



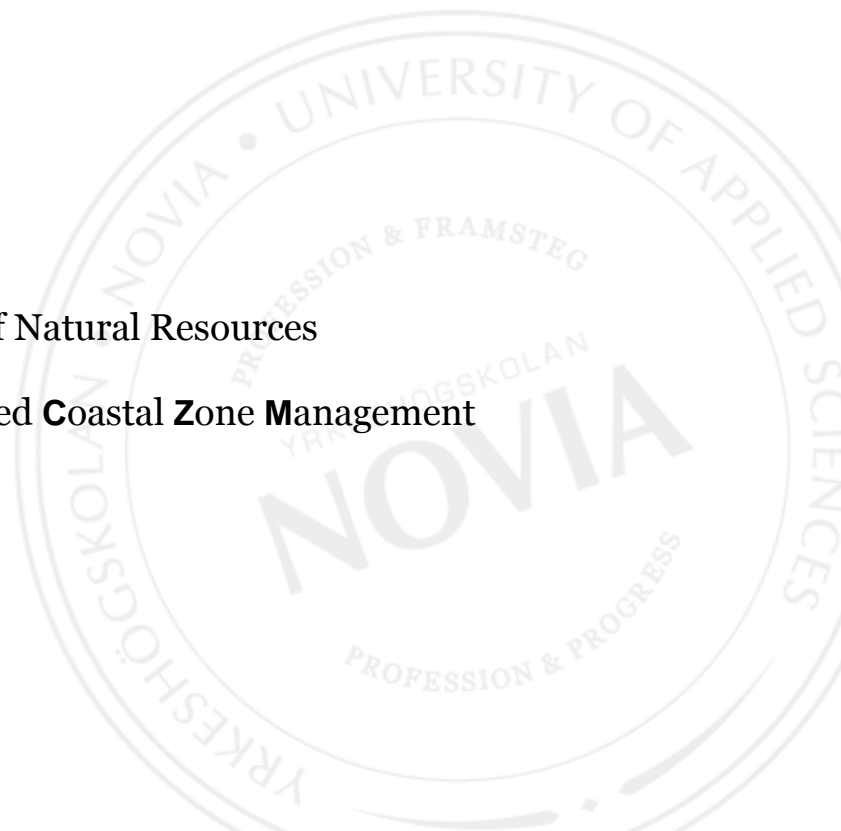
IMPROVING SOLID WASTE MANAGEMENT IN THE DAR-ES-SALAAM COASTAL BELT, TANZANIA

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Abstract

The aim of the study was to understand the factors which influence the state of solid waste management in the Dar-es- Salaam Coastal Belt, Tanzania. The research used semi-structured and structured interviews, group discussions, field observations and review of various literatures as the major methods of the study. Questionnaires were used for interviews. Results showed poor community awareness (except students and beach goers) of solid waste management and its significance; and of how waste management functions in the municipality. Results on the factors influencing solid waste generation were: waste generation increased with increase of population; habits of domestic food preparation generated food leftovers as waste; over use of plastic bags and containers; reliance on waste disposal rather than waste prevention. Results on factors influencing inadequate solid waste collection were: unplanned (squatter) settlements which are not easily accessible; inadequate waste collection facilities and equipment, lack of motivation within waste collection companies and lack of enforcement of municipal bylaws. The situation can be improved by providing environmental and waste management education, enforcement of waste management bylaws and enactment of national solid waste management legislation and strategy based on the waste management hierarchy as it is in the European Union and South Africa.

Key words: Solid waste management, coastal belt, community based organizations, non-governmental organization

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Figure 1: Part of Dar –es- Salaam coastal City, Tanzania (Left) and Solid waste deposited on a Dar-es-Salaam Coastal Belt (beach) (Right). Photo: John Maziku, November 2013.

1. Introduction

Municipal Solid Waste (MSW) is a worldwide problem which countries in Europe, Asia, Africa and elsewhere have been experiencing for a long time (Jatput, R., Prasad, G. & Chopra, A.K., 2009; Ngoc, U.N. & Schnitzes, H. 2009). When solid waste is not efficiently and effectively managed it results into serious environmental pollution which has harmful effects upon people's health, animals, biodiversity and the environment.

Although there are many human activities across the Western part of the Indian Ocean bordering Dar-es-Salaam City which take place within and outside the Ocean that might cause negative effects to the ecosystems and beaches the land activities might be the major source of pollution to the Ocean. Things such as pesticides and fertilizers from urban agriculture conducted within the City and the old and modern sewage systems which discharge sewage waters directly into the Ocean could be harmful to Dar-es-Salaam Coastal Belt. According to Mrs. Rogathe Kisanga, Principal Chemist, Division of Environment, Vice President's Office, Tanzania (personal communication in November, 2013) the official width of the coastal belt in Tanzania extends 60 meters wide inland along the coast line.

In addition, one of the greatest land-based sources of pollution in the Dar-es-Salaam Coastal belt which affects the Indian Ocean is marine litter. Marine litter in the Dar-es-Salaam Coastal Belt appears in different forms of solid waste such as plastics, papers, glasses, metals, and other kinds of organic waste (Figure 1). Such solid waste is generated by the high city population and much of it gets swept into the ocean via rivers and streams, floods, unauthorized dumping into valleys and open drainage systems, surface fishing activities and irresponsible recreational activities on beaches (Lukambuzi, (2006), staff of the National Environment Management Council (NEMC), Tanzania in her unpublished Consultancy Final Report: "National Overview and Assessment on Marine Litter Related Activities in Tanzania" as an input to the UNEP/Regional Seas Programme on the management of marine litter in the Western Indian Ocean region.

Improving the Dar-es-Salaam coastal and marine environment is essential because of the importance of the Indian Ocean to the economy and society of the Dar-es-Salaam City and

that of Tanzania in general. The livelihood of many people of Dar-es-Salaam depends on the Indian Ocean in many ways. For example, the Indian Ocean is a source of food from aquatic animals such as fish of different species; source of income for fisherman and fish mongers and provides sandy beaches for tourism and recreation.

In view of such environmental threats posed by municipal solid waste the government of Tanzania has since a long time taken various policies, and legislative and institutional initiatives to deal with the problems of the environment including that of solid waste management including marine littering. While this has been taking place the state of the Indian Ocean particularly in Dar-es-Salaam City is yet to be clearly known because to-date there has not been any serious researches on what, how, when and to what extent the Indian Ocean on the Tanzanian side has been affected by land based marine littering.

Looking at the stress which marine ecosystems in the Indian Ocean experience from various sources of pollution, particularly land based of the nature of municipal solid waste (marine litter) type and also its negative effects on people's health, livelihood, the environment, beauty of the beaches, economy and tourism, I was highly motivated to undertake this research on solid waste management in the coastal city of Dar-es-Salaam. The major aim was to know the reason behind the worsening situation of these problems despite the government initiatives to reduce the effects of land based sources of pollution to the Ocean.

The European Union (EU), for instance, also focuses its attention generally on solid waste management and on marine litter which takes the form of minute plastic materials as a special type of pollution which has affected central Pacific, the North East Atlantic and Greece (European Environment Agency, 2010). The litter is found both floating in the water and at the bottom of the sea floor. The very small plastic particles (as cited by the European Environment Agency (2010) from Van Franeker et al., 2005, Gregory, 2009) have been found to cause reproductive, breathing problems to sea animals and birds. Definitely these similar phenomena cannot be excluded in the Indian Ocean part of the Dar-es-Salaam Coastal Belt. Countries in Africa such as the Republic of South Africa, Kenya and others have been taking similar initiatives towards environmental management.

2. Aim of the Research

The aim of the research was to understand the factors which influence the state of solid waste management in the Dar-es- Salaam (City) Coastal Belt.

2.1 Objectives of the Research

The specific objectives of the research were as follows:-

- (1) To find out people's awareness of solid waste management and its significance on the Dar-es-Salaam (City) Coastal Belt and its environment at large.
- (2) To find out factors influencing solid waste generation and collection and their trends in the Dar- es- Salaam (City) Coastal Belt.

3. Waste Management-Related Concepts Defined

Solid waste management worldwide is guided by and undertaken according to a specific waste management policy and legal framework of a particular country. The waste management policies and legislation which, besides other things, define the relevant concepts which govern the waste management process in a particular country or region. It is not surprising, therefore, as rightly observed by Kaseva and Mbuligwe (2003) that the definition of the concept of solid waste and impliedly the definitions of other relevant waste management concepts differ from country to country. Because this study has also made a quick comparative survey of the policy and legislation frameworks of three countries- the European Union (EU), the Republic of South Africa (RSA) and the United Republic of Tanzania (URT), it is logical also to explore some definitions of concepts that are related to waste management in the three regions.

3.1 Definitions of Solid Waste Management- Related Terms in European Union Legislation

Within the legal framework of the European Union there are various directives concerning waste management which also include definitions of relevant concepts. Specifically, Directive 2008/98/EC of the European Parliament and the Council establishes the legal framework for managing waste in the European Union. Also Directive 2008/98/EC lays down basic concepts and definitions which should apply in the waste management process within the European Union member countries. Some of the relevant terms used in this Act

such as waste, waste management and waste management hierarchy have been defined as follows:-

“Waste: any substance or object which the holder discards or intends or is required to discard (Directive 2008/98/EC).” However, the following substances are excluded from the meaning of waste as used in this piece of legislation:-

- “gaseous effluents;
- radioactive elements;
- decommissioned explosives;
- faecal matter;
- waste waters;
- animal by-products;
- carcasses of animals that have died other than by being slaughtered
- elements resulting from mineral resources” (Directive 2008/98/EC).

The definition of waste restricts the idea of a substance or object to be discarded to a particular person’s point of view. An object regarded by one person as waste could be something still useful to someone else. Hence in this sense where waste ends with a particular person (individual or organization) recycling or reuse takes over.

Another concept, “Waste management,” has been defined in the Directive 2008/98/EC (Waste Framework Directive) as “the collection, transport, recovery and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker.”

On the other hand the term, “waste management hierarchy” (or simply waste hierarchy) is defined in the Directive 2008/98/EC as the treatment of waste in line with the following hierarchy which is listed in order of priority:

- Prevention;
- preparing for reuse;
- recycling;
- other recovery, notably energy recovery;
- disposal.(Directive 2008/98/EC)

These terms expressing the activities which comprise the waste management hierarchy are in turn defined in the Directive as follows:-

“Prevention” has been defined as the “measures taken before a substance, material or product has become waste.”

“Recovery” is defined as “any operation the principal result of which is waste serving a useful purpose.”

“Recycling” has been defined as “any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes” (Directive 2008/98/EC).

The other two terms in the Waste Framework Directive; recovery and disposal, were not defined.

3.2 Definitions of Solid Waste Management- Related Terms in the Policy and Legislation Framework of South Africa

The National Environmental Management: Waste Act (NEMWA), 2008, Act No. 59 of 2008 provides a good number of solid waste management terms which it defines and therefore provides good guides in the undertaking of solid waste management plans. The following is a selection of such terms and their respective definitions:-

"Business waste" means waste that emanates from premises that are used wholly or mainly for commercial, retail, wholesale, entertainment or government administration purposes;

"By-product" means a substance that is produced as part of a process that is primarily intended to produce another substance or product and that has the characteristics of an equivalent virgin product or material;

"Disposal" means the burial, deposit, discharge, abandoning, dumping, placing or release of any waste into, or onto, any land;

"Domestic waste" means waste, excluding hazardous waste, that emanates from premises that are used wholly or mainly for residential, educational, health care, sport or recreation purposes;

"General waste" means waste that does not pose an immediate hazard or threat to health or to the environment, and includes—

- domestic waste;
- building and demolition waste;
- business waste: and
- inert waste;

"Hazardous waste" means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment;

"Incineration" means any method, technique or process to convert waste to Hue gases and residues by means of oxidation;

"recovery" means the controlled extraction of a material or the retrieval of energy from waste to produce a product;

"recycle" means a process where waste is reclaimed for further use, which process involves the separation of waste from a waste stream for further use and the processing of that separated material as a product or raw material;

"re-use" means to utilise articles from the waste stream again for a similar or different purpose without changing the form or properties of the articles;

"storage" means the accumulation of waste in a manner that does not constitute treatment or disposal of that waste;

"treatment" means any method, technique or process that is designed to change the physical, biological or chemical character or composition of a waste; or remove, separate, concentrate or recover a hazardous or toxic component of a waste; or destroy or reduce the toxicity of a waste, in order to minimise the impact of the waste on the environment prior to further use or disposal:

"waste" means any substance, whether or not that substance can be reduced, re-used, recycled and recovered- that is surplus, unwanted, rejected, discarded, abandoned or disposed of; which the generator has no further use of for the purposes of production; that must be treated or disposed of; or that is identified as a waste by the Minister by notice in the *Gazette*, and includes waste generated by the mining, medical or other sector, but—a by-product is not considered waste; and any portion of waste, once re-used, recycled and recovered, ceases to be waste;

"waste management activity" means any activity listed in Schedule 1 or published by notice in the *Gazette* under section 19, and includes—

- the importation and exportation of waste;
- the generation of waste, including the undertaking of any activity or process that is likely to result in the generation of waste:
- the accumulation and storage of waste;
- the collection and handling of waste;
- the reduction, re-use, recycling and recovery of waste;
- the trading in waste;
- the transportation of waste;
- the transfer of waste;
- the treatment of waste; and
- the disposal of waste;

"Waste management services" means waste collection, treatment, recycling and disposal services;

"Treatment" means any method, technique or process that is designed to change the physical, biological or chemical character or composition of a waste; or remove, separate, concentrate or recover a hazardous or toxic component of a waste; or destroy or reduce the toxicity of a waste" (National Environmental Management: Waste Act (NEMWA), 2008, Act No. 59 of 2008).

These definitions of waste management-related terms can be good basis for making comparisons with similar terms in other countries such as the European Union and Tanzania within the same discipline of Waste Management.

3.3 Definitions of Solid Waste Management- Related Terms in the Policy and Legislation Framework of Tanzania

Taking the Environmental Management Act, 2004 as a sample from the existing Tanzanian waste management policy and legislation framework, one can be able to explore the meaning of some of the waste management-related terms contained and defined in the Act. The following are a few terms and their definitions as found and defined in the Environmental Management Act, 2004.

“Hazardous waste” means any solid, liquid, gaseous or sludge waste which by reason of its chemical reactivity, environmental or human hazardousness, its infectiousness, toxic explosiveness and corrosiveness is harmful to human health, life or environment;

"Industrial waste" means waste emanating from processing industries or non-processing industries that is the source of energy, water, treatment plants or communication and includes any other solid waste referred to under Part. IX;

"solid waste disposal" means the final stage in solid waste management system;

"solid waste" means non-liquid materials arising from domestic, street, commercial, industrial and agricultural activities; and includes refuse or garbage, non-liquid materials arising from construction and demolition activities, garden trimmings and mining operations, dead animals and abandoned cars scraps;

"solid waste management" means an essential service that is provided to protect the environment and public health, promote hygiene, recover materials, avoid waste, reduce waste quantities, decrease emission and residuals and prevent the spread of diseases.

“Waste” means any matter whether liquid, solid, gaseous or radioactive, which is discharged, emitted or deposited in the environment in such volume, composition or manner likely to cause an alteration of the environment, and includes such waste as may be prescribed under this Act;” (Environmental Management Act 2004, Act No. 20, 2004, Tanzania).

Definitions of “waste” and “waste management” compared among the European Union, South African and Tanzanian legislations:

The comparison of definitions of terms in the environmental management policy and legislation framework of the European Union, South Africa and Tanzania can be quite interesting to see the possible similarities and differences too. Take a small example of the definitions of “waste” and “waste management” among the three countries;

The Waste Framework Directive of the European Union, Directive 2008/98/EC, has a very narrow concept of waste: “Waste: any substance or object which the holder discards or intends or is required to discard.” However the following are excluded from the meaning of waste as used in this piece of legislation:-

- gaseous effluents;
- radioactive elements;
- decommissioned explosives;
- faecal matter;
- waste waters;
- animal by-products;
- carcasses of animals that have died other than by being slaughtered
- elements resulting from mineral resources” (Directive 2008/98/EC).

On the other hand the term “waste management” is defined in the European Union Directive 2008/98/EC as; “the collection, transport, recovery and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker.”

According to the South African National Environmental Management: Waste Act (NEMWA) 2008, Act No. 59 of 2008, waste has been defined as follows:-

"waste" means any substance, whether or not that substance can be reduced, re-used, recycled and recovered—that is surplus, unwanted, rejected, discarded, abandoned or disposed of; which the generator has no further use of for the purposes of production; that must be treated or disposed of; or that is identified as a waste by the Minister by notice in the *Gazette* (Official Government Newspaper), and includes waste generated by the mining, medical or other sector, but—a by-product is not considered waste; and any portion of waste, once re-used, recycled and recovered, ceases to be waste.”

In the South African National Environmental Management: Waste Act, 2008, “Waste management activity” includes-

- “the importation and exportation of waste;
- the generation of waste, including the undertaking of any activity or process that is likely to result in the generation of waste:
- the accumulation and storage of waste;
- the collection and handling of waste;
- the reduction, re-use, recycling and recovery of waste;
- the trading in waste;
- the transportation of waste;

- the transfer of waste;
- the treatment of waste; and
- the disposal of waste;" (National Environmental Management: Waste Act (NEMWA) 2008, Act No. 59 of 2008).

On the other hand the Environmental Management Act 2004, Act No. 20, 2004, Tanzania defines waste and solid waste management as follows:-

"Waste" means any matter whether liquid, solid, gaseous or radioactive, which is discharged, emitted or deposited in the environment in such volume, composition or manner likely to cause an alteration of the environment, and includes such waste as may be prescribed under this Act;"

"Solid waste management" means an essential service that is provided to protect the environment and public health, promote hygiene, recover materials, avoid waste, reduce waste quantities, decrease emission and residuals and prevent the spread of diseases."

From the above cited waste management-related legislations of the European Union, South Africa and Tanzania, similar terms relatively mean differently among the respective legislations.

4. The Challenges of Solid Waste Management

Most countries in the world, both developing and developed, acknowledge the significance of solid waste management though they may differ in the kinds of concerns they emphasize. In many African countries including Tanzania there is concern for solid waste management due to the harmful effects of improper and inefficient waste management system on people's health, animals, biodiversity and the environment. The ineffective solid waste management system has serious effects on sanitation, health and vector-borne diseases such as malaria and worms, as well as diarrhea, tuberculosis and cholera (Mbuya, 2009; Palfreman, 2011; Oberlin, 2012; Jones & Mkoma, 2013).

In the European Union (EU) the major concern about solid waste management is the extremely large amount of household waste which is generated and discarded by the 500 million people every year. The solid waste amounts to about half a tone per household a

year, 360 million tons of waste from manufacturing and 900 million tons of waste from construction and 95 million tons of waste from water and energy supply; altogether the EU generated 3 million tons of waste every year (European Union, 2010). These figures have definitely increased by the year 2014.

The EU's concern with the amount of waste generated annually is threefold; the pollution which it causes to the environment and the effect to climate change due to the greenhouse gas emissions and the waste in terms of material. Besides this there is a lot of waste material which is hazardous and harmful to the population and therefore needs to be properly managed (European Union, 2010).

Also the EU has focused its attention on marine litter in the form of minute plastic materials as a special type of pollution which has affected central Pacific, the North East Atlantic and Greece (European Environment Agency, 2010). The litter is found both floating in the water and at the bottom of the sea floor. The European Environment Agency (SOER, 2010) has reported (according to Van Franeker et al., 2005, Gregory, 2009) that minute plastic particles have been found to cause health problems to sea animals and birds such as reproductive and breathing problems (European Environment Agency, SOER 2010).

Waste management in the European Union (EU) is not only a big challenge but also it is necessary in order to minimize pollution; minimise losses of valuable material which Europe as a big importer of raw materials cannot continue to bear in the form of material waste losses (European Union, 2010).

5. Solid Waste Management Policy, Legislation and Strategy Frameworks of the EU (Finland), South Africa and Tanzania

The waste problem is universal and attracts the attention of every government to manage its waste for various reasons; one being to protect the health and welfare of its citizens. The European Union, African countries and other countries in the world have taken different measures to deal with the waste problem including municipal solid waste.

Indeed, the focus of this study was to investigate the factors which influence the state of solid waste management in the coastal belt of the City of Dar-es-Salaam, Tanzania.

Also the study took an overview comparative survey of the solid waste management policy, legislation and strategy frameworks of the European Union (EU), Republic of South Africa (RSA) and the United Republic of Tanzania (URT) Tanzania. The choice of the three regions (units of countries) for comparing their waste management policies, legislations and practices was to get a variety of learning experiences from different countries with different cultures and levels of socio-economic development. It was basically assumed that the three countries (Tanzania inclusive) undertook solid waste management somewhat differently in terms of legislation and practices. Therefore, the comparative study was expected to generate learning experiences which the researcher could find useful particularly in proposing strategies for improving the solid waste management in the City of Dar -es- Salaam and its Coastal Belt.

In the Tanzanian context the study was undertaken with the objective of comparing the solid waste management legislation and practices within the three Dar-es-Salaam City Municipalities of Kinondoni, Ilala and Temeke. The purpose was to identify factors which influence the efficiency of solid waste management in the respective municipalities. Again the learning experiences from this comparative experience could provide useful findings for making suggestions for improving the solid waste management situation in the Dar-es-Salaam City as a whole and in its constituent three municipalities.

5.1 Solid Waste Management in the European Union

Solid waste management in the European Union is dealt with through various legislation and policies which are directed at various challenges.

The EU has been taking waste management seriously through developing policies and strategies which are geared toward the reduction of negative environmental and health impacts of the big amounts of waste generated and aims at making the EU resource efficient (European Union, 2011). The EU waste management policy has developed over the past 30 years or by means of action plans and legislation which aim at reducing the

negative impacts of waste on the environment and human health and instead create a resource – efficient and energy economy (European Union, 2010).

5.2 Waste Management Hierarchy (European Union Act on waste management)

The European Union Waste framework Directive –2008/98/EC is based on the current and modern approach to waste management which focuses at waste prevention rather than waste disposal and also emphasizes on waste recycling. It aims at the prevention of the harmful effects of waste generation. This Directive embraces a hierarchy of five steps of waste management. These are:

- Prevention- as the most preferred option;
- Preparing for re-use; then
- Recycling; followed by
- Other forms of recovery; notably energy recovery; finally
- Disposal. (Figure 2).

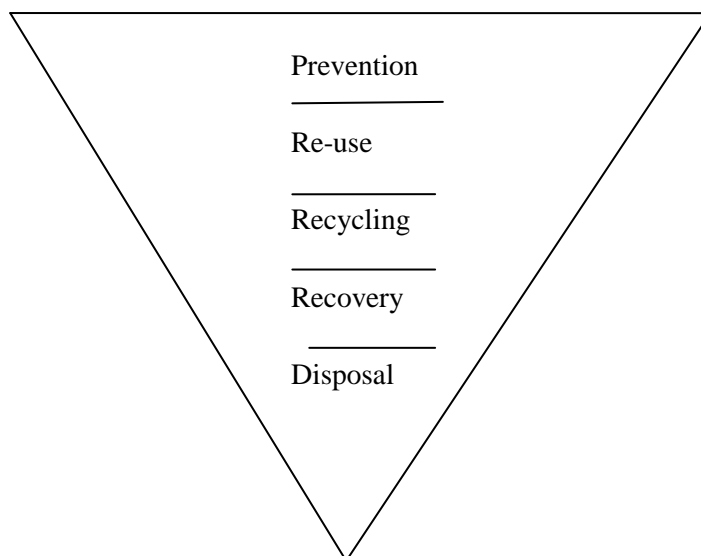


Figure 2: The Waste Management Hierarchy

The Commission Communication in December 2005 put forward a Thematic Strategy on the prevention and recycling of waste COM (2005) 666. The strategy puts up guidelines for EU action and describes how waste management can be enforced. The thematic strategy aims at reducing the negative impacts of waste on the environment (European Commission- COM (2005) 666).

The relevant Act for land fill waste is the Council Directive 1999/31/EC enacted on 26 April, 1999. This directive lays down strict requirements for landfills for preventing and reducing the negative effects on the environment especially on surface water ground water, soil, air and human health. According to the Act the landfills are divided into:-

- Landfills for hazardous waste.
- Landfills for non-hazardous waste.
- Landfills for inert waste. (Council Directive 1999/31/EC on landfill of waste).

Council Directive 2000/76/EC of the European Parliament and of the Council enacted on 4th December, 2000 lays down measures to prevent or reduce air, water and soil pollution caused by the incineration of waste and reducing risk on the health of human beings. The directive imposes strict operating conditions and technical requirement waste incineration plants (Directive 2000/76/EC On the incineration of waste.

5.3 Waste Management Practices In the European Union (Case study of the Helsinki Region in Finland)

Waste management practices in Finland have been selected for discussion among waste management practices of other European Union member countries. Finland has a well organized modern system of managing different kinds of waste including solid waste; starting from sorting, collection and treatment. All waste is sorted at the generation point and are recycled according to the type and nature of the particular waste (Figure 3). In the capital area it is compulsory for all bio waste to be collected from all residential properties which contain more than 10 housing units and from those properties which generate more than 50 kg of bio waste per week. Collection of bio waste from smaller properties is not compulsory. However, the practice in Finland is that bio waste is not taken at collection points. The treatment of different types of waste is discussed here under. (Helsingin seudun ympäristöpalvelut – HSY, 2014).



Figure 3: Sorting waste at the generation point in people's premises in Ekenäs, Finland. Photo: John Maziku 4.6.2014

Bio Waste

There are different types of bio waste such as: (1) Professional kitchen bio waste and (2) packing bio waste. Professional kitchen bio waste includes all food remains such as spoiled food, tea leaves with filter bags, small bones, egg cartons, peels etc. Packing bio waste which are good include the bio waste used for packing that is capable of decomposing such as newspapers, paper bags, bio waste bags bought from stores, cardboard packing excluding milk cartons and other plastic coated cartons (Helsingin seudun ympäristöpalvelut – HSY, 2014).

Garden Waste and Brushwood

In Finland under garden waste and brushwood classification are included grass, leaves, fallen apples, chipped brush wood with a diameter of less than 20 cm. In sorting apples should be separated from garden waste and placed in different containers. During autumn in Finland apples are received by Sortti stations at the same fee as garden waste. In the Helsinki region bio waste and garden waste are treated by decomposing at the Ämmässuo Waste Treatment Centre in Espoo. Also brushwood of specific standard measurement is collected separately and is applied as raw material for decomposing and for conditioning soil (Helsingin seudun ympäristöpalvelut – HSY, 2014).

Clothes and Textiles

In Finland there are specific regional collection points for clothes and textiles, for example, Emmaus, Helsinki Metropolitan Area Re- Use Centre and FIDA Second hand Charity Shop. These shops receive exclusively clothes which are in good condition. Most of these clothes are sent to Africa, others are sold by wholesale internally and the rest particularly those in poor condition are used as rag in industry (Helsingin seudun ympäristöpalvelut – HSY, 2014).

Energy Waste and Mixed Waste

Energy waste can only be recovered as material for energy production and not for recycling. Plastics can be used as energy waste but it is not all plastic which serves as energy waste. Energy plastics should not contain aluminium or PVC. For example, plastic products are classified and differentiated by codes 01, 02, 03, 04, 05, 06 and 07 to indicate the kinds of plastics and plastic packaging used. The specific codes involve all types of plastic and plastic packaging used for food stuffs, plastic sacks, plastic bags, disposable cardboard and plastic plates and cups, photographs and negatives, CD and DVD discs and cases. All products containing PVC (those marked with code 03) and aluminium such as foil-lined potato chips and juice cartons, coffee bags and containers, ink cartridges and VHS and C cassettes cannot be used as energy waste (Helsingin seudun ympäristöpalvelut – HSY, 2014).

In Finland energy waste is not provided at collection points. Housing companies may order energy waste from HSY Waste Management customer service. Companies like Sortti Stations and the Munkinmäki Waste Stations receive energy waste for a fee.

In the occasion where sorting of waste is not done, the mixed waste is usually taken to landfill. In the year 2014 the mixed waste power plant in Vaasa is expected to generate electricity and energy for human consumption .However, several other power plants have been built and some are still under constructions to decrease the use of landfills and to increase energy recovery from waste (Helsingin seudun ympäristöpalvelut – HSY, 2014).

Waste Paper

In the category of waste paper many types of paper are included such as newspapers and magazines, brochures and advertisements, all kinds of printed material, product catalogues

and phone books, paper bags including any other type of paper which is delivered at home or office that is recyclable (Figure 4). According to the waste management regulations of Finland recyclable paper should not be put in mixed waste containers. However, the collection and reuse of paper are activities that come under producer liability (Helsingin seudun ympäristöpalvelut - HSY, 2014).



Figure 4: Waste paper container in Ekenäs, Finland. Photo: John Maziku 4.6.2014

Household Metal Waste

In Finland household metal include such metals as tins, aluminum dishes and foil, beverage cans, metal hinges and screws, and cutlery. In Finland grocery shops and Alko outlets serve as collection points for household metal waste such as returnable drink items. Also the service company Lassila & Tikanoja coordinates its customers with service companies by maintaining an efficient system of collection points for recyclable household metal waste all over Finland. The main aim is to turn Finland from a consumer society into a recycling society. In Helsinki region beginning 1st January 2014, properties that have 10 or more housing units or generate over 50 kg of household metal waste per week are supposed to have a collection obligation (Helsingin seudun ympäristöpalvelut - HSY, 2014). Figure 5.

Under the category of scrap metal in Finland are included such items as sheet metal and drain pipes, metal pipes and cables, pots and pans, bicycles, metal furniture parts, metal

machines and devices, and wood burning stoves. In the Helsinki region Sortti stations and Munkinmäki Waste Station are used as collection points for scrap metals. During spring season in Helsinki, Helsingin seudun ympäristöpalvelut`s vehicles go around the city collecting scrap metal that are used as raw materials for manufacturing new metal products (Helsingin seudun ympäristöpalvelut - HSY, 2014).



Figure 5: Household metal waste container at a collection point in Ekenäs, Finland. Photo: John Maziku 4.6.2014

Glass

Different types of glass for example coloured glass and clear glass are sorted and put in separate containers (Figure 6). The type of recyclable glass may include glass bottles and jars and these are used for making new glass containers, glass wool and glass foam glass (Helsingin seudun ympäristöpalvelut - HSY, 2014).

In the Helsinki region there are three kinds of collection points for returnable bottles; grocery shops, Alko outlets and voluntary collection points in streets (Helsingin seudun ympäristöpalvelut - HSY, 2014).



*Figure 6: Glass container at a waste collection point in Ekenäs, Finland. Photo: John Maziku
4.6.2014*

Electrical Equipment

All types of electronic waste such as large and small home appliances, for example washing machines, refrigerators, freezers, electric stoves, computers, laptops, printers, video cameras and the like are collected for re-use. The activity undertaken for electronic waste that are taken for re-use is done separately to ensure that all the components of the materials of the devices such as harmful substances like mercury and lead are recovered for re-use. The task of collection and re-use are under producer liability (Helsingin seudun ympäristöpalvelut - HSY, 2014).

All kinds of hazardous waste such as unused medicines, fluorescent lights, used car batteries, sulphuric acids throughout Finland are treated by Ekokem. Ekokem is a company which is owned by the state and municipalities and treats 100,000 tons of hazardous waste per year. Ekokem is the only company which treats hazardous waste in Finland (Helsingin seudun ympäristöpalvelut- HSY, 2014; Berninger *et al*, 2010).

Municipal Waste Incineration Practice

In Finland about one third of all the municipal waste generated is incinerated. Currently, Finland has nine waste power plants in use (Jätelaitosyhdistys, 2014). Figure 7.

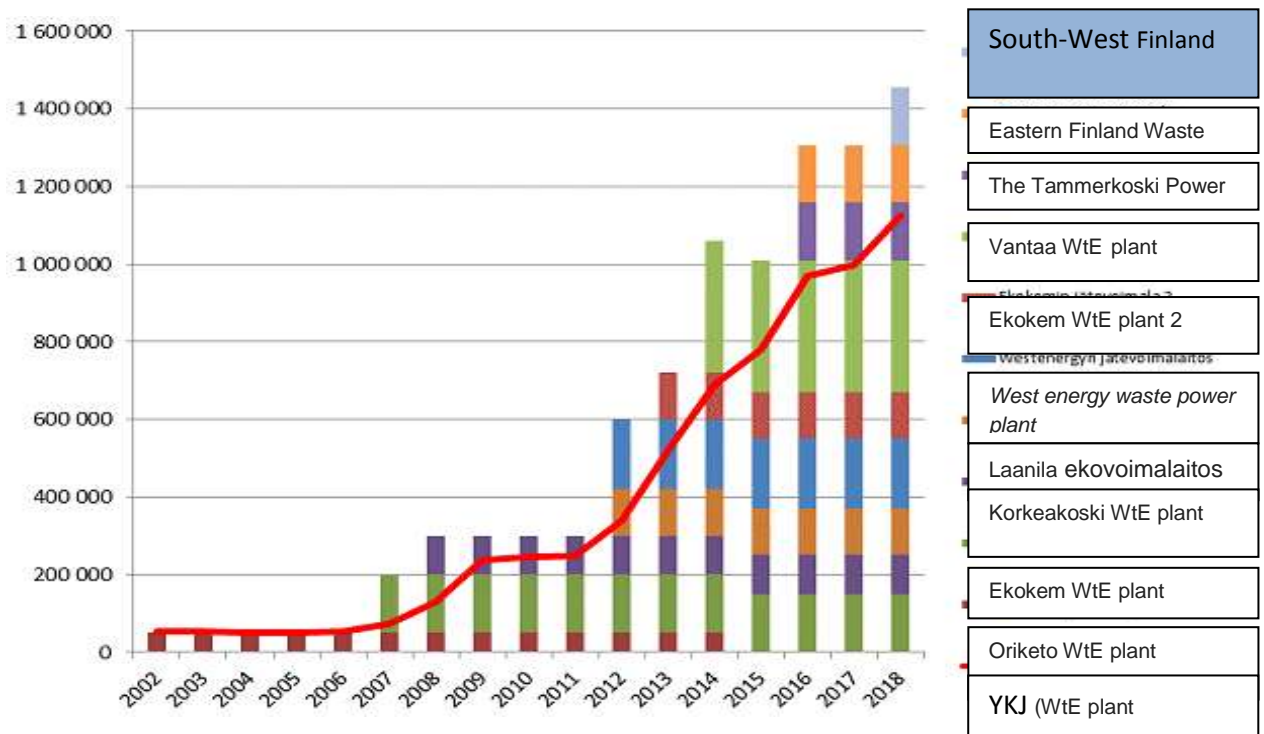


Figure 7: Waste energy projects in Finland

Source: Jätelaitosyhdistys, 2014.

The growth of the total capacity of the waste incineration plants is shown as individual projects. The red line indicates the capacity for municipal waste. The rest of the capacity is for the construction and production waste (Jätelaitosyhdistys, 2014).

6. Solid Waste Management in South Africa

In the Republic of South Africa (RSA) there have been many challenges regarding waste management in general and solid waste management in particular. In the effort to deal with the challenges of waste management the South African government has identified the challenges themselves and has been enacting various waste management legislations and undertaking a number of waste management strategies to meet the identified waste management challenges (National Waste Management Strategy, No. 344 of 2012).

6.1 Challenges facing Waste Management in South Africa

The challenges facing waste management in South Africa are well stated in the National Waste Management Strategy, No. 344 of 2012. The challenges are many; these are:

population and economic growth which give rise to increased generation of amounts of waste, historical backlog of waste services in local areas which were formally marginalized and increased complexity of waste streams arising from urbanisation and industrialization. Other challenges of waste management are the lack of policy and regulatory environment that promotes the waste management hierarchy and its economic potential, the absence of recycling infrastructure, highly underpriced waste management thus making waste disposal the most preferred alternative. Moreover, posing as another challenge is the small number and very expensive waste treatment options hence making land fill to be the most affordable practice and in many cases these landfills are not compliant (National Waste Management Strategy, No. 344 of 2012).

6.2 Waste Management Legislation Framework in South Africa

In order to meet the challenges facing waste management in the Republic of South Africa several pieces of legislation have been enacted over a period of time and form the basis for managing waste. Among such legislation are the following:-

- (1) Environmental Management Policy 1998.
- (2) The National Environmental Management Act (NEMA) 1998, Act No. 107, 1998.
- (3) The National Environmental Management: Waste Act (NEMWA) 2008, Act No. 59 of 2008.
- (4) National Waste Management Strategy No. 344, 2012.

6.3 Environmental Management Policy for South Africa, 1998

In May 1998 the Ministry of Environmental Affairs and Tourism issued the White Paper on Environmental Management Policy for South Africa. The purpose of the policy was to serve as an overarching (umbrella) framework policy that governs and guides all government institutions in formulating specific subsidiary and sectoral policies and strategies in all matters dealing with day to day management of the environment. The policy establishes an integrated and holistic environmental management system which aims at, resource efficient, people-centred, participatory, and environmentally sustainable, social economic development. The White Paper on Environmental Management Policy 1998, South Africa sets out principles, and strategic goals which are necessary to ensure

the environmental policy is realized (Environmental Management Policy 1998, South Africa).

The South African environmental management policy sets out a number of fundamental principles which the government and all its institutions are required to use in making decisions, legislation, regulations and enforcement on matters concerning environmental management. Examples of the policy principles are the accountability principle to the government, function allocation principle to government institutions, cradle to grave principle of environmental management; polluter pays principle, waste avoidance and minimization principle, to mention only a few (Environmental Management Policy 1998, South Africa).

The national Department of Environmental Affairs and Tourism as the government central coordinating organ is charged by the national environmental policy with the responsibility for developing the National Environmental Strategy and Action Plan (Environmental Management Policy 1998, South Africa).

The Environmental Management Policy 1998, South Africa also lays down the environmental management structural framework for the implementation of the environmental policy, strategies and regulations as it is spelled out by the South African Constitution. There are four constitutional levels: 1) the national legislative powers- power to amend the constitution and make laws concerning the environmental management. 2) National executive powers- have the power to intervene in provinces where it thinks there is need. 3) Provincial Legislative and executive powers and 4) Local Government. All the four levels interact in environmental management, thus including waste management (Environmental Management Policy 1998, South Africa).

Principles for Environmental Management

The environmental management policy 1998, South Africa sets a number of principles to use in making decisions, legislation, regulation and enforcement such as government accountability, allocation of functions necessary for achieving the policy objectives, capacity building and education to enable the people participate effectively both in sustainable development and resource use (Environmental Management Policy 1998, South Africa). Other principles are the principle of custodianship the government which

has the responsibility to protect the environment in order that the present and future generation benefit. This principle obliges the government, besides other things, to address itself to pollution control and waste management (Environmental Management Policy, 1998, South Africa).

Another principle included in the Environmental Management Policy 1998, South Africa which is relevant to this research is the principle of waste avoidance and minimization. This principle requires waste management to minimize and avoid the creation of waste at source particularly toxic and hazardous waste encourages waste recycling, separation at source and also safe disposal of unavoidable waste (Environmental Management Policy, 1998, South Africa).

Strategic Goals and Objectives of the Environmental Management Policy

In order for the government to achieve its vision for environmental management the policy requires the policy goals and objective be translated into the National Environmental Strategy and Action Plans. The environmental management policy identifies 7 strategic goals for achieving environmental sustainability and integrated environmental management; these are:-

- 1) Effective Institutional Framework and Legislation
- 2) Sustainable resource use and impact management
- 3) Holistic and integrated planning and management
- 4) Participation and partnership in Environmental Governance
- 5) Empowerment and environmental education
- 6) Information management for sustainable development
- 7) International Cooperation (Environmental Management Policy, 1998, South Africa).

Even though all the strategic goals are relevant here in our stud, goal 2; sustainable resource use and impact management is of immediate relevance to our study particularly to the following supporting objectives:-

- a) Sustainable resource use both renewable and non-renewable,
- b) Conservation of biodiversity
- c) Coastal zone management
- d) Environmental resource economics
- e) Integrated pollution and waste management (Environmental Management Policy, 1998, South Africa).

Numbers (d) and (e) are of special significance in this study. Under environmental resource economics among the elements included there are two which are immediate relevance, namely: reduce the waste stream to a level which is safe to the environment and human health, and promote the application of more efficient technology that lead to reduction in the use of resources, waste reduction and pollution (Environmental Management Policy, 1998, South Africa).

In the area of integrated pollution and waste management the goals are very relevant in this study; such as prevention, reduction and management of pollution of the environment, and setting targets to minimize waste generation at source. Also other waste management goals which are relevant to this study are the promotion of a hierarchy of waste management practices such as reduction of waste at source, re-use and recycling with safe disposal as the last resort as they directly related to the research subject – improving solid waste management (Environmental Management Policy 1998, South Africa). One of the important areas in the Environmental Management Policy, 1998, South Africa is its intention to promote the waste management hierarchy (Environmental Management Policy 1998, South Africa).

6.4 National Environmental Management Act (NEMA) 1998, Act No. 107, 1998

The National Environmental Management Act (NEMA) 1998, Act No. 107, 1998 is a fundamental environmental legislation upon which all other subsidiary environmental legislation in the Republic of South Africa are based (City of Johannesburg Integrated 2011, 2011). The National Environmental Management Act, 1998 is, therefore, a basic and general environmental legislation which aims at promoting cooperative environmental

governance in South Africa, establishes broad decision making principles of environmental management, sets up institutions for promoting cooperative governance and coordinates all environmental functions by state organs (Environmental Management Policy, 1998, South Africa). The National Environmental Management Act, 1998 essentially translates the objectives of the South African Constitution whereby it aims at establishing a framework of good environmental management and integrating all the development activities in order to obtain among other things prevention of pollution and ecological degradation and promote environmental conservation (Environmental Management Policy, 1998, South Africa).

The National Environment Management Act 1998, Act No, 107, 1998 Chapter I Section 4, among other things, seeks for sustainable development in conserving the ecosystems and biodiversity by observing the following:-

- i) Minimise or avoid actions causing disturbance or loss of the ecosystem and biodiversity.
- ii) Avoid, minimize or remedy pollution and degradation of the environment;
- iii) Avoid waste but where it cannot be completely avoided it should be minimized and reused or recycled where possible or else it should be disposed in a responsible way.
- iv) Use and exploit non-renewable natural resources in a responsible and equitable manner and they should not be used up completely (National Environment Management Act 1998, Act No, 107, 1998).

These objectives or requirements are quite in line with the waste hierarchy requirements which are well specified in European Union Directive Waste (Directive 2008/98/EC - Waste Framework Directive).

6.5 The National Environmental Management: Waste Act (NEMWA) 2008, Act No. 59 of 2008

The National Environmental Management: Waste Act (NEMWA), No. 59 of 2008 or simply the Waste Act, 2008 is a subsidiary act of the National Environment Management Act (NEMA), No. 107, 1998; and its major role is to regulate all waste management within the Republic of South Africa while also defining the different roles and responsibilities of the different sectors of the government entrusted with its implementation (City of Johannesburg Integrated Waste Management Plan 2011 (2011), South Africa).

The objectives of the Waste Act, 2008 are quite many; among them being minimization of consumption of natural resources, implementation of the waste management hierarchy and obtaining ecologically sustainable development. Furthermore, the Waste Act, 2008 aims at prevention of ecological degradation and pollution, promotion of effective waste delivery, enhancement of people's awareness regarding the impact of waste on their health and wellbeing and the provision of compliance and enforcement and the provision of national standards and norms for waste management (National Environmental Management: Waste Act (NEMWA), No. 59 of 2008).

Section 6 (1) of the Waste Act, 2008 provides for the establishment of a national waste management strategy as a means to achieve the objectives of the Act. The waste management strategy could also include waste reduction targets, provide national norms and standards, provincial norms and standards and waste service standards and also bind all relevant persons and state organs responsible for its implementation (National Environmental Management: Waste Act (NEMWA), No. 59 of 2008).

The Waste Act, 2008 also focused at the establishment of a national waste information system for purposes of effective management of waste and for providing information to different state organs, individuals and other organizations who may require. Moreover, the Waste Act provided for compliance and enforcement requirements and conditions to ensure its effectiveness (National Environmental Management: Waste Act (NEMWA), No. 59 of 2008).

6.6 National Waste Management Strategy (NWMS), No.344, 2012, South Africa

The National Waste Management Strategy, No. 344, 2012, South Africa is a legislative requirement which was provided in the National Environmental Management: Waste Act (NEMWA) 2008, Act No. 59 of 2008, Section 6 (1). In itself it is therefore a subsidiary legislation of the Waste Act, 2008. The purpose of the National Waste Management Strategy is to act as an instrument for achieving the objectives of the Waste Act, 2008. Specifically the National Waste Management Strategy intends to safeguard the health, well-being of the people of South Africa and the environment as a whole by applying good waste management practices including the waste management hierarchy (National Waste Management Strategy, No. 344, 2012, South Africa).

The objectives of the National Waste Management Strategy (NWMS) to mention only a few are: (1) To promote minimisation of waste, re-use, recycling and recovery of waste through application of the Waste management hierarchy (similar to the one set by Directive 2008/98/EC of the European Union). (2) To make sure that health services are delivered efficiently and effectively through proper planning and allocation of waste management responsibilities (National Waste Management Strategy, No. 344, 2012, South Africa).

6.7 Waste Management Practices in South Africa

Waste management practices in the Republic of South Africa are guided by various policies and legislations. The National Waste Management Strategy No. 344, 2012 puts into force the National Environmental Management: Waste Act, No. 59 of 2008), making it legally obligatory for different implementing organs to develop integrated waste management plans. With that, however, the practice of waste management in South Africa cannot be uniform all over the country. In this work the researcher has chosen to have as an example the practices of waste management in the City of Johannesburg (City of Johannesburg Integrated Waste Management Plan 2011, South Africa). The City of Johannesburg with an area of nearly 1644 square kilometres (km²), the engine of economic growth in South Africa and has a fast growing population growth rate of 20.6 % from 2001 to 2007 (City of Johannesburg Integrated Waste Management Plan 2011 (2011), South Africa).

Waste generation in the City of Johannesburg is a big problem due to the big population size and the high population growth rate which is largely caused by immigration from the country side (City of Johannesburg Integrated Waste Management Plan 2011 (2011), South Africa). Waste generation in the City of Johannesburg has been estimated to be 1,492,000 tones general waste per year as per 2008 figures- a reduction of 4.4% compared to 2003 figures. However, these figures are only rough estimates as they are based on disposal data and does not include all waste disposed illegally, waste unlawfully disposed and not all waste diverted away from landfills (City of Johannesburg Integrated Waste Management Plan 2011 (2011), South Africa).

Data collected for 3 years (2007/08 to 2009/10) show that weekly waste collection from households accounts for 54.7% of the total waste streams, 45.3% from other source (6.3% street cleaning, 9.7% garden refuse, and 12.2% from different categories) and 16.5% from illegal dumping. This makes illegal dumping the second highest single waste stream to household waste stream and indeed a big waste problem (City of Johannesburg Integrated Waste Management Plan 2011 (2011), South Africa).

Pikitup (PTY) Limited, a waste management utility formed in 2001, with 100% ownership by the City of Johannesburg is responsible for the collection and disposal of waste in the City of Johannesburg, owns and operates 11 waste management depots, 4 landfill sites and 42 garden refuse sites, some private sites, 1 composting plant and 1 incinerator (City of Johannesburg Integrated Waste Management Plan 2011 (2011)). The Pikitup underperforms with regard to service delivery. On the basis of 2009/2010 figures there was a decline of waste disposal rates since 2008/2009 (City of Johannesburg Integrated Waste Management Plan 2011 (2011), South Africa).

7. Solid Waste Management in Tanzania

The study of solid waste management in Tanzania has been discussed in this section on the point of view of challenges of waste management in Dar-es-Salaam and the various policy and legislation efforts so far undertaken by the state organs of Tanzania.

7.1 The Challenge of Waste Management in Dar-es-Salaam

Solid waste Management has been a big problem in municipal centers in Tanzania including Dar-es-Salaam (State of the Environment Report -2008, Tanzania). The challenge of solid waste management began to worsen in the mid 1980s' when generally social service delivery started to deteriorate (Jones and Mkoma, 2013). Several reasons have been given for the continued deterioration of the waste management situation in the Dar-es-Salaam City among them being the extreme rapid growth of the city population resulting from up country immigration, the ever growing high population density and unplanned human settlements (Mbuya, 2009; Jones & Mkoma, 2013;). Figure 8. The solid waste does have negative effect not only on people but also to marine creatures as well (Mbuya, 2009; Palfreman, 2011).



Figure 8: Pathway in a squatter area at Buguruni Kwamyamani (left) and Posta area (right) in Ilala Municipality, Dar-es-Salaam. Photo: John Maziku November, 2013.

The seriousness of the solid waste management situation in Dar-es-Salaam has continued to worsen in spite of the Government efforts to try to solve it through administrative reforms. In 1994 the Government made reforms by liberalizing the function of waste collection to private campaigns. The reforms initially resulted into positive effect in solid waste collection. Due to these reforms it is estimated that solid waste collection increased from less than 5% in 1992 to nearly 40% in 2000 and together with this about 50% of the entire solid waste of about 2500 tones generated per day was being managed (Palfreman, 2011 as referred to from Dar-es-Salaam City Council).

The liberalization of the solid waste management went hand in hand with the subdivision of Dar-es- Salaam administrative responsibilities for solid waste management into three municipalities – Kinondoni, Temeke and Ilala Municipal Councils and the Dar-es-Salaam City Council as the lead partner. The private sector in the form of private companies Community Based Organization (CBOs), Non-Government Organization (NGO) and Community groups were contracted/engaged in the solid waste management business (Palfreman, 2011).

In spite of the initial positive effects of the liberalization efforts of the Government of Tanzania, it has been reported that approximately 3100 tons of solid waste are generated per day but out of this only about 39% of it is legally discharged (Palfreman, 2011). This deteriorating situation is partly attributed to the unplanned high rate of population increase in the city which stands at 5.6% in Dar-es-Salaam City (2012 Tanzania Population and Housing Census, 2012, National Bureau of Statistics, Tanzania). There seems to be a correlation between population growth and solid waste disposal in Dar-es-Salaam. As the population in Dar-es- Salaam increases also waste generation increases and the problem of waste collection also becomes more complex (Mbuya, 2009; Palfreman, 2011; Jones & Mkoma, 2013).

However, in the meantime the Government of Tanzania has been taking a number of initiatives in terms of formulation of a number of policies and legislation at the central and local levels that are intended to manage the environment in general and solid waste in particular (National Environmental Action Plan (NEAP) 2013-2018 (2013).

7.2 Environmental Policies in Tanzania

There are a number of environmental policies which govern solid waste management in Tanzania and in Dar es Salaam City in particular and the most relevant among them include the following:-

- The National Environmental Policy 1997, Tanzania
- The National Health Policy 1990, Tanzania.

- The Sustainable Industrial Development Policy 1996, Tanzania.

7.3 National Environmental Policy 1997, Tanzania

The National Environmental Policy (NEP), 1997, Tanzania was established in 1997 under the Vice President's Office. The National Environmental Policy gives a broad definition of the term "environment" such that it includes "air, land and water; plant and animal life including human life. The social, economic recreational, cultural and aesthetic conditions and factors that influence the lives of human beings and their communities; buildings, structures, machines or other devices made by man; any solids, liquids, gases, odour, heat, sound, vibration or radiation resulting directly or indirectly from the activities of man; and any combination of the foregoing and the inter-relationships between two or more of them" (National Environmental Policy, 1997, Tanzania). This definition of the environment includes "solids" as being one among many of the elements of the environment. In this general way solid waste are also included elements of the environment (National Environmental Policy (NEP), 1997, Tanzania).

The National Environmental Policy (NEP), 1997, Tanzania identifies and addresses six (6) major environmental problems which need to be urgently addressed; land degradation; lack of accessible, good quality water in urban and rural areas; pollution of the environment; loss of wildlife habitats and biodiversity; deterioration of aquatic systems; and deforestation (National Environmental Policy -NEP, 1997, Tanzania).

Among the issues which the National Environmental Policy (NEP), 1997, Tanzania elaborates, among others, is solid waste pollution in towns as it affects the health of the people. The NEP also points out that pollution and poor management has threatened the productivity of lake, river; coastal and marine waters (National Environmental Policy - NEP, 1997). As regards municipal waste, approximately 10,000 tons of municipal solid wastes are daily being generated all over the country (National Environment Action Plan – NEAP, 2013-2018, 2013, Tanzania).

In Dar es Salaam, for instance, the 4 major rivers; Mpiji River, Msimbazi River, Kizinga River and Mzinga River discharge their waters into the Indian Ocean carrying loads of domestic solid waste that are usually dumped by city residents in the poor settlement areas (Figure 9). The waste pollutes beaches and likely harm marine life (Lukambuzi, 2006 – unpublished).



Figure 9: Msimbazi River bank with waste dumped on its slopes (Left) and mixed waste dumped into Msimbazi River (Right). Photo: John Maziku November 2013.

The overall objective of the National Environmental Policy (NEP), 1997, Tanzania is to ensure there is security, sustainable and equitable use of resources in order to meet the basic needs of the present and future generations while avoiding environmental degradation, health and safety risks. The National Environmental Policy (NEP), 1997 has a number of specific objectives amongst being the conservation of biological diversity of the ecosystem; raising people’s awareness of the importance of environment and its linkage with development; to promote community participation in matters regarding the environment; and promote international cooperation in matters concerning environment (National Environmental Policy- NEP, 1997, Tanzania).

In this regard the objectives of National Environmental Policy (NEP), 1997, Tanzania address every general issue; they do not directly point to specific Municipal Solid Waste issues. However, it is important to note that the National Environment Policy is sectoral cross-cutting in nature; it addresses all the sectors of the social economy which in turn are obliged to include and implement it in their specific policies and plans (National Environmental Policy - NEP, 1997, Tanzania).

7.4 National Health Policy 2007, Tanzania

The National Health Policy 2007, Tanzania, with regard to environmental health, aims at protecting community health through enhancing sustainable environmental health and thereby intends to achieve the following:-

- a) Make sure that the community abides to health standards;
- b) Improve waste management system together with the disposal of hospital wastes;
- c) Undertake on-going health education providers on the significance of environmental health in their places of work;
- d) Review and make laws and procedures for the conservation and protection of the environment (National Environment Action Plan, 2013-2018, 2013, Tanzania).

7.5 Sustainable Industrial Development Policy, 1996, Tanzania

The Sustainable Industrial Development Policy, 1996 aims at promoting industrial development which is environmentally friendly and ecologically sustainable while at the same time aims at establishing an incentive system which encourages the conservation of the environment, promotes the application of the integration of preventative environmental strategy to industrial processes, products and services (National Environment Action Plan (2013-2018) 2013, Tanzania).

8. Legislation Related to Municipal Solid Waste Management in Tanzania

There are two legislations that form the backbone of the legal and institutional framework for sustainable management of the environment in general and for municipal solid waste management; these are:-

- (a) The Environmental Management Act 2004, Act No. 20 of 2004, Tanzania and
- (b) Local Government (Urban Authorities) Act No. 8 of 1982, Tanzania.

8.1 Environmental Management Act 2004, Act No. 20 of 2004, Tanzania

The overall objective of the Environmental Management Act 2004, Act No. 20 of 2004, Tanzania, is to provide for and promote the enhancement, protection, conservation and management of the environment. The Environmental Management Act 2004, Act No. 20 of 2004, Tanzania, among other things, includes the following provisions which are directly relevant to the management of the environment:

- (i) The legal framework for the overall management of the environment giving power and responsibilities for various organs and enforcement mandate.
- (ii) Establishes the administrative and institutional framework for the management of the environment (Part II Sections 11 – 41).

Part XI of the Environmental Management Act 2004, Act No. 20 of 2004, Tanzania, dwells on waste management. Part (a) deals with solid waste and places the responsibility for solid waste management to local government authorities. The role of the Local Government Authorities is to ensure minimization of the solid waste in their areas of jurisdiction. The Environmental Management Act 2004, Act No. 20 of 2004, Tanzania also gives mandate to the Local Government Authorities to involve the private sector and Non-governmental Organizations (NGOs) in solid waste management activities (Environmental Management Act 2004, No. 20 of 2004, Tanzania).

Section (b) of Part XI of the Environmental Management Act 2004, Act No. 20 of 2004, Tanzania deals with the management of litter. “Litter” under Section 120 of the Act is defined as “any refuse, rubbish, animal remains, glass, metal, plastics, garbage, debris, dirt, filth, urine, rubble, ballots, stones, earth, sewage or waste matter or any other things of like nature.” In the Environmental Management Act 2004, Act No. 20 of 2004, Tanzania the handling of litter is entrusted to every individual who has a public place under one’s control (Environmental Management Act 204, Act No. 20 of 2004, Tanzania).

The Environmental Management Act 2004 under Part XI gives Local Government Authorities the responsibilities among other things to undertake solid waste management. Hence the Local government (Urban Authorities) Act No. 8 of 1982, Tanzania) entrusts to urban authorities the responsibility, among other things, the responsibilities to ensure that

their areas of jurisdiction and sanitary conditions are kept clean. Section 55 of the Act gives the responsibility for managing the waste in urban areas to urban local authorities (Local Government (Urban Authorities) Act No. 8 of 1982, Tanzania).

8.2 Local Government (Urban Authorities) Act No. 8 of 1982, Tanzania and By-Laws

On the basis of the Local Government (Urban Authorities) Act No. 8 of 1982, Tanzania all the urban authorities in Tanzania are given the mandate to make their own by-laws to enable them execute their responsibility of waste management in their respective areas of administration. The Local Government (Urban Authorities) Act No. 8 of 1982, Tanzania delegates to the local authorities, including the Dar-es-Salaam City Council and its three constituent municipalities Kinondoni, Ilala and Temeke the power to make waste management by-laws within their respective areas of administrative control (Local Government (Urban Authorities) Act No. 8 of 1982, Tanzania).

The Dar-es-Salaam City Council (Collection and Disposal of Refuse) By-Laws of 1994 were based on section 56 of the Local Government (Urban Authorities Act) No. 8 of 1982 and were meant to be applicable and enforced in all the three Dar-es-Salaam municipalities of Kinondoni, Ilala and Temeke. Upon the mandate of these by-laws the Dar-es-Salaam City Council is required to facilitate the collection and disposal of refuse from residential areas and business premises; it has also to determine the place where the waste has to be deposited. The bylaws also forbid the deposition and throwing of all types waste and the accumulation of dust of any kind. In case one does not abide to these bylaws it is taken as committing an offence and is liable for being prosecuted. If such a person is found guilty is fined an amount not exceeding five thousand shillings (5000/-) or imprisonment for a term not exceeding six months in case one is found guilty (as cited by Lukambuzi, 2006, from the Dar-es-Salaam City Council (Collection and Disposal of Refuse) By-Laws of 1994).

The Dar es Salaam City Council was established in 1996 together with the creation of three urban Municipal Commissions; Kinondoni, Ilala and Temeke Districts and all constitute the Dar es Salaam Region. The Kinondoni Municipal Commission (Collection and Disposal of refuse) by-laws of 2000 categorise waste into various groups; liquid or

solid waste, domestic refuse or trade waste; hazardous or bulk waste (as cited by Lukambuzi, 2006). Also the bylaws give waste management responsibilities to other entities other than Kinondoni Municipal Commission; these are the Municipal Commission's registered agents or contractors. In case one fails to comply with these by-laws it is taken as a criminal offense and if found guilty is liable for being fined not more than Tshs. 50,000/= or up to twelve (12) months jail or both (as cited by Lukambuzi, 2006). Ilala Municipal Council by-laws were made under section 80 of the Local Government (Urban Authorities) Act, 1982, are similar to the bylaws of Kinondoni and Temeke municipalities and are used for solid waste collection and disposal in the Ilala Municipal Council (as cited by Lukambuzi, 2006).

The Temeke Municipal Commission bylaws on solid waste management (collection and disposal of refuse) by-laws, 2002 made under section 80 and 81 of the Local Government (Urban Authorities Act), 1982 categorise waste into three groups: "bulk waste," "bundle waste," and "domestic refuse" whereby the three terms are defined as follows:-

"Bulk waste" includes large appliances, machines, furniture, and other solid waste (Including construction or demolition debris or dead animals with weights or volumes greater than those allowed for bundle waste or dustbins);

"Bundle waste" includes tree parts, shrubs, bush trimmings, news papers, magazines, cartons or solid waste securely tied as a package not exceeding one meter in length or 1 kg in weight;

"Domestic refuse" means normal household waste produced on any residential building used wholly as a private dwelling.

"Hazardous wastes" means waste whole is toxic, flammable, corrosive, radioactive, explosive or otherwise dangerous in accordance with the Tanzania Environmental Protection Agency, and shall also include motor oil, diesel, fuel, gasoline (petrol), paint, solvents, dry cell and batteries, pesticides and infectious or medical wastes from hospitals and clinics, metallic and/or oily sludge or solvents from commercial and industrial establishments, asbestos materials, pesticides, radioactive wastes, and the like (Temeke Municipal Commission (Solid Waste Management) (Collection and Disposal of Refuse) By-Laws, 2002).

Operation wise the Temeke Municipal Council provides solid waste management services through registered contractors and provides directives on management of the different kinds of refuse to all responsible entities. And also provides for the payment of waste

collection fees by the households or occupiers to the Authority or authorized agents and is responsible for disposal fees for persons and agents who transport wastes to dumping sites. If one does not comply to the requirements of the by-laws and if found guilty can be fined not more than Tshs. 50,000/= or be imprisoned for up to twelve (12) months or both (Temeke Municipal Commission (Solid Waste Management) (Collection and Disposal of Refuse) By-Laws, 2002).

9. Waste Management Practices in Tanzania

In Tanzania sorting is not done at the generation points because of the poor environmental education which people have as well as money to buy various waste bags for the separation of waste. Collection points usually take every mixture of waste regardless of the types of waste involved. Though recycling is not well stated in the law it is encouraged to some extent; the Division (Ministry) of Environment supports the recycling system hundred percent under sustainable industrial development policy (as stated by Mrs. Kisanga, Principal Chemist in the Division of Environment, Vice President's Office, Tanzania, 2013). Figure 10.



Figure 10: Collection point with a mixture of waste at Jamhuri Street in Ilala Municipality, Dar-es-Salaam. Photo: John Maziku, November 2013.

In Tanzania there is no law or policy which states clearly how recycling should be done. In Dar-es-Salaam City which is the largest and commercial city in Tanzania, recycling of bio waste is done only by Ilala Municipality with the help of a Germany organization called Bremen Overseas Research and Development Association (BORDA). The two municipalities of Kinondoni and Temeke do not undertake recycling (According to verbal

communication with Mr. Bernado, Environmental Engineer at KIKUTA Waste Recycling Station, Gongo la Mboto; Dar-es-Salaam, in November, 2013). Figure 11.



Figure 11: KIKUTA Recycling Station at Gongo la Mboto Ward; Ilala Municipality, Dar-es-Salaam. Photo: John Maziku November 2013.

Recycling of plastic bottles and cans is done privately by scavengers in the streets and at the Pugu Kimyamwezi Dump Site. It is estimated that 350-400 scavengers go every day to the Dumpsite and the numbers fluctuate daily (as stated by Mr. Kishere, The Pugu Kinyamwezi Dump Site Manager in January, 2014). Figure 12. The scavengers are undertaking the recycling activity voluntarily for their daily bread. Likewise recycling of other goods such as tires, batteries, scrap metal are also done by individuals with private companies in a small scale and large scale. There are lots of challenges in collection points which are inadequate in the city.



Figure 12: Scavengers at Pugu Kinyamwezi Dumpsite. Photo: John Maziku November 2013.

10. Material and Methods

10.1 Area of Study

The study was undertaken in Dar-es-Salaam City between early September and December, 2013. This was the period during which the researcher undertook field practical at the Vice President's Office, Division of Environment.

The city is situated along the western shores of the Indian Ocean at the extreme Eastern part of Tanzania. The City has been described as one of the fastest growing cities in Sub Saharan Africa and it is also the largest administrative, commercial, industrial and cultural, educational and transportation city in Tanzania (Dar-es-Salaam City Environment Outlook 2011, (2011)).

The City is located in the Eastern part of Tanzania mainland between latitude 6°36' and 7°0' South. On the East it borders the Indian Ocean with a long stretch of sandy beach and shore line which is covered dunes, tidal swamps and coastal plain. To the North, West and South it is surrounded by the Coast Region. The city covers a total surface area of 1,800 square kilometres (km²). It comprises about 0.9% of the entire area of mainland Tanzania (Dar-es-Salaam City Environment Outlook 2011 (2011)).

The city consists of three municipalities; Temeke with land surface area of 652 km² (46.8%), Kinondoni having 531 km² (38.1%) and Ilala having 210 km² (15.1%) (Dar-es-Salaam City Environment Outlook, 2011 (2011)). Administratively Dar –es-Salaam city is run by four Local Government Authorities which are the Dar- es-Salaam City Council and three Municipal Councils of Temeke, Kinondoni and Ilala (Dar-es-Salaam City Environment Outlook 2011, (2011)). Figure 13.

The Dar-es-Salaam coastal and marine ecosystem comprising mangrove forests, sandy beaches, estuaries, coral reefs and sea grass beds and also rich in many types of marine and fresh water resources has suffered over the past several decades of serious degradation because of pollution and over exploitation by human activities. This has lead to the

disruption of the ecological balance of the ecosystem, reduction of natural resources, loss of habitat and biodiversity and in turn this has negatively affected human life and social economic development (Dar-es-Salaam City Environment Outlook 2011, (2011)).

The City has sandy beaches stretching along the coast line which serve as places for recreation and tourist attraction and also has four major rivers; Mpiji, Msimbazi, Kizinga and Mzinga rivers and several streams which are severely polluted and yet are sometimes used as sources of water by poor households in squatter settlements and for irrigation of vegetable farms. The rivers and streams are badly polluted by untreated solid and liquid wastes discharged from industrial, commercial and domestic sources (Dar-es-Salaam City Environment Outlook 2011, (2011)).

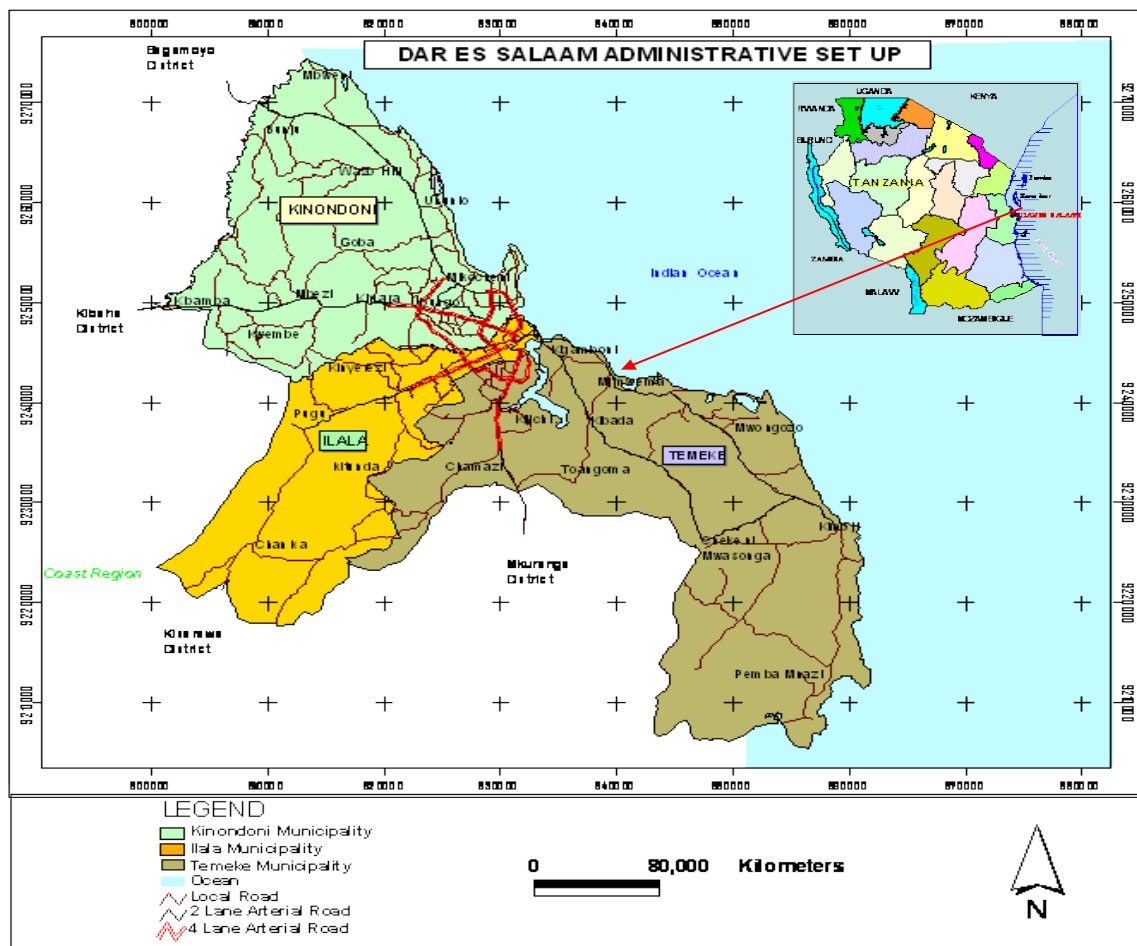


Figure 13: Locations and Administrative setup of Dar –es- Salaam with insert showing the location within Tanzania.

Source: Dar - es Salaam City Environment Outlook 2011 (2011), Second Draft, Division of Environment, Vice President’s Office, United Republic of Tanzania, Dar-es-Salaam.

Population

The city has a total population of 4,364,541 distributed over the three constituent municipalities as shown in Table 1.

Table 1: Population Distribution over Dar-es-salaam City Municipalities-2012

S/N	District/Council	Total	Male	Female	Household Size
0	Total	4,364,541	2,125,786	2,238,755	4.0
1	Kinondoni Municipal	1,775,049	860,802	914,247	4.0
2	Ilala Municipal	1,220,611	595,928	624,683	4.0
3	Tememe Municipal	1,368,881	669,056	699,825	3.9

Source: 2012 Population and Housing Census Report (2012), National Bureau of Statistics, Tanzania, Dar-es-Salaam.

According to the 2012 Population and Housing Census Report (2012) Tanzania the Dar-es-Salaam City had the highest population among the 30 Administrative Regions of Tanzania (25 in Mainland Tanzania and 5 in Zanzibar) and accounts for 10 % of the total mainland population (2012 Tanzania Population and Housing Census Report, Tanzania). The City has the highest population density in the country numbering 3,133 persons per square kilometre in relation to the overall country's average population density of 51 persons per square kilometre. Moreover, the City has an average annual population growth rate of 5.6% of the Dar-es-Salaam compared to the National average population annual growth rate of 2.7% in 2012. While the overall average population annual growth rate of Tanzania shows a declining trend of 3.2% in 2002 to 2.7% in 2012, the Dar-es-Salaam City growth rate shows an increasing trend of 4.3% between 1988 to 2002 and to 5.6% between 2002 and 2012 (2012 Population and Housing Census Report, Tanzania (2012)).

According to the relative distribution of population in the three Municipalities of Dar –es-Salaam City as shown in table 1 above, Kinondoni Municipality ranks the highest in

population, followed by Temeke and Ilala ranking the last. This has implications in terms of the demands for and provision of various social and economic services including waste management services. The higher the population the higher is the demand for the social and economic services.

The reason for high growth of the population in Dar- es- Salaam City has been attributed to high immigration of people particularly young people from all over Tanzania seeking better opportunities such as employment, trade, business, education and generally expectations for better living conditions in the City (Dar-es-Salaam City Environment Outlook 2011, (2011)). The population growth in the three Dar-es- Salaam City Municipalities of Kinondoni, Ilala and Temeke pose challenges to the provision and management of social services such as education, health, transport, housing and waste management (Dar-es-Salaam City Environment Outlook 2011, (2011)).

10.2 Study Population and Study Sample

The potential population of study from which the researcher collected the information for the study consisted of a mixture of groups of individuals with different social and occupational characteristics. These comprised officials from the Department of Environment in the Vice-President's Office, officials from Municipal Authorities, fishermen, workers and employees in companies involved in refuse collection and the public at large particularly those who regularly visited the seaside for recreation purposes or for any other business. The researcher selected this mixture of study population because from the various groups he anticipated he would get different samples of respondents from whom he could get relevant and sufficient data to enable him attain the objectives of his research.

From the target groups of the study population the researcher selected the following study samples;-

- Department of the Environment, Vice President's Office: The researcher decided to take one senior officer as a sample. The researcher was satisfied to take only one person because he had the opportunity to get a good amount of data while interacting with the

other employees during office hours as he was doing his field internship at the office. The researcher sought general information regarding environmental management, policy matters and waste management in general including challenges.

- Officials from Temeke, Ilala and Kinondoni Municipal Authorities: The researcher selected a sample of 1 (one) environmental officer from each municipality.
- Fishermen: The researcher selected a sample of 10 fishermen from whom he obtained information regarding waste management in general at their place of work- the Kivukoni Fish Market.
- The public at large: 30 Beach goers at Koko Beach recreation area and 20 students of a higher learning institution (the Institute of Finance Management) who frequently hold group discussions at the Ocean Road seaside during times of examinations periods. The researcher sought information about their awareness concerning waste management in general and at the beach along the Indian Ocean.
- Six (6) employees and workers from waste management companies and civil- based organizations: all dealing with waste management. The aim was to get their perceptions of the state of the environment in Dar-es-Salaam and how effective solid waste management was being undertaken.

10.3 Sampling and Data Collecting Methods

The researcher used mainly two methods in selecting his sample from the major groups of possible population groups: (a) purposive (non-probability) sampling method and (b) probability sampling method. The researcher was obliged to use the purposive (non-probability) sampling method in the Division of Environment; Vice President's Office, Tanzania where he was serving as an intern. One senior officer who was regarded to possess the necessary information which the researcher required was assigned to respond to all his needs for data on environmental issues within the Division. As a result the officer was the only respondent who was available for interview.

In a similar manner, the researcher after getting permission to undertake research from the Municipal Director of each of the three Dar-es-Salaam Municipalities, one environmental

expert was assigned to the researcher to respond to all his information requirements. In all the three City Municipalities the three municipal environmental officers dealing with waste collection were assigned for him to form his sample. The criteria for the Municipal authorities to appoint the environmental officers to the researcher was their expertise their possession of information on environmental and waste management which the searcher was seeking.

The researcher selected the three groups of the civil community; the beach goers, fishermen and students of the Institute of Finance Management (IFM) using the purposive sampling method. The criterion used to select them was their close familiarity with the Indian Ocean and the beaches and therefore the knowledge regarding the solid waste situation. The beach goers visited the beach for recreation such as fresh sea breeze and for swimming; the fishermen earned their living through fishing far away into the Indian Ocean and washed their fish at Kivukoni Fish Market which was on the coastline. The students often frequently visited the beach near their Institute for holding study discussions along the seaside. As for selecting who to interview in each of the three groups of the civil society the researcher used random selection method.

The researcher applied four methods for collecting primary (first hand) data for the study; semi-structured individual interviews, group discussions, field observations, stakeholder consultations and presentations with Ministry officials and questionnaires were used in order to obtain primary data. Also unstructured interview was used with employees and workers of a waste management company and a Civil-Based Organisation (CBO) dealing with waste collection. The purpose of the interview was to understand how those organizations performed the task of waste management (collection) and the challenges they faced in undertaking the task.

Semi-structured interviews were administered to the Chief Chemist in the Division of Environment, Vice-President's Office, Tanzania and to the environmental officers in three Dar-es-Salaam municipalities of Kinondoni, Ilala and Temeke. The interviews were based on an interview guide prepared in advance by the researcher. The researcher administered the questionnaires face to face orally to each respondent. The questions in the questionnaires were both closed questions and open-ended questions.

Three main types of questionnaires (interview guides) were used in the data collection:

(1) The first type of questionnaire administered to the Chief Chemist in the Division of Environment, in the Vice-President's Office was intended to obtain information regarding environmental management from a central ministry dealing with overall environmental management policy in Tanzania.

(2) The second type of questionnaire (interview guide) was used to collect information from three Environmental Officers – one from each of the three Dar-es-Salaam City Municipalities of Kinondoni, Ilala and Temeke. Environmental Officers in the three Municipalities are knowledgeable and are responsible in the municipality for managing waste and the environment at large.

(3) The third type of questionnaire was the one used to collect data from three groups of the civil society who used to spend good amount of time at the sea side (at the beach) making recreation and others even going far away into the Indian Ocean fishing . The first group of the civil society consisted of **30 beach goers** who go to the beach for swimming or just enjoying cool sea breeze particularly during weekends.

The second group of the civil society comprised **10 fishermen** whose main occupation was fishing far away into the Indian Ocean and also after harvesting their fish they come offshore and spend a good amount of time at the Kivukoni Fish Market cleaning and selling their catch. The fishermen were relatively older than the other two groups of the civil society- the beach goers and the students of the Institute of Finance Management- whom I interviewed. Also the fishermen were likely to be less educated than the two other groups of the civil society. The choice of this group was influenced by the need partly to find out their awareness of the importance of waste management to them at the Dar-es-Salaam coastal belt.

The third group of the civil society consisted of **20 students** from the Institute of Finance Management (IFM). The IFM is a higher learning institution equivalent to university. The IFM students were those who had the habit of frequently holding academic discussions at the sea side (Ocean Road areas close to Ocean Road Hospital and State House) while preparing for examinations. This group of respondents was a group relatively more

educated than the other two groups and hence presumably more aware of the significance of waste management at the coastal belt.

The aim of these interviews were to determine the interviewees' awareness of environmental issues, including waste management, pollution, the challenges which such waste management issues posed to individuals and to the government. Also it was to find out the role they played in the management of the environment and waste. Moreover, brief interviews were conducted with employees and workers of a waste management company and a Civil-Based Organization. The interviews were unstructured and aimed at finding out the perceptions of the interviewees regarding the challenges involved in waste collection.

The interview method was preferred to the questionnaire method because in Tanzania respondents feel more comfortable with interviews than the questionnaire method. Many target respondents feel reluctant to fill in questionnaires. Therefore using the questionnaire method can likely result into very few questionnaires being returned or else they can be delayed. The researcher, therefore, used a semi-structured interview method to collect information from the various groups of respondents, i.e. the Chief Chemist in the Department of the Environment, Vice Presidents' Office, the Environmental Officers of the three Municipalities, the beach goers, the fishermen and the students. The researcher used to record the various responses of each interviewee in a separate sheet of paper- the questionnaire, instead of giving each respondent a separate questionnaire to fill.

The researcher started collecting data by end of September after obtaining official authorization from the Regional Commissioner's Office of Dar-es-Salaam Region. Thereafter, the researcher started contacting the three Municipalities of Temeke, Ilala and Kinondoni where finally he was assigned to the municipal environmental experts.

Language

All the sets of interview guides which the researcher used in collecting data from different groups of respondents had been prepared in English but the interviews were administered in English or Kiswahili Language (the Tanzanian National language) or both languages depending on the level of competence or at which the interviewee was in the particular

language. The researcher used English in administering the interview with the officer in the Division of Environment of the Vice President's Office, Tanzania and with the three Environmental Officers of the three Dar-es-Salaam municipalities (Kinondoni, Ilala and Temeke). Kiswahili was occasionally used to elaborate some points on both parties. Also the interviews with the students of the Institute of Finance Management (a polytechnic University) were initially conducted in English as the researcher read each question from the interview guide which he had prepared in English. However, there was flexibility with the respondents who were free to use both languages as the discussion progressed; the researcher also had to do the same to be in line with them.

Interviews with the beach goers and the fishermen, all were done in Kiswahili only taking into account the fishermen's understanding of the English language is very low if not completely nil. However the researcher translated the questions in the interview guide to the interviewees as he went along with the interviews. All the discussions were done in Kiswahili. Also interviews with workers and employees of waste management company and the Civil Based Organization were conducted totally in Kiswahili.

In conducting brief interviews with the employees and workers of the waste management company and the Civil-Based Organizations dealing with waste collection Kiswahili language was used for the same reason that the respondents knew very little English.

Field observations

The researcher also used the observation method to collect primary data by conducting field surveys in various areas of the Dar-es-Salaam City including coastal beaches in order to observe the social economic activities including social services based on the environmental perspectives provided and the current state of the environment in Dar-es-Salaam. The researcher observed the state of solid waste pollution in Dar-es-Salaam and the sources of solid waste and marine litter to parts of the Dar-es-Salaam coastal belt. Through observation the researcher also took photographs as illustrations and evidence. Photographs are included in the thesis.

Stakeholder consultations

Also the researcher held several consultations and discussions with various key stakeholders such as scavengers, the Heads of Community Based Organizations some NGO workers in order to get their perceptions on the state of the environment and waste management in Dar-es-Salaam City and the challenges involved and possible management actions that could be taken to ensure sustainable environmental management within the City.

Presentations- Conferences and Meetings

By attending a number of conferences within a Ministry of Environment in Tanzania as an intern the researcher was able to gather important information regarding issues concerning environmental management in Dar-es-Salaam. Also the researcher participated in a one week seminar for book review titled “The State of the Environment Report 2008-Draft.” The conference and seminars and discussions in the Department of the Environment in the Vice Presidents’ Office made his understanding and awareness of the environment and pollution in Tanzania particularly in Dar-es-Salaam. He was also able to get articles from the website on solid waste management.

Literature study

The literature study method was also used for collecting data (already available data) on the environment, waste management and legislation from various sources such as books, online articles from the internet and reports from the Municipalities. The articles were on the European Union, South Africa, East Africa including Tanzania and other countries in the areas of environmental and waste management. The data obtained on solid waste generation and collection was for the whole Dar-es-Salaam City and they were not grouped according to the three municipal authorities. Moreover the data was limited to the period from 1994 to 2007. More current data was not available from any of the municipalities.

Data Analysis

After collecting the data the researcher organized the data and analyzed them. Because the study was basically qualitative research which involved the collection of respondents' views, opinions and perceptions, the analysis also was qualitative. The collected data was grouped into similar categories of similar nature and logical analysis was applied and finally conclusions were made.

The process of analyzing the qualitative data also used some quantitative tools of simple additions to get the number of respondents who gave similar ideas. Finally simple percentages where possible were calculated in order to get percentages of respondents who gave similar responses out of the total number of respondents in a group. It was only once when some quantitative technique (statistical analysis) was used in analyzing the data for solid waste generation and solid waste collection in order to determine their trends and relationships over the years. Therefore, SPSS program was used for analyzing linear regression between two types of groups ; independent and dependent groups of data.

11. Results

The research was basically qualitative in nature hence the data collected was also mainly qualitative except some data were quantitative regarding solid waste generation and collection in the Dar-es-Salaam Municipality between 1994 and 2007. The qualitative data was obtained through interviews which the researcher carried out in Dar-es- Salaam City from September to early December 2013. The interview data has been summarized in Appendices I, II, III and IV. The quantitative data on solid waste generation and collection were obtained from documentary review provided by one of the environmental officers of one of the municipalities of the Dar-es-Salaam City.

The data contained in the interview guides appearing as Appendices I to IV, the qualitative data collected by NGOs and CBOs dealing with waste collection and the quantitative data on waste generation in Dar-es-salaam City in the period 1994 to 2007 contain valuable data but not all of it was directly relevant to the research. Specifically, the data which was relevant to meeting the objectives of the research were the only ones which were used in presenting the research results. In particular, the research results have been derived from

the data obtained from the various sources (including the various groups of respondents) mostly as contained in the Appendices I, II, III and IV. The research results have been presented here below in relation to the specific objectives of this research.

11.1 Objective 1: People's Awareness of Solid Waste Management

The purpose of this research objective was to find out whether people in Dar-es-Salaam understood the importance of solid waste management to the Dar-es-Salaam Coastal belt and to its environment at large. Results from interview responses of an official from the Department of the Environment in the Vice President's Office, three groups of the Civil Society and Municipal Environmental Officers provide the following information about people's awareness of different aspects of the significance of solid waste management within the Dar-es-Salaam City Coastal belt and on its environment as a whole:-

Results from the Department of the Environment

Response results from the designated officer in the Department of the Environment in the Vice President's Office- the organ responsible for environmental legislation and policy formulation in Tanzania to question number 3 on whether the "Ministry" had any plans to educate the people concerning waste management and to question 5 on people's awareness about the environment revealed that already a campaign with the slogan, "everybody should clean his premises" had been launched on the 12th February, 2011. However, it was informed that the campaign was poorly implemented. Also the response to question 5 reveals poor environmental awareness among the people Dar-es-Salaam City. Interview results to question 3 and 5 are obtained in Appendix I: Results on Questionnaire to the Division of the Environment, Vice President's Office.

Results from Municipal Environmental Officials of Kinondoni, Ilala and Temeke:

Environmental officers in the Municipalities are responsible for the overall management of the environment within the administrative boundaries of the respective municipalities. Results from interview responses of three Environmental Officers of Kinondoni, Ilala and Temeke Municipalities on question 4, "What challenges do you face in solving and implementing your waste management plan?" Two of the environmental officers out of 3 (= 66%) stated the absence/ lack of community awareness about environmental

management and the side effects of waste. As examples, of the lack of awareness of people regarding waste management: people in the municipalities threw their food leftovers and some peelings into the flood drains along the city street roads- actions which blocked the drains and caused city roads to flood with water mixed with waste.

Interview results from Municipal Environmental Officers also reveal that many inhabitants of Ilala Municipality had their latrine pipes connected to discharge their liquid wastes into the Msimbazi River. Finally the river discharge it's water into the Indian Ocean and pollute it. Also it was noted that community members were reluctant to pay waste collection fees. Appendix II: Results to questionnaire on solid waste management in Dar-es-salaam coastal City by environmental officers of Kinondoni, Ilala and Temeke Municipalities, contains all the responses from the interviewed municipal environmental officers to the questions.

Results from the Civil Society Groups in Dar-es-Salaam

The Civil Society in this study was represented by 30 Beach Goers aged 20 to 25 years, 10 Fishermen aged 30 to 50 years and 20 IFM Students aged 20 to 25 years who were selected purposely because of their close familiarity with the coastline as they frequently visited the beach; one group recreated at the beach, another earned its living in the ocean through fishing and the other frequently spent time studying at the beach. The three groups were expected to give their views regarding the significance of solid waste management to the Dar-es-Salaam City in general and to its coastal belt in particular through answering several interview questions as detailed here under. The full tabulation and analysis of the responses are summarized in Appendix III: Results on questionnaire to Civil Society Groups (beach goers, fishermen and students).

Question 1: Are you satisfied with the waste management services given by the municipalities?

Results from responses by beach goers, fishermen and students to this question are summarised in Table 2.

Table 2: Responses from civil society groups on whether they were satisfied with the waste management services

S/N	Type and Frequencies of Responses	Satisfied		Not satisfied		I don't know	
	Number & Type of Respondents	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	30 Beach Goers	10	33%	19	63%	1	3%
2	10 Fishermen	10	100%	0	0	0	0
3	20 Students	3	15%	17	85%	0	0

(a) Results from responses by **30 beach goers** on the question whether they are satisfied with the waste management services given by the Dar-es-Salaam Municipalities of Kinondoni, Ilala and Temeke indicate the following:-

Ten (10) out of 30 beach goers-respondents (i.e. 33%) indicated they were satisfied. They further commented that the municipalities tried to clean (the beaches) but the results were not clearly seen. Nineteen (19) out of 30 respondents (i.e. 63%) expressed they were not satisfied and commented that they did not see any one cleaning the beach and the waste remained uncollected. One (1) out of 30 respondents (i.e. 3%) indicated that he/she did not know. In addition the researcher's own observation was that waste was scattered all over the beach.

(b) Results from responses by **10 fishermen** on the question number 1 on whether they were satisfied with the waste management services given by the Dar-es-Salaam Municipalities were as follows:-

All the 10 respondents (fishermen) (i.e. 100%) stated that they were happy and very much satisfied; now water was available at the Kivukoni Fish Market for cleaning the toilets and for washing their fish ready for sale compared with the previous years as this their comment explains: "We are very satisfied compared to previous years, whereby there was no water at all in this market, so toilets were just stinking; we could not wash the fishes ready for sale etc. We are really happy and satisfied now."

However, according to the researcher's observations, the situation at the fish market looked filthy. There was a pile up of plastic bags, packaging materials, plastic bottles, paper boxes, and coconut shells (solid waste) and all mixed with water and mud. Figure 14.



Figure 14: A Pile of waste mixed with water at Kivukoni Fish Market. Photo: John Maziku November, 2013.

(c) Results from responses by **20 students** of the Institute of Finance Management (IFM) to question number 1 on whether they were satisfied with the waste management services given by the Dar-es-Salaam Municipalities were as follows:-

Three (3) student respondents out of 20 (i.e. 15%) were satisfied adding that every morning they used to see people cleaning the place but thereafter in the afternoon waste accumulated because there were no waste bins. “We normally see people cleaning in the morning whenever we come; but the problem is the people who pass by usually throw plastic bottles and plastic bags because there are no waste bins around as you see now. People clean every morning but after some time in the afternoon waste accumulates.”

Seventeen (17) **student respondents** out of 20 (i.e. 85%) answered they were dissatisfied with the waste management services and claimed that they did not see anyone cleaning the place. Table 2 displays the responses of the three groups of the civil society.

The overall results from the three groups of Civil Society which were interviewed show that on the average 38% were satisfied with the management services as opposed to a majority of 60% of the respondents (i.e. 60) who were not satisfied.

Question 2: If no (If you are not satisfied with the waste management services), what are you doing in your small ways to reduce the problem?

This question intended to find out the awareness of the sampled section of the Civil Society of its role in improving the quality of solid waste management on the coast belt. Results from responses by the sampled groups of the Civil Society to the question based on the 4 alternative answers; (i) I try not to pollute the environment whenever I am here, (ii) It is not my responsibility, (iii) I don't know and (iv) Other, are shown in Table 3.

(a) Response results to the interview question from **30 beach goers** showed that 7 (i.e. 23%) tried not to pollute the environment whenever they were at the beach; none (i.e. 0%) felt that it was not his/her responsibility to do something to reduce the problem. Twenty three (23) (i.e. 77%) of the respondents responded under "Other" category of responses with such a typical remark, "Anyone who comes here will automatically be compelled to pollute the environment because there are no waste bins."

Table 3: Responses from Civil Society Groups on whether they were doing anything to reduce the problem of solid waste

S/N	Type and frequencies of Responses	I try not to pollute the environment whenever I am here		It is not my responsibility		I don't know		Other	
	Number of respondents	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	30 Beach Goers	7	23%	0	0	27	73%	0	0
2	10 Fishermen	10	100%	0	0	0	0	0	0
3	20 Students	12	60%	1	5%	0	0	7	35%

(b) Response results from all the **10 (i.e. 100%) fishermen** expressed that they tried not to pollute the environment whenever they were at the coast belt.

(c) Twelve (12) out of 20 (i.e. 60%) students responded that they tried not to pollute the environment whenever they were at the beach. Also some of them added these comments: “I educate people at home; I clean the environment where I live; I am ready to walk with a plastic bottle from morning to evening if I don’t see waste bins.”

One (1) out of 20 (i.e. 5%) student respondents felt it was not his/her responsibility to do anything to reduce the pollution problem at the Coast belt. In addition the respondent added these comments to justify his stand: “It is not my responsibility. It is the responsibilities of the Municipality because they are paid for it from our own taxes and they do nothing. For example; when Obama (President of the United States of America) came here, the beach was very clean; not even a single plastic bag; and it was the Municipality which was doing that.”

These comments imply that this particular respondent felt that the Municipality was not fulfilling its own responsibility of keeping the environment and the coastal belt clean; giving as an example the state of the beach during President Obama’s visited to Dar-es-Salaam when the Municipality kept the beach very clean.

Under the third suggested option of responses, “I don’t know,” there was no student who responded to this. On the other hand 7 (i.e. 35%) of the student respondents put their answers under the fourth alternative category of responses, i.e. “Other,” and gave these comments: “I don’t pollute at all in the street; I only clean where I live; there are no waste bins throughout the city; people are not yet civilized.” These comments are very similar to the responses of the 12 students whose responses fell under the first option of responses- “I try not to pollute the environment whenever I am here.”

Question 3: Why do we still experience the waste problems in our society/ Dar-es-Salaam?

This question is intended to find out from the three groups of Civil Society (30 beach goers, 10 fishermen and 20 students) what they perceived to be the reasons for the waste

problems to continue to exist in the City of Dar-es-Salaam. Hence, the question was intended to find out the respondents' awareness of the reasons for the problem of waste to continue being experienced in the City of Dar-es- Salaam and its Coastal belt. Interview results are summarized in Table 4.

Table 4: Respondents' views on why the waste problem continues to be experienced

N/A	Number & Types of Respondents	Type of Response
1	30 Beach Goers	No waste bins in the whole city not only here at the beach*
2	10 Fishermen	(It seems they do not see any problem of waste)
3	20 Students	-No waste bins throughout the city. People are not yet civilized.

All the 30 (i.e. 100%) beach goers (respondents) pointed to the absence of waste bins not only at the beach but also in the whole city.” Similarly, all the 20 (100%) student respondents gave similar reasons that there were no waste bins throughout the city and people were not yet civilized. On the other hand, all the (10) ten (100%) fishermen respondents were silent. Possibly they did not see any waste problem in Dar-es-Salaam City and at the coastline in the same way as they expressed they were satisfied with the waste management services given by the Dar-se-Salaam Municipalities in question 1.

Question 4: Have you ever experienced any problem associated with waste?

The intention for this question was to find out the respondents' experiences, hence their awareness, regarding problems brought about by waste as a way of testing their awareness of the harmful effects of waste to individuals and society. The respondents were required to give any one of the three suggested alternative answers: (i) Yes, (ii) No (iii) I don't know. The respondents were 30 beach goers, 10 fishermen and 20 students. Table 5 displays the responses.

Table 5: Responses on whether civil society groups have ever experienced any problem associated with waste

S/N	Type and Frequencies of Responses	Yes		No		I don't know	
	Number & Type of Respondents	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	30 Beach Goers	22	73%	8	27%	0	0%
2	10 Fishermen	6	60%	4	40%	0	0%
3	20 Students	2	10%	18	90%	0	0%

Twenty two (22) (i.e. 73%) of 30 beach goers agreed (said Yes) to have experienced problems with waste that it causes diseases such as cholera and typhoid. Specifically, they gave these experiences as examples of the effects of waste: “I got typhoid when I was in school; I have seen some people suffering from cholera; I got stomach ache when I ate food which was not good.” Eight (8) (i.e. 27%) of the beach goers answered “No” to the question; that is they had never experienced any problem associated with waste. Six (6) (i.e. 60%) of the 10 fishermen respondents agreed they had experienced problems with regard to waste (i.e. answered “Yes”) without further elaboration. The remaining 4 (i.e. 40%) of the fishermen answered they had not experienced any problem with waste (answered “No”).

Results from the interviews with 20 students show that 2 (i.e. 10%) of the respondents agreed (said “Yes”) to have experienced problems with waste. One of the respondents said he saw one man where he used to live who was suffering from cholera. Eighteen (18), that is 90% of the student respondents denied (answered “No”) to have experienced any problem with waste. Interview results are summarized in Table 5.

Question 5: Do you know how waste management is functioning in the City Municipalities?

The question was intended to find out whether the respondents (the Civil Society groups) were aware of how waste management was functioning in the Dar-es-Salaam City Municipalities. Table 6 displays all the responses to the question.

Table 6: Responses of Civil society groups on awareness of how waste management functions in the City Municipalities?

S/N	Type and Frequencies of Responses	Yes		No		I don't know	
		Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	30 Beach Goers	0	0%	27	90%	3	10%
2	10 Fishermen	10	100%	0	0%	0	0%
3	20 Students	4	20%	16	80%	0	0%

Interview results show that among 30 beach goers twenty seven (27) (i.e. 90%) answered “No” to the question; that is they were not aware how waste management was functioning in the Municipalities. One of the respondents commented, “Though I usually see waste management vehicles and people cleaning around the City; still there is always waste scattered around.” Three (3) respondents which are equal to 10% of the respondents indicated that they did not know how waste management was functioning in the Dar-es-Salaam City Municipalities. The 27 respondents who said “no” and the 3 respondents who said “I don’t know” expressed almost the same thing that they were not aware of how waste management was functioning in the Dar-es-Salaam City Municipalities. This makes 100% of the beach goers being ignorant of how waste management functioned in the Dar-es-Salaam City. Also results show that 10 fishermen (100%) expressed that they were

aware of how waste management was functioning in the Dar-es-Salaam City Municipalities.

Results show that 4 out of 20 student interview-respondents (20%) indicated a “Yes” response to the question. That is they knew how waste management was functioning in the Dar-es-Salaam City Municipalities. The remaining 16 of the student respondents (i.e. 80 %) by saying “No,” means they were not aware.

Question 6: Do you know where you are supposed to put your waste?

Question 6 was intended to find out the awareness of the three groups of Civil Society where they were supposed to deposit their waste. Interview results are summarized in Table 7.

Table 7: Response on the awareness of where one is supposed to put the waste

S/N	Type and Frequencies of Responses	Yes		No		I don't know	
	Number & Type of Respondents	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	30 Beach Goers	30	100%	0	0%	0	0%
2	10 Fishermen	10	100%	0	0%	0	0%
3	20 Students	20	100%	0	0%	0	0%

All the 30 beach goers (i.e. 100%) gave a “Yes” response to the question; meaning that they knew where they were supposed to put their waste. However, they indicated the problem of where to put the waste: “The problem is, there are no waste bins throughout the City. Though they started putting waste bins in the City unfortunately people remove them.”

Also the interview results show that all the 10 fishermen (i.e. 100%) gave a “Yes” response to question 6; thus indicating they were aware of where they were supposed to put their waste. To illustrate their awareness they added these comments: “When we remove fish scales and intestines we usually throw them back to the ocean. The other types of waste we usually put them in waste collection places around the market areas.”

However, according to the researcher’s observation, the fish market lacked open skip buckets for putting the waste. As a result, other solid waste streams were only dumped around the market floor.

Results about the responses of 20 student respondents to question 6 reveal that all the twenty respondents (100%) provided a “Yes” response. This meant that the student respondents were aware where they were supposed to put the waste. However, they also pointed to the same problem of lack of waste bins throughout the Dar-es-Salaam City to put their waste.



Figure 15: A street in Oysterbay (Left) and a street in Masaki in Kinondoni Municipality, Dar-es-Salaam (Right) without waste bins. Photo: John Maziku, November, 2013

Question 7: Do you know where your waste ends after being discharged into the drains?

Question 7 was aimed at finding out the respondents’ awareness about the final destination of the waste after being discharged into the drains. Table 8 summarizes the responses.

Table 8: Respondents' awareness of where the waste ends after being discharged into the drains

S/N	Type and Frequencies of Responses	Yes		No		I don't know	
	Number & Type of Respondents	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	30 Beach Goers	26	87%	0	0%	4	13%
2	10 Fishermen	10	100%	0	0%	0	0%
3	20 Students	19	95%	1	5%	0	0%

Interview results from 30 beach goers-respondents indicate that 26 beach goers (i.e. 87%) gave a “Yes” response to the question. Specifically these 26 respondents were clear with where the waste ended and their effect. Hence those beach goers explained: “Some of them (the waste) block the drains and some of them do come here (at the beach) during rainy season especially those from the low lying areas such as Jangwani area.” However, only 4 of the beach goers (13%) gave an “I don't know response,” with an uncertain explanation as this: “Perhaps (the waste go) into the streets” Hence the interview results show that the majority of the beach goers-respondents were aware of the destination and effects of the waste- they finally ended at the beaches during the rainy season and some of them blocked the drains.

Results from the interviews of the 10 fishermen-respondents show that all 10 of them (i.e. 100%) provided a “Yes” response to the question. This meant that they knew where their waste ended and their ultimate effects after being discharged into the drains. These comments illustrate their awareness: “Here whenever we throw away something like fish intestines they go directly into the ocean; but in the streets the waste usually block the drains and make the water overflow during the rainy season and cause roads floods.”

Out of the 20 student respondents 19 of them (i.e. 95%) responded with a “Yes” and only 1 respondent, the equivalent of 5% of all the respondents, gave a “No” response. Hence

the majority of the student respondents not only know where the waste ended but also their effects. These students' comments illustrate: "They (wastes) block the drainage system and cause floods during the rainy season."

Question 8: Do you think these wastes will bring any harm to the aquatic animals or plants?

This question was intended to find out from the respondents whether they were aware of the harmful effects of the waste which are discharged or thrown into the ocean to the aquatic animals or plants. Responses to the question are summarized in Table 9.

Table 9: Responses on awareness of whether waste bring harm to the aquatic animals or plants

S/N	Type and Frequencies of Responses	Yes		No		I don't know	
	Number & Type of Respondents	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	30 Beach Goers	2	7%	28	93%	0	0%
2	10 Fishermen	2	20%	2	20%	6	60%
3	20 Students	20	100%	0	0%	0	0%

Out of the 30 beach goers who were asked only 2 of them, an equivalent of 7% of all the respondents, answered "Yes." They gave this explanation: "The industries which discharge poisonous water into the ocean might kill the fish." However, they were not sure whether the poisonous substances could kill the fish.

Twenty eight (28) out of the 30 beach goers (i.e. 93%) who were interviewed gave a "No" response to the question. They explained their response in the following terms:-

"As you see the plastic bags are outside the ocean; they are within the sandy beaches. It seems the ocean is very active; it does not take in any type of waste. Whatever goes in is usually brought out by the ocean waves particularly when the ocean water is coming again to the coast at the time of high tide after disappearing.

Interview responses of 10 fishermen show that 2 of them (i.e. 20%) stated a “Yes” response to question 8; implying that they were aware of the negative effects to the aquatic animals or plants of the waste which are discharged or thrown into the ocean. However, these two respondents added that still they did not know the kinds of problems the aquatic animals and plants would suffer. Two (2) other fishermen who were interviewed making another 20% of all the fishermen gave a “No” response to question 8. To explain their answer they commented: “Usually solid wastes can’t survive in the ocean; the waves normally push them out to the coast.” This is a similar belief which two of the interviewed beach goers also held. It is a common belief which coastal people also generally hold.

The results of the interviews of the remaining six (6) fishermen, making 60% of all the fishermen-respondents, fall under the “I don’t know” response category. It means that the respondents were not sure whether the wastes had any effect on aquatic animal and plants or not. Hence their comment: “We don’t really know; perhaps health officers might have accurate answers.”

Interview results for 20 student respondents show that all of them (100%) gave a “Yes” response to question 8, agreeing that wastes harmed the aquatic animals and plants. The respondents listed these harmful effects of waste to the coast belt: “They kill fish especially when fish eat plastic bags; they disturb fish; the beauty of the beach disappears; animal habitats disappear and they can block boat machines/engines.”

Question 10: What is your relationship with the Ocean?

Question 10 aimed at establishing how the beach goers, fishermen and students respondents related with the ocean. Five options were suggested to the respondents from which to indicate their relationships: Fishing, Boating, Working, Swimming, Water Sports and Other. Responses are displayed in Table 10.

Table 10: Respondents' kinds of relationship with the Indian Ocean

S/N	Number & Types of Respondents	30 Beach Goers		10 Fishermen		20 Students	
	Types & Frequencies of Responses	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	Fishing			10	100%	3	15%
2	Boating						
3	Working						
4	Swimming	22	73%			6	30%
5	Water Sports						
6	Other	8	27%			11	55%

Interview results from 30 beach goers respondents reveal that 22 of them (73%) used the Indian Ocean for swimming recreation and 8 of the beach goers (27%) use it for “other purposes” specified as recreational purposes other than swimming- e.g. sea breeze, outing. Results also tell that all 10 fishermen respondents (100%) used the Indian Ocean for fishing through which they earned their livelihood. Interview results for 20 student respondents are of three types: Three (3) respondents (15%) used the ocean for fishing, 6 (30%) for swimming and 11 (55%) for recreational purposes such as fresh air, good environment for conducting academic discussions. The results to this question show that all the respondents in all the three civil society groups derived some benefits from the Indian Ocean and its coast line.

Question 11: What problems do you think there are in the Indian Ocean?

This question intended the respondents to select any three of 5 suggested problems that could have been in the Indian Ocean: (i) Eutrophication, (ii) overfishing/ illegal fishing, (iii) industrial pollution and (iv) oil spills and (v) other. The purpose was to identify the kinds of problems which respondents perceived to exist in the Indian Ocean. Responses are summarized in Table 11.

Table 11: Responses on the kinds of problems found in the Indian Ocean

S/N	Number & Types of Respondents	30 Beach Goers		10 Fishermen		20 Students	
		Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	Eutrophication						
2	Overfishing, illegal fishing					6	30%
3	Recreational boating						
4	Industrial Pollution			1	10%	8	40%
5	Oil Spills						
6	Air Pollution						
7	Other	30	100%	9	90%	6	30%

Results from interviews with 30 beach goers-respondents reveal that 30 respondents (100%) indicate solid waste pollution of the beaches and noise pollution from the music people play loudly from their cars at the beaches as “other” problems. Results of interview of 10 fishermen respondents showed that 1 respondent (10%) pointed to industrial pollution as a problem. Other 9 fishermen respondents (90%) identified hygiene as a problem and suggested more efforts be put into the hygiene area and suggested more people be employed to clean the fish market place. Fishermen had been all along focusing narrowly on the issue of cleanliness of their workplace; the fish market being their major concern.

Results of the interview of 20 student respondents reveal that 6 of the respondents (30%) indicated overfishing and illegal fishing as problems in the Indian Ocean; 8 respondents (40%) pointed to industrial pollution and 6 student respondents (30%) stated solid waste pollution of the coastal belt, sea erosion and plastics as problems under “Other” group of problems.

Question 12: What should be done to improve the situation?

The question was aimed at gathering suggestions from the three groups of Civil Society (beach goers, fishermen and students) interview respondents on the plans of action which should be undertaken to improve the situation at the coastline. Four (4) alternative strategies for improving the Dar-es-Salaam Coastal belt were suggested in the interview guide: (i) To improve environmental laws and policies, (ii) To increase the amount of Funds, (iii) Public involvement and (iv) Other. Table 12 summarises the responses to the question.

Table 12: Responses on what should be done to improve the waste situation in the Indian Ocean

S/N	Number & Types of Respondents	30 Beach Goers		10 Fishermen		20 Students	
		Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	To improve environmental laws and policies					2	10%
2	To increase the amount of Funds					3	15%
3	Public involvement	8	27%			6	30%
4	Other	22	73%	10	100%	9	45%

Interview results of 30 beach goers-respondents reveal that 8 respondents (27%) selected public involvement strategy to improve the situation. They commented, “It is everyone’s responsibility to keep the environment clean.” Responses from the remaining 22 beach goers-respondents (73%) proposed under “Other” group of strategies “to put waste bins and make cleanliness from time to time.” Responses from all 10 fishermen-respondents (100%) suggested under “Other” response category that many environmental workers should get employment and concentrate with this area (the fish market) only, because it is so sensitive as you see by yourself.”

Interview results of 20 students have given these results: Two (2) student respondents (10%) selected the improvement of environmental laws and policies. They further elaborated: “People must be educated to know the laws if ever they (do) exist; strict laws must be formulated.” Three (3) of the student respondents (15%) suggested the increase of the amount of funds; and 9 (45%) suggested two strategies; to increase police patrols over illegal fishing and the City Municipalities should clean the environment effectively.

Question 13: How do you value the Indian Ocean? You may rank from 1-5, 1 is the least important of all and 5 the most important one.

This question intended to find out the extent to which the various groups of civil society valued the Indian Ocean as an indication of their value attachment to it and their intention to keep it clean. The respondents were required to state their scores on a five point valuation scale: 1 to 5 (1 = least important; 5 = most important). Table 13 displays the responses.

Table 13: The extent the respondents value the Indian Ocean

S/N	Rank	1	2	3	4	5	Explanation to the score
	Respondent						
	30 Beach goers					x	= 5 We value it; that’s why we come here
	10 fishermen					x	= 5 Is the source of our livelihood
	20 students					x	= 5 Because it is the source of employment to some people(fisher men) -We recreate here cause there is a very good ocean breeze -We get different kinds of Fish from this ocean (source of food)

All the 30 beach goers respondents (100%) unanimously agreed to award it 5 points and remarked, “We value it; that’s why we come here.” Also all the 10 fishermen (100%) together gave it 5 points with a remark, “It is the source of our livelihood.” Similarly, all the 20 students agreed among themselves to give a 5 point score. They added the following explanations:-

“Because it is the source of employment to some people (fisher men); we get our recreation here as there is a very good ocean breeze. We get different kinds of fish from this ocean (source of food).”

Question 15: Do you do something to improve the state of the Ocean?

This question aimed at finding out whether the respondents took the function of improving the condition of the Indian Ocean as a shared communal responsibility or as the sole responsibility of the City municipalities? Responses are displayed in Table 14.

Findings from the responses of 30 beach goers reveal that none of them (0%) gave a “Yes” response to the question. This implies that none of the beach goers did something to improve the condition of the Indian Ocean.

Table 14: Responses on whether respondents do anything to improve the Indian Ocean.

S/N	Type and Frequencies of Responses	Yes		No		Other	
		Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	30 Beach Goers	0	0%	26	87%	4	13%
2	10 Fishermen	10	100%	0	0%	0	0%
3	20 Students	2	10%	18	90%	0	0%

On the state of the Indian Ocean: Twenty six (26) of the beach goers-respondents (87%) gave a “No” response, specifically meaning that they never did anything to improve the condition of the ocean. In elaborating their stand they gave they commented: “We only come here during weekends, how we can do that? There are some people who are paid for that, why should I bother myself.”

All the 10 fishermen respondents (100%) provided a “Yes” answer to the question. Also they added these comments: We try to clean whenever we finish our activities over this

place, as well as reminding one another about it.” Two (2) student respondents out of 20 (i.e. 20%) gave a “Yes” response but throwing the responsibility to the people who live outside the City Center- Temeke and Kinondoni Municipalities. Eighteen (18) student respondents (90%) gave a “No” response with a comment that they could not say anything without making research on the kind of problem there are in the Indian Ocean.

Question 16: How do you become aware of the problems that exist in the Indian Ocean particularly in Dar es-Salaam?

This question aimed at finding out the means of communication by which the respondents usually got informed of the problems of pollution which existed in the Indian Ocean, particularly in Dar-es-Salaam. This could help in selecting the most efficient and effective means of communication which could be used to sensitize people regarding solid waste management issues for the Dar-es-Salaam Coast Belt. Table 15 displays the responses by respondents.

Table 15: Means through which respondents get informed of what exists in the Ocean

S/N	Number & Types of Respondents	30 Beach Goers		10 Fishermen		20 Students	
		Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	Media/observation	20	67%	10	100%	16	80%
2	Internet						
3	Friends	4	13%	10	100%		
4	Studies and observation					4	20 %
5	Other	6	20%				

Media observation: Beach Goers: 20 (= 67%): If there are bad weather conditions such as flooding from the Ocean, we usually get information via media. Four respondents 4 (= 13%) got informed sometimes through friends who tell them not to go to some places within the beaches because of robbers who disturb visitors. Other 6 (= 20%): Some people close to us tell them.

On the part of fishermen all 10 (= 100%) got informed through the media and observation and also through friends. Students respondents 16 (80%) got informed through the media and 4 (20%) through studying and observation.

From those responses the groups respondents from the civil society had different means of getting information; the media, friends, observation and studying.

11.2 Objective 2: Factors Which Influence Solid Waste Generation, Collection and their Trends

The purpose of research objective 2 was to explore solid waste generation and solid waste collection in Dar-es-Salaam City and its Coast Belt (for the period from 1994 to 2007 in order to) determine their trends. However, a number of issues regarding solid waste management were explored before making comparison of the waste generation and waste collection. Therefore, the following interview questions were posed to a number of respondents: a senior official from the Department of Environment in the Vice President's Office, three Environmental Officers from the Dar-es-Salaam Municipalities of Kinondoni, Ilala and Temeke and respondents of three Civil Society Groups provided. All provided part of the information used to work out/ process Objective Number 2.

Types of Common Solid Waste in Dar-es-Salaam

Question 1: What are the most common waste does the city municipality generate (bio wastes, metals, plastics...)?

The purpose of this interview question was to find out from the municipal environmental officers the types of waste which are generated in the Dar-es-Salaam City. Results from the environmental officers' responses indicate the following kinds of waste which are generated in the Dar-es-Salaam City:-

Bio waste (organic waste), office waste such as papers; metals, plastic bags, plastic bottles, iron metals, lead, copper waste, used bus tickets and used cell-phone vouchers were the most common types of waste generated in the municipality according to the responses of

the municipal environmental officers. It was further revealed from the interview results with the municipal environmental experts that food waste accounted for greatest share of the total solid waste generated in Dar-es-Salaam.

Also data obtained from Dar-es-Salaam City Council records shows the waste composition in Dar-es Salaam consists mainly of kitchen waste, plastics (bottles and bags), grass, wood, papers, ceramics and stones, leather and rubber (Table 16).

Table 16: Solid Waste Composition in Dar-es-Salaam

Waste Components	Percentage by wet weight (%)
Kitchen waste	39
Grass/wood	10
Papers	8
Ceramic and stones	6
Metals	5
Plastics	16
Glass	2
Leather and rubber	6
Textiles	5
Others	3
Total	100

Source: Dar-es-Salaam City Council, 2014.

Trend of waste generation and collection

Results from the interview with a Senior Officer from the Division of the Environment in the Vice President's Office as was asked, "What has been the general situation regarding waste of Dar- es-Salaam Coastal belt? Is it improving or deteriorating?"

Findings from the interview indicate that waste collection has been improving. The following were the reasons given: "Because previously the government used to take care of the waste management in Dar-es-Salaam. Now the new mechanisms used is to hire private companies in order to take care of the Coastal belt and the environment at large. Private companies seem to be more effective in doing the job. The regulations concerning plastic bags were reviewed; right now the plastic bags allowed are the ones which are more than 30 microns." Appendix I.

A similar question was directed to municipal environmental officers of the Kinondoni, Ilala and Temeke Dar-es-Salaam Cit Municipalities:”What is the state of the annual waste generation in the Municipality since 1994? Is it increasing or decreasing?” The data available and provided on the state and trend of solid waste generation and collection for the whole city Dar-es-Salaam City was from 1994 to 2007 as shown in Table 17.

Table 17: State of Solid Waste Generation and Collection in Dar-es-Salaam City: 1994 – 2007

S/N	Year	Generation/Day (Tons)	Collection/Day (Tones)	Percentage (%)
1	1994	1500	185	12
2	1995	1620	230	14
3	1996	1772	260	15
4	1997	1850	300	16
5	1998	1980	380	20
6	1999	2144	454	21
7	2000	2200	354	16
8	2001	2300	476	21
9	2002	2400	719	30
10	2003	2600	792	30
11	2004	3091	849	27.5
12	2005	3156	900	28
13	2006	3350	1207	36
14	2007	3500	1406	40

Source: Dar-es-Salaam City Council, 2014.

The above data on waste generation and collection from year 1994 to 2007 in Dar-es-Salaam City were analysed statistically with the purpose of obtaining their trends. It could be observed among other things that there was a linear incremental trend in the daily waste generation from 1994 to 2007 as it could be observed in figure 15 (a) where the correlation was found to be highly significant (linear regression, $F_{1, 12} = 322$, $p = 0.000$). This phenomenon could be attributed to myriads of factors including population growth.

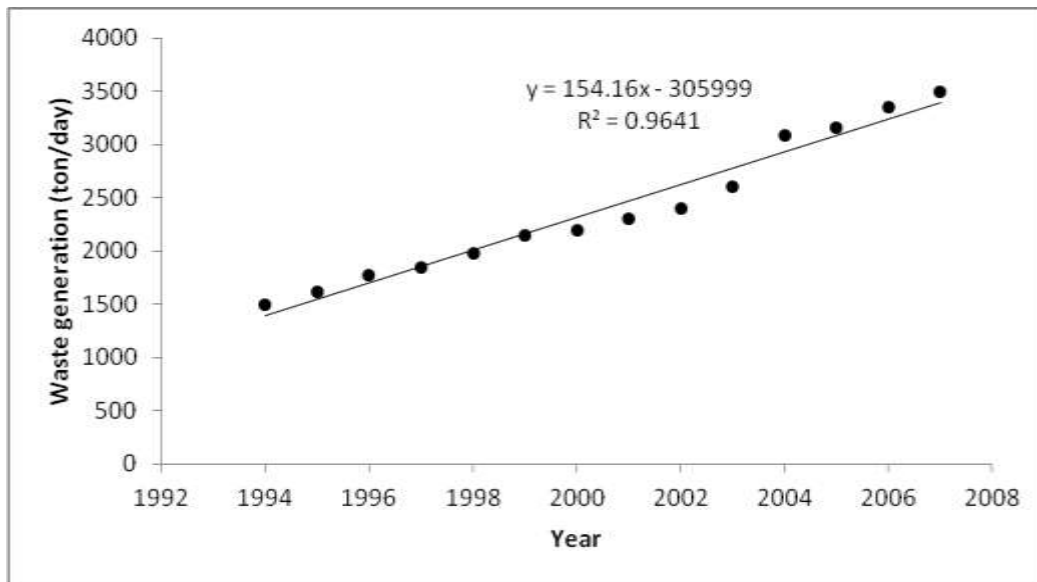


Figure 15 (a): Trend of Solid Waste Generation in Dar-es-Salaam City:1994 - 2007

Similar phenomenon was observed in the solid waste collection recorded within the same period (Figure 15 b) with daily collection increasing on annual basis (linear regression, $F_{1, 12} = 105.6$, $p = 0.000$) with relatively high significant coefficient of determination ($R^2=90$).

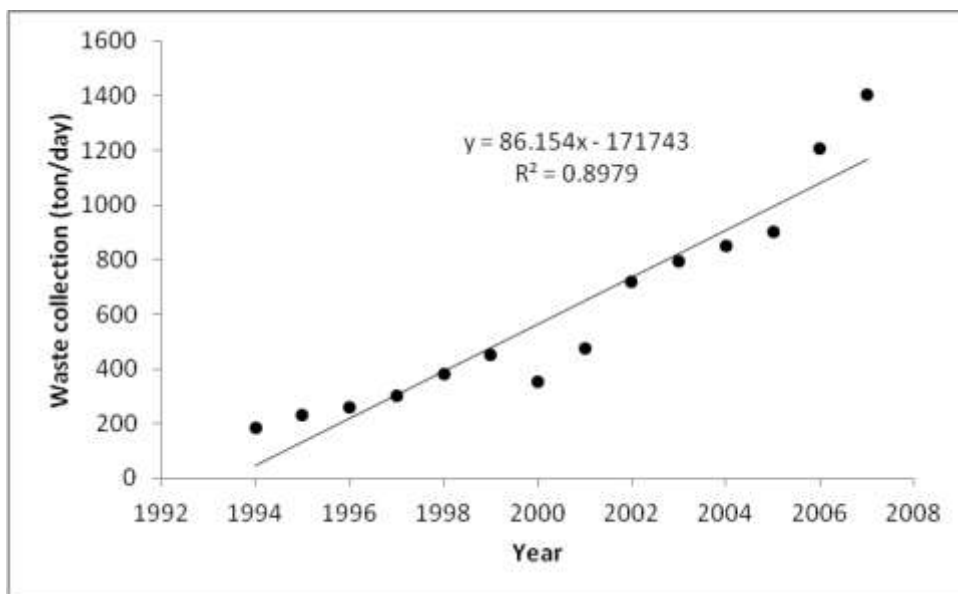


Figure 15 (b): Trend of Solid Waste Collection in Dar-es-Salaam City:1994 - 2007

However, management intervention has seen a positive response in the solid waste collection. As waste generation increases (Figure 15 c) and so does the waste collection (Figure 15 c) by the municipality where the two variables were found to be highly correlated (linear regression, $F_{1, 12} = 162.4$, $p = 0.000$) with very high coefficient of determination ($R^2=93$) as it could be observed from Figure 15 (c).

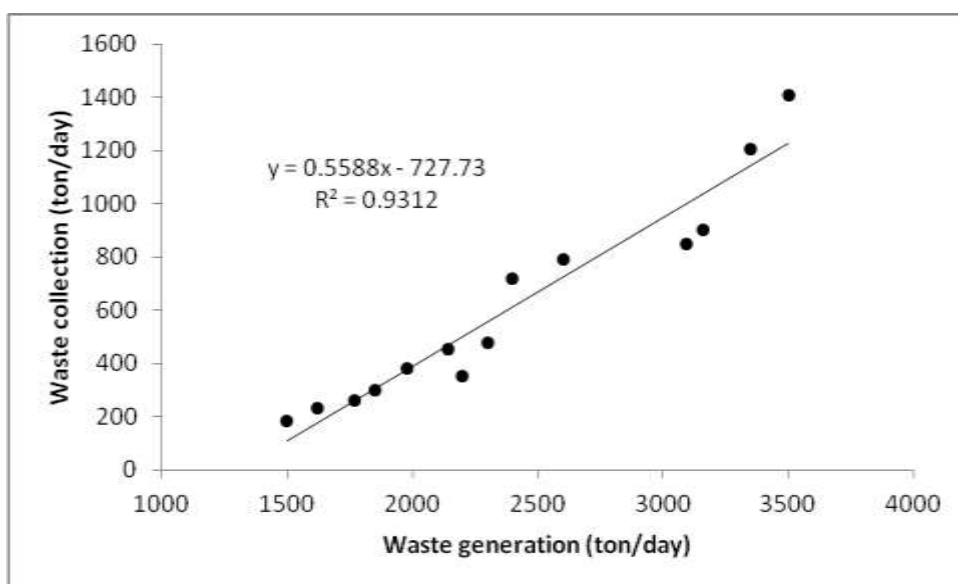


Figure 15 (c): Relationship between Solid Waste Generation and Collection

In addition, in response to the same interview question whether the annual solid waste situation was still increasing or decreasing in the current situation, all the three municipal environmental officers (100%) acknowledged increasing trend of both solid waste generation and waste collection per day in the three City municipalities of Kinondoni, Ilala and Temeke. Furthermore, the Chief Chemist in the Division of Environment in the Vice President's Office remarked particularly on the improvement of waste collection attributing it to the involvement of private businesses in the waste collection task.

The available data for solid waste generation and collection in the three City Municipalities of Ilala, Temeke and Kinondoni for year 2010 were as shown in Table 18.

Table 18: Solid waste generation and collection in Dar-es-salaam City Municipalities in 2010

Municipality	Generated amount (tons/day)	Collected amount (tons/day)	% collected
Ilala	1100	430	39
Temeke	1,035	280	27
Kinondoni	2,026	823	41
Total	4,161	1,533	37

Source: Dar-es-Salaam City Environment Outlook, 2011, (2011). Division of Environment, Vice President's Office, United Republic of Tanzania.

From the data in Table 18 one finds that among the three Dar-es-Salaam City municipalities, Kinondoni generates the greatest amounts of solid wastes per day, followed by Ilala and the least by Temeke Municipality.

11.3 Factors affecting solid waste generation and collection in Dar-es-Salaam Municipalities

Results from the interviews with the official from the Division of Environment in the Vice President's Office, the Municipal Environmental Officers and one Civil Based Organization dealing with waste collection in revealed a number of factors which directly influence solid waste generation and collection in the City of Dar-es-Salaam. The following are the major ones:-

(i) High population and population growth rate.

From the research results obtained the first municipality in the generation of largest amounts of solid wastes is Kinondoni, the second is Temeke, and last is Ilala (Table 18). One of the factors influencing the amount of waste generated is size of population within the municipality. The higher the population in the municipality the greater the amount of waste generated; this is because of the relatively greater economic, human and social activities in a municipality with higher population. Relate Table 1 and Table 18.

(ii) Another reason that was given as a factor affecting solid waste collection was the state of city physical planning. Where city planning is poor as the case is of Temeke and Kinondoni municipalities compared to Ilala Municipality, collection is also relatively poor. The situation is made worse by big sizes of Kinondoni and Temeke municipalities as they generate more waste. Ilala Municipality is smaller, well planned and is within the City centre where there are offices, ministries, shops, schools, colleges good restaurants and hotels which are better and more efficiently served by waste collection companies.

(iii) Unplanned settlements which have grown as squatter areas

Dar-es-Salaam has many unplanned settlements with very high population density and lack infrastructure such as roads and sewage systems. Waste collectors find it difficult to access unplanned settlements (squatters) with trucks when collecting waste. Figure 16.



Figure 16: Squatter area at Buguruni Kwa Mnyamani in Ilala Municipality, Dar-es-Salaam. Photo: John Maziku November 2013.

(iv) Shortage of facilities for waste management collection such as vehicles, waste containers.

Municipal environmental Officers and waste collection Civil based organizations personnel revealed there was inadequate equipment for solid waste collection such as vehicles, motor bikes with trailers. Instead they used inefficient equipment such as hand-drawn carts (mikokoteni). Figure 17.



Figure 17: Hand-drawn carts at Buguruni Malapa waste collection point, Ilala Municipality, Dar-es-Salaam. Photo: John Maziku November 2013.

(v) Shortage of facilities for temporary solid waste storage.

Environmental officers of the City Municipalities revealed that the municipalities are faced with shortages of basic facilities and equipment for waste collection. For instance, Kinondoni Municipality did not have official waste collection points to which wastes from households ought to be brought together.

It was informed that Kinondoni Environmental authorities deliberately discouraged the establishment of waste collection points because of shortages of equipment to remove the waste from collection points to the Dump Site. They fear that if they establish collection points in the Municipality the waste may not be collected in time. As a result, the waste may accumulate unattended to and so become a public embarrassment. They prefer the waste collection companies directly gather the waste from the households and transport it to the Pugu Kinyamwezi Dump Site. The waste which they are not able to collect remains with the households. However, from the researcher's observation there are unofficial collection points where wastes are dumped. Figure 18.



Figure 18: Un-official waste collection point at Magomeni-Kanisani, in Kinondoni Municipality, Dar-es-Salaam. Photo: John Maziku November 2013.

The situation in Ilala Municipality was that there were 36 collection points but according to the Environmental Officers these were not enough. In Temeke Municipality there were 3 big waste collection points and 17 small ones. Still it was informed that in Ilala the

collection points were not sufficient compared to people's needs. This limited the ability of waste collection. A smaller amount of waste could only be collected for final disposal.

(vi) Reluctance of community members to pay waste management fees

It was informed by the Municipal environmental officers that people in the municipalities were reluctant to pay fee for waste collection services. This situation was worsened by local politicians who encouraged their voters not to pay in order to gain popularity.

Similar results were obtained from one Head of a Civil Society Organization dealing with waste collection whose response to my interview question regarding factors which are hindering them from performing their waste collection tasks. He itemizes them as:

- ”- poor city planning squatter areas;
- people don't want to pay the collection fees;
- political interference from councillors;
- people do discharge wastes into drains; and
- luck of funds.”

(vii) Lack of waste bins in the City.

The respondents from the Civil society groups complained that there were no waste bins at the beach and throughout the city. The absence of waste bins encouraged littering in the streets and at the beaches. The researcher also had similar observation.



Figure 19: Beach at Ocean Road area, in Dar-es-Salaam without any waste bins. Photo: John Maziku November 2013.

(viii) Lack of community awareness on environmental management.

It was also revealed by the Municipal Environmental Officers that community awareness was lacking among many people in the city about cleanliness.

(ix) Lack of Law Enforcement.

It was revealed from the findings that the Municipality authorities did not enforce the by-laws on waste management. People were not obliged to comply; this was exacerbated by political interference where by local municipal and ward politicians discouraged their voters not to pay for the waste collection fees to the waste collectors.

(x) Lack of Motivation within Waste Collection Companies.

It was revealed from some employees of some waste collection companies that employees were paid very low wages per month which could not adequately support them and their families. Also the waste collectors were not given waste collection equipment and protective facilities such as hand gloves and gum boots. This discouraged them. One of the waste collectors remarked this: “Low wages, you can imagine I receive only Tsh 100,000/= per month, I do this job because I have no alternative. Another waste collector said this: “We are not well equipped in order to protect ourselves against diseases; we are told to change our names every month in order to be seen as new employees who are on probation period. The guys are just avoiding Tanzanian law which says after sixth months at work you should get permanent employment.” Appendix IV.

Another worker remarked: “I normally choose any available job to do, but we don’t get any motivation; it’s really discouraging for sure, we don’t have zeal to do this job at all, because of that.”

Volume of Waste Collected per day in the Coastal Belt

The Municipal Environmental Officers were asked to respond to question 8: What are the total volumes of waste generated per day in the coastal belt in your municipality? Appendix II.

One Municipal Environmental Officer from one Municipality declared that he did not know the amount of waste generated per day in the coastal belt of the municipality. As a result he remarked that this was a challenge. A second municipal environmental officer from another municipality responded that it was difficult to know because they did not separate the waste collected from the Coastal Belt from that collected from other areas. A third municipal environmental officer acknowledged that they did not have separate data regarding waste collected in the coastal belt because the solid waste collection contractors within their municipality collected waste together without separating the waste from the specific areas of origin. Hence as a whole all the 3 (100%) Municipal Environmental Officers of three Dar-es-Salaam City Municipalities declared that they did not keep separately the solid waste data for their respective coastal belts.

Sources of Solid Waste in the Coastal Belt

The Municipal Environmental Officers were also asked whether they knew about the sources of the waste in their coastal belts municipalities, all three (100%) stated similar sources: household (domestic) waste street waste, institutional (office) waste (papers), industrial waste, market waste, such as the Bank of Tanzania (paper waste), market waste e.g. Buguruni Market, fish market and other markets from other areas within the City.

Largest Kinds of Solid Waste within the Dar-es-Salaam Coast Belt

Results from responses by the three Municipal Environmental Officers to the interview question, “What kinds of waste are the largest of all within the coast line in your municipality?” were very similar. One environmental officer mentioned specifically plastic bags as largest kind of waste in the coast line. The second environmental officer identified four type of waste that are found in large quantities; organic waste (bio waste), plastic bottles with their covers, plastic bags, some kinds of papers and cans. The third environmental officer stated similar kinds of waste found in his municipality coastal belt particularly at the beaches, namely domestic and industrial solid waste such as plastic bottles and cans, plastic bags and pieces of trees. Figure 20.



Figure 20: A mixture of waste swept on the Ocean Road Beach, Dar-es-Salaam.

Photo: John Maziku November 2013.

Largest Polluter in the Dar-es-Salaam Coastal Belt

The three municipal officers were asked the question “Who is the greatest polluter in the coast belt within your municipality?” Results from their responses indicate that rivers which discharge their water in the Indian Ocean are the largest polluters of the coast line. Also from the researcher’s observations pollution of the coast line from the river discharges is highest during rainy season when there are floods in the streets causing wastes to be drifted into the drains and rivers and finally are deposited into the coast line.

Results from the researcher’s observations at the Dar-es-Salaam beaches plastic bags, plastic water and soft drink bottles, soft drink cans and paper packaging materials are found scattered all over the place particularly in some public beaches especially during weekends when there are a lot of visitors who come for recreation. The situation is made worse with the absence of waste bins on the beaches thus making pollution inevitable.

Organisation of Collection and Disposal of Solid Waste in Dar-Es-Salaam

Response results from the Municipal Environmental Officers to the interview question, “How do you collect these waste, are they sorted or mixed together?” provided the following information regarding collection and disposal of solid wastes in the three Dar-es-Salaam City municipalities of Kinondoni, Ilala and Temeke:-

The responsibility for solid waste management in the Dar-es-Salaam City under the three municipalities of Kinondoni, Ilala and Temeke while the Dar-es-Salaam City Council deals with the management of solid waste disposal facilities such as the Pugu Kinyamwezi Dump Site. The actual solid waste collection activities are undertaken within each city municipality by private contractors (i.e. large, small and medium private enterprises), Community Based Organizations (CBOs) and individuals who are informally self-employed and each of these plays its own role. The CBOs collect waste from households to collection points or enclosures. The private contractors (large, medium and small enterprises) collect waste from households, collection points (enclosures), transfer stations, unauthorized dumps in the streets and from open spaces and transport it to the Dump Site at Pugu Kinyamwezi. The participation of the three Dar-es-Salaam City municipalities themselves participate by collecting the solid waste from collection points and unauthorized small dumps and transport it to the Dump Site.

The organization of solid waste management differs among the three city municipalities. In Temeke Municipality waste management is handled by private companies who collect waste from people's houses and transport them directly to Pugu Kinyamwezi Dump Site. Also some Community Based Organizations (CBOs) collect waste directly from people's houses and transport them to collection points ready to be taken to the dumpsite.

Ilala Municipality is the most organized municipality among the three municipalities in Dar es Salaam particularly in the area of waste management as it involves the best planned part of the Dar-es-Salaam City. In Ilala municipality waste collection is divided into three zones; low income zones, middle income zones and high income zones. The Community Based Organizations are responsible for collecting waste from the low income zones (low income earners) and mainly use very poor and weak equipment. They charge a collection fee of 5000/= Tanzanian shillings per month per household.

Residents in the mid-income zone which include Jangwani Ward, Kariakoo Ward, Gerezani Ward, Mchikichini Ward and Ilala Ward pay a collection fee of 10,000/= Tanzanian shillings per household in a month. The high income zone in the Ilala Municipality includes five wards; Mchafukoge Ward, Kisutu ward, Kivukoni Ward, Upanga West Ward and Upanga East Ward. In this zone are found government offices,

best conditioned houses, and five star hotels. In the high and middle-Income zones, waste collection is done by contractors with sophisticated tools. Figure 21. The waste collection fee charged the contractors is 15,000/= Tanzanian shillings per month for each household.



Figure 21: Collection of Solid Waste in some areas of Dar es Salaam use modern transport equipment. Photo: John Maziku November 2013.

Forms in which Solid Waste is collected from Source

The three Municipal Environmental Officers from the City Municipalities were asked the interview question, “In what form do you collect these waste; are they sorted or mixed together?” Response results to this question from all the three respondents were the same: the solid waste were all mixed up (i.e. not sorted) as there were no sorting formalities. The waste is collected and transported to Pugu Kinyamwezi Dump Site. It is here where according to Mr. Kishere, the Pugu Kinyamwezi Dump Site Manager, informed that about 350 to 400 scavengers visit the dump every day to sort each one the item is interested in and take it away and sell it to private recycling firms who in most cases pay them very little money. Figure 21.



Figure 22: Scavengers at Pugu Kinyamwezi Dumpsite, Dar-es-Salaam. Photo: John Maziku November, 2013.

Recycling Policy

Do you have any recycling policy, or recycling system which helps a bit to deal with wastes? For example:- Plastic bottles, cans etc. If no, do you have a master plan to put it down?

Interview responses from Mrs. Kisanga, Principal Chemist in the Division of Environment in the Vice President's Office clearly reveal that there was no recycling policy in Tanzania though the Ministry fully supported the recycling system hundred percent under the Sustainable Industrial Development Policy.

Also in response to the question, "Are there some waste re-use strategies currently being implemented such as composting?" According to the Kinondoni Municipal Environmental Officer, they had a plan which was expected to start by January 2014 with the help of Belgium technical cooperation. Ilala Municipality did not have such a plan but they already had two composting stations; one at Gongo la Mboto known as Kikuta Waste Management Station; and a second one at Buguruni Malapa waste collection site under the assistance of Bremen Overseas Research and Development Association. The Ilala Environmental officer also informed that in their Municipalities there are small recycling businesses undertaken by individual entrepreneurs who re-use old car tires for making

slippers, sandals, mats for cleaning feet; and make use of tin, or metal related materials for making oil lamps known as "vibatari."

12. Discussion

Objective 1: To Find Out People's Awareness of Solid Waste Management and its Significance to the Dar-es-Salaam City Coastal Belt and its Environment at Large.

The results obtained from this study about people's awareness of solid waste management and the effects of waste are divided into two parts. On one hand the results from environmental experts (respondents) i.e. the Principal Chemist in the Division of Environment in the Vice President's Office and the Municipal Environmental Officers informed that there was inadequate awareness among the City community about environmental and waste management and side effects of waste. To illustrate this point it was pointed out that people throw their food leftovers and peelings into the drains and eventually block the drains and when it rains and this causes roads to flood with water from the drains. Also partly due to lack of awareness many inhabitants of Ilala Municipality have their latrines pipes connected such that they discharge their liquid wastes into the Msimbazi River. Finally, the river discharge it's water into the Indian Ocean and thus polluting it to affect human health and the aquatic animals and plants.

On the other hand, a somewhat different picture regarding the awareness of the people of Dar-es-Salaam regarding solid waste management and the effects of waste is given by the results obtained from the three groups of civil society which frequently spent a good amount of time at the beach and or in the Indian Ocean. These are the beach goers, fishermen and students. There are several aspects of awareness regarding solid waste management about which interview results were obtained.

(i) Experience with problems associated with waste

Seventy three (73%) of the beach goers had experienced problems with waste that it causes diseases such as cholera and typhoid. Sixty per cent (60%) of the fishermen respondents also agreed they had experienced health problems due to waste.

(ii) Awareness regarding how satisfactory the waste management services provided by City municipalities

The results reveal that sixty three per cent (63%) of the beach goers and 85% of the student respondents were not satisfied because both did not see anybody clean the beach and as a result there were a lot of waste in the form of plastic bottles and plastic bags scattered all over the beach. Even the 33% of the fishermen and 15% of the students who expressed to have been satisfied with the waste management services of the municipality in the end they remarked that whatever efforts the municipality made to clean the beach, all the same at the end of the day there was a lot of solid waste scattered all over the place. The major reason they gave was the absence of waste bins. This joins the group which expressed to be satisfied with the unsatisfied group.

However, the fishermen were different because all of them (100%) responded to be satisfied with the services provided by the municipalities. The reality is that the fishermen viewed the issue of waste management services very narrowly; in terms of availability of water to wash the fish they catch and to clean the toilets at the Kivukoni Fish Market. But according to the researcher's observation there was a lot of solid waste piled up which was mixed with water at the fish market. But this did not bother the fishermen.

(iii) Action taken by those who were not satisfied with the waste management services to reduce the waste problem

The question behind intended to find out the awareness of the Civil Society groups of their responsibility to share in improving the quality of solid waste management on the coast belt with the Municipalities.

Response results reveal that 23% of the beach goers, 60% of the student respondents and 100% of the fishermen all tried not to pollute the environment whenever they were at the beach/sea side. However, the fishermen had a narrow perception of the waste problem taking merely the handling of the fish intestines which they always threw away the fish intestines back into the sea. Thirty five percent (35%) of the student respondents tried not to pollute the environment but they also remarked about the absence of waste bins. On the

other hand 77% of the beach goers expressed they were compelled to pollute the environment because there were no waste bins.

It can be generalised therefore that the civil society particularly students and beach goers were aware of their responsibility of keeping the environment (the beach) clean. This may indicate the level of education of the beach goers and students is relatively high enough. The fishermen are usually relatively less educated hence less aware of situations.

(iv) Awareness of where one is supposed to put one's waste

The question behind was to find out whether the respondents were aware of where they were supposed to put the waste they generated. Response results revealed that 100% of the beach goers and 100% of the students knew that they were supposed to keep their waste in waste bins but they remarked that there were no waste bins at the beach and in the entire City. Although the response result from the fishermen indicated that all of them (i.e. 100%) were aware of where they were supposed to put their waste, they had a very narrow perception of waste. The fishermen regarded waste only the fish intestines which they removed from the fish they caught and the place where they were supposed to put those intestine was to throw them back into the ocean. The reason for such narrow perception of waste management could have been due to low level of education. Usually fishermen are relatively of low education.

(v) Awareness of where one's waste ends after being discharged into the drains

This question was intended to find out whether the respondents were aware where the waste finally ended after being discharged into the drains. From the interview results it has been revealed that 87% of the beach goers, 95% of the students and 100% of the fishermen were aware that the waste blocks the drainage system and makes the water overflow during rainy season causing floods into the City roads and some of it is carried down into the beaches and into the ocean. On the Dar-es-Salaam beaches the wastes washed into the ocean are clearly seen as they are scattered all over.

(vi) Reasons for continuing to experience the waste problems in Dar-es-Salaam City

Awareness of the reasons for continuing to experience the waste problems in our Dar-es-Salaam can be a step toward finding solution for improving the situation. A hundred per

cent (100%) of the beach goers and 100% of the student respondents pointed to the absence of waste bins at the beach and in the whole city being the main reason for the continued presence of the problem of waste in Dar-es-Salaam City. The behavior of the people of dumping solid wastes along road sides and in flood drains and rivers is another cause.

(vii) Awareness of the functioning of waste management in the City municipalities

The issue here was to find out whether the three groups of the civil society were aware of how the waste management in the city municipalities functioned.

According to the results obtained 90% of the beach goers and 80% of the students respondents declared they did not know how waste management system functioned in the Dar-es-Salaam City Municipalities. This implies that the lack of awareness of how waste management functioned is a big weakness to the system. If the waste management system is to function effectively every individual in the municipality is supposed to know it and fully participate in the activities such as gathering and storing the waste into bags ready for collection and providing payment for the waste management services.

(viii) Awareness of whether the solid waste brings any harm to the aquatic animals or plants

Response results from the civil society groups reveal that 60% of the fishermen respondents expressed incomplete awareness as they only accepted that the waste harmed the aquatic animals and plants but they did not know how. Ninety three (93%) of the beach goers denied that the waste did cause any harm to the animals and plants. They explained their answer by saying that all the waste which is swept into the ocean eventually is thrown out by the ocean because the ocean does not accept any solid waste. All the student respondents (100%) expressed that waste had a number of harmful effects; they kill the fish especially when fish eat plastic bags; they disturb the fish, destroy the beauty of the beaches, animal habitats disappear and they can block boat engines. This observation by the student respondents is in line with what was recognized by the Abidjan and Nairobi Conventions as reported by Mbuya (2009) that solid waste dumped into the ocean ruins coastal habitats, kills biodiversity, endangers navigation and negatively affects tourism and recreation.

Objective 2: To Find Out Factors Influencing Solid Waste Generation and Collection and their Trends in the Dar-es-Salaam City Coastal Belt and Its Environment

(i) Types of Common Solid Waste in Dar-es-Salaam City

The research results identified 10 common types of solid waste found in the Dar-es-Salaam municipality with the four ranking topmost in percentages wet weight being kitchen waste (39%), plastics (16%), glass/wood (10%) and papers (8%). It was revealed from the interviews results with environmental experts from the municipalities that food waste took the greatest share of the total waste in Dar-es-Salaam and even in other towns and municipalities in Tanzania. The reason given was that people were not cost conscious with food and they did not have refrigerators to preserve their food. Plastics take the second place mainly because much of the containers to hold soft drinks, cosmetics and different types of containers such as buckets and plastic bags add to the problem of solid waste as they get disposed.

(ii) Solid waste generation and waste collection

Solid waste generation in Dar-es-Salaam City has been increasing year after year in terms of tons per day (as shown in Table 3). Figure 2 (a) also illustrates the rising trend of the solid waste generation in Dar-es-Salaam from 1994 to 2007.

Solid waste collection in the Dar-es-Salaam city has also been increasing year after year (Table 3 and Figure 2 (b) illustrate). Even though solid waste generation and collection from 2008 to 2013 were not available from the City municipalities still some reliable observations can be made based on the available data.. However, comparing the daily solid waste generation and solid waste collection, daily waste collection does not keep pace with generation. A smaller percentage of solid is collected daily.

(iii) Solid waste generation and waste collection in the three Dar-es-Salaam City Municipalities

Solid waste management in the City of Dar-es-Salaam is the responsibility of the three municipalities of Kinondoni, Ilala and Temeke. From the research results obtained the first

municipality in the generation of largest amounts of solid waste is Kinondoni, the second is Temeke, and last is Ilala (Table 4). The reason is the population density within the first two municipalities is higher than the last one, Ilala (Table 1). Another reason which was given is the City planning of the Temeke and Kinondoni is poor physical planning compared to Ilala Municipality. Ilala Municipality is small and well planned and is within the City center where there are offices, ministries, shops, schools, colleges and good restaurants and hotels.

(iv) Constraints of Solid Waste Collection in Dar-es-Salaam Municipalities

From the results it has been revealed that solid waste collection in the Dar-es-Salaam municipalities is faced with many challenges. Although daily solid waste collection increases year after year, it does not cope with the increased amounts of daily waste generation (Table 3 and Table 4). The following are the main challenges which hinder effective solid waste generation:-

(a) Shortage and lack of waste management facilities and equipment. Interview results have revealed that facilities such as vehicles and waste containers are in short supply making the entire waste management activity inefficient and ineffective to undertake leaving most of the waste uncollected daily.

(b) Lack of waste bins in the entire City up to the coastal beaches where people could deposit their waste and easily be collected. Results from groups of Civil Society Groups interviewed, beach goers and students complained of the absence of waste bins at the beaches and throughout the City of Dar-es-Salaam. They reported to have failed to find a place to deposit their waste and often times in desperation some were forced to through away their wastes and pollute the environment.

(c) Dar-es-Salaam city has unplanned settlements which have grown as squatters areas with high population density and lack of infrastructure. Dar-es-Salaam has an average annual population growth rate of 5.6% and a population density of compared to the National average population annual growth rate of 2.7% and a population density of 3,133 persons per square kilometre - highest in the country in 2012 in relation to the overall average in 2012 country population density of 51 persons per square kilometre (2012

Tanzania Population and Housing Census). This makes collection of waste very difficult as many of the settlements are not easily accessible.

(d) According to the results obtained from both the environmental officers and the daily collection rate is low is also due to the reluctance of community members to paying waste management fees to the for waste collection services. This is because of low awareness and lack of willingness to pay the set fees for waste collection services.

(e) Political interference by local politicians to maintain political influence. There is political interference from councillors who are siding with people who do not want to pay collection fees claiming that it is too expensive to afford.

(f) Lack of community awareness on environmental management. There is low community awareness on environmental management on environmental cleanliness and communal responsibility. According to the results obtained from the environmental officers, community awareness was lacking in Dar-es-Salaam. However, the results from the beach goers and students, this is a little different. The respondents showed good awareness. The reason could be because of their relatively higher level of education.

(g) Poor city planning and infrastructures are among the obstacles to the real environmental development. Due to poor city planning people build their settlements anyhow such that they create squatter areas. It is difficult to collect waste from such areas. People also build their houses in wetlands such as the Jangwani area in Dar –es Salaam where it is impossible to collect waste.

(h) Absence of separate data for waste generation and waste collection in the coastal belt. Interview results obtained from the municipal environmental officials revealed that even though each City Municipality was responsible for solid waste management within its specific part of the Dar-es-Salaam Coastal Belt there has not been any data available for this important component of the City environment. The waste collection companies do not separate the waste collected from the coastal areas with that from other areas of the city. They mix it up and transport it to the Pugu Kinyamwezi Dump Site. This is a challenge for

proper waste management of the Dar-es-Salaam Coastal Belt. Lack of waste generation and collection data for the coastal belt makes it impossible to plan for improved coastal belt waste management strategy.

Results from interviews with officials from the Division of Environment and Municipal Environmental Officials have shown that all the three City Municipalities of Kinondoni, Ilala and Temeke have waste management plans. However, the following challenges have made it difficult for the effective implementation of the waste management plans:-

(i) Lack of enforcement of laws. Each Municipality has its own bylaws on waste management but it has proved difficult to enforce them upon the people in the community. The National Environmental Management Council (NEMC) is legally responsible for ensuring that all environmental laws, regulations and policies are followed.

Comparison of Waste Management policy, legislation and strategy frameworks of the European Union, South Africa and Tanzania

The comparison of the waste management policy, legislation and strategy frameworks of the European Union, South Africa and Tanzania reveal important learnings which can be helpful to the improvement of the Tanzanian solid waste management efforts. The European Union waste management policy and legislation which is specially expressed by the Waste Framework Directive –2008/98/EC is based on the current and modern approach to waste management which particularly focuses on waste prevention and recycling rather than waste disposal with special acknowledgement of waste as valuable resource to be utilized. Thus the adoption of the Thematic Strategy on Prevention and Recycling of Waste in 2005 puts to the European Union a long term goal to be a recycling society which avoids waste and utilises waste as a resource (European Commission, 2011). The Waste Framework Directive 2008/98/EC is a big innovation to the waste management thinking and practice as it introduced the lifecycle concept in the European Union waste policy and the concept of waste management hierarchy which favours in the order of priority the prevention of waste, reuse, recycling, recovery, and disposal of waste as the last option (European Commission, 2011).

The European Union through the Waste Framework Directive has set up specific provisions in the legislation which aim at maximizing waste prevention efforts within each individual EU member states' waste prevention programmes. Furthermore, The Waste Framework Directive established minimum standards for recycling activities in the member states, sets collection reuse, recycling and recovery targets and these are often reviewed and revised (European Commission, 2011).

Through the application of targets to the Landfill Directive substantial waste in particular bio waste has been recovered from land fill to recycling. All these efforts have encouraged the development of reuse markets, recycling and energy recovery industries. The waste management policy and legislation of the European Union have resulted in considerable stabilization of waste generation and has resulted in the reduction of the impacts of waste on people's health and environment. Also the waste management policy and legislation have resulted into an increase in the availability of raw materials through material recovery and sustained waste management and recycling industries (European Commission, 2011).

On the other hand the South African waste management policy and legislation framework has similar features of the waste management policy and legislation framework of the European Union. To start with the Environmental Management Policy for South Africa, 1998; this is the framework policy that governs and guides all government institutions in formulating specific subsidiary and sectoral policies and strategies in all matters dealing with day to day management of the environment and provides a number of principles, and strategic goals which are necessary to ensure the environmental policy is realized. It is interesting to learn that the Environmental Management Policy for South Africa, 1998 promotes the hierarchy of waste management practices such as reduction of waste at source, re-use and recycling with safe disposal as the last resort just as is included in the Waste Framework Directive of the European Union.

Also there is the National Environmental Management Act (NEMA), No. 107, 1998, South Africa which is another fundamental environmental legislation upon which all other pieces of subsidiary environmental legislation in South Africa are based. The objectives of the National Environmental Management Act (NEMA), No. 107, 1998, South Africa are in line with the waste management hierarchy provisions as also expressed by the Waste Framework Directive- 2008/98/EC.

In addition, there is the National Environmental Management: Waste Act (NEMWA), No. 59 of 2008, South Africa as a subsidiary act of the National Environmental Management Act (NEMA), No. 107, 1998, South Africa. The major role of this Act is to regulate all waste management activities in South Africa and defines the roles of different organs in the waste management effort. Among the objectives of the Waste Act, 2008 of South Africa are the minimization of consumption of natural resources, implementation of the waste management hierarchy and obtaining ecologically sustainable development.

Also there is the National Waste Management Strategy, No. 344, 2012, South Africa which is the legislative requirement that was provided in the National Environmental Management: Waste Act (NEMWA), 2008 (Act No. 59 of 2008) to serve as an instrument for achieving the objectives of the Waste Act, 2008 specifically by applying good waste management practices including the waste management hierarchy.

On the basis of the four South African waste management policy and legislation framework instruments; Environmental Management Policy, 1998, the National Environmental Management Act (NEMA), No. 107, 1998, the National Environmental Management: Waste Act (NEMWA), No. 59 of 2008, South Africa, National Waste Management Strategy, No. 344, 2012 all national, regional and local level waste management legislation and activities are regulated. It should be noted that the concept of Waste Management Hierarchy upheld in the European Union Waste Framework Directive 2008/98/EE also is the main principle governing the South African waste management policy, legislation and practice with waste avoidance, minimization, recycling and efficient resource utilization as the major priority.

The waste management policy and legislation framework in Tanzania is the third case for comparison. The Tanzanian National Environmental Policy 1997, the National Health Policy 1990 and the Sustainable Industrial Development Policy 1996, are the most relevant policies which govern waste management in the country. Indeed these policies are not focused on specifically waste management; they are very general. In addition there are two legislations that form the backbone of the legal and institutional framework for sustainable management of the environment in general and for municipal solid waste management in particular. These pieces of legislation are the Tanzanian Environmental Management Act No. 20 of 2004 and the Local Government (Urban Authorities) Act No.

8 of 1982. In turn, the Local Government (Urban Authorities) Act No. 8 of 1982, Tanzania gives the responsibility for waste management to all the urban local authorities in Tanzania within their respective areas of administration and provides them the mandate to make their own by-laws necessary for the execution of their waste management responsibility. Thus the Dar-es-Salaam City municipality of Kinondoni, Ilala and Temeke each has its waste management bylaws.

Therefore, at the national level in Tanzania there is no policy or legislation which is specific for solid waste management and as a result each city and municipality in Tanzania separately makes its own bylaws to deal with waste management matters within its administrative jurisdiction (Mbuya, 2009). Such municipal bylaws lack solid waste management principal law or policy basis and they are not comprehensive enough to give long-term national focus and uniformity.

Also the existing solid waste policy and legislative framework in Tanzania is based on the outdated thinking about waste management which takes waste management narrowly as a matter of waste collection and then disposal. There is not much of waste prevention, minimization, recycling and reuse. Therefore, one of the major differences between the Tanzanian waste management policy and legislative framework on one hand and the waste management legislative frameworks of South Africa and the European Union on the other, is that for Tanzania the concept of waste management hierarchy is not an issue. This is a big weakness as all efforts of waste management are outdated and one cannot expect to win the struggle against the large amounts of waste which are being generated daily in the city municipalities without applying the waste management hierarchy.

13 .Conclusion

From the findings and discussion the following conclusions can be made based on the aim of the research and the research objectives:-

(1) Objective 1: On people's awareness of solid waste management and its significance to the Dar-es-Salaam Coastal Belt and Its Environment at Large

(i) Poor awareness by the community in Dar-es-Salaam on waste management and

negative effects of waste to people's health, aquatic animals, beauty of the city and the Ocean beaches.

(ii) Lack of facilities (e.g. waste bins) to in the greater part of the Dar-es-Salaam City and at the coastal beaches for individuals with awareness to put their waste.

(iii) The poor awareness of people is reinforced by poor enforcement of laws which leaves those who do not comply to the waste management laws of the Municipalities to go without being punished.

(iv) Awareness of beaches goers and students is relatively higher than the general awareness in Dar-es-Salaam community as expressed by the Government officials.

Hence the following challenges regarding awareness among the community:

- How to improve the awareness among the population regarding the importance of waste and environmental management in general to individuals, economy and society.
- Inadequate and/or unavailability of waste bins in the greater part of the city.
- Non-enforcement of waste management by-laws by the Municipalities.
- Poor solid waste management at the public beaches and entire coastal line.

(2) Objective 2: On factors influencing solid waste generation and collection and their trends in the Coastal Belt and its environment as a whole

There has been an increasing trend of both solid waste generation and solid waste collection in the City of Dar-es-Salaam and its costal belt as a whole since year 1994 up to the time the study was undertaken.

(a) Factors which have influenced the increase of solid waste generation in the Coastal belt including the City Municipalities.

(i) The higher the increase of population size and population rate of growth in the City the greater the generation of solid waste.

(ii) Food preparation habits in families are not done according to the needs of the number of family members. As a result there are lots of food remains which are thrown away as waste due to the lack of refrigeration facilities for preservation.

(iii) Bad habits of people of dumping waste in flood drains along municipal streets and in the Msimbazi River causes floods which generate waste at the coastal Belt beaches and into the Indian Ocean.

(iv) Too much use of plastics bags for carrying goods for daily consumption from shops which mostly are not used more than once or twice.

(v) Increase of industrial, commercial, educational and office activities which generate different kinds of waste including solid waste.

(vi) Too much reliance on waste disposal rather than waste prevention, reuse and recycling by the Government- by Central and Local Governments, organizations and individuals. This induces unnecessary increase of waste generation and burden of waste disposal.

Hence the following challenges of increase of waste generation:

(i) How to minimise generation of solid waste e.g. plastic bags.

(ii) How to control generation of solid waste at the source and at the coastal belt.

(iii) How to collect data on the amount of solid waste generated on the coastal belt-e.g. beaches.

(b) Solid waste collection has also been increasing since 1994 after privatisation of undertaken.

Factors which have influenced the increase of solid waste collection:

- (i) Relative efficiency of solid waste collection by private contractors and participation of the community.
- (ii) There are no data which shows how much waste is being collected from the beaches (coastal belt)

Challenges facing solid waste collection leading to relatively smaller percentage of waste being collected than generated:-

- (i) Poor infrastructures such as unplanned settlements (squatters) with no roads to reach them.
- (ii) Lack of transfer stations in the municipalities from collection points before dumping them to the disposal sites.
- (iii) Shortage and lack of waste management facilities and equipment –e.g. vehicles, waste containers are in short supply making the entire waste management activity inefficient and ineffective to undertake, leaving a lot of waste uncollected.
- (iv) No sorting of waste either at the household level or at the collection points.
- (v) Reluctance of community members to pay waste collection fees due to low awareness, lack of willingness to pay the set fees and political influence.
- (vi) Shortage of waste management experts to manage the waste management activities.
- (vii) Too much waste being collected against a bigger amount of waste being generated daily.
- (viii) A great amount of waste is thrown away (wasted) which could be turned into useful resources.
- (ix) Inadequate government budget allocations for waste management from the Central Government.

(x) Shortage of well trained waste management experts to plan and monitor waste management activities.

14. Recommendations

(a) General Recommendations

(i) Formulation of national legislation specifically addressing solid waste management for the whole country to replace the existing waste legislations which are formed by each municipality and other local authorities.

This should follow the example shown by the European Union and the Republic of South Africa.

(ii) There is need to formulate a national long term solid waste management strategy for the whole country to address the challenges facing not only the Dar-es-Salaam municipalities but the entire country. The strategy should have a long term plan of implementation with specific targets addressing the challenges.

(iii) The solid waste legislation should be built upon the concept of waste management hierarchy as practiced by the European Union and the Republic of South Africa. It can help municipalities to direct their efforts on waste prevention, waste recycling rather than waste disposal as the usual practice in Tanzanian municipalities.

(iv) The formulated national solid waste legislation and national solid waste strategy should guide the various implementing organs including sector ministries and municipalities in formulating their specific by-laws, plans and regulations.

(b) Specific recommendations

1) Provide education to people of all ages, children and adults about environmental and solid waste management and their importance through formal education and seminars.

2) Strict enforcement of existing laws on environmental and solid waste management and entrusting the responsibility to the Municipal police.

- 3) Increase of budget allocation by the Government to buy facilities and equipment for waste management
- 4) Complete abolition of utilization of plastic bags; instead the Government should encourage alternative shopping bags particularly those which use decomposable materials such as baskets and containers made from bamboo and palm leaves materials.
- 4) Purify tap water to make it clean and safe to drink in order to reduce the production of bottled water which generates a lot of plastic bottles.
- 5) The Government to convince private waste collectors to improve the wages and other employment conditions of their staff and workers.
- 6) To establish waste recycling and alternative use industries to absorb some of the waste materials and create employment.
- 7) Establish well planned satellite cities around the big City of Dar-es-Salaam in order to reduce the population concentration.
- 8) Rehabilitate the squatter areas and construct passable roads.
- 9) Legally binding agreement should be made by the Municipalities with waste collection companies and Civil Based Organisations (CBOs) on better and morale raising terms of employment reached between the companies and CBOs on one side and the employees on the other.

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Appendices

Appendix I

RESULTS FROM QUESTIONNAIRE FOR THE DIVISION OF ENVIRONMENT- VICE PRESIDENT'S OFFICE

S/N	QUESTION	RESPONSES	COMMENTS	Classify the kind of problem/objective addressed
1	What has been the general situation regarding waste of Dar –es-Salaam Coastal belt? Is it improving or deteriorating. If it is improving, what are the mechanisms used?	It is improving but not very well	-Because previously the government used to take care of the waste management in Dar –es-Salaam. Now the new mechanisms used is to hire private companies in order to take care of the Coastal belt and the environment at large. Private companies seem to be more effective in doing the job -The regulations concerning plastic bags were reviewed, right now the plastic bags allowed are the ones which have 30 microns	State of waste management
2	Do you have some foreseen challenges due to demographic changes? If there are, do you have any plan to combat them? (What	There are lots of them because of the following :- -The population in Dar- es-Salaam is growing very rapidly, the	<u>The plan to combat them:</u> -People who built their houses within 60 m are removed from the areas close to the river Bank such as Msimbazi river and	<u>Challenges</u>

	are the mechanisms used)	problems are poor City planning and infrastructures are among the obstacles to the real environmental development. For example the liquid waste infrastructures as well as solid wastes. -People do build their houses to the wetlands such as Jangwani area in Dar - es- Salaam.	even those who built 60 m. to the Ocean are being removed as well . -The future plan of the government is to have a new City plan which will help the smooth running of environmental operations within the City -Some hotels are built within the 60 m limit away from the coast line	
3	Do you have short, medium and long term plan to educate people concerning waste management?	Yes we do	There is a campaign which was launched on 12 th February 2011, it is about keeping the City clean. The slogan of the campaign is everybody should clean his premises. The weakness of the Campaign Poor implementation of the plan	Awareness campaign
4	Do you have any recycling policy, or recycling system which helps a bit to deal with waste? For	No such policy	Though the ministry supports the recycling system hundred percent under sustainable industrial development policy	State of waste management

	example:- Plastic bottles, cans etc.. If no, do you have a master plan to put it down?			
5	What are the challenges do you face?	There are many	-poor environmental awareness of people about environment. -Inadequate of resources particularly money -No sanitary dumpsite in Dar es salaam as it was planned before; instead we have a crude dumpsite.	Challenges
6	Which municipality generates more waste in the City? If there is one what are the reasons, Demographic change? Negligence of municipal officials? Lack of education or what else?	1. The first one is Temeke 2. Secondly is Kinondoni 3. Followed by Ilala	The reason is the population density within the first two municipalities is higher than the last one (Ilala) and also the City planning of the Temeke and Kinondoni is poor compared to the last one (Ilala). Because the Ilala municipality is within the City centre. Therefore the offices, ministries, shops, schools, collages, good restaurants are within this Municipality	
7	Could you tell me the waste management hierarchy from	We don't have		

	top to the bottom or from the ministerial level to municipalities particularly in Dar es salaam?			
8	When you make laws or regulations, how do you form them?	We just hire a consultant in order to make a draft. After that, we call upon key stake holders in order to review a paper and make some comments on it/inputs .And finally we send the draft to the parliament.		
9	What is the difference in functionalities between you (the ministry of Environment) and the National Environment Management Council (NEMC)?	-We are the law makers and the NEMC job is to enforce environmental laws throughout the country		

(1) Interviewed: Mrs. Rogathe Kisanga- Principal Chemist, Division of Environment, Vice President's Office, United Republic of Tanzania.

(2) Date of Interview: November, 2013.

Appendix II

RESULTS FROM QUESTIONNAIRE FOR ENVIRONMENTAL OFFICERS OF KINONDONI, ILALA AND TEMEKE MUNICIPALITIES OF DAR-ES-SALAAM COASTAL CITY

S/ N	QUESTION	ORGANISATION					
		RESPONSES			COMMENTS		
		Kinondoni Municipality	Ilala Municipality	Temeke Municipality	Kinondoni Municipality	Ilala Municipality	Temeke Municipality
1	What is the most common waste does the municipality generates: bio waste, metals, plastics...?	1) Bio waste 2) Offices' waste such as papers 3) Metals, 4) Plastics 5) Tree branches	-Bio waste (Organic waste) -plastic bags -Plastic bottles -Metals (Iron metals, lead, copper →E-waste) - Bus tickets -Cell phone Vouchers	Generation 1138 tons per day Collected 535 tons per day Collected 47%	Types of waste: Dominant type of waste; In developing countries dominant waste is food waste.	A) People cook too much food for excess, mean while they don't have refrigerators for preserving it B) Not enough waste bins C) No enough	

							waste bins D) No enough waste bins and people don't care much about dumping waste
2	Do you have any waste management plan in your municipality?	Yes we do	Yes	We don't have data regarding waste collected in the coastal belt only within our municipality			We have the old one ,though the new one is still under way
3	Who is responsible for taking care of the coastal belt in your municipality	Municipality itself	The municipality itself	Municipality itself			
4	What challenges do you face in solving and implementing your waste management	We have many	So many	Lots of them	Challenges to waste management: Lack of enforcement of laws	-Shortage of facilities for waste management such as vehicles, waste	1) Political interference from councillors who are siding with people who

	plan?					<p>containers. -Unplanned settlements -Reluctance of community members in paying waste management fees -Political interference -lack of community awareness on environmental management -people's negligence -Poverty of many community members -Lack of fund from the Central government</p>	<p>don't want to pay their collection fees for a reason that it is too expensive. 2)A few collection points 3)Inadequate of funds 4) Inadequate of resources such as Bull dozers 5)No specific treatment of any kinds of waste 6) People have little awareness of waste management and the side effects of waste. 7) poor</p>
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						because the fund which is allocated for waste management is too small In adequate of well-trained experts in the field of waste management	arrangement of the city, squatters which hinder an effective waste collection by using cars
5	Do solid wastes pose serious challenges to the municipality?	Of course Yes	Yes	Yes	Challenges	-They don't reach collection points from the households timely as scheduled because of the lack of facilities and shortage of human resources(environmental experts)	Conflict between waste management companies (contractors) and civilian on waste collection fees

						<p>-Poor infrastructures such as unplanned settlements</p> <p>-Lack of transfer stations from collection points before dumping them to the disposal site(Dum site)</p> <p>House Holds ↓ Collection points ↓ Transfer station(Receive waste from every collection point in the City) ↓</p>	
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						<p>Dumpsite</p> <p>-The plan to build the transfer station by the City Council is still under way with the help of the world Bank</p> <p>-During the rainy season, the dump site is very slippery which cause the Cars to get stuck in between before dumping the waste to the dumpsite</p> <p>-No waste sorting either at the household</p>	
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						level or at the collection points	
6	What is the state of the annual waste generation in municipal since 1994? Is it increasing or decreasing?	increasing	It is increasing	Increasing	Waste Generation challenge	Though the waste collection exercise is improving. 60% of the waste generated is collected. Refer to the Review of the Annual and Quarter Report of the Municipality	
7	What is the total volume of waste generation per day in your Municipality?	2026 tons per day	It is estimated to produce 1,088 tons per day	Generation 1138 tons per day Collected 535 tons per day Collected 47%	Challenge		
8	What are the total volumes of waste	We don't know for sure	Actually it is difficult to know because we don't	We don't have data regarding waste collected in	Challenge		Because the contractors within our

	generated per day in the coastal belt in your municipality?		separate them with the waste from other areas	the coastal belt only within our municipality			Municipality do collect waste collectively without separation of the specific areas within the Municipality
9	Do you know the sources of this waste?	Yes	Yes	Yes	Characteristics of Waste-Source	<ul style="list-style-type: none"> -House hold wastes -Institutions such as the Bank of Tanzania (paper waste) -Waste from the markets such as Buguruni market, Ilala Market, Fish market and other markets within the municipality 	They come from households (domestic waste), Industrial waste, waste from market areas, and street waste

10	What kinds of waste are the largest of all within the coast line in your municipality?	Plastic bags	1. Organic waste (Bio waste) 2. Plastic bottles with their covers 3. Plastic bags and some kinds of papers 4.Cans	Domestic and Industrial such as plastic bottles and cans, plastic bags, pieces of threes etc.			Because they are discharged by the rivers and drainages to the sea and some Industries discharge their waste direct to the rivers
11	How do you collect these waste, are they sorted or mixed together?	Not yet, mixed	Mixed	They are mixed		Because there is no sorting formalities	
12	How does the municipal dispose this waste?	To the dump site: Pugu Kinyamwezi;	1)To the dump site 2)Some are Re used	To the dump site	Challenge	1) Pugu-Kinyamwezi Dumpsite 2) Car tires are reused for making slippers , sandals ,	

						<p>mats for cleaning feet</p> <p>2 b) some tin metal related materials are used for making oil lamps known as “vibatari”</p>	
13	<p>Are there some waste reuse strategies currently being implemented such as composting?</p>	<p>The plan is still under way, by January 2014 by the help of Belgium technical cooperation the project will commence</p>	Yes	No such plan	Challenge	<p>We have two composting stations</p> <p>1) is at Gongolambo to known as KIKUTA Waste Management Station.</p> <p>2) Is at Buguruni Malapa waste collection site under the assistance of</p>	

						Bremen Overseas Research and Development Association	
14	Does the municipality have treatment for specific wastes such as hazardous waste, electric and electronic waste, liquid waste etc.	No. we don't have such program at all	There is no any kind of treatment for these waste	No specific treatment for any kind of waste	Challenge	Hospital waste are incinerated although incinerators are not enough	Only hospital wastes are incinerated
15	Do you see any problem when people discharge waste to the drains?	Yes there is a big problem; they block drains, cause floods, other waste find their way into the ocean	The problem is so big	Yes	challenge	-Because majority of the waste discharged are not treated at all -The River Msimbazi is one of the biggest victims of these	Particularly the waste from the factories which pose a great danger to human health and the environmental at large. Also the smells which

						<p>confidential activities done by the inhabitants of Ilala, whereby people have connected their latrines' pipes to discharge it's water to the river. Finally the river discharge it's water to the Indian Ocean</p> <p>-People do throw their food left over and some peelings to the drains</p> <p>-Small scale</p>	<p>come from the rotten waste is very bad. Not only that but also the discharged waste do block the drains</p>
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						industries also channel their water to the drains	
16	Can you tell me the waste management hierarchy in your municipality?	It's hard to say	There is no exactly a drawing but I may draw of the hierarchy which is in place already but I may give you a sketch which can be suitable for you in accordance with the daily activities and orders we receive from top officials in our municipality	It is so complex	Does not understand the term?		Because it is a cross cutting phenomenon. It involves three to two ministries and environmental officers from the municipality and ministries and district
17	How do you differ in terms of functionality between you and the city authority	The city is monitoring the municipal activities along with managing the Dump site Our activities is	The city authority deals only with the Pugu Kinyamwezi dumpsite. We deal with the	City council is responsible for managing the Pugu-Kinyamwezi Dump site in Dar es Salaam, we are			

		to make sure the municipality is clean	collection of waste and the general cleanliness in our Municipality	responsible for taking care of the cleanliness in our municipality			
18	Do you have enough environmental experts in your municipality?	They are not enough	There are enough	Yes we do	Challenge		The problem is inadequate of funds
19	How many waste collection points do you have in your municipality?	We don't have waste collection points	36	We have 3 big waste collection points and 17 small waste collection points	Collection Practice: My observation there are unofficial collection points where waste are collected.	But they are not enough	They are very few compared to the people's needs, they are not enough at all
20	According to your experience, do you know one waste collection point can serve how many people	There are waste bins in our municipality	From 200-300 people		A challenge		

21	Who is the greatest polluter in the coast belt within your municipality	Bio-waste	Rivers which discharge their water the Ocean				
					Category of		

Appendix III

**RESULTS FROM QUESTIONNAIRE FOR CIVIL SOCIETY GROUPS (BEACH GOERS, FISHERMEN, AND IFM STUDENTS)
IN DAR –ES-SALAAM COASTAL CITY**

S/N	QUESTION	RESPONSES		
		GROUPS OF CIVIL SOCIETY		
		BEACH GOERS:N=30	FISHERMEN:N=10	IFM STUDENTS:N=20
I)	Are you satisfied with the waste management services given by municipalities?			
A	Satisfied?	Satisfied = 10 = 33% They try to clean sometimes we see them.	Satisfied=10 = 100% We are very satisfied compared to previous years, whereby there was no water at all in this market, so toilets were just stinking; we could not wash the fishes ready for sale etc. We are real happy and satisfied now: plastics. [Comments: My observation The situation looks to be filthy in the fish market. A pile up of plastic bags; packaging materials; plastic	Satisfied = 3 = 15% We normally see people cleaning in the morning whenever we come, but the problem is the people who pass by, usually through plastic bottles and bags because no waste bins around as you see now; People clean every morning but after some time in the afternoon waste accumulates.

			bottles; paper boxes; coconut shells; (solid waste); they are mixed with water and mud.]	
B	Not Satisfied?	Not satisfied = 19 = 63% We don't see any one cleaning the beach. Waste remains uncollected.	We are very satisfied compared to previous years, whereby there was no water at all in this market, so toilets were just stinking; we could not wash the fishes ready for sale etc. We are real happy and satisfied now: plastics. [Comments: My observation The situation looks to be filthy in the fish market. A pile up of plastic bags; packaging materials; plastic bottles; paper boxes; coconut shells; solid waste-; they are mixed with water and mud].	Not satisfied = 17 = 85% We normally come here to the beach no one cleans the beach;

C	I don't know?	I don't know = 1 = 3% I don't usually come here [My comments: Observation: I observed waste scattered on the beach]	My Comment: Respondents are not fully aware of solid waste problems. They are only concerned with issues related with the availability of water for washing their fish.]	
2	If no. What are you			

	doing in your small ways to reduce?			
A	I try not to pollute the environment whenever I am here	I try not to pollute the environment whenever I am here =7 = 23%		I try not to pollute the environment whenever I am here = 12 = 60% -I educate people at home. -I clean the environment where I live -I am ready to walk with a plastic bottle from morning to evening if I don't see waste bins
B	It is not my responsibility	It is not my responsibility= 0		It is not my responsibility = 1 = 5% -It is the responsibilities of the municipality because they are paid for it from our own taxes and they do nothing. For example:-When Obama came here, the beach was very clean , not even a single plastic bag, and it was the municipality which was doing that
C	I don't know	I don't know = 0	I don't know	I don't know - 0
D	Other	= 23 = 77% Anyone who comes here will automatically be compelled to pollute the environment because there are no waste bins		Other = 7 = 35% -I don't pollute at all in street, I only clean where I live
3	[If Yes,] Why do	No waste bins in the whole city	[My comments: To them solid	-No waste bins throughout the city.

	we still experience the waste problems in our societies?	not only here at the beach	waste does not exist so long as they have plenty their business of cleaning the fish bowels goes on well. Stinking smell stench	People are not yet civilized.
4	Have you ever experienced any problem associated with waste?			
A	Yes	= 22 = 73% -I got typhoid when I was in school -I have seen some people got cholera. I got stomach ache when I ate food which was not good	Yes = 6 = 60%	Yes = 2 = 10%-I saw one guy where I used to live , he was suffering from cholera
B	No	= 8 = 27% I only hear from the media	No = 4 = 40%	No = 18 = 90%
C	I don't know	I don't know		
5	Do you know how waste management is functioning in this municipality?			
A	Yes	Yes = 0	Yes = 10 = 100%	Yes = 4 = 20%
B	No	No = 27 = 90% Though I usually see waste management vehicles and people		No = 16 = 80%

		cleaning around the City; still there is always scattered around.		
C	I Don't know	I don't know = 3 = 10%	I don't know 0 = 0%	I don't know = 0 = 0%
6	Do you know where you are supposed to put your waste?			
A	Yes	Yes = 30 = 100% The problem is there are no waste bins throughout the City. Though they started putting waste bins in the City unfortunately people remove them	Yes = 10 = 100% When we remove fish scales and intestines we usually throw back to the Ocean, other types of waste usually we put in waste collection places around the market areas. My Observation: other solid waste streams are placed any on the floor. They lack open skip buckets	Yes = 20 = 100% The problem is no waste bins throughout the City.
B	No	= 0	0	
C	I don't know	= 0	0	
7	Do you know where your waste ends after discharging to the drains			
A	Yes	Yes = 26 = 87% Some of them block the drains	Yes = 10 = 100% Here whenever we throw away	Yes = 19 = 95% They go to block the drainage

		and some of them do come here during rainy season especially those from the low lying areas such as Jangwani area	something like fish intestines goes directly to the Ocean, but in streets the waste usually block the drains and make the water over flow during rainy season and cause roads to flood.	system, and cause floods during rainy season
B	No	No = 0 =		No = 1 = 5%
C	Don't know	Don't know= 4 = 13% Perhaps in the streets		
8	Do you think these waste will bring any harm to the aquatic animals or plants?			
A	Yes	Yes = 2 = 7% The industries which discharge the poisonous water to the Ocean might kill the fish	Yes = 2 = 20% But we don't know what kinds of problems	Yes = 20 = 100% -They kill fish especially when fish eat plastic bags -They disturb fish -The beauty of the beach disappear -Animal habitats disappear -They can block boat machines
B	No	No = 28 = 93% As you See the plastic Bags are outside the Ocean, are within the sandy Beaches. It seems the Sea is very active it does not take	No = 2 = 20% Usually solid waste can't survive in the Ocean, the waves normally push them out to the sea side/show.	

		any type of waste. Whatever goes in usually is spilt brought out by Ocean waves particularly when the ocean is coming again after disappearing		
C	I don't know	= 0 = 0	I don't know = 6 = 60% We don't really know, perhaps health officers might have accurate answers	
9	How far do you live from the Sea?		[To understand how their lives are closely related with what happens to the ocean.]	
A	Very Far	Very far = 15 = 50%		Very far = 16 = 80%
B	Not very far	Not very far = 11 = 37%	Not very far = 6 = 60%	Not very far = 4 = 20%
C	Close to the Sea	Close to the Sea = 4 = 13% [Objective: Nearness to the ocean one becomes acquainted with the behaviour and what is happening at the sea side.]	Close to the Sea = 4 = 40%	
10	What is your relationship with the Ocean?			
	Fishing	Fishing	Fishing = 10 = 100% Our livelihood dependent on the ocean	Fishing = 3 = 15%

	Boating	Boating		Boating
	Working	Working		Working
	Swimming	Swimming = 22 = 73%		Swimming = 6 = 30% We like swimming
	Water Sports	Water Sports		Water Sports
	Other	Other = 8 = 27% Recreational purposes		Other Recreational purposes = 11 = 55%
	Fishing	Fishing		
	Boating	Boating		
11	What problems do you think there are in Indian Ocean?			
	You can choose 3 of them			
A	Eutrophication	Eutrophication = 0		
B	Overfishing, illegal fishing	Overfishing, illegal fishing = 0		Overfishing, illegal fishing = 6 = 30%
C	Recreational boating	Recreational boating = 0		
D	Industrial Pollution	Industrial Pollution = 0	Industrial Pollution = 1 = 10% I think so according to what you told us	Industrial Pollution = 8 = 40%
E	Oil Spills	Oil Spills = 0		
F	Air Pollution	Air Pollution = 0		

G	Other	Other = 30 = 100% Solid waste pollution of the beaches and noise pollution from the music people play loudly from their cars Because no waste bins	Other = 9 = 90% More efforts should be put into the hygiene of this area. More people should be employed to clean	Other = 6 = 30% Solid waste pollution of the coastal belt and Ocean erosion - Plastics
12	What can be done to improve the situation?			
	To improve environmental laws and policies	To improve environmental laws and policies		[To improve environmental laws and policies] = 2 = 10% People must be educated to know the laws if ever they exist Strict laws must be formulated
	To increase the amount of funds	To increase the amount of funds		To increase the amount of funds = 3 = 15%
	Public involvement	Public involvement = 8 = 27% It is everyone's responsibility to keep the environment clean		Public involvement = 6 = 30%
	Other	Other = 22 = 73% To put waste bins and make cleanliness from time to time	Other = 10 = 100% Many environmental workers should get employment and concentrate with this area only, because it is so sensitive as you see by yourself.	Other = 9 = 45% - To increase police patrol over the illegal fishing in the Ocean -The respective authorities should clean the environment effectively

13	How do you value the Indian Ocean? you may rank from 1-5, 1 is the least important of all and 5 the most important one			
A	1 Least Important			
B	2			
C	3			
D	4			
E	5 Most Important	E = 30 = 100% We value that's why we come here	Most Important = 5 = 100% Is the source of our livelihood	Most Important = 20 = 100% -Because it is the source of employment to some people(fisher men) -We recreate here cause there is a very good Sea breeze -We get different kinds of Fish from this ocean (source of food)
14	Do you know which Municipality in Dar-es-Salaam is the main Pollutant and why?			
Yes	Yes	Yes = 1 = 3% I think the ones which has lots		

		of markets which generate a great deal of waste		
No	No	No = 0 = 0	No = 10 = 100%	
Yes	I don't know	I don't know = 29 = 97% You must make your own investigation		
15	Do you do something to Improve the state of the Ocean?			
A	Yes	Yes =	Yes = 10 = 100% We try to clean whenever we finish our activities over this place, as well as reminding one another about it; Observation: They clean their work place- cement floor	Yes = 2 = 10 I think the ones who are not within the City Center (Kinondoni and Temeke)
B	No	No = 26 = 87% -We only come here during weekends, how we can do that. -There are some people who are paid for that why should I bother myself		No = 18 = 90% We can't say without making research
C	Other	Other = 4 = 13%		
16	How do you become aware of	[A general question left to the respondent to decide which		

	the problems that exist in the Indian Ocean particularly in Dar es-Salaam?	problem he thought was important. Aimed at testing whether he had in mind any problem related to the aquatic animals brought about by pollution from land based pollution.]		
A	Media/observation	Media/observation = 20 = 67% If there are bad weather conditions such as flooding from Sea, we usually get information via media	Media/observation= 10= 100% [All of them answered this part, media, observation]	Media/observation = 16 = 80% Newspapers, radio and television
B	Internet	Internet		
C	Friends	Friends = 4 = 13% Yes, cause some times friends tell us not to go to some places within the beaches because of robbers who disturb visitors	Friends = 10 = 100% [All of them answered this part]	
D	Studies and observation	Studies and observation		Studies/observation = 4 = 20%
E	other	Other = 6 = 20% Some people close to us tell us about the bad places which we should not go		

I: Beach Goers

- (1) Venue: Coco beach: Kinondoni Municipality
- (2) Observation: Solid wastes scattered all over the beach. Juice plastic containers (paper), coconut shells (madafu), plastic bottles; wrapping; plastic bags; sponges-washed ashore by sea tides; wine bottles; pray cans; ice cream containers.
- (3) Mode of interview: Group interviews- of clusters of 10.
- (4) Date: End of October;
- (5) Two days: Saturday and Sunday

II: Fishermen; At Kivukoni Fish Market

Along the beach plastic bags stuffed with solid wastes- scattered small piles along the beach.

Purpose: (1) To find out how far they protect the marine environment.

- (2) To determine their awareness of the importance of wastage management to society and their individual economy (livelihood) and their effect on human health and aquatic animals.
- (3) I wrote the questions in English but while I was interviewing them I was translating the questions into Kiswahili and left to them to answer in English. Used as a semi-structured interview.
- (4) Mode of the Interview was group discussion.
- (5) To take
- (6) Venue: Kivukoni Fish Market, Dar-es-Salaam.
- (7) Time Taken: 2-3 Hours.
- (8) Date: 3/12/2013 at about 2.00 pm.

III: IFM STUDENTS;

- (1) Venue: Anti erosion embankments at the Dar-es-Salaam, sea side; every day they sit there in group discussions.

- (2) Mode of interview; I asked all 20 to gather together.
- (3) Time taken; 2 hours.
- (4) Interview guide-written in English
- (5) Interviewed: I read the interview questions in English. Respondents answered both in Swahili and English.
- (6) Date: November, 2013.

Appendix IV

RESULTS FROM QUESTIONNAIRE FOR A WASTE MANAGEMENT COMPANY AND CBO STAFF

Questioner with 3 waste management company workers at Kariakoo Market

1. What challenges do you encounter within your work?

-Low wages, you can imagine I receive Tsh 100,000/= per month, I do this job cause I have no alternative.

-We are not well equipped in order to protect ourselves against disease, we are told to change our names in every month in order to be seen as new employers, who are in probation period; the guys are just avoiding Tanzanian law which says after sixth months at work you should get permanent employment

2. What made you to work with waste management?

I normally choose any available job to do, but we don't get any motivation, it's real discouraging for sure, we don't have zeal to do this job at all, because of that.

3. What have you done to stand up for your right?

-We are little guys here we can do nothing, we are so grateful for your visit as a researcher here, you should expose these evil activities done to us.

RESULTS FROM QUESTIONNAIRE FOR MR. MOHAMED KATOMA, HEAD OF A COMMUNITY ORGANIZATION-THE HYGIENE TECHNICIAN ENVIRONMENTAL GROUP AT BUGURUNI KISIWANI WARD.

1. What challenges do you encounter within your work?

-We don't have good environmental equipments, such as motor bikes with trailers instead we have "mikokoteni" (hand drawn carts) which are powered by human beings; however they cannot go many trips.

- Poor city planning squatter areas
- People don't want to pay the collection fees.
- Political interference from councillors.
- People do discharge wastes to drains.
- Luck of fund

RESULTS FROM QUESTIONNAIRE FOR TWO WORKERS OF A WASTE MANAGEMENT COMPANY IN TEMEKE

1. What challenges do you encounter within your work?

- Low salary
- Poor working conditions, both issues make me not to have zeal in my work, look at me I have a wife and kids but I receive Tsh 80,000/= per month you can imagine.

QUESTIONNAIRE WITH TWO IN CHARGES OF WASTE COLLECTION POINTS IN UHURU STREET, ILALA MUNICIPALITY

1. What challenges do you encounter within your work?

Personally say, "I'm paid like TSh 150,000/= per month which is very little but the top bosses are not aware of the issue of low wages to workers, first I'm not really employed; it is my friend's job. He gives me this amount of money and he takes the rest. So I have no means because I don't have any other job to do."

2. Are people aware of the solid waste problems?

Yes, they are very much aware, that's why you don't find solid waste scattered in the streets; you only see a pile up of solid waste here.