minimum requirements for which should

be used as a framework to administer site selection, designing and operation of waste disposal facilities. Key person the DCC particularly the head of the waste management department revealed that, always, solid waste dumping sites are selected under crisis and political pressure. Hereby no clear structure or process is followed. Important aspect like conducting EIA is no part and parcel for decision-making. He claimed that for the siting process followed all necessary procedures including an EIA.

Meanwhile, responses from interviews with the heads of waste management sections from Ilala, Kinondoni and Temeke Municipalities, revealed that all dumpsites were selected based on the concession between local residents and council. They added that the Mtoni sabasaba and the newly established Kigogo dumpsites came into operation following request raised by residents from respective settlements to refill the areas, which had been degraded by water in low lying settlements using municipal waste and thus securing their properties and life.

They nevertheless admitted that other processes like an analysis and a detailed site investigation, including an EIA, were not conducted, as both dumping sites were selected under crisis. The former was established following court injunction on the operation of Vingunguti dumpsite in 2000 the latter has been established after the central government banned the operation of Mtoni dumpsite.

Table 9: Views on processes of siting Mtoni and Kigogo dumpsites

S/N	Site selection process	Frequency	Percentage
1	Preliminary site assessment	4	16.6%
2	Site ranking	NA	NA
3	Discussion with communities	7	29.2
4	Site elimination	NA	NA
5	Detailed site investigation EIA, feasibility study	NA	NA
6	Feedback meeting	3	12.5%
7	Approval by communities	3	12.5%
8	Approval by municipal and city council	7	29.2%
9	Final permit by NEMC	NA	NA
	Total	**24**	**100**

Source: Official interview 2007, NA= No Answer

The only process, which was followed in all cases, was discussion with few local communities and agreements with the municipal council based on the fact that it was intended to rescue properties that were in danger of being degraded by water.

4.2.1 Use of minimum requirement for landfill siting

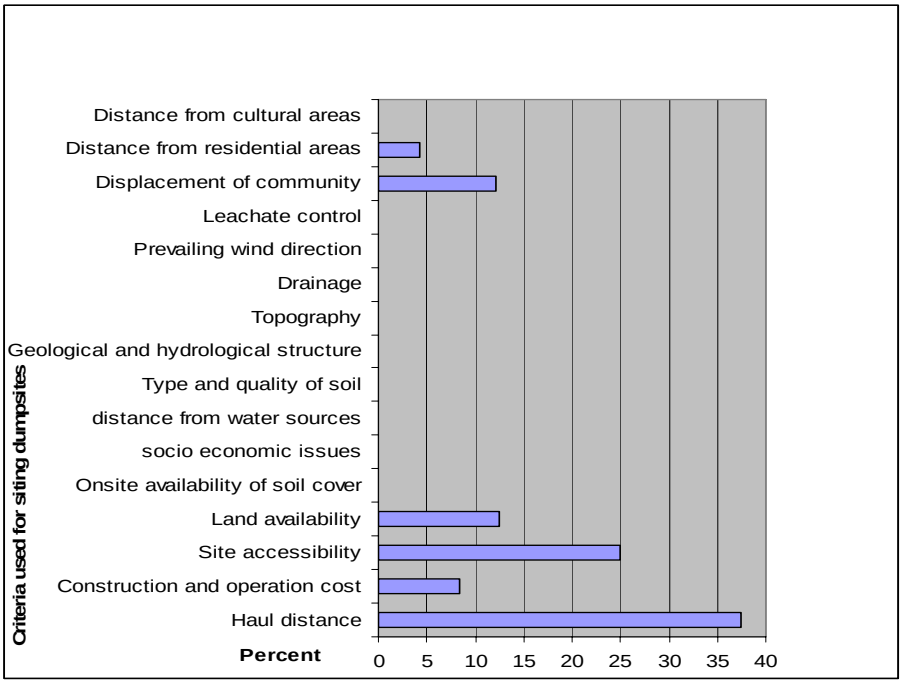
For the question concerning minimum requirements used for the selection of eligible sites to establish a solid waste disposal, fifteen criteria were used. The minimum requirement as indicated by langmore and Jarrod (1998), also in Rushbrook and Pugh (1999) include; determine waste disposal need and inform the public, identification of candidates landfill site, elimination of areas with fatal flaws, ranking the sites, feasibility study, detail investigation and an EIA, to mention a few. In an interview with key persons from Ilala, Temeke, Kinondoni municipalities and DCC indicated that main criteria used for the establishments of Mtoni and Kigogo dumpsites was their proximity to waste generation points (haul distance) site accessibility, land availability and displacement of community. They further added that other factors like

environmental and social-economic impacts were not considered as both sites were established under crisis. They argued that, Muncipal council heeded to the request presented by mtoni and Kigogo residents to reclaim the degraded areas using municipal waste.

Key persons also pointed out this fact from NEMC, VPO, Urban Authorities Support Unit (UASU) and Sustainable Dar es Salaam Project. They all admitted that currently criteria and minimum requirements to guide siting, development, and management of solid waste disposal facilities are not followed. The municipalities have just been taking advantage of using either abandoned quarry or sand sites in places where few residents have requested council to fill eroded land with municipal refuse for the purpose of reclaiming degraded area and to rescue loss of properties and human life. They however admitted that there is a need to develop minimum requirements and criteria to guide the selection of sites and development of landfill in the country.

A key person from MLHSD came up with different arguments. She argues that poor siting of landfills is not caused by the lack of guidelines but rather by implementation weaknesses of local government officials. She further added that in 1991 the Director of Urban Development of MLHSD issued technical guidelines no. 3 for cemetery and solid waste disposal space standard refer appendix 5 to all cities, municipal and town council planners, which among others provided guidelines for size, type and location for solid waste disposal sites. These have however never been considered by none of the local government authorities. The respondent further commented that the space standards were provided to assist municipalities in complying with the national human settlement development policy, which seeks to ensure that every Tanzanian can live in a clean and healthy environment.

Figure 8: Officials opinions on criteria used for siting Mtoni and Kigogo dumpsites



Source: Official interviews Dar es Salaam, July 2007

From the above figure, it can be concluded that, for the siting of the two examined dumpsites in Dar es Salaam city, impacts, which dumpsites can cause to the environment and public health, were not taken into consideration. The figure above reveals that proximity of the site to the city centre (haul distance) is given as the main criteria (37%), followed by site accessibility 25%, land availability and displacement of community (13%). Nevertheless both sites are adjacent to water bodies, which might cause serious pollution due to presence of leachate containing heavy metals from mixed waste including industrial and hospital waste. It is clearly indicates that, environmental factors such as air quality, gas control, depth of water, and geological and hydrological factors were not considered as important.

Image 1: Leachate flow to Msimbazi river valley At Kigogo dumpsite

Image 2: Leachate flow to Indian Ocean at Mtoni dumpsite

Source: Field survey Dar es Salam, July 2007

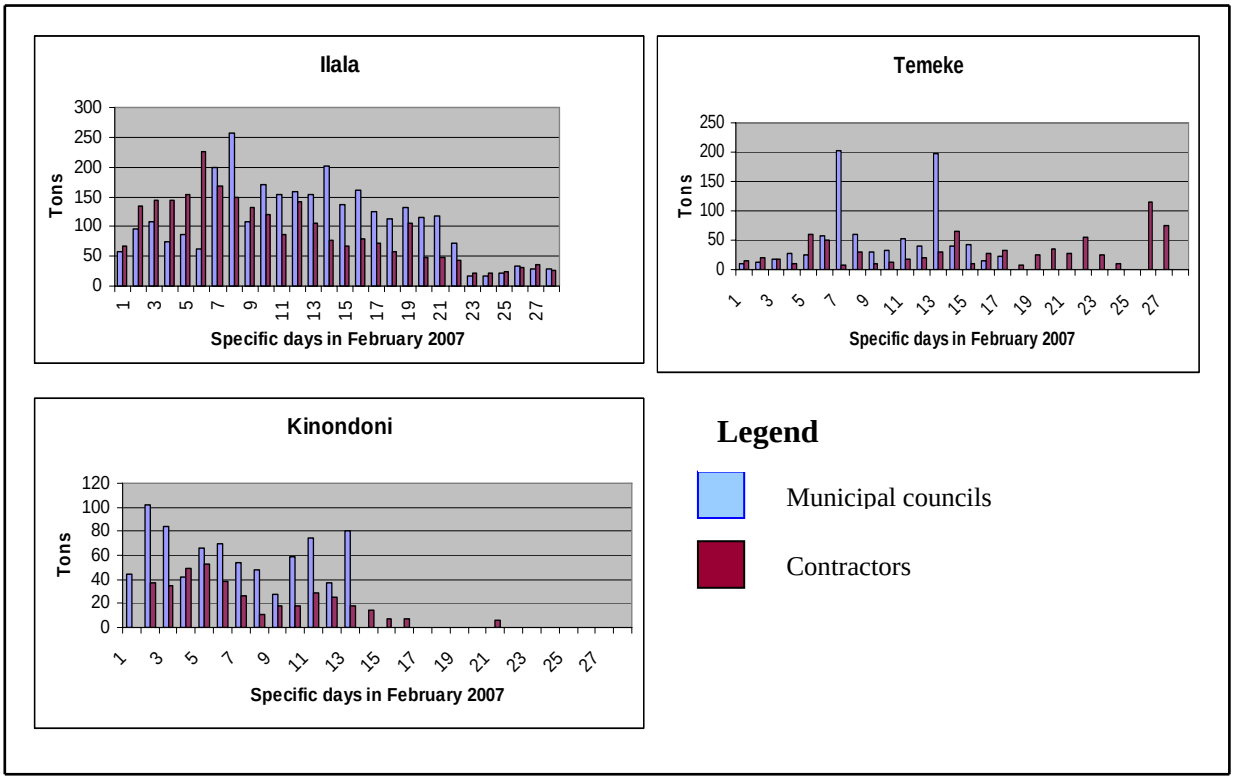
4.2.3 Stakeholders involvement in landfill siting

There is insufficient stakeholders' involvement in the process of siting waste disposal facilities (dump sites) in Dar es Salaam city. This has been revealed by different actors interviewed on the siting of previous and the newly established solid waste disposal sites at Kigogo kati in Kinondoni and Pugu Kinyamwezi in Ilala municipal councils. Based on the official interviews, main actors involved in the siting of both Mtoni and Kigogo dumpsites were the DCC, Municipal experts, WDC, and politicians (councillors).

Except for privatization of solid waste collection services in some parts of the city, all decisions related to the sites for refuse disposal are entirely taken by local government authorities. During interviews with local government officials from Ilala, Temeke and Kinondoni municipalities, controversial statement were raised, arguing that the establishment of the new landfill site at Pugu Kinyamwezi administered by DCC did not sufficiently involve all actors and they did not compromise. As results since its inception in February 2007, neither municipal councils nor private contractors are disposing waste to the newly established landfill reasons being high transport cost as it is almost 70 km from the city centre.

The statement was validated during an interview with the manager of Pugu dumpsite. He said that after the inauguration of the site all municipalities were disposing refuse at the site. However, this trend has been diminishing and currently the new landfill, which is considered a sanitary site, receives less than 60 tones of refuse per day. See figure 9 and 10.

Figure 9: Transportation of refuse to new landfill by the municipalities



Source; Dar es Salaam city council, July 2007

The figures portray insufficient use of the new landfill by all the three Municipalities and private contractors. The amount of solid waste disposed per day in February 2007 was less than 300 tones. As shown by figures above the magnitude of solid waste transported to the new landfill site kept decreasing and some of the municipalities indefinitely stopped. All the municipalities and private contractor are now disposing the collected refuse at the newly established "Kigogo" dumpsite.

Similar argument was raised during interview with Director of environmental compliance and enforcement at NEMC. He remarked that the environmental act requires the municipal council to seek a permit from the NEMC to establish a landfill site. He added that in practice no permit requests have been presented to NEMC prior to the establishment of Mtoni and Kigogo dumpsites

Along with that, an interview with key person from two NGOs (LEAT, ENVIROCARE) also raised similar concern on insufficient stakeholders' involvement in dumpsites siting process. They both alleged that no NGOs in the country particularly those dealing with environmental issues have been involved in landfill site selection process. They further commented that the former and the newly established dumpsites did not take part in final decision for its location. They also insisted on the significance of stockholder's involvement in the siting processes as this facilitates to take into account all necessary factors and values without compromising the health and environmental well being of local communities living near the envisaged dumpsites.

4.2.4 Extent of community involvement in the siting of dumpsites

Community participation is an imperative factor to be taken into account in the siting of solid waste disposal facilities. According to Langmore and Jarrod (1998), community involvement assures public acceptance on the proposed sites as they would always need a guarantee on how possible adverse impacts such as public health, quality of life, property values, and natural environment will be protected and also facilitate to avoid the NIMBY[10] syndrome.

With regards to this aspect a question was set to assess the extent of public involvement during the siting of the Mtoni and Kigogo dumpsites. In total 37 households were interviewed comprising 20 and 17 households from Mtoni and Kigogo respectively involving residents living close to these dumpsites were interviewed. For the clarity of data received from the household several social variables that could affect the quality of responses were considered.

The variables included sex, age, marital status, levels of education, residence status and distance of houses from the dumpsites. Table10 summarises social characteristics of the respondents.

[10] NIMBY Not In My Backyard

Table 10: Social characteristics of respondents Mtoni and Kigogo settlements

Variable name	Frequency	Percent
Sex		
Male	18	48.6
Female	19	51.4
Age group		
15-25	3	8.1
26-35	8	21.6
36-45	11	29.7
46-55	7	18.9
56-65	5	13.5
66-75	3	8.1
Marital status		
Single	5	13.5
Married	29	78.4
Widow	3	8.1
Level of education		
Primary	18	48.6
Secondary	7	18.9
College	9	24.3
University	1	2.7
Other	2	5.4
Residency status		
Owners	24	64.9
Tenants	13	35.1
Distance of house from dump site		
0-50m	14	37.8
51-100m	10	27.0
101-150m	1	2.7
151-200m	12	32.4

Source: Household survey, July 2007

From the household survey only 35%of the sample population from mtoni dumpsite revealed to have been involved on final decisions towards siting of the dumpsites through meetings and discussions, while those who were involved in Kigogo consisted 47.1%. The data also shows that only house owners were involved in the decisions for the location of dumpsites in these settlements. Despite the fact that hazards caused by unsanitary landfills cut across all levels society in urban setting (Langmore and Jarrod, 1998), (Nickolas and Priscilla, 2007). Table 11 and 12 illustrates the extent of community participation.

Table 11: Community involvement on the siting of dumpsites

A. Mtoni residents

Variable	Frequency	Percent
Yes	7	35.0
No	13	65.0
N=20		

B. Kigogo residents

Variable	Frequency	Percent
Yes	8	47.1
No	9	52.9
N=17		

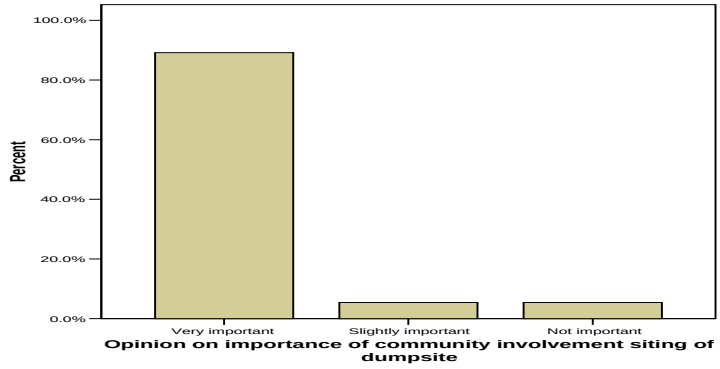
Source: Field survey Dar es Salaam, July 2007

Based on the above results the proportion of local residents involved in siting of the two dumps in Dar es Salaam city was very small. This is rather contradictive with the arguments from the local government authorities that both dumpsites were established

following requests from local residents. This verifies the fact that most of dumpsites in the city had been operational for short time as they are being closed down following an outcry of the communities or high court rulings.

The sample population highlighted that community involvement in the selection of the location of a landfill is fundamental. From official and households interviews shows that over 90% identified community involvement and influence in site selection process as a very important factor to ensure the site to be developed as dumpsite is environmentally sound and socially acceptable. Only 5% of the sample population indicated community involvement as slightly important and 5% indicated as not important. This demonstrates that people are concerned with their living environment. The figure below provides summarised opinions from the respondents.

Figure 10: Importance of community involvement in the siting of landfills



Source: Official and household interview; July 2007

4.3 Community perception on impacts caused by dumpsites

There are wide ranges of impacts associated with crude dumping of solid waste. The analysis included responses from these respondents to the fact concerning about the impacts of dumpsites and were ranked in order of the importance by the respondents. The nine different impacts included visual appearance, ground and surface water pollution, health hazards, fire explosion, bad odour/pungent smell, air pollution, insect/flies and animal attraction, littering of waste and noise pollution. The responses ranging from the most to the least serious impacts caused by dumpsites as perceived by respondents are indicated in the Tables below

Table 12: responses from Mtoni dumpsite on the most serious impacts

Variables	Frequency	Percent
Air pollution/smoke	5	25.0
Health hazards	3	15.0
Fire explosion	3	15.0
Bad odor/pungent smell	6	30.0
Insect/flies/animal attraction	3	15.0
N=20		

Source: Household survey; July 2007

Table 13: responses from Kigogo dumpsite on the most serious impacts

Variables	Frequency	Percent
Ground and surface water pollution	1	5.9
Air pollution/smoke	1	5.9
Health hazards	4	23.5
Bad odor/pungent smell	10	58.8
Insect/flies/animal attraction	1	5.9
N=17		

Source: Household survey; July 2007

Based on the similar characteristics of both settlements for which they are informal and consisting low income residents, the respondents revealed similar perception on impacts caused by unsanitary landfills. From table13 and 14 both settlement indicated bad odour/pungent smell as the most serious impact they face. This was indicated by 30% of sample from Mtoni dumpsite, while in Kigogo it was indicated by 58.8% of the sample. On the other hand there is slight different on the least perceived impacts from the two settlements. While Mtoni dumpsite ranked air pollution/smoke 25% as the second problem followed by health hazards, in Kigogo health hazards was ranked the second with 23.5%. From these results it can be concluded that nearly one third of the sampled population from both sites are not aware of the long term impacts caused by dumpsites.

Only small proportion of the sampled population is knowledgeable on the longterm impacts like ground and surface water pollution

Image 3: Crops grown at downstream of the present Kigogo dumpsite

Source: Field survey July 2007

This is affirmed by the fact that agricultural activities are taking place on plots close to the dumpsites. Various vegetables such as spinach, cabbage, and maize are grown, despite the oozing out of leachate from the dumpsite, which may contain heavy metals originating from various industrial, and hospital wastes disposed at the dump.
This endangers the health of those who consume these vegetables. House owners favoured the dumpsite as it helped to rescue their houses from being degraded by water. The data also reveal that the interviewed respondents are apparently more concerned about their physical properties than their health. A 65 years old respondent from Kigogo dumpsite remarked:

> "*My son this house is the only property I possess. I have spent all my resources to invest in this house, and it is the only asset that I can pass on to my children and grand children. I had to do everything to make sure that my house is protected. The nuisances from the dumpsite like smell, fire e.tc. are temporarily and we can tolerate but if my house is gone it will be a big disaster to my entire family. It is better to have the dump than to let it degraded by erosion"*

4.4 Perceptions on a clean and healthy living environment

Community awareness on rights to enjoy a clean and healthy living environment is a fundamental factor that greatly determines the ability to accept or contest the establishment of dumpsites within settlements (Sloan, 1993). The research therefore focused on querying respondents in responses to the question concerning citizen's knowledge on their rights to live in clean and healthy environment.

Data illustrate that a big proportion of the respondent is not aware of the rights. This was reflected in both settlements depicting similarities on the level of awareness in the two settlements. About 50 % of the interviewed respondents in mtoni indicated that they don't understand at all, while in Kigogo was indicated by 47.1%. Very few interviewed respondent indicated that they strongly understand their right, this consisted only 10.% and 11.1% in both Mtoni and Kigogo dumpsites respectively. The summaries of responses are presented in table 15 and 16.

Table 14: Citizens knowledge on rights to live in healthy environment

Mtoni dump site

Variables N=20	Frequency	Percent
Strongly understand	2	10.0
Slightly understand	8	40.0
I dont understand	10	50.0

Table 15: Citizens knowledge on rights to live in healthy environment

Kigogo dumpsite

Variables N=17	Frequency	Percent
Strongly understand	2	11.8
Slightly understand	7	41.2
I dont understand	8	47.1

Source: Household survey; July 2007

A cross-classification analysis was conducted to assess the likely existing relationship between socio economic characteristics of the sampled population and their awareness on the rights to live in clean and healthy environment and participate in decision making pertaining siting of solid waste disposal facilities

The data show that there is a significant relationship between the level of education and awareness of the respondents on the rights to live in a clean and healthy environment. 50% of the sample population from mtoni dumpsite all with primary education background indicated that they don't understand their rights, while Kigogo respondents with similar education background indicated 47.1%. On the other hand, population sample with secondary education indicated that they slightly understand and those with a college and university education background were the ones who indicated as they strongly understand their rights.

Lacks of knowledge on their rights for most uneducated residents expose them to vulnerability of social exclusion, as most of dumpsites in the city are located in these communities. However, it was also noted that this does not correlate with active participation of on decision-making. This was reflected by 80% and 76% from Mtoni and Kigogo respectively, indicating that were ready to participate in the siting of dumpsite.

4.5 Accommodation of waste pickers at waste disposal

A common feature at most dumpsites in the developing countries is the occurrence of waste pickers. Waste picking has become an employment opportunity for urban poor and is encouraged to be integrated in the management of solid waste disposal (Rushbrook, 1999). With regard to this aspect, public officials were questioned on the importance of integrating waste pickers at the dumpsites. Based on the official interviews waste pickers are seen as the problem to management. 24 respondents from nine different institutions consisting central and local government authorities and two NGOs were interviewed. 67% indicated as not important, 23% indicated slightly important and only 10% indicated accommodation of waste pickers as very important at dumpsites.

On the other hand lack of basic services like water and sanitation at dumpsites appeared to be major problem faced by waste pickers. This was indicated during the interviews with six (6) waste pickers at Kigogo dumpsite. 50% of the respondents indicated lack of sanitation as major problem they face followed by lack of drink water supply, periodic policy arrest, and robbery. During an interview with a scavenger explaining a magnitude of the problems had this to say;

> *"the government doesn't care about us. On this dump there is no toilet where people can serve themselves, each one of us find his/her own ways, just look around all these food vendors if you ask them where they fetch water for cooking you will be surprised, It is only God who keeps us alive"*

There is hardly any recognition of the presence of waste pickers by the local government authorities in the management of waste disposal sites. This was depicted during interviews with six (6) waste pickers at Kigogo dumpsites of whom 50% indicated the need for recognition by the local government authorities followed by 33.3% who indicated the provision of drink water supply. This portrays that local government authorities does not consider waste pickers as important stakeholders in the management of dumpsites. That is why most dumpsites have not been provided with basic services. The only feasible investment that can be realised is provision of access road to the dumpsites

Image 4: Waste pickers sorting valuable items at Kigogo dump

4.6 Conclusion

This chapter has unveiled siting of dumpsites in realities. It has revealed a big discrepancy between what is required to be done based on principles processes, standards with respect to siting of landfill and the actual practices on ground. It has also depicted that even policy and legislation developed by the government are not complied. On the other hand decision-making process with respect to siting of landfill is still confined into few individuals.

There is limited public and stockholder's participation on the siting and management of dumpsites. The analysis has also showed a significant percentage of the sample population are not aware about various long term impacts caused by unsanitary landfills. Most of the local communities in low-income settlement close to the dumpsite have shown much concerned about their physical properties than their health a situation which DCC and Municipal authorities have been taking advantage for locating dumpsites as a means to reclaim degraded land threatening to destroy their houses. The study also empirically proved that minimum standards and technical guidelines for guiding siting of landfills are not in place, a situation which has led to the continued haphazard siting of dumpsites in the city.

CHAPTER FIVE: CONCLUSION AND RECOMENDATIONS

5.1 Introduction

This chapter consist of three parts. The first part provides the final conclusions from the study in relation to the research questions, and assumptions posed in chapter one. The second part covers reflections on theories examined from literature on landfill siting in chapter two. The final part proposes recommendations based on the findings and directed to improvement measures required for sustainable siting of solid waste disposal facilities in Dar es Salaam city and other developing countries.

5.2 Final conclusion

This study aimed at examining the sustainability of the siting processes, procedures and criteria used for siting urban solid waste disposal facilities and assess the levels of communities' awareness on impacts caused by unsanitary waste disposal. The study attempted to answer two main research questions; **how sustainable are siting processes, procedures and criteria for solid waste disposal facilities in Dar es Salaam city? How aware are the selected communities about the impacts of unsanitary disposal of waste in Dar es Salaam city?** The two main research questions were supported by six sub- questions, and the conclusions are pinched from the realities of the siting of dumpsites in Dar es Salaam city, based on interview results from government officials (local and central), NGOs, households and waste pickers.

For the purposes of gaining an insights on how to answer the research questions, the analysis of data, was based on the assessment criteria derived from literature review in chapter 2. This was done through comparing procedures and criteria outlined in the literature with actual siting processes and criteria adopted in Dar es Salaam city.

The study has unveiled that the majority of disposal sites in Dar es Salaam city are open dumps generally located within urban setting in the close proximity of informal settlements predominantly next to surface water sources and wetlands. The location of dumpsites in the city does not conform the social, economic and environmental considerations that need to be taken into account; the siting process is and will therefore be unsustainable. This is also inflicted by the fact that technical guidelines, alternative specifications and minimum requirements to guide site selection whenever a new site is to be planned for are not in place. The only factor which seems to be important and mostly considered by the city authorities is space availability, proximity to waste generation sources in order to save transport cost and compromises made by minority of local residents and leaders living close to the proposed sites.

Another evidently aspect, which was found to impede the sustainability of disposal siting, is limited public and stakeholders involvement in the siting process. Despite the existence of different organisations and actors with a stake in waste management in general and SWD siting in particular including; VPO, NEMC, MLHSD, DCC, and NGOs to mention a few, it was found that decisions on where to locate dumpsites in the city are basically made by the city authorities solely. Although a small proportion of residents living close to dumpsites are involved, they do not represent the interest of all citizens particularly if are the poor who are the victims of the siting procedures. Furthermore, NEMC, which is the central government agency with mandate to approve and issue permits for landfill site development, has never been consulted. As a result, the life span for the most recent dumpsites in the city was less than 10 years whereas usually a life span of 25 -30 years is recommended (Langmore and Jarrod, 1998), due to litigation raised by the public against city councils following realization of nuisance and

adverse impacts caused by dumpsites. In several instances, the DCC has been ordered to close down dumpsites based on central government appeal or the high court proceedings.

The study also examined in how far the DCC took into account environmental and socio-economic impacts considerations during the siting of the dumpsites. To assess the extent of integration, indicators such as abutting land uses, proximity to water sources and sensitive ecosystem area, existing geological and hydrological conditions, distance from water sources, topography, haul distance and community values that need to be considered were used. Based on these indicators, assessment was conducted by comparing described criteria alongside with the fulfilled procedures by the city councils in the siting of dumpsites.

The study unveiled that these factors are not integrated in landfill siting process by Dar es Salaam city councils. This is demonstrated by the current location of dumpsites next to surface water sources, wetlands and human settlements. Furthermore, there are no pollution control mechanisms in place; leachate and landfill gasses like CH_4[11], CO_2[12], emitted from dumpsites, are directly discharged to the natural environment, which, despite pollution of surface and ground water, also reduces the carrying capacity of the existing ecosystems. In most instances, the evidently management mechanisms practised at dumpsites are refuse scattering and compaction only. This is done by means of heavy equipments like bulldozers and compactors on irregular basis.

The second focus area of this study involved examination of awareness levels and perception from selected communities living close to dumpsites on the impacts which unsanitary waste disposal can have on their health and living environment. The findings of the research indicate that a significant percentage of the responding sample did not know about various long-term adverse impacts caused by unsanitary waste disposal. Interviewed respondents indicated strong pungent smell/bad odour as their main problem.

This was also reflected during household's interviews and author's observations. Looking at livelihood activities of these households, it became clear that, they are not aware on the adverse impacts. The growing of crops in these settlements was found to be an important livelihood strategy for the urban poor as it reduces the amount of little income expended on food; however, it was found that vegetables are grown using water ponds with high leachate concentration. Additionally, surrounding communities use the dumpsites as potential source of animal feed as most of them hold pigs close to the dumpsites. This surely poses potential adverse health impacts through food chains as concluded by the research on waste agriculture (Plumers and Hart 1996). These characteristics provides an array of potential environmental impacts to the surrounding communities

The study uncovered that the respondents of surrounding informal settlements consider their material possessions particularly physical properties (houses) more important than their actual health. It was found that, houses as only in-heritage for their children, they had to strive to protect from being degraded. During interviews some households revealed that, in a bid to overcome the natural hazards, they requested the municipal authorities to reclaim the degraded area by using it as refuse dumpsites, and were ready to tolerate the nuisance as long as the threat to their houses is eliminated. Although

[11] CH_4 is the Methane gas emitted from dumpsites
[12] CO_2 is Carbon dioxide gas emitted from dumpsites

some admitted that the presence of dumpsites within their living environment is uncomfortable, the threat posed to their houses by water was much greater than discomfortability caused by the dumpsites.

The findings revealed that, there is urban social exclusion particularly for people living in low-income settlements. The history of Dar es Salaam in respect to the siting of SWD, has proved that, all the dumpsites in the city has been located in direct proximity into low income settlements. The argument raised is that it is community driven initiatives for the purpose of reclaiming degraded land and securing their properties from being demolished.
This argument, demonstrate that, the government is increasing social exclusion as the rights of these people are ignored. Nevertheless, it is clearly stated in the constitution and environmental management act that, every person living in Tanzania shall have the right to clean, safe and healthy living environment including people living in informal settlements. However when it comes to siting of dumpsites, this aspect is completely ignored. The social exclusion is also inflicted into waste pickers. It was found that despite the role played by waste pickers at dumpsites, whom waste sorting and recycling is their only means of livelihood, the local government do not recognise them as potential actors for waste minimization. There are no evident strategies to formalise the activities of scavengers at dumpsites,

Another important finding highlighted from the study is the weak institutional coordination and enforcement of laws, which consequently impedes the sustainable siting of landfills in Dar es Salaam city. The DCC has statutory mandate for siting, development and operation of landfills in the city; however, it does not execute this power and responsibilities. Lack of financial and human resources coupled with absence of enabling polices, legislations, and technical guidelines are considered to limit the extent to which siting of dumpsites can be executed at minimum standards for sanitary environmental sound practices.

The study also revealed that, the implementation of the SDP has no significant impacts on the improvement of siting, development and operation of dumpsites in Dar es Salaam city. Although solid waste was earmarked as the priority problem to be addressed by SDP, but very little political and institutional attention has been directed on sanitary practices of SWD. Consequently, the practice of open dumping as the method for waste disposal employed by municipalities is still in place. Futhermore, the existing guidelines that contradicts with environmentally sound waste disposal development has not been changed during the implementation of the SDP.

5.3 Reflection of the findings to theoretical framework

The literature review in chapter two, enabled the author to develop a conceptual framework and consequent formulation of questionnaires used during primary data collection. The reviewed literature facilitated to expand author's knowledge on the important criteria that must be considered prior to landfill siting.

The literature has clearly unveiled the logical sequences of processes and procedures guiding the siting of landfills, and the importance of complying with minimum requirements. It was also clearly articulated by several authors that, public and stakeholders' participation as a significant stage towards public acceptance. The most important stages to follow during landfill site selection include; informing the public about the project through meetings, preliminary site investigations and elimination, social consideration, feasibility studies including EIA, seeking public and council

approval to mention a few. These stages have to be backed up with basic criteria that must be considered in the field of social, economic, and environmental aspects. These criteria are well adopted by countries in the north. However, the situation is different for many cities from developing countries like Tanzania.

Landfill siting based on the integration of economic, social, environmental, and a safety criterion with full public and stakeholders' participation is perhaps a foremost challenge for the implementation of sustainable landfilling. Although a properly sited, designed and developed landfill is imperative in solid waste management system, this seems difficult to be achieved by cities like Dar es Salaam due to the fact that, successful landfill siting and operation depends on many linked factors, such as; the political influences, government priorities and commitment, existing social status, priorities of local communities, and awareness on potential impacts, existing policies, legislations and its enforcement, and finally financial and human resources capacities.

The siting of dumpsites in Dar es Salaam city portrays a clear indication of non-compliancy of fulfilling minimum requirements stated in the literature. All criteria that are aimed at ensuring selected sites for landfills are environmentally and socially acceptable are not adopted. Along with that lack of community awareness on hazards caused by unsanitary landfills leads to a preference of material possession above their healthy. The landfill siting framework highlights stages, procedures and criteria to be used in all phases during of landfills siting. However t, from the perspective of the author, the discussions on landfill siting are centred on activities. Little attention is paid on responsibilities of different actors and stakeholders, to describe who should do what, and in what way.

Furthermore, the existence of laws, guidelines and standards has been pointed out as important components for environmentally sound siting of landfills. However if there are no incentives when the laws and regulations are not obeyed, impede the compliancy in the siting and operation of landfills. The fact that, waste is considered useless material and to get rid of it as quickly as possible, solid waste disposal does not receive the required attention to how and where has to be sited particularly in the developing countries. In this case the recommendations are based on the findings and reviewed literature.

5.4 Recommendation

The recommendations are divided into three parts; they include institutional, environmental, and social aspects

Institutional/economic recommendation

Dar es Salaam city being economic, industrial and administration centre of the country, the central government should render financial, technical and human resources assistance to the DCC for the development of sanitary landfill that will cater for solid waste disposal facility for the three municipalities. The Vice President's Office –and National Environmental Management Council (NEMC) in liaison with other sector ministries should develop solid waste management policy and strategy with a broad range of interventions including siting and management of waste disposal facilities.

The DCC in collaboration with central government has to find the possibilities of attracting private investors on the development and operation of sanitary landfill in Dar es Salaam city

Social recommendation

For continued land reclamation, municipal authorities (Ilala, Temeke, Kinondoni) in liaison with the DCC and Ministry of works, should consider the possibilities of using waste soil from road construction projects and demolition debris from housing rehabilitation/construction works as landfilling materials, wherever there is a need to reclaim land degraded by water in the human settlements, instead of using municipal refuse. Also the DCC should recognise and accommodate waste pickers (scavengers) at landfill sites for waste sorting, as they have potential role of waste separation. Through accommodation of waste pickers, it provides employment opportunities for the urban poor and promotes the growth of recycling industries.

The central government in liaison with NGOs and CBOs should introduce on going awareness and sensitization campaign to educate local communities and other stakeholders on adverse impacts caused by unsanitary landfills and encourage them to participate in the siting process whenever a new landfill site is required.

The DCC which has a statutory mandate for siting, establishment and operation of landfills in Dar es Salaam city should ensure that, landfill site selection is conducted with full public and stockholder's participation including private contractors who are collecting refuse in the city

Environmental recommendation

Due to potential soil and water contamination with heavy metals as results of dumping of waste (Industrial, domestic and hospital), the central government in liaison with DCC should restrict human activities like agricultural and livestock keeping and use of water from boreholes dug in areas close to dumpsites for human consumption.

The NEMC in collaboration with other sector ministries and local government authorities should develop technical guidelines and specifications that will be used as minimum requirement for the siting, development, and operation of landfills and in addition to remediation and closure of the existing dumpsites

NEMC should strengthen environmental monitoring and use its power to administer punitive measures for any local government authority, which establish landfill without complying with sanitary practices.

The DCC should develop the proposed landfill at Pugu Kinyamwezi as soon as possible and should make it obligatory for all municipalities to dispose collected refuse at the new landfill. Nevertheless The DCC in collaboration with the three municipalities should also consider the possibility of establishing transfer stations where collected refuse shall be stored before it is transported to new landfill site for final disposal.

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Appendix 1: Guiding questions for interviews

1. Guiding questions for the households (Mtoni and Kigogo settlements)

Open questions:

1. Name …….
2. Gender…….
3. Age……..
4. Marital status……
   Single ☐ Married ☐ Divorced ☐ Widow ☐
5. Level of education

   Primary ☐ Secondary ☐ College ☐ University ☐ Other ☐

6. What is your resident status in this settlement or

   Owner ☐ tenant ☐ other ☐
7. How long have you been living in this area?……
8. How far is your house from the dumpsite?

   100m ☐ 200m ☐ 50m ☐ other ☐
9. How did you know the dumpsite is sited close to your community?
10. What was your reaction when you knew your neighbourhood was selected to host a dumpsite?
11. Were you involved in the process of final selection of this area to host the dump site?
    Yes ☐ No ☐ if yes
12. What were your roles and responsibilities in the siting process?
13. What is your opinion on the importance of community involvement in the siting of dumpsites?
    Very important ☐ slightly important ☐ Not important ☐
14. Do you know any negative impacts/ problems caused by landfill in general?
    Yes ☐ No ☐
15. Can you please mark the problems caused by unsanitary landfill in the order of seriousness using number 1- 9
    a. Visual appearance ☐
    b. Ground and surface water pollution ☐
    c. Air pollution ☐
    d. Health hazards ☐
    e. Fire explosion ☐
    f. Bad odour/fumes ☐
    g. Insect and animal attraction ☐
    h. Noise pollution ☐
    i. Littering of waste ☐
16. How often are you confronted with these problems? How have you been addressing them?.....
17. What could be appropriate measures to address these problems?
18. Do your children happen to play to the dumpsite or nearby? What risks/problems are they confronted with?
19. Do you have a well around your house? Or where do you fetch water?
20. Do your children happen to play at the dumpsites or nearby? What risks are they confronted with?
21. Do you have a vegetable garden around your house or settlement? What crops do you grow?
22. What is the main source of your drinking water
    Tape water ☐ Bore hall ☐ Deep well ☐ other specify ☐
23.
24. What could be appropriate measure for the government to do?
25. Do you know any organisation within your community (Mtoni) which worked with the municipality on site selection for this dump?
    Yes ☐ No ☐

26. If you were invited to participate in the decision making for this site to be a dump would you agree it? If yes why? If not what are the reasons?
27. Do you know any one from the community who was involved during the site selection? how was he/she involved and who selected them
28. What is you opinion about the operation and management of the dumpsite?
29. What do you think should be improved in the selection and management of dumpsite?
30. How would you assess your understanding on the right to clean, safe and healthy living environment?
    Strongly understand ☐ slightly understand ☐ I don't know ☐
31. What is your general comment to the government about the problems caused by the existing dumpsite to the environment and public health

2. Guiding questions for Municipal Town planning officer

1. How is the siting of landfills carried out in the city?
2. Are there any guidelines/standards which administer the selection for a new dumpsite?
3. Does the municipality have set aside potential areas for the location for new dumpsite?
4. How were these areas selected? and who were involved in the selection process?
5. What are your opinions on the existing policies and legislation framework towards addressing solid waste management issues in general and landfill siting and operation in particular?
6. Why areas zoned as sanitary landfill sites in the city master plan of 1979 were not developed?
7. What is your opinion on the importance of community and stakeholders involvement on selection of areas for locating a dump site?
   Very important ☐
   Slightly important ☐
   Not important ☐
8. As a municipal physical planner were you involved in the siting process?

   Yes ☐ No ☐
9. What was your main role during the siting of Mtoni/Kigogo dumpsites?
10. What impacts / problems have these dumpsites caused to environment and human?
11. Based on your experiences what criteria have been considered for siting of Mtoni/Kigogo dumpsites ?
    (a) Distance from solid waste collection
    (b) Construction, operation and maintenance cost
    (c) Geological assessment of the proposed site
    (d) Depth of water table
    (e) Environmental problems developed by landfill site
    (f) Adjacent land uses and land values
    (g) Approval of site by local residents
    (h) Approval of selected site by local government
    (i) Conduct EIA and feasibility study
    (j) Socio economic consideration
    (k) Presence of scavengers who collect waste for their interest
12. What is your opinion on the importance of community and other stakeholders' involvement in selection of areas for locating a dump site?
    Very important ☐ slightly important ☐ Not important ☐
13. Based on your knowledge and experiences do you think environmental standards are adopted in the selection process? How is it done?
14. How were the residents of …… involved on decision-making on siting of the dumpsite in their settlement?
15. What other stakeholders were involved in the site selection process? How were they selected
16. What is your opinion on the level of awareness of the communities on hazards caused by unsanitary dumpsites? Awareness is high ☐ Awareness is low ☐ Not aware at all ☐

3. Guiding questions for Municipal environmental officer

1. How was the current dump site selected?
2. What process and criteria that are adopted to administer site selection for the location of new dump site in your municipality?
3. Who are the key stakeholders involved? And what were their roles and responsibility during selection process?
4. What were their advices with regard to current location of dumpsite? And how were they incorporated into decision making?
5. How were these areas selected? and who were involved in the selection process?

6. What are your opinions on the existing policies and legislation framework towards addressing solid waste management issues in general and landfill siting and operation in particular?
7. Why areas zoned as sanitary landfill sites in the city master plan of 1979 were not developed?
8. When was Mtoni/Kigogo dumpsite selected and started its operation?
9. What is your opinion on the location of Mtoni/Kigogo dumpsite?
10. How is the municipal council involved in decision making for the location of new dumpsites?
11. Based on your experiences what criteria have been considered for siting of Mtoni/Kigogo dumpsites ?
    (a) Distance from solid waste collection
    (b) Construction, operation and maintenance cost
    (c) Geological assessment of the proposed site
    (d) Depth of water table
    (e) Environmental problems developed by landfill site
    (f) Adjacent land uses and land values
    (g) Approval of site by local residents
    (h) Approval of selected site by local government
    (i) Conduct EIA and feasibility study
    (j) Socio economic consideration
    (k) Presence of scavengers who collect waste for their interest
12. Who endorse the final site selected land for development of dump site?
13. What impacts / problems have these dumpsites caused to environment and human living environment?
14. What strategies and mechanism are in place to minimize pollution from the dumpsites?
15. Are there any guidelines and standards used to evaluate potential sites for locating dumpsite? How are they adopted?
16. How were the residents of Mtoni/Kigogo involved on decision-making on locating the dump site in their settlement?
17. What is your opinion on the importance of community and other stakeholders involvement in selection of areas for locating a dump site?
    Very important ☐ Slightly important ☐ Not important ☐
18. What mechanism are used to ensure that community opinions and concerned are taken into consideration?
19. What should the national government do to improve siting and management of waste disposal facilities in the city?
20. Are there any constraint and limitation concerning the siting of dumpsite in the city?
21. Do you have any opinion concerned with the current practices of securing land for locating dumpsites?
22. What is your opinion on the level of awareness of the communities on hazards caused by unsanitary dumpsites? Awareness is high ☐ Awareness is low ☐ Not aware at all ☐

4. Guiding questions for PMO-RALG Urban Authorities Support Unit (UASU)

1. What national policies and strategies are in place on SWM in general and municipal land filling in specific?
2. Are there any specific guidelines or environmental standards administering the selection of sites for development of solid waste disposal facilities?
3. What are your roles in the process of siting municipal waste disposal site?
4. Based on your experiences why areas zoned as sanitary landfill sites in the city master plan of 1979 were not developed?
5. What kind of interventions that are carried out when municipalities locate a landfill in places which are vulnerable to natural environment and public health?
6. What interventions have been taken so far with regard to location of landfills in areas which are environmentally not conducive? (Mtoni, vingunguti, Kigogo dump)
7. Are there any capacity building activities for municipal authorities in the field of SWD facility siting and management?
8. Does your office provide any financial resources to support the improvement of municipal solid waste disposal facilities development and management?

17. What is your opinion on the level of awareness of the communities on hazards caused by unsanitary dumpsites? Awareness is high ☐ Awareness is low ☐ Not aware at all ☐
9. What are your general observations with respect to the siting of solid waste disposal facilities (landfills) in the country in general and Dar es salaam city in particular?

10. What are the future plans and strategies for the promotion of waste management practices to the local authorities in general and sanitary land filling in particular?

5. Guiding questions for Sustainable Dar es Salaam project and the working group on SWM

1. What were your roles during the selection of Mtoni/Kigogo settlement for the location of dumpsite?
2. On your opinion does the current location of Mtoni/kigogo dumpsites fits to principles of sustainable development?
3. What criteria and standards were used for development of dumpsites?
4. How were the communities from the areas located dumpsite involved in the decision making?
5. What are your roles with regard to siting and management waste disposal in the municipalities?
6. Based on your experiences why areas zoned as sanitary landfill sites in the city master plan of 1979 were not developed?
7. How does the siting of landfills integrate environmental policies and legislations? Does the current policies and legislation framework sufficiently address solid waste management issues?
8. Has the institution done any research to assess the level of pollution caused by unsanitary landfills in the country in general and Dar es salaam city in particular? Are there any empirical data?
9. What is your opinion on the importance of community and other stakeholders' involvement in selection of areas for locating a dump site?
   Very important ☐ Slightly important ☐ Not important ☐
10. Based on your experiences what problems have been caused by Mtoni/vingunguti/kigogo dumpsites to the residents? And to the natural environment?
11. What strategies and intervention have been undertaken to address such problem?
12. What were the efforts in the field of SWD facility siting during the SDP implementation?
13. What strategies are in place to ensure sustainable siting and operation of solid waste disposal facility in cities?
14. What is your opinion on the level of awareness of the communities on hazards caused by unsanitary dumpsites? Awareness is high ☐ Awareness is low ☐ Not aware at all ☐

6. Guiding questions for National Environmental Management Council (NEMC)

1. Do you have any environmental standards or guiding principles for siting of waste disposal facilities in the country?
2. What are your roles with regard to siting and management waste disposal in the municipalities?
3. Are there any environmental impact assessment carried out prior to the selection of site for the operation of dumpsite?
4. Are there any mechanisms to enforce municipality to carry out EIA prior to site selection for dump site? How is it done?
5. How often do you inspect the operation of the dumpsites?
6. What actions have been taken for the operation of unsanitary landfills in the city?
7. What are your opinions on the existing policies and legislation framework towards addressing solid waste management issues in general and landfill siting and operation in particular?
8. Based on your experiences why areas zoned as sanitary landfill sites in the city master plan of 1979 were not developed?
9. Has the institution done any research to assess the level of pollution caused by unsanitary landfills in the country in general and Dar es salaam city in particular? Are there any empirical data?
10. Based on your experiences what problems have been caused by the Mtoni/vimgumguti/Kigogo dumps to the residents? and to the natural environment? What intervention have been taken to address these problem?
11. Has the office ever received complains from the residents, politicians or activist with regard to the location of mtoni dumpsites?
12. What strategies are in place to ensure sustainable siting and operation solid waste disposal facility in cities?
13. What is your opinion on the level of awareness of the communities on hazards caused by unsanitary dumpsites? Awareness is high ☐ Awareness is low ☐ Not aware at all ☐

14. What is your opinion on the importance of community and other stakeholders' involvement in selection of areas for locating a dump site?

Very important ☐ Slightly important ☐ Not important ☐

7. Guiding questions for Vice Presidents Office (Division of Environment)

1. Are there any regulations, guidelines, and standards for the guiding the selection of sites for waste disposal facilities?
2. How are they mainstreamed into municipal authorities and how compliance is ensured?
3. What are your opinions on the existing policies and legislation framework towards addressing solid waste management issues in general and landfill siting and operation in particular?
4. Based on your experiences why areas zoned as sanitary landfill sites in the city master plan of 1979 were not developed?
5. What is your opinion on the importance of community and other stakeholders' involvement in selection of areas for locating a dump site?

   Very important ☐ Slightly important ☐ Not important ☐
6. What is you opinion on the trend on the siting and operation of municipal solid waste disposal?
7. What actions have been taken to avert unsanitary location of landfill in the country in general and Dare s salaam city in particular?
8. Has the office ever received any complains from the residents, politicians or activist with regard to the location of mtoni dumpsite? How was then dealt with?
9. What are the future plans and strategies for the promotion of waste management practices in general and sanitary land filling in particular?
10. What is your opinion on the level of awareness of the communities on hazards caused by unsanitary dumpsites?

    Awareness is high ☐ Awareness is low ☐ Not aware at all ☐

8. Guiding questions for Ministry of lands and Human Settlement Development (MLHSD)

1. Are there any regulations, guidelines, and standards to direct the selection of eligible sites for waste disposal facilities?
2. Has the ministry provided any circular to administer siting of solid waste disposal facilities (transfer stations/ landfill sites) by municipal council?
3. What are your opinions on the existing policies and legislation framework towards addressing solid waste management issues in general and landfill siting and operation in particular?
4. How does municipal waste management integrated into preparation of strategic urban development plans?
5. What is your opinion on the practises for siting solid waste disposal facilities (landfills) in the country in general and Dar es salaam city in particular?
6. Does Town planning drawings include zoning of areas for solid waste disposal facilities like transfer stations/landfills site?
7. How does the ministry ensure the compliancy of this by local government authorities?
8. Based on your experiences why areas zoned as sanitary landfill sites in the city master plan of 1979 were not developed?
9. How was solid waste disposal facilities integrated during planning and implementation of the recently project of 20000 plots in Dar es Salaam city?
10. What future plans and strategies do the Ministry has to promote provision of solid waste disposal facilities in TP drawings?
11. What is your opinion on the level of awareness of the communities on hazards caused by unsanitary landfills in the country in general and Dar es Salaam in particular?

    Awareness is high ☐ Awareness is low ☐ Not aware at all ☐
12. What is your opinion on the importance of community and other stakeholders' involvement in selection of areas for locating a dump site?

    Very important ☐ Slightly important ☐ Not important ☐
13. In what ways does the ministry facilitate local government authorities to integrate the provision of solid waste disposal facilities during the preparation and implementation of strategic urban development plans?
14. What are the basic preconditions for the approval of SUDP submitted by local government authorities?
15. What are your general observations with respect to the siting of solid waste disposal facilities (landfills) in the country in general and Dar es Salaam city in particular?
16. What should be done to avert the prevailing weaknesses on the siting of urban solid waste disposal facilities?

9. Guiding questions for City council

1. What process and criteria that are adopted to administer site selection for the location of new landfill site in the city? (Vinguguti, Mtoni, Kigogo, and Pugu Kinyamwezi)
2. Who were the key stakeholders involved? And what were their roles and responsibility during siting process?
3. What are your roles and responsibilities concerning landfills management in general and site selection for location a new landfills in the city?
4. Are there any regulations, by-laws, guidelines that are used to administer landfill site selection by municipalities? How is the compliancy ensured?
5. What are your opinions on the existing policies and legislation framework towards addressing solid waste management issues in general and landfill siting and operation in particular?
6. Does the city council have set aside potential areas for the location for new dumpsite?
7. How were these areas selected? and who were involved in the selection process?
8. Based on your experiences why areas zoned as sanitary landfill sites in the city master plan of 1979 were not developed?
9. On your opinion does the current location of Mtoni/kigogo dumpsite fits to principles of sustainable development? (economic efficiency, environmental sustainability and social equity)
10. How were the communities from the areas located dumpsite involved in the decision making?
11. How does the city integrate environmental and socio economic impacts during siting a new landfills in the city?
12. Has the city council done any research to assess the level of pollution caused by dumpsites in Dar es salaam city? Are there any empirical data?
13. What strategies are in place to minimize these problems?
14. What is your opinion on the importance of community and other stakeholders involvement in selection of areas for locating a dump site?

    Very important ☐ slightly important ☐ Not important ☐
15. Based on your experiences what problems have been caused by Mtoni/vingunguti/kigogo dumps to the residents? And to the natural environment?.
16. What strategies and interventions are in place to address such problem?
17. What are the plans to ensure sustainable siting and operation solid waste disposal facilities in Dar es salaam city?
18. What are the future plans and strategies for the promotion of waste management practices in general and sanitary land filling in particular
19. What is your opinion on the level of awareness of the communities on hazards caused by unsanitary dumpsites?

    Awareness is high ☐
    Awareness is low ☐
    Not aware at all ☐
20. Has your office received any formal complaints raised by communities for locating dump site in their settlements (Vinguguti/mtoni/Kigogo? Are there any written documents your office?
21. What was your response to such complaints if any?

Has the city council done any research to assess the level of pollution caused by unsanitary landfills in Dar es salaam city? Are there any empirical data?

10. guiding questions for Civil society (NGOs)

22. When was the organisation established?
23. What is the main objective of your organisation? And how does it relate to solid waste management?
24. What is your opinion on the practises for siting solid waste disposal facilities (dumpsites) in Dar es salaam city?
25. What are the main problems caused by unsanitary landfilling in Dar es Salaam city?
26. What are your opinions on the existing policies and legislation framework towards addressing solid waste management issues in general and landfill siting and operation in particular?
27. Has your organisation been involved in siting process of SWD facilities in the city? What role did you play?
28. What is your opinion on the level of awareness of the communities on hazards caused by unsanitary dumpsites?

    Awareness is high ☐
    Awareness is low ☐
    Not aware at all ☐
29. In what ways does your organisation facilitate to raise community awareness on the risk posed by unsanitary landfill?
30. What is your opinion on the importance of community and other stakeholders' involvement in selection of areas for locating a dump site?

    Very important ☐
    Slightly important ☐

Not important ☐

Does your organisation provide any financial support for people dealing with waste collection and or recycling activities? How is it done?

Has your organisation conducted any research to assess the levels of pollution caused by dumpsites in Dar es Salaam city? Are there any empirical data?

11. Guiding questions for Ward executive officer

1. How was …… settlement chosen to host the dumpsite?
2. Who were the main stakeholders involved during the evaluation and selection process? And what was your role in the whole siting process?
3. How long did it take from site identification into operation of the dump?
4. Were the community from ..... involved in the siting process? If yes how? if no why?
5. Did the municipality convene any meetings with the residents to discuss about the decision of locating dumpsite in ……..ward?
6. What is your opinion on the importance of community and other stakeholders' involvement in selection of areas for locating a dump site?
   Very important ☐
   Slightly important ☐
   Not important ☐
7. Did the communities raised any complains for locating dump site in ? Are there any written complains on your office?
8. Do you know any negative impacts/ problems caused by landfill in general?

   Yes ☐ No ☐ if the answer is yes answer the next question

9. Please rate the problem listed in the order of seriousness impact caused by unsanitary landfill
   (Answer can be more than one)
   a. Visual appearance ☐
   b. Ground and surface water pollution ☐
   c. Air pollution
   d. Health hazards ☐
   e. Fire explosion ☐
   f. Bad odor/fumes ☐
   g. Insect and animal attraction
   h. Other ☐
10. Based on your experiences what problems have been caused by theMtoni /Kigogo.dump to the residents? And to the natural environment?
11. Are there any environmental pollution /serious problems caused by the dump?
12. What is your opinion on the current location of dumpsite?
13. What should have been done to improve the situation?
14. What is your opinion on the level of awareness of the communities on hazards caused by unsanitary dumpsites?
    Awareness is high ☐
    Awareness is low ☐
    Not aware at all ☐

12. Guiding questions for waste pickers (at dumpsite)

1. Personal particulars

Name …….

Gender…….

Age……..

(a) Marital status……

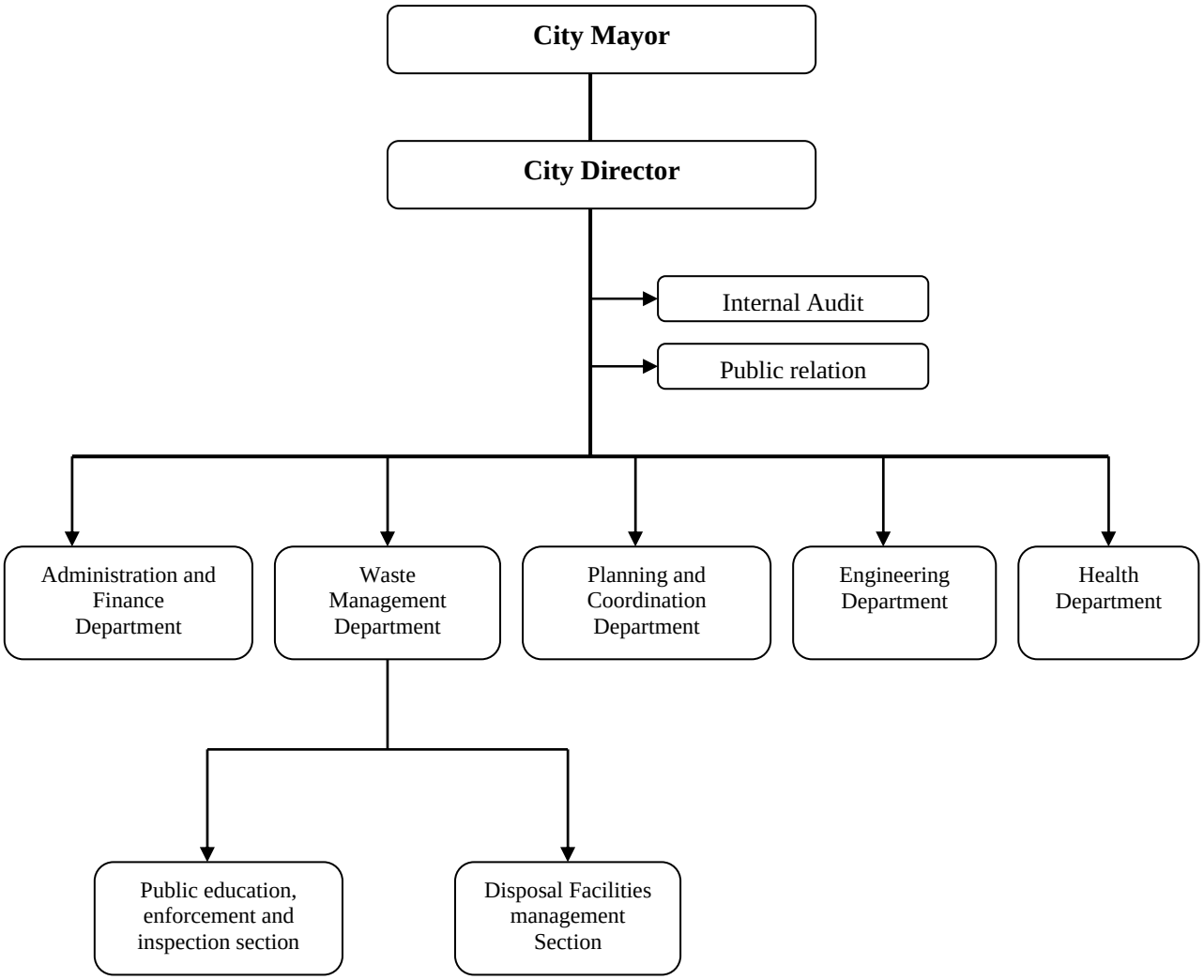
Single ☐ Married ☐ Divorced ☐ Widow ☐

(b) Level of education

Primary ☐ Secondary ☐ College ☐ University ☐ Other ☐

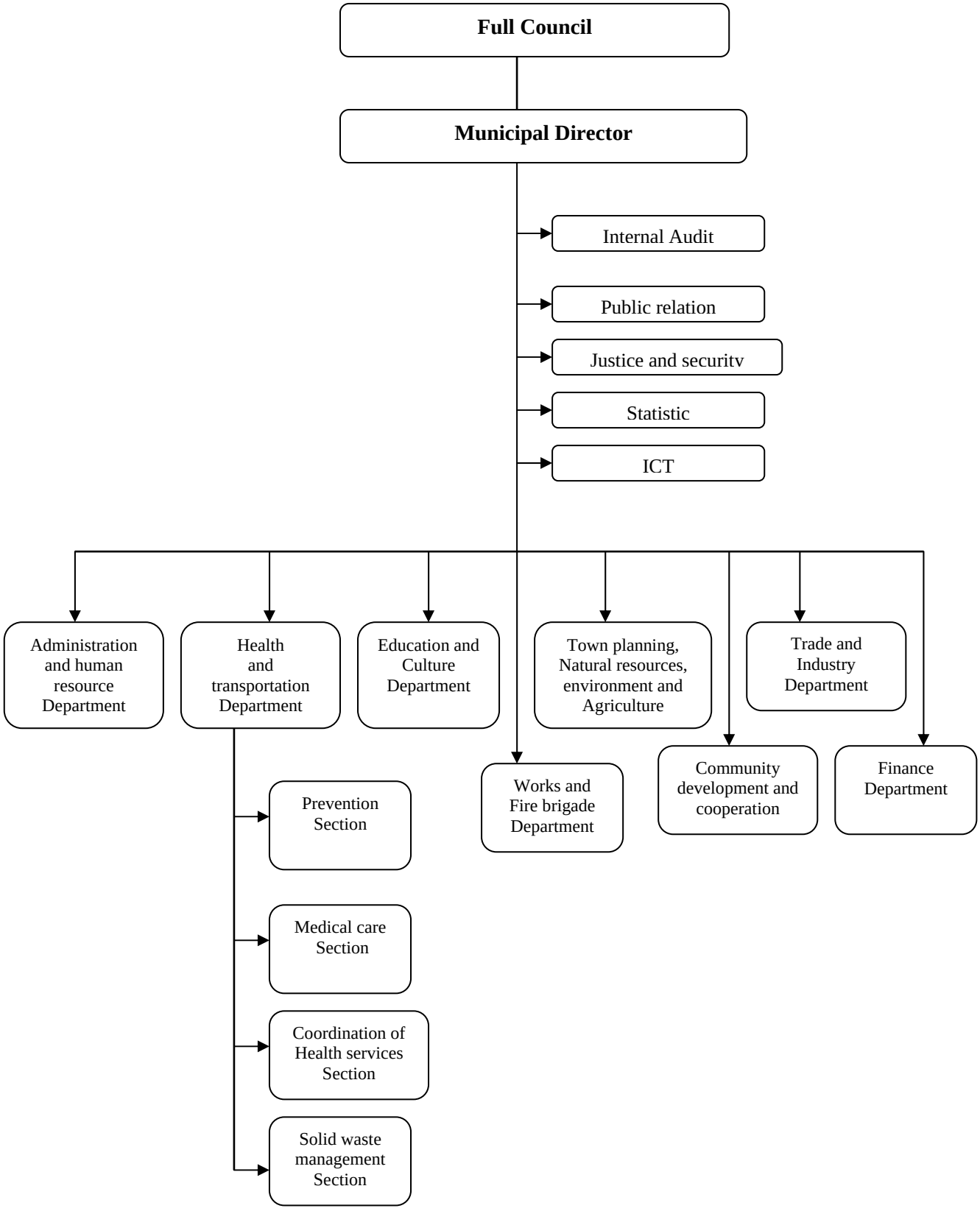
2. How long have you been working as waste picker
3. What are the major problems; you are facing on your daily activities?
4. How do you address them?
5. How would you suggest the government to address them?
6. Do you have any organisation that is responsible for organising your activities of waste collection?

Appendix 2: Administrative structure of the DCC



Source: Dar es Salaam city Council, 2007

Appendix 3: Administrative structure of Kinondoni Municipal council



Source: Kinondoni Municipal Council, 2007

Appendix 4: Technical instruction No. 3 Standards for Cemeteries and SWD

Appendix 5: Dar es Salaam SW Treatment, Disposal and Street Littering By-laws