GOVERNANCE INSTRUMENTS AND LIQUID WASTES MANAGEMENT IN URBAN INDUSTRIAL AREAS OF TANZANIA:
A CASE OF MOROGORO TEXTILE INDUSTRY

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A CASE OF MOROGORO TEXTILE INDUSTRY

By

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A Dissertation Submitted in Partial Fulfillment of the Requirements for the Award of the Degree of Master of Science in Environmental Management (Msc. EM) of Mzumbe University

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CERTIFICATION

We, the undersigned, certify that we have read and hereby recommend for acceptance by the Mzumbe University, a dissertation titled **Governance Instruments and Liquid Wastes Management in Urban Industrial Areas of Tanzania: A Case of Morogoro Textile Industry,** in partial fulfilment of the requirements for award of the degree of Master of Science in Environmental Management (MSc. EM) of Mzumbe University.

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I, **Humphrey Donald Mwakaboko**, declare that this dissertation is my own original work and that it has not been presented to any other university in a similar or any other degree award.

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DEDICATION

Special dedication to my beloved parents Mr. and Mrs. Alfred D. Mwakaboko for their great support which they gave me until reaching this level of study, Thanks for your love to me.

LIST OF ABBREVIATIONS

ADB	African Development Bank
AEPA	Australian Environmental Protection Authority
ATU	Acute Toxicity Unit
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
EMA	Environmental Management Act
EPA	Environmental Protection Agency
FEP	Federal Environmental Protection Agency
MoH	Ministry of Health and Social Welfare
NBS	National Bureau of Statistics
NEM	National Environmental Management Authority
NEMC	National Environmental Management Council
NEP	National Environmental Policy
NGO	Non Governmental Organization
OSHA	Occupational Safety Health Authority
PVA	Polyvinyl Alcohol
SPSS	Statistical Package for Social Sciences
TANEP	Tanzania National Environmental Policy
UK	United Kingdom
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environmental Programs
URT	United Republic of Tanzania
US	United States
VOCs	Volatile Organic Chemicals
WHO	World Health Organization

ABSTRACT

This research aimed at examining how governance instruments are applied in managing liquid wastes, its efficiency and effectiveness in the Morogoro Textile Industry. A case study research design was used and eighty three (83) respondents were interviewed by using questionnaires and participant observations. Data collected were presented using Statistical Package for Social Science (SPSS, version 16) and analysed using percentages, graphs, and tables.

The findings show that, the Morogoro textile industry does not implement all the governance instruments for waste management, the applied one are 48.3% recycling, 16.7% environmental regulation, 6.7% environmental policy and 28.3% environmental standards, and the liquid waste management system/programs adopted by the Morogoro textile industry were less effective and efficient. The findings show that, 60% of workers were not satisfied with the situation of liquid waste management practices in the industry and 28.3% were less satisfied and 11.7% were completely dissatisfied. About 75% of the community said that no any environmental education concerned liquid waste was provided to them, while 25% they do not recall if there was environmental education provided to them.

This study recommends improving infrastructures of waste collection and treatment plant, adhering to the rules and regulations from NEMC, applying governance instruments properly, improving the working environment for employees, to improve environmental education and public awareness to the people. The existing technologies need to be updated to minimize liquid wastes produced. Recycling and re-use of liquid wastes and adoption of cleaner or low liquid waste technologies should be emphasized. To date there is no policy for liquid waste management at the national level, thus the government should formulate a liquid waste management policy accompanied by the enabling legislation, to regulate the operations in liquid waste management.

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CHAPTER ONE

INTRODUCTION

This chapter gives the introduction to the entire study and presents the context of the research. It covers the background to the study, highlighting the issues of governance instruments and liquid waste management in urban industrial areas in Tanzania, a statement of the research problem, objectives of the study, and the significance of the study, scope and limitation of the study.

1.1 Background to the Problem

Man has always generated waste materials which are either by-product of his activities, for which he could not find any use, or products which have reached the end of useful life (Syed, 2006). Although this was going on throughout the ages, it was not a problem until recent times because natures own waste treatment processes like dispersion, dilution and degradation, which took care of these problems. The situation today is not so simple. The problem is due to both quantitative and qualitative nature of the wastes we are producing. The natural degradation processes are slow and can take care of only a limited amounts and specific kinds of wastes (Syed, 2006).

Managing waste is a major concern all over the world. If wastes are not well managed, it easily becomes a health hazard causing the spread of diseases and affecting human health (Riedijk, 2010). Liquid waste generation is one of the major issues in every country and liquid waste quantities are generally growing. Some heavy metals contained in industrial effluents (either in free form in the effluents or adsorbed in the suspended solids) from the industries have been found to be carcinogenic (Tamburlini *et al*., 2002) while other chemicals equally present is poisonous depending on the dose and exposure duration (Kupchella and Hyland, 1989). These chemicals are not only poisonous to humans but also found toxic to aquatic life (WHO, 2002) and they may result in food contamination (Novick, 1999).

The discharge of untreated or inadequately treated wastewater from industry, agriculture, and sewage often causes pollution or harmful effects to the environment

and human health, including undesirable changes to ecosystems, reduction in the economic value of resources, aesthetic damage, and human health risks (Fagan et al, 1995). Wastewater may be defined as any discharge into the environment (effluent or sludge) with or without treatment (human excrement, effluent, flushing water, industrial wastewater and storm water) (SOPAC, 2002). Contaminants of concern that are present in wastewater include pathogens (microorganisms), nutrients, heavy metals, suspended solids, biological oxygen demand (BOD), and oil and grease.

The quantity and quality of industrial wastes have increased over the years; however, there is hardly any waste recycling/treatment or proper management practices in the industries (EPA, 2002). The major producers of industrial pollutants are textiles, food manufacturing, petroleum refining and handling, and mineral exploitation and processing. The textile and garment industries produce floor wastes, yarns, wax cotton fluffs and cutoffs (EPA, 1991). Textile industries are major sources of these effluents (Ghoreishi and Haghighi, 2003), due to the nature of their operations which requires high volume of water that eventually results in a higher wastewater generation.

EPA (1974) reported that the pollution parameters in textile wastewater effluents are suspended solids, Biological Oxygen Demand (BOD) , Chemical Oxygen Demand (COD), nitrogen, phosphate, temperature, toxic chemicals (phenol), chromium and heavy metals, pH, alkalinity-acidity, oils and grease, sulfides, and coliform bacteria. Federal Environmental Protection Agency (1991) also supported these and demands for their proper monitoring in the textile effluents in the country. Textile effluents are high in BOD due to fibre residues and suspended solids (Australian Environmental Protection Authority, 1998). They can contaminate water with oils, grease, and waxes while some may contain heavy metals such as chromium, copper, zinc and mercury (EPA, 1974).

Textile processes such as bleaching involves the use of chemicals, which may cause negative effects on the ecosystem if effluents are not treated before disposed (Blomqvist, 1996). The chemicals of concern in textile effluents include

Sodium Hydroxide, Sodium Hypochlorite, Sodium Sulphide, Hydrochloric Acid and reactive dyes (Blomqvist, 1996). The inorganic chemicals, even at extremely low concentrations may be poisonous to fish and other smaller aquatic microorganisms. Textile process effluents therefore require proper treatment before it can safely be disposed off into the water (Nemerow, 1978).

Like many other developing countries, Tanzania has recently realized the importance of environmental management in all sectors for the profit making or service providers. To ensure that there is effectiveness in achieving this goal, there is a set of environmental governance instruments like environmental policy, laws, bylaws and regulations that have been developed to guide the process (Palela, 2002). Tanzania sustainable industry development policy (1996-2020) did not put much emphasis on management of wastes generated by industries, it just regulate disposal mechanisms to attract investors to the site.

In part IXC of Environmental Management Act (EMA) number 20 of 2004 it explains about Environmental quality standards, but in realities it is not practiced in most of Tanzanian industries. The National Environmental Policy (NEP) of 1997 has stipulated policy objectives based on the promotion of the use of environmentally sound technologies, that is, technologies that protect the environment. This objective is meant for the industries and how they should take care of their wastes (Palela, 2002).

The overall objectives of the NEP are to ensure sustainable and equitable use of resources without degrading the environment, ecosystems as well as to conserve and enhance natural and man-made heritage, including the biological diversity of the unique ecosystems of Tanzania (Pallangyo, 2007).

The NEP also provides for the execution of a range of strategic functions using governance instruments such as environmental impact assessments, environmental legislation, economic instruments and environmental standards, and indicators. A framework also provides for institutional arrangements and coordination (Pallangyo,

2007).

The industrial sector in Tanzania is experiencing a recovery after the collapse of many parastatal industries in the mid-90s. Most of the industries are old and rely in old equipment and technologies. Thus most of these industries are potentially polluting and need to be regulated while they are encouraged to improve their environmental standards (NEMC, 2012). The management and control of industrial chemicals are regulated by law: the Industrial and Consumer Chemicals (Management and Control) Act No. 3 of 2003. The Ministry of Health and Social Welfare through the Registrar of Industrial chemicals regulates this sector (NEMC, 2012).

The Morogoro textile industry is one of several industries in the country where liquid waste management is unsatisfactory. Liquid waste is not managed in accordance with the governing instruments of the Country.

River Morogoro is a major river which receives the effluents from Morogoro textile industry. It does not only run across the entire city but it is a major tributary of the Ngerengere River which is a major River which cut across larger areas of Morogoro Municipality. The River is also widely used in many social-economic activities. This indicates the extent to which pollutants in the effluent may reach. Therefore, this calls for a proper treatment and management of effluents from the industries to be sure that environmental indicators do not exceed the set limit at any point in time.

This research aims to assess the way Morogoro textile industry apply Governance Instruments in managing liquid wastes produced. It also assesses how the Environmental Governance Instruments may help to protect the environmental health and people well being by controlling the liquid wastes produced in the industries. Therefore, there is a need of examining how governance instruments are applied in managing liquid wastes, its efficiency and effectiveness in the Morogoro textile industry.

1.2 Problem Statement

The main problem in handling industrial liquid wastes in most cases is the way industrial bylaws, policy, and regulation are followed in managing industrial liquid wastes. A large proportion of industrial liquid wastes are often disposed of to the environment without any control mechanisms in many urban industrial areas in Tanzania. Wastes that are not properly managed from households, industries and the community are a serious health hazard and could lead to the spreading of diseases. Unattended wastes lying around will attract flies, rats, and other creatures that, in turn, spread diseases.

The governing instruments for environmental waste management are well formulated for the industries to follow, but various industries do not well adhere to these instruments. Most industries have no environmental bylaws or policies to implement, thus, limiting their capacity to manage liquid waste produced. "Experience has shown that the existing institutional framework cannot effectively face the challenge of integrating environmental concuss into development activities. The current institutional framework is an obstacle to effective implementation" (Green, 1995:25).

A number of sectoral policies such as National Environmental Policy (1997), National Water Policy (2002), Sustainable Industrial Development Policy (SIDP, 1996), and the National Health Policy (1990), which address issues pertaining to environmental health and sanitation are in place; these policies have pinpointed pertinent issues pertaining to waste management by providing the governance instruments to guide and/or control waste produced in different areas however the challenge has always been to implement these policies for improvement of environmental sound waste management.

Industrial liquid waste management is one of the areas, which have been given urgent consideration in policy statements, laws, and regulations. The only concern is to what extent these instruments are being implemented. The establishment of governance instruments in managing liquid wastes was aimed at reducing the poor management of these wastes that existed for a long time. But in unknown reasons, there is an

improper management of liquid wastes in industries. Therefore, this study aims at assessing on how these governance instruments are applied in managing liquid wastes produced in the Morogoro textile industry.

1.3 Objectives

The objectives of the study include the general objectives and specific objectives as mentioned below.

1.3.1 General objective

The general objective of the study was to assess the role of governance instruments in managing liquid wastes in the Morogoro Textile Industry.

1.3.2 Specific objectives

The specific objectives of the study were;

i) To assess how the existing governance instruments have been implemented to manage liquid wastes in the Morogoro Textile Industry.
ii) To examine the impacts of liquid wastes on flora, fauna and the settlement areas around the Industry.
iii) To assess the challenges of liquid waste disposal facing the Industry.
iv) To examine how the Firm is addressing the challenges of liquid waste disposal.

1.4 Research Questions

i) How the existing governance instruments are implemented to manage liquid wastes in the Morogoro Textile Industry?
ii) What are the impacts of liquid wastes on flora, fauna and the settlement areas around the Industry?
iii) What are the challenges of liquid waste disposal facing the Industry?
iv) How is the Firm addressing the challenges of liquid waste disposal?

1.5 Scope of the Study

The spatial scope of the study concerns only in Morogoro textile industry and the

community living near the Industry which were from the Kihonda ward in Mafisa kwa Sina , Mafisa kwa Sudi, Viwandani and Kayenzi Streets.

In terms of depth of investigation, the research was restricted to assessing the governing instruments and liquid waste management in urban industrial areas of Tanzania. The study focused on how the industry complies with environmental governance instruments involved in managing liquid waste before disposing off without harming human health and the environment.

1.6 Significance of the Study

This research will contribute to know how the governing instruments are used and help to manage liquid wastes in urban industrial areas of Tanzania. The study will also help to understand how the industry complies with waste management practices, environmental policies, bylaws and strategies, are involved in treating the liquid waste before disposing off without harming human health and the environment.

This study will help policy makers, especially in the developing world, to identify, evaluate and apply governance instruments to address a country's environmental problems within the country. On the other hand, the study is very important for me as a student of social science and social relationships in seeking answers to various social environmental problems. Also it will inculcate scientific and inductive thinking, promote new skills as well as development of logical habits of work and organization.

It will facilitate government's efforts of promoting sustainable environmental management as articulated in the National Environmental Policy (1997), National Water Policy (2002), Sustainable Industrial Development Policy (1996), and National Health Policy (1990). The study's findings will also bridge the gap existing between studies in the management of industrial wastes especially in the urban areas.

The study's findings will additionally help policy makers and planners in understanding how to address issues of liquid wastes and community involvement in the management of environmental challenges in their areas.

1.7 Limitations of the Study

The research focused on assessing potential governance instruments that were applied in the Morogoro textile industry in the liquid waste prevention, reduction or treatment that is liquid waste management. That is, how effectively they are applied and how they are useful in enhancing liquid waste management. The target population was the industrial workers, industrial administration and the community from Kihonda Ward especially from Mafisa kwa Sina, Mafisa kwa Sudi, Viwandani and Kayenzi Streets which are around/ near the Textile industry.

The limitations in the whole process of conducting this research were inadequate finance to pay respondents who were not willing to fill the questionnaire without being paid. The problem was solved through the management of the industry who explained to the respondents that a researcher was a student and the research that I was doing was for academic purposes and not otherwise.

And other workers instead of giving the required response, they exposed their work difficulties as if I am the one to solve them. This costed me in terms of time and finances. In the first instance, the administration was not cooperative as they doubted my presence. For the same week I reported, the Government leaders also visited the industry including Minister of industry and business as well as the Regional Commissioner, they all found fault with the factory's liquid waste management. It took time for me to make them understand that I was doing this for the purpose of academic.

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

This chapter presents the literature review, whereby the researcher gives theoretical and empirical literature review of the problem area including findings by others (Ndunguru, 2007). It also presents the conceptual framework of the study, whereby, the researcher will assemble set of research concepts cum variables together with their logical relationships in the form of a diagram.

The chapter deals with two parts of literature review. The first one, theoretical literature review, is about the principles, policies, procedures proposed or followed as the basis of action in the efficient and effective management of industrial liquid wastes. It discusses some basic concepts related to liquid waste management these include the concept of waste, liquid wastes and liquid waste management; the objectives, principles and strategies of waste management, as well as some tools for liquid waste management.

The second, the empirical literature review is about the said principles, policies, procedures proposed or followed as the basis of action in the observed experience of governance instruments in managing liquid wastes in Morogoro textile industry.

2.1 Theoretical Literature Review

It discusses some basic concepts related to liquid waste management these include the concept of waste, liquid wastes and liquid waste management; the objectives, principles and strategies of waste management, as well as some tools for liquid waste management.

2.1.1 The Concept of Waste

The notion of waste is relative in two main respects. First, “something becomes a waste when it loses its primary function for the user. A waste is therefore relative to this primary function”. However the second perspective, “what is considered waste with regard to this primary function may be useful for a secondary function. In other words, somebody´s waste is often somebody else´s (secondary) raw

material". Nature is an excellent example of this reality since, for example, in many cases; the defecation of mammals is used as food by some insects.

The definition of waste from the Basel Convention, as adopted by the European Union in 1993 is: *"Wastes are substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law"*. This definition is relative to national law and opens the debate between the meanings of the term discard versus dispose. The lack of common understanding of the term discard is a major issue in the waste definition debate (WHO, 2005).

Definitions of 'waste' are rather commonly found in such documents as dictionaries, encyclopedia and technical reports of governments and organizations. For example, the Longman Dictionary of Contemporary English (p. 1612) defines waste as "the unwanted material or substance that is left after you have used something" while the New Shorter Oxford English Dictionary on Historical Principles defines it as "the unusable material left over from a process of manufacture, the use of consumer goods etc, or the useless by-products of a process".

Gilpin (1996) provides a more elaborate definition of the term waste. According to him, the concept of waste embraces "all unwanted and economically unusable byproducts or residuals at any given place and time, and any other matter that may be discarded accidentally or otherwise into the environment" (Gilpin, 1996:228). McLaren (1993) has also referred to waste as the "unwanted materials arising entirely from human activities which are discarded into the environment".

Waste management refers to the process of collecting, transporting, processing, recycling and disposal of waste materials. Such process is usually connected with various human-related activities that generate waste and is undertaken for the purpose of reducing its effects on health and the environment as well as to recover utilisable resources from it, usually ones produced by human activity in an effort to reduce their effect on human health or local aesthetics or amenity.

Gbekor (2003:18), for instance, has referred to waste management as involving "the collection, transport, treatment and disposal of waste including after care of disposal sites". Similarly, Gilpin (1996:201) has defined waste management as "purposeful, systematic control of the generation, storage, collection, transportation, separation, processing, recycling, recovery and disposal of solid waste in a sanitary, aesthetically acceptable and economical manner" thus, the priority of a waste management system must always be the provision of a cleaning service which helps to maintain the health and safety of citizens and their environment (Cooper, 1999). Gilpin (1996) regards the business of waste management as a professional practice which goes beyond the physical aspects of handling waste. It also "involves preparing policies, determining the environmental standards, fixing emission rates, enforcing regulations, monitoring air, water and soil quality and offering advice to government, industry and land developers, planners and the public" (Gilpin, 1996:228).

Management indicates managing wastes in such a way that it would be beneficial in any way. In view of associated environmental hazards and their impacts on public health and safety, efforts must be made to minimize waste generation, systematic disposal practices must be followed and sound waste management methodologies need to be adopted. Waste management must therefore be carefully planned in advance and take place in the following order (Department of Water Affairs and Forestry, 1998).

Waste prevention: the prevention and avoidance of the production of a waste, perhaps by regulation, waste minimization: the reduction of the volume of waste during production by means of different processes or clean technology, resource recovery: recycling of waste or the recovery of energy through incineration and biodegradation, treatment: the treatment of waste to reduce volume or hazardousness and disposal: the safe disposal of waste so that it will not pollute the environment or cause health hazards.

The Rio Declaration on Sustainable Development (UNCED, 1992) defined

sustainable waste management as the application of the integrated life cycle management concept in waste management. This was later elaborated by the United Nations (2005) Agenda 21as: "Environmentally sound waste management must go beyond the mere safe disposal or recovery of wastes that are generated and seek to address the root cause of the problem by attempting to change unsustainable patterns of production and consumption".

In effect, the Declaration suggests an approach to waste management that incorporates environmental, social and economic perspective into environmental policy, planning and practice. However, it is only recently that waste management policies, plans and programs have begun to consider all of these different stands of sustainability. As Nilson-Djerf and McDonald (2000) argue for a waste management system to be sustainable, it needs to be environmentally effective, economically affordable and socially acceptable.

Within the broader framework of sustainable development, the concept of sustainable waste management is also an appropriate framework for studying not only the effects of improper waste management on human health and the natural environment but also the implications of current waste management practices for resource conservation and environmental sustainability (Schubeller *et al.*, 1996; Watson and Bulkerley, 2004).

The principles of waste management, as identified by Schubeller *et al.* (1996, page 19), are "to minimize waste generation, maximize waste recycling and reuse, and ensure the safe and environmentally sound disposal of waste". This means that waste management should be approached from the perspective of the entire cycle of material use which includes production, distribution and consumption as well as waste collection and disposal. While immediate priority must be given to effective collection and disposal, waste reduction and recycling should be pursued as equally important longer-term objectives (Schubeller *et al.,* 1996).

2.1.2 Liquid waste management processes

The Environmental Management System needs to address waste management with

an aim to minimizing the quantity of liquid waste generated and improving on the liquid waste disposal and management techniques adopted. The liquid waste management practices as explained by Syed (2006) in the Emirates Journal for Engineering Research, includes;

2.1.2.1 Waste Avoidance

Waste avoidance is the first hierarchical in reducing the amount of waste produced. The approach to waste avoidance and reduction will aim to minimize the production of waste materials in accordance with the Governments Waste Reduction and Purchasing Policy.

The generation of waste can be avoided by substituting inputs for those that generate waste, increasing efficiency in the use of raw materials, energy, water or land, redesigning processes or products, and/or improving maintenance and operation of equipment.

2.1.2.2 Waste Reuse / Recycling

Recycling is a process involving the collection and separation of waste materials, which are transformed into useable products. This may give the primary material for the waste producer to reuse, such as electroplating salts from plating wastes, or a secondary material which is related, such as metal oxides for smelting of metal again from plating wastes. A waste may be reused, rather than recycled, when it is employed for a different purpose, for example, the burning of waste lubricating oils or solvents for their heat content.

2.1.2.3 Waste Removal Principles

Waste removal requires the transport and disposal of waste material that cannot be reused or recycled, either on-site or off-site. The following waste removal principles have been adopted.

2.1.2.4 Waste Disposal

The wastes generated by the industry must be disposed of in a way that causes the least harm to the environment. Waste will be sent for disposal only once other

options have been exhausted. Disposal of liquid waste includes dumping on land; underground to rivers or to the sea, some pre-treatment of waste may be necessary before disposal in order to comply with the legislation. Destruction, for example by incineration is also included. Dumping for short term for future recovery is employed for liquid wastes such as solvents which are accumulated until the process of recovery is practical and viable.

But long term storage has been seriously proposed only for solid wastes with the exception for radioactive liquid wastes which are a special case.

2.1.2.5 Waste Reuse Principles

Every effort will be made to ensure that waste material is seen as a resource and is used, either on-site within the project or off-site either on other projects or by other persons.

2.2 Overview of Pollutants and Waste Streams in the Textile Industries

Key environmental issues associated with textile manufacture are water use, treatment and disposal of aqueous effluent. The risk factors are primarily associated with the wet processes, scouring, desizing, mercerizing, bleaching, dyeing and finishing. Desizing, scouring and bleaching processes produce large quantities of wastewater. For instance, treating azo-dyes results in production of amines which could be a greater environmental risk than the dye itself (EPA, 1996).

Textile wastewater includes a large variety of dyes and chemical additions that make the environmental challenge for textile industry not only as liquid waste but also in its chemical composition. Main pollution in textile wastewater comes from dyeing and finishing processes. These processes require the input of a wide range of chemicals and dyestuffs, which generally are organic compounds of a complex structure (Parvathi, *et al*, 2013). Textile processing generates many waste streams, including water-based effluent as well as air emissions, solid wastes, and hazardous wastes. The nature of the waste generated depends on the type of textile facility, the processes and

technologies being operated, and the types of fibres and chemicals used (EPA, 1996).

Most textile operations produce little or no hazardous waste as part of their routine operations, but a small percentage of textile mills (perhaps 10 percent to 20 percent) are hazardous waste generators. Any facility that uses chemicals can produce hazardous waste if a chemical exhibiting the hazardous characteristics of ignitability, toxicity, corrosively, reactivity, or flammability is spilled on the ground (EPA, 1996). These pollutants include colour residues in dyeing wastewater, electrolytes in dyeing wastewater, toxic air emissions from wastewater, low metals in dyeing wastewater and aquatic toxicity in dyeing wastewater (EPA, 1996).

Several textile processes can potentially generate hazardous waste as a normal, routine by-product. In addition, occurrences such as spills, process excursions, and upsets can produce hazardous waste unexpectedly. Although many textile mill screens out chemicals that might potentially generate hazardous waste, abnormal events that result in hazardous waste spills can still occur and must be planned for.

2.2.1 Textile Processes

The textile industry is energy, water, and chemical-intensive. Within the industry, the majority of energy, water, and chemicals consumed are for wet processing. Most wet processing involves treatment with chemical baths, which often require washing, rinsing, and drying steps between key treatment steps. Consequently, wastewater is generated, having a very diverse range of contaminants that must be treated prior to disposal , energy is consumed to (1) heat and cool chemical baths and washwater, and (2) dry fabrics or yarns (The U.S. Environmental Protection Agency, 1996).

Because of the quantity and toxicity of generating wastewater, the industry has faced increasing pressure regarding environmental and waste-related concerns. Most of the effluent volumes arising from a textile mill come from washing operations, fabric preparation and dyeing operations (The U.S. Environmental Protection Agency, 1996).

Because there is such a diverse product and application range of textiles, the type of processing used is highly variable and depends on site-specific manufacturing practices, in addition to the type of fiber used, and the final physical and chemical properties that are desired. Even for a constant product type, no two textile mills use exactly the same methods of production (The U.S. Environmental Protection Agency, 1996).

Textile manufacturing begins with the production or harvesting of raw fibre. After the raw natural or manufactured fibres have been shipped from the chemical plant or the farm, they pass through the following processing stages: (1) yarn formation, (2) fabric formation, (3) fabric preparation, (4) dyeing, (5) printing (6) final finishing, and (7) product fabrication. Some of the processes may be omitted, and the order of the operations may vary, depending upon the particular end-product that is desired (U.S. EPA/semarnap, 1996).

Here, as explained by U.S. EPA/semarnap pollution prevention work group on December 1996, each above mentioned textile process and its associated waste streams will be discussed briefly.

2.2.1.1 Yarn formation

In yarn production, natural fibres, predominantly cotton and wool, are cleaned, blended, carded and/or combed, drawn, drafted, and then spun into yarn. Man-made cellulosic and synthetic fibres are often shipped as staple, which are ready for spinning, or as continuous filament yarn, which may be used directly or following further shaping or texturizing. Natural fibre contaminants include natural waxes and oils, metals, agricultural residues, and lubricant residues arising from harvesting and processing. Synthetic fibres can contain impurities, such as finishes, polymer synthesis by-products, and processing additives, which are imparted to the fibres during fibre manufacturing and before they reach the textile manufacturer.

2.2.1.2 Fabric formation

Textile fabrics are formed mainly by weaving or knitting processes. Knit fabrics are

used largely in the hosiery and stock markets, for the manufacture of underwear, lingerie, and outerwear, such as knit sport shirts. Yarns are also used directly in the production of floor coverings. Narrow Wovens, waddings, Nonwovens, and rope and cordage are used mainly in industrial applications.

2.2.1.3 Fabric preparation

Fabric preparation, which is reserved for natural fibre-containing fabric, cleans the fabric and increases its absorbency and whiteness, which ensures better dye uniformity and colour fastness. In fabric preparation, or fabric pretreatment, contaminants that will interfere with dyeing, printing, and finishing are removed by using a series of cleaning treatments. These preliminary treatments include singeing, desizing, scouring, and bleaching. Additional treatment processes, including heat setting and mercerizing, are used to make the cloth more stable and chemically reactive, so that subsequent chemical finishes will be more permanent. Singeing and mercerization are always carried out in continuous mode.

Scouring uses a hot caustic solution to remove impurities and handling contaminants that are present in the fibre. These impurities and contaminants may include lubricants, dirt, other natural materials, water-soluble sizes, antistatic agents, and fugitive tints. Bleaching decolorises coloured impurities that are not removed during scouring, and prepares the cloth for further finishing processes, such as dyeing or printing.

Characteristic wastes include, degraded starch (high BOD), enzymes, and polyvinyl alcohol (PVA) from desizing operations; sodium hydroxide, chelates, fats, oils, pectins, wax, organic material, knitting lubricants, and spin finish from scouring; hydrogen peroxide, sodium silicate, sodium hydroxide, surfactants, chalets, and sodium carbonate from bleaching; and sodium hydroxide from mercerizing. If size recovery is not practiced, the caustic or bleach stream will generally degrade many size compounds to an extent that they cannot be recovered.

2.2.1.4 Dyeing

After preparation, colour is applied to fabric through dyeing and/or printing. Textiles may be dyed, during any of the four stages of production, by using either batch or continuous techniques which are; in fibre form (before spinning), as spun yarns, after the finished material has been woven or knit, or, in the case of apparel, in garment form after cutting and sewing. Batch and continuous dyeing processes both consist of dye application, dye fixation with heat and/or auxiliary chemicals, and washing. Dye categories include acid, azoic, basic, direct, disperse, pigment, reactive, solvent, sulphur, and vat dyes.

Dyeing processes generate many pollutants, which may either originate from the dyes, or derive from auxiliary chemicals such as salts, surfactants, lubricants, and alkalis used in the processes. Dyeing contributes most of the metals and, essentially, all of the salt and colour in wastewater effluent from textile operations. Dyeing uses many volatile chemicals, which contribute to air emissions. Cleaning solvents used during dyeing equipment maintenance and cleaning constitute an additional source of air and water pollutants.

Certain dyes and/or their metabolized degradation products are mutagens or carcinogens, which increases their environmental liability. Colour in effluent from textile dyeing and printing operations is being increasingly regulated. Generally, effluent from most textile dyeing operations has a dark reddish-brown hue that is aesthetically unpleasing when discharged to receiving waters. Although there are many methods of removing colour, none works in every case.

2.2.1.5 Printing

In printing, colour is deposited on the fabric and fixed by using steam, heat, or chemical treatment. Print pastes are formulated to ensure proper flow properties during application (thixography), and adhere to the fabric until they are dried. Commercial printing methods include pigment printing, which comprises about 75 to 85 percent of all printing operations, wet printing, discharge printing, and carpet printing.

Print application consumes less water and produces fewer BODS than the preparatory operations such as desizing, scouring, and bleaching that precede it. In pigment printing, the main source of waste is from the cleanup, during which unused printing paste is removed from the screen. The typical wastes generated during various printing techniques include colour residues, AP based surfactants, solvents, urea, and metals.

2.2.1.6 Final finishing

Most fabrics undergo one or more final finishing process (involving both chemical and physical processes) to enhance properties such as durability, appearance, or safeness. Fabric coating operations based on latex materials and solvents such as methyl ethyl ketone, acetone, toluene, and xylene produce (1) various waterproof products, (2) offset printing blankets, (3) landfill liners, and (4) other engineered textile products. In many cases, they are produced by swelling or dissolving natural or synthetic rubber or latex materials in a mixture of solvents, then spreading or spraying the plasticized material onto fabrics, followed by drying or curing.

Finishing processes can generate solid wastes (scrap fabric, fibre dust, paper tubes, and empty chemical drums), liquid wastes (discarded finishing compounds, rinse waters, and wash water for general cleaning), and air pollutants (VOCs from drying and curing).

2.2.1.7 Product fabrication

Finished cloth or fabric is fabricated into a wide variety of apparel, household, and industrial products. Textile mills produce some of the simpler products, such as bags, sheets, towels, blankets, and draperies. However, goods to be made into apparel or the more complex house wares are usually sold to the cutting trades for fabrication. The amount of waste generated by product fabrication operations varies with the type of goods being produced. On average, open-width knits appear to generate the least waste of (13% - 16 %) followed by denim manufacturing (16% -24 %) and knit tubular (25% - 27 %). Because textile operations produce so much wastewater, mills may be tempted to assume that they cannot avoid large volumes of

wastewater, and therefore, they may become negligent in pollution prevention. In practice, mills vary considerably in the amount of water and wastewater pollutants they discharge. One essential and often difficult step in water pollution prevention has been to accurately and realistically assess the mill's current status and its potential for improvement. This assessment is necessary to target specific waste streams that will maximize pollution prevention.

Any wastewater stream deserves attention if it exceeds industry norms, it exceeds Publicly Owned Treatment Works (POTW) pretreatment or National Pollutant Discharge Elimination Standards (NPDES) permit limits, it is economically advantageous to eliminate and if it is one of the four types most amenable to pollution prevention (high volume, offensive, persistent or resistant to treatment, dispensable).

2.2.1.8 Sources of colours and metals in Wastewater

Dyes and pigments for printing and dyeing operations are the principal sources of colour in textile effluent. Dyes and pigments are highly coloured materials used in relatively small quantities (a few percent or less of the weight of the substrate) to impart colour to textile materials for aesthetic or functional purposes (American Association of Textile Colorists and Chemists, 1981). In typical dyeing and printing processes, 50 to 100 percent of the colour is fixed to the fibre and the remainder is discarded in the form of spending dye baths or in wastewater from subsequent textile-washing operations (Wagner, 1993).

The presence of metals in textile mill effluents is of concern primarily because of their toxicity to aquatic and mammalian species (Richardson, 1991; Wagner, 1993). Metals also inhibit waste treatment operations and are difficult to remove or treat using pollution control technologies (Smith, 1989).

To address this problem of liquid waste production in industries, there are governance instruments established to govern the management of it. Monza *et al,* (2009) (in International Review of Waste Management Policy) explained policy instruments which could be used to address the issues which arise in the context of waste

management. These are command and control instruments and economic instruments as explained below.

Command and control instruments (directive-based regulation) involve direct regulation and rely primarily on the application of regulatory instruments which set standards that have to be met (e.g. Compulsory targets for recycling), or limits (e.g. To emissions of pollutants) that cannot be exceeded. These might include; Technology standards: for example, the elaboration of best available techniques. Product quality standards: for example, standards for different quality grades of compost. Emissions standards or limit values: for example, the limit values set for emissions from incinerators under the Waste Incineration Directive and Performance targets: for example, local authority recycling targets.

Economic instruments can change behaviour indirectly by creating a set of incentives and disincentives through pricing (OECD, 1999). Pricing can offer a more cost-effective and dynamic form of regulation than the traditional command and control approach. Economic instruments will be applied within the overall fiscal and taxation policy of government. This includes; User charges: for example, charges for the use of waste services. Note that the definition of 'charges' is not formalized, but that typically, a charge will be paid in exchange for a service, and the charge will vary with the level of service demanded / received. Product charges: for example, charges applied to products that create pollution either through their manufacture, consumption or disposal (e.g. Charges on batteries). In the waste arena, these are typically used to modify relative prices and / or to finance collection and treatment systems;

Taxes: Taxes differ from charges in that they are unrequited payments to the central government. The unrequited nature of these payments relates to the fact that they are paid irrespective of the level of service received from central government (for example, landfill taxes, product (e.g. Plastic bag) taxes, etc.). Taxes are occasionally earmarked for specific purposes (as with the revenues from the Irish taxes, which are channeled to an Environmental Fund). There has been much discussion in the

literature regarding the wisdom, or otherwise, of this type of approach.

Tradable allowances, or credits: for example, the use of tradable allowances for land filling, or tradable compliance credits for achieving packaging recovery targets, as used (in both cases) in the UK.

Deposit-refund schemes are most commonly used for beverages. Noncompliance fees: Imposed under civil law on polluters who do not comply with environmental or natural resource management requirements and regulations. They can be proportional to selected variables such as damage due to non-compliance, profits linked to reduce (non-) compliance costs.

Performance bonds: polluters or users may be required to deposit revenue in the form of a bond so as to guarantee compliance with specified requirements. The fund (or part of it) is typically refunded once compliance is achieved. Liability payments are payments made to 'victims' to compensate for damage caused by pollution activity. They can operate in the context of specific liability rules and compensation schemes, or the payments can be made from a fund financed by contributions from 'potential polluters' (The best examples relate to oil-spills). Subsidies: Subsidies include any form of explicit financial assistance to polluters (grants, soft loans, tax breaks, and accelerated depreciation).

The polluter pays principle. According to the polluter pays principle, all generators of waste (including businesses and households) are responsible for the costs of managing the waste generated. These include not only the direct financial costs of collection, treatment and disposal of waste, but also externalities such as health and environmental impacts.

2.2.2 Environmental governance instruments in Tanzania

Like many other developing countries, Tanzania has recently realized the importance of environmental management in all sectors be the profit making or service providers. To ensure that there is effectiveness in achieving this goal, there is a set of policies,

laws, bylaws and regulations that have been put forward to guide the process. The only concern is to what extent these policy statements; laws and regulations are actually being implemented on the ground (Palela, 2002). The following are governance instruments applied in Tanzania in different sectors of production to manage waste produced,

2.2.2.1 National Environment Management Act

The National Environment Management Council Act of 1983 was the first law to demonstrate the government's interest in development that takes the environment into consideration. The Act created the National Environment Management Council (NEMC) in 1983 in terms of the National Environment Management Council Act, No 19 of 1983 for the purpose of 'acting as an advisory body to the government on all matters relating to the environment' (Michelson, 1986 as cited by Pallangyo, 2007).

Environmental Management Act, 20 of 2004 was passed by the National Assembly and replaced the National Environment Management Council Act, 1983 (Pallangyo, 2007). This Act is a framework Act (a comprehensive umbrella) in that it is the legislation governing environmental aspects in Tanzania. The Act includes provisions for; legal and institutional framework for sustainable management of the environment; an outline principles for management, impact and risk assessments, prevention and control of pollution, waste management, environmental quality standards, public participation, compliance and enforcement; and the basis for implementation of international instruments on the environment. However, the Act further repeals the National Environment Management Act, 1983 and provides for the continued existence of the National Environment Management Council and provides for the establishment of the National Environmental Trust Fund to provide for other related matters (Pallangyo, 2007).

The Act creates a general duty for waste holders to avoid generating waste and, failing that, to minimize the amount and the toxicity of the waste generated. Thereafter, they are expected to re-use, recycle or recover waste. Various instruments in the Act give effect to this duty of care, including norms and standards, integrated waste management plans, industry waste management plans, extended producer

responsibility, and priority wastes. The management and control of industrial chemicals are regulated by law: the Industrial and Consumer Chemicals (Management and Control) Act No. 3 of 2003. The Ministry of Health and Social Welfare through the Registrar of Industrial chemicals regulates this sector (NEMC, 2012).

2.2.2.2 Environmental Legislation

Legislation is a law or regulation that governs the internal affairs of a company or other organization. These are a small environmental group of laws (by law/regulation) which originate from act and is put or practiced in accordance to what the environmental act stipulate, it involves different by-law of the particular area or institution. Environmental law is an essential component of effective environmental management and improvement of the quality of life. The inherent nature of environmental law to set demands, impose duties and limits and create obligations for the individual for private and public bodies means that it can make a clear contribution to fit human activities into the laws that govern the patterns of our air, water, soils and plant and animal life.

Sectoral legislations shall be designed in such a way as to factor environmental policy objectives in their areas of coverage. It is recognized that for effectiveness, environmental law must be understood and appreciated by the people to whom it is aimed. Furthermore environmental standards and procedures have to be in place before or as a result of legislation for this instrument to be effective. Tanzania is a signatory and has acceded to a number of International treaties on the environmental protection. A review of these treaties will be made with a view to incorporating them into national legislation (URT, 1997).

2.2.2.3 National Environmental Policy

Policy is broadly defined as a plan of action outlining the aims and ideals of a government, a political party or a business company (Makuku and Masiye, 2002). In this report, the term is used to refer to a framework of guidelines put together in the form of a document in order to give guidance on how certain activities (in this case

liquid waste management) can best be undertaken.

The NEP, 1997 provides a framework for making fundamental changes that are needed to bring environmental considerations into the mainstream of decision-making in Tanzania (Michelson, 1986 as cited by Pallangyo, 2007). The NEP (1997) has stipulated policy objectives which incorporate sanitary practices in the following areas:-

Technology: "The primary policy objective shall be the promotion of the use of environmentally sound technologies, that is, technologies that protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, and handle residue wastes in a more acceptable manner for which they are substitutes." This objective is meant for the industries and how they should take care of their waste (Palela, 2002).

The overall objectives of the NEP are, therefore, to ensure sustainable and equitable use of resources without degrading the environment or risking health or safety; to prevent and control degradation of land, water, vegetation, and air which constitute the essential life support systems; to conserve and enhance natural and man-made heritage, including the biological diversity of the unique ecosystems of Tanzania; to improve the condition and productivity of degraded areas including rural and urban settlements in order that all Tanzanians may live in safe, productive and aesthetically pleasing surroundings; to raise public awareness; to promote individual and community (Pallangyo, 2007).

In chapter two of Environmental policy of 1997, page 18 on industries has stipulated the following objective; The policy objective with respect to environmental protection is the prevention, reduction, control and limitation of damage, and minimization of the risk from the generation, management, transportation, handling and disposal of hazardous wastes, other wastes and emissions. Some of policy objectives be pursued in industry were;

Industries shall be planned in a manner that minimizes adverse effects on the

environment at all stages (i.e. Location, effluent discharge, waste disposal, use and disposal of products); environmental audits/inventory shall be carried out for both new and existing industries for pollution control and waste minimization and installation of resource-saving and waste-recycling facilities, use of clean technology and production of safe and less toxic products shall be promoted and supported (NEP, 1997).

The NEP also provides for the execution of a range of strategic functions using policy instruments in chapter four such as environmental impact assessments, environmental legislation, economic instruments and environmental standards, and indicators. A framework is also provided for institutional arrangements and coordination. Until recently, environmental issues were the responsibility of sectoral ministries (Pallangyo, 2007). These instruments are also discussed below,

2.2.2.4 Environmental Impact Assessment (EIA)

One of the governing instruments considered most effective for the achievement of sustainable development is the requirement that an environmental impact assessment shall be undertaken for all proposed activities that are likely to have significant adverse impacts on the environment and which are subject to a decision of a competent national authority (Clayton and Sadler, 2003 as cited by Pallangyo, 2007). The National Environmental Action Plan describes the objective of EIA as 'allowing maximization of long-term benefits of development while maintaining the natural resource base' (Pallangyo, 2007). Such assessment forms the basis for refusal of permission to undertake a particular activity or grant of permission with conditions necessary to minimize the effect on the environment.

The EMA, Act number 20, (2004, Section 81, pg64) provides that, 'Any person, being a proponent or a developer of a project or undertaking of a type specified in the third schedule to this Act [i.e. The EMA, 2004], to which environmental impact assessment is required to be made by the law governing such project or undertaking [...] Shall undertake or cause to be undertaken, at his own cost, an

environmental impact assessment study'. 'An Environmental Impact Assessment study shall be carried prior to the commencement or financing of a project or undertaking. 'A permit or license for the carrying out of any project or undertaking in accordance with any written law shall not entitle the proponent or developer to undertake or to cause to be undertaken a project or activity without an environmental impact assessment certificate issued under this Act, (EMA, 2004, Section 81). At this level there is far greater scope than at the project level to integrate environmental considerations into development goals and objectives. It allows problems of environmental deterioration to be addressed at their upstream source in policy and plan making processes, rather than mitigating their downstream symptoms or project-level impacts.

2.2.2.5 Use of Economic Instruments

Principle 16 of the Rio Declaration (1992 States that individual country should endeavor to internalize their environmental costs through the use of economic instruments. The same principle also states clearly that the polluter must pay for the damage which arises as a result of his or her activities.

Economic instruments applied in environmental protection and resource conservation should encompass all tools that are designed to influence economic behavior. They usually include funds for environmental cleaning or progressive investment, deposit schemes for containers, subsidies, emission charges, product charges, exemption fees, and administrative fees to supervise environmental protection and resource conservation, non-compliance fees, and tradable emission quotas (Rio Declaration, 1992).

Traditionally, in Tanzania, environmental protection litigation and standards have been enforced through imposition of negative sanctions prescribed by the laws themselves. This approach is increasingly supplemented by the use of economic instruments (URT, 2004).

2.2.2.6 Tax relief and subsidies

Tax is a penalty. Subsidies are more like 'encouragement programs'. Subsidies

encourage polluters to install equipment to decrease pollution by having a subsidy in the amount reduced. The idea is to give payments to firms who pollute below a certain level. Environmental taxation has been widely applied in a number of countries, such as consumer taxes, fees paid for direct resource use, waste disposal, and income taxes.

Taxation is mainly a government instrument for raising revenue; however taxation may also be used to achieve other objectives such as encouraging or discouraging certain activities or behavior (Pallangyo, 2007). The government can use taxation to support environmental protection by waiving or imposing lower taxes on environmentally friendly technologies or products. Governments can also induce compliance with environmental standards by providing government subsidies for those who adopt the methods of abating pollutants which arise from production or consumption. The NEAP indicates that tax relief and subsidies are among the key policy instruments the Government of Tanzania deploys in pursuit of sustainable development. However, the possibility of this (tax relief and subsidies) happening depends much more on the current fiscal policies and realities (Pallangyo, 2007).

Taxation may be, and has been, used as a disincentive to environmental degradation by imposing taxes on environmentally damaging processes, products, as well as consumption patterns. In addition to the preventive aims, taxes so raised have been committed to environmental protection activities in Tanzania (Pallangyo, 2007). Normally, taxes on a particular industry or product would go to support remedial measures for the element of the environment damaged by the industry or product. For example, money raised from taking wood products of a particular tree may be used in planting new trees of the same species (Milne, 2000).

The NEAP proposed the establishment of an environmental tax on permits, imports and domestic goods, earmarked for the following areas: Air pollution enforcement and subsidy programs, water pollution enforcement and subsidy programs, solid waste management or pollution enforcement and subsidy programs, protection of

public health through enforcement of public health laws and land reclamation activities (Pallangyo, 2007).

2.2.2.7 The polluter pays principle

The ‘polluter pays principle’ refers to a device of internalizing environmental costs of making those who benefit from the environmentally damaging activity bear the costs of the damage. The polluter pays principle is implemented through charging polluters for the right to pollute (Mwalyosi, 2004 as cited by Pallangyo, 2007).

This may be achieved through a variety of means, including taxes and fees for licenses. The difference between these kind of taxes and environmental taxes discussed above lies in their respective objectives. While ‘green taxes’ aim of raising money from polluting activities with the principal objective of putting the sums so raised into environmental protection, ‘polluter pays’ taxes are mainly intended to punish the polluter without necessarily using the monies raised for environmental protection activities.

The "polluter pays principle" holds the person or organization causing pollution is liable for any costs involved in cleaning it up or rehabilitating its effects. It is noted that the polluter will not always necessarily be the generator, as it is possible for responsibility for the safe handling, treatment or disposal of waste to pass from one competent contracting party to another (India Study Report, 2010).

The other method which is increasingly being used to implement the polluter pays principle is the legal imposition of compensatory damages as well as environmental reparation features which hereto have seldom been included in pollution control legislation (Pallangyo, 2007). The application of economic tools also has a strong incentive in stimulating the application of new techniques in the industry. Usually, with the increase of pollution tax, the polluter must pay more attention on adopting new techniques to decrease the pollutant discharge.

2.2.2.8 Precautionary principle

The precautionary principle assumes that a waste or an identified contaminant of a

waste is both highly hazardous and toxic until proven otherwise. Since the legislation is stricter for highly hazardous and toxic wastes, the costs for their treatment and disposal are consequently higher than for wastes of low hazard. It is therefore obviously in the generator's interest to obtain the necessary information to prove that the material or waste product is of a lesser hazard. The burden of proof shall always be on the generator of the waste in question (India Study Report, 2010).

2.2.2.9 Product stewardship

Product stewardship principle, the producer or importer of a product should take all reasonable steps to minimize environmental harm from the production, use and disposal of the product (URT, 1997).

2.2.2.10 Environmental Standards

The control authority imposes a separate emission standard on each source. An emission standard is a legal limit on the amount of the pollutant an individual source is allowed to emit. In terms of section 140 (1) of the EMA, the National Environmental Standards Committee of the Tanzanian Bureau of Standards is required to develop, review and submit to the Minister of Environment, proposals for environmental standards relating to water quality, discharge of effluent, air quality, noise and vibration, sub-sonic vibration, ionizing and other radiation, soil quality, noxious smells, light pollution, electro-magnetic waves and microwaves.

However, to date, the Tanzanian Bureau of Standards has only issued effluent standards for a limited number of specified industries. In the meantime, the standards established by the World Bank and World Health Organization are applied, and most foreign companies or aid agencies apply these or the pollution control standards from their home countries. In concluding, the above policy instrument is mainly from the Tanzanian environmental policy of 1997, in this research the following governance instruments were investigated, which are; Environmental Standards, Recycling, Environmental Acts, Environmental regulation and Environmental policy and Bylaws.

2.3 Empirical Literature Review

Governance instruments aiming at waste prevention and recycling have been reviewed. This research aimed to investigate the role of governance instruments in enhancing liquid waste management in Industrial areas on a broader basis. These investigations were carried through with quantitative methods as well as qualitative analysis aiming to improve their environmental performance.

Although the level of industrialization is low in Tanzania, untreated industrial waste causes significant levels of localized pollution. About 80 % of the industries, including agro- and chemical industries, breweries and steel manufacturing industries, are located in the coastal Dar es Salaam. It has been estimated that almost 70% of the industries pollute directly or indirectly the Indian Ocean (Mgana and Mahongo, 2002 as cited by URT, 2005).

A number of studies on liquid waste management have been carried out worldwide and in Tanzania. However, most of them have focused more on liquid waste treatment and disposal systems but not on how governance instruments enhance liquid waste management in urban Industrial Areas. These include the studies done by Chemical and Pharmaceutical Research in 2012, Mgana and Mahongo 2002, Blomqvist 1996, Nemerow 1978, Souther 1965, EPA 1974. Study of Governance instruments aiming at waste prevention and recycling have been reviewed by Dette & Jülich (1999).

The study done by Mniwasa, and Shauri, (2001, page 25), on the Review of the Decentralization Process and its Impact on Environmental and Natural Resources Management in Tanzania, concluded that ‘there is inadequate expertise in the field of environmental to implement the designed policies. Most industries have no laws or policies to implement, thus, limiting their capacity to manage liquid waste produced. There are also inadequate policy and legal provisions, disintegrated authoritative, administrative and institutional mechanisms handle environmental matters’.

This study it relates to the study done by Tomas Ekvall (2000), entitled: Towards

Sustainable Waste Management. In this study, the author based on how policy instruments aiming at sustainable waste management and sustainable consumption affect the material flows in the society and assessed policy instruments or combinations of policy instruments which are effective for guiding the waste management system in a sustainable direction.

This research differs from the past mentioned studies in that it has focused on the role of governance instruments and liquid waste management in urban industrial areas. This research program aims at identifying governance instruments and other strategic decisions that contribute to the development of a more sustainable liquid waste management. This study contributes to investigating the environmental effects of the governance instruments and the ecological sustainability of present and potential systems for liquid waste management. It results in knowledge on how to reduce the environmental hazard of liquid wastes in the urban industrial areas of Tanzania.

There is a need to understand better the underlying interrelationships between resources and the potential for liquid waste management in keeping the environment clean, which can lead to wealth and the inherent power relations among the owners of the industries and the communities that have to live and put up with the consequences a liquid waste.

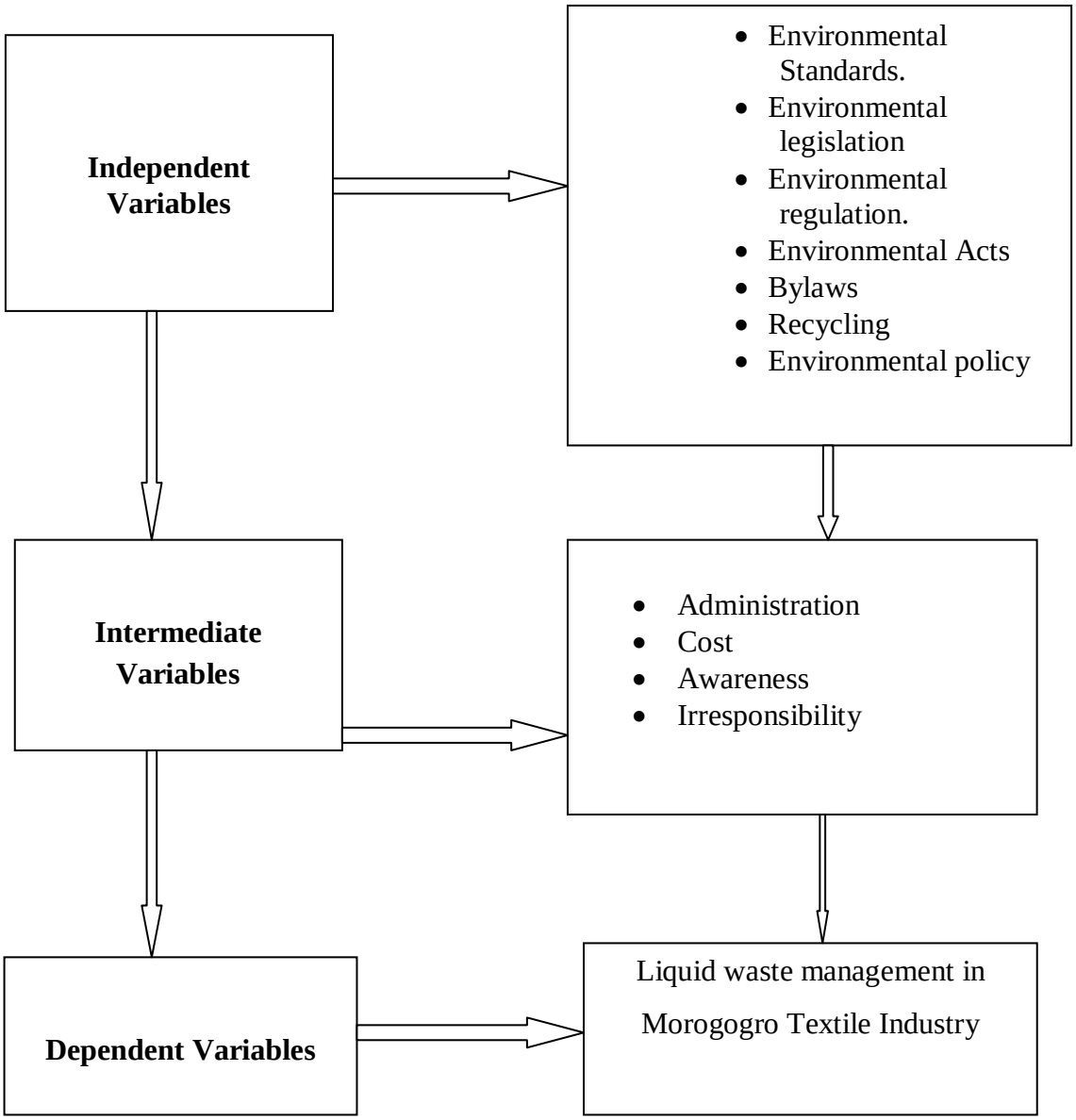
2.4 Conceptual Frame Work

The conceptual framework is an assembled set of research concepts cum variables together with their logical relationships often represented in the form of diagrams, charts, graphs, pictographs, flowcharts, organ gram, or mathematical equations (Ndunguru, 2007). The dependent variable was liquid waste management in Morogogro textile industry, the independent variables were, Recycling, Environmental Standards, Environmental Legislation, Environmental regulation, Environmental Acts, Environmental Policy and By laws and the intermediate variable are Administration, Cost, Awareness and Irresponsibility.

Low awareness leads to low commitment to comply with governance instruments.

Since there is no commitment, there is no liquid waste management in the industry. There is no commitment in administration to comply with governance instruments it means there is low enforcement which leads to increase in liquid waste problems in the industry. Also it is assumed that if the community will have environmental education, they will increase their level of awareness on the problem of improper management of the liquid waste and change their cultural attitudes towards liquid waste management. Good institutional framework and enforcement of bylaws will lead into effective liquid waste management through effective application of governance principles.

Figure 2.1: Conceptual framework



Source: Researcher's own creation, 2012

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 The study area

The study was conducted in Morogoro Municipality at Kihonda Ward where textile industry is located specifically at Viwandani Street, Mafisa kwa Sina street, Mafisa kwa Sudi street and Kayenzi street. Morogoro municipal is one of the major urban areas with growing industrial activities and therefore affected by environmental related problems particular production of liquid wastes. This has placed an even heavier burden on an already stressed environment and human health.

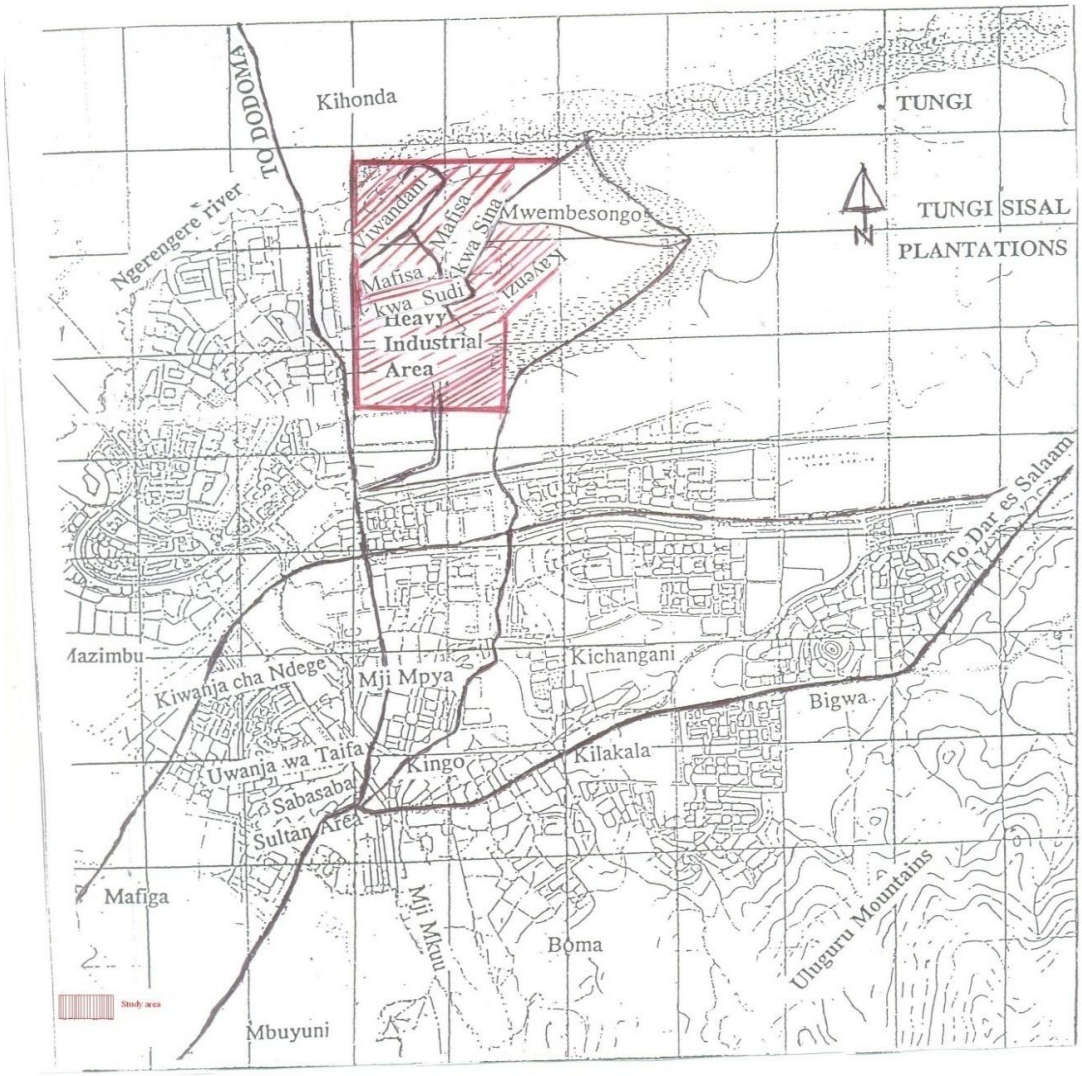
3.2 Location and General Information

Morogoro municipal council is located in Morogoro Region between latitudes 06°49′20″S and longitudes 037°39′55″E. Morogoro Municipal is one of the 6 districts of the Morogoro region of Tanzania which occupies 260 km2 lands - 0.4% with no large water body. Morogoro Municipal is the headquarters of Morogoro region, which is one of the 21 regions of Tanzania Mainland. It is bordered to the East and South by the Morogoro Rural District and to the North and West by the Mvomero District (URT, 2006).

The municipality was established in 1984 in accordance with the provisions of Section 8 and 9 of the Local Government (Local Authorities) Act 1982. Like all municipalities in Tanzania, Morogoro municipal operates under the directives of the Full Council, which is the supreme body for legislative responsibilities (URT, 2006).

The Municipal Director (MD) is the Chief Executive Officer of the Municipality. The Municipal occupies an area of about 260 km2 which is divided into 19 wards (NBS, 2007). According to different national censuses, the population of this Municipality has been growing very fast. For instance, in 1967, 1978, 1988 and 2002 censuses, there were 24,999, 74,114, 117,601 and 228, 863 people respectively. The number of households was also increased in 1988 there were 26,706 households with an average size of 4.4 per household; by 2002 households had already increased to 54,207, with an average size of 4.2 per household (NBS, 2007 and URT, 1997).

Figure 3.1 The map of Morogoro Municipal



Source: Morogoro Municipal profile, 2008.

3.2.1 Population

According to the 2002 Tanzania National Population Census, the population of the Morogoro Municipal was 228,863 with a 4.7 per cent growth rate. The population has been growing very fast. For instance, in 1967, 1978, 1988 and 2002 censuses there were 24,999, 74,114, 117,601 and 228, 863 people respectively. The number of households was also increased in 1988 there were 26,706 households with an average size of 4.4 per household; by 2002 households had already increased to 54,207, with an average size of 4.2 per household (NBS, 2007 and URT, 1997). The

Morogoro Municipal population is unusually high because of its metropolitan characteristics which attract many people looking for employment in industries and surrounding sisal estates as well as services, hotels, offices.

3.2.2 Administrative set up

The Morogoro Municipal is administratively divided into 19 wards with only one Division: Bigwa, Boma, Kichangani, Kihonda, Kilakala, Kingo, Kingolwira, Mafiga, Mazimbu, Mbuyuni, Mji Kuu, Mji Mpya, Mlimani, Mwembesongo, Mzinga, Sabasaba, Sultan Area, Uwanja WA Ndege and Uwanja WA Taifa (URT, 2006).

3.2.3 Economic Activities

The economic activities in the study area include, farming and keep some livestock like cattle, goats, pigs and numerous poultry. The economy is heavily dependent on agriculture but also relies on business operations as this makes up over a third of economic activity in the area all of which have been affected by the Industrial liquid waste (URT, 2006).

3.3 Research design

Research design is the arrangement of conditions for the collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. It constitutes the blueprint for the collection, measurements and analysis of data (Kothari, 2004).

This study used case study research design, due to the fact that it offers the researcher with an opportunity for doing an in depth examination intensively and detailed information was needed for the study as it covers a variety of characteristics ranging from individual to community level. It helped to get the detailed information and data about the problem of liquid waste management in Morogoro textile industry. Hence the researcher was able to do in depth study of the study area. The case study design is also flexible in data collection and analysis.

3.4 Sample size

A total of eight (83) samples of people were selected by simple random

sampling and purposive sampling and it was selected from the universe population of 500 for the study area. The sample unit comprised 60 experienced industrial workers in the Morogoro textile industry also 20 people from the community residing near Morogoro textile industry, five (5) from each street whether is the head of the house or not but must be more than 20years old. The key informants were 3 from a Morogoro Municipal environmental officer, Ward executive officer and Industrial environmental officer. The sample was obtained using the formula; n = N/1+N (e) 2 by Yamane (1972). Where,

n = sample size, which was 83

N = population size, which was 500

e = standard error with area of confidence (10%).

Table 3.1 gives a summary of distribution of respondents

Table 3.1: Distribution of Respondents

Category	Response
Industrial workers	60
Key informants	3
Households	20
Total	83

Source: field research, 2013.

3.5 Sampling Techniques

Probability and non probability sampling techniques were used. For probability sampling simple random was used to obtain respondents from the industrial workers (production and effluent site) and household around the textile industry in Kihonda ward especially Viwandani Street, Mafisa kwa Sina street, Mafisa kwa Sudi street and Kayenzi street and for non probability the purposive procedure was used to get information from key informants who are Municipal environmental officer, Ward Executive Officer and industrial environmental officer.

The household respondents were selected with respect of time they stayed in the villages (at least 5 years) and matured individuals of above 20years old as they are considered to have information on situation of liquid wastes in the industry from long

time. Key informants were selected purposefully so as to get accurate information from the right person.

3.6 Types and sources of data

During the study both primary and secondary data were collected. The primary data are the first hand information; the data was collected directly by the researcher from the study area. These include personal data, for instance age, sex occupation and education level.

The sources of primary data were obtained in the field study area and the related departmental offices while the sources of secondary data were obtained from the literature, organization departmental reports, journal, magazine, Internet and reports which contain related information on liquid waste.

3.7 Data collection methods

Primary data were gathered through a combination of methods, including interviews guided with questionnaires and participant observations. The secondary data was obtained from the literature, organization departmental reports, journal, Internet and reports. Officials in the liquid waste control and management departments at Municipal, Industrial and Ward levels were interviewed. In total, three officials, one from the Municipal, Ward Executive officer, and the Industrial environmental officer were interviewed. The officials were asked to provide opinions and answers on policy-related questions, current and future plans, strategies, technical matters and hindrances to liquid waste management issues taking place in the Morogoro textile industry. In addition, 60 industrial workers and 20 people from the community living near the Morogoro textile industry were interviewed, providing information on the existing situation of liquid waste in the industry.

The choice of the mixed methods approach was informed by a number of reasons. First, it was meant to achieve the 'logic of triangulation' Denzin (1989) since no single method (such as questionnaire, interviewing of documentary analysis) could completely capture all the relevant features of the study. Furthermore, the combination of qualitative and quantitative methods enabled me to cross

check the data gathered by different methods, thereby, making the results of the study valid and realistic. As observed by Bryman (2004) "combining different methodologies in a single study enhances the researcher's claim for the validity of his or her conclusions if they can be shown to provide mutual confirmation". Thus, combining qualitative and quantitative methods in the present study made it possible for the issues relating to liquid waste management in the Morogoro textile industry to be captured from the perspectives of key stakeholders in the waste sector as well as from my own perspective. This is because some of the data required were qualitative in nature and could best be obtained through interviews while others were quantitative and thus, could be elicited by means of questionnaires. Furthermore, aspects of the data were physically observable and could be gathered through direct field inspection or observation.

3.7.1 Questionnaires

The questionnaire is one of the most widely used instruments for collecting data in survey research. Bryman (2004) suggests that the appeal of the questionnaire partly stems from its cheapness and quickness in terms of administration, the absence of the interviewer effect and its convenience for correspondence. Apart from these advantages, the questionnaire enables one to collect standardized information in respect of the same variables for everyone in the selected sample (Parfitt 1997 cited by Shari, 2007). This makes the questionnaire an indispensable tool in gathering primary data about people, their behaviour, attitudes, opinions and awareness of specific issues. The questionnaire is a specific set of closed or open ended questions that respondents must answer McNabb, (2008: p 135). This study used both structured and unstructured questionnaire to obtain the information concerning the researched topic. The questionnaire was given to respondents aiming at obtaining the information concerning the industrial liquid waste management.

3.7.2 Interviews

Interviewing is a useful way of collecting qualitative data because the technique is 'introspective' and allows respondents to report on themselves, their views, their

beliefs, practices, interactions and concerns (Freebody, 2003). Besides, most people are more willing to talk in an interview than the case would be if they were asked to write or fill out a questionnaire (Robson, 1993). This is a technique of gathering data from humans by asking questions and getting them to react verbally (Potter, 1996). This was important because the researcher had a chance to come into contact with individuals to get access to facts and opinions and to receive facts directly from the persons.

The interview technique is associated with a number of advantages over the questionnaires and these showed up in the interviews I conducted. Interview creates the opportunity for interviewees ask for clarification when they do not understand a question just as the interviewer can ask for elaborations on answers given by interviewees. Furthermore, there is the guarantee that all questions would be answered or, at least, attempted by the interviewee (once he or she can allow enough time for the interview) which ensures a high response rate. Moreover, it becomes possible to check on the reliability of a response by asking the same question differently and at different stages of the interview (Freebody, 2003). The interview technique was employed to obtain data from a number of stakeholder groups in the study. These were officials of the municipal environmental departments, owners/operators of Morogoro textile industry and other workers and residents of communities residing around textile industry.

3.7.3 Field observation

According to Yin (1982), observation is a form of evidence that do not depend on verbal behaviour, and the method enables the investigator to observe the phenomenon under study directly. This offers an investigator the opportunity to gather "live" data from naturally occurring social situation. In this way, the researcher can look directly at what is taking place in situ rather relying on second hand accounts (Cohen et al, 2007).

Miller and Brewer (2003) have categorized observation into 'unobtrusive observation' and 'participant observation' based on the degree of participation by the

researcher, and into ‘covert’ and ‘overt’ observations based on the level of awareness subjects have of being observed.

The phenomenon under study, liquid waste, is one which lends itself to direct field observation. Thus, in addition to questionnaires and interviews, I also conducted field observation as part of the data collection exercise. This involved the observation of liquid waste situations and other conditions that could affect liquid waste management in the study areas. The method enabled me to gain first-hand information of the liquid waste situation in the industry including the level of liquid waste disposal services available and disposal of liquid and to compare the actual liquid waste situations in the industry with the information gathered through interviews, household questionnaire and documentary analysis.

3.8 Data analysis methods

Data collected were analysed using the Statistical Package for Social Science (SPSS, version 16), Excel and quantitative data were analysed using percentages, graphs, and tables were used in the discussion.

3.9 Data presentation

The analysed data have been presented using charts, graphs and tables.

CHAPTER FOUR
PRESENTATION AND DISCUSSION OF THE FINDINGS

4.0 Introduction

This chapter presents the data analysis and the major findings from the study. Data was obtained by using interviews, questionnaires and field observation. A total of 80 questionnaires were collected from the households and industrial workers. Findings are presented in words, tables, percentages and graph.

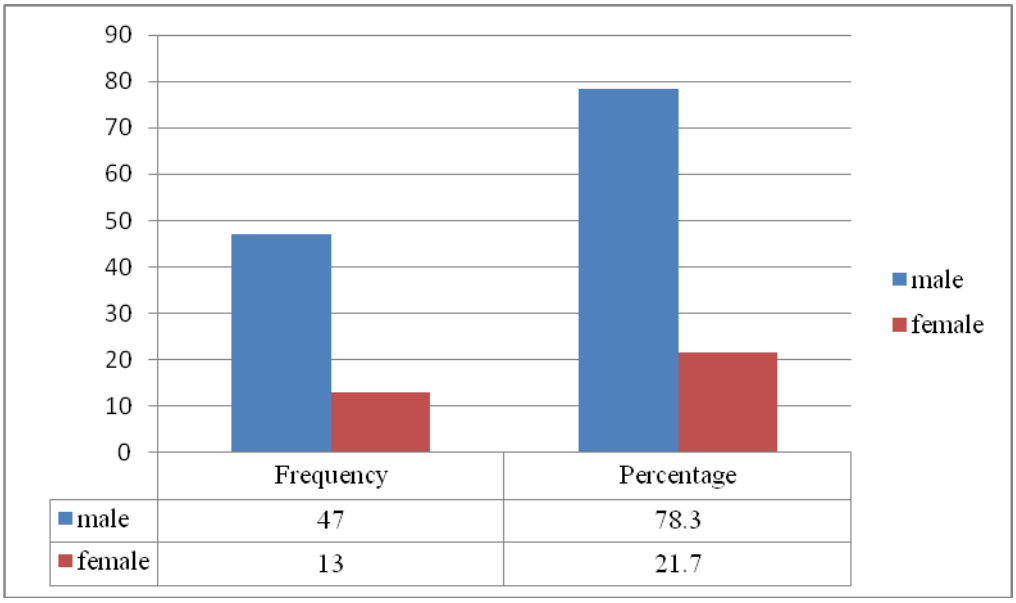
4.1 Characteristics Respondents

Characteristics of respondents considered different variables which included sex of respondents, age, and education level of the respondents from the Morogoro textile industry as well as from the community living around the textile industry. In the 80 population interviewed, 66.25% of them were male and only 33.75% of them were female. This shows that more male were interviewed than female. Out of the 80 total respondents, 21.25% of them attained a primary school education, 58.75% a secondary school education, 10% attained a college education, and only 10% attained university education.

4.1.1 Respondents by Sex

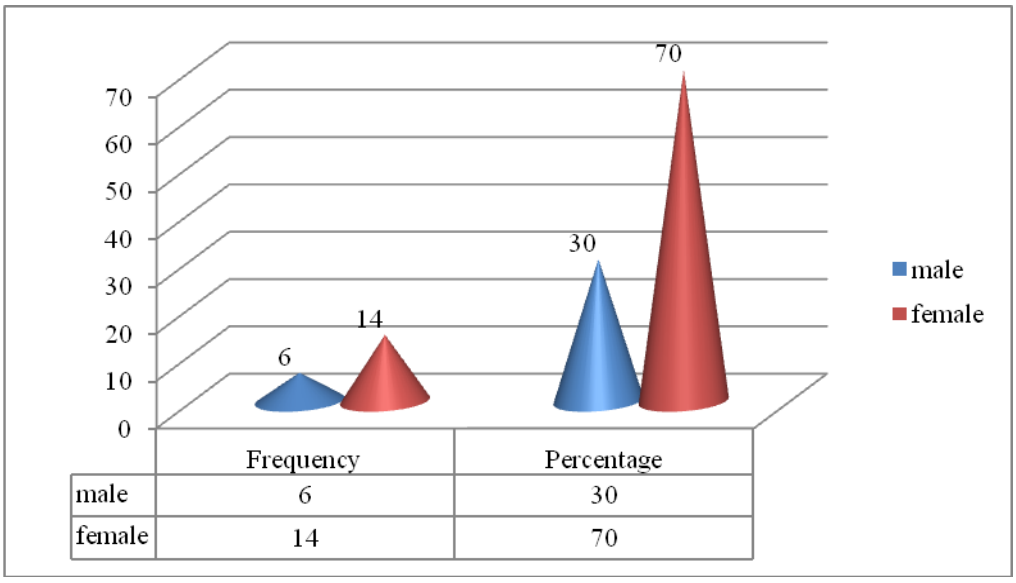
About 80 respondents interviewed, 66.25% of them were male and 33.75% were female. This shows that more male were interviewed than female. From Morogoro textile industry population samples surveyed were mainly males with 78.3% while females interviewed were only 21.7% and from the community living around female were 70% and male were 30% as seen in figure 4.1 and 4.2. Men were more than women during the data collection in the Morogoro textile industry because men were more involved in production activities that produced liquid wastes and were obtained easily compared to women who were few in number and not easily available. In the selected streets more female were present around in their households while most of the men were on the farms and women are most affected by inadequate water supply and sanitation facilities that may be caused by pollution from Industrial liquid waste. Figure 4.1 and figure 4.2 give the summary of sex of respondents

Figure 4.1: The sex of respondent in**Morogoro Textile Industry**



Source: Field research, 2013.

Figure 4.2: The sex of respondent living near the Industry



Source: Field research, 2013.

4.1.2 Age of respondents

The researcher investigated the age cohort of respondents to establish the age groups which were involved in this study. The respondents who took part in the study from Morogoro textile industry were of age between 20-39 years who were 55% this implies that this is a working group in the industry. About 33.3% were of age 40-59 and 11.7% of respondents were of age 60-79years. This implies that most of the respondents were belonging from the segment of the population which is an active population and the labour power source for both skilled and unskilled in industrial development.

From the community living near the textile industry were as follows, 18years and below were 10%, 20-39years were 25%, and the age group of 40-59years were 40% and respondents of age 60-79years and above were 25%. These findings indicate that all age groups were involved in the study at different degree.

Table 4.1 The Age of respondent working in the Textile Industry

Age of Respondent	Frequency	Percentage
20-39	33	55
40-59	20	33.3
60-79 and above	7	11.7
Total	**60**	**100**

Source: Field research, 2013.

Table 4.2 The Age of respondent living near the Industry

Age of Respondent	Frequency	Percentage
18 and below	2	10
20-39	5	25
40-59	8	40
60-79 and above	5	25
Total	**20**	**100**

Source: Field research, 2013.

4.1.3 Education level of respondents

The researcher established this component to know the education level of respondents. The results indicates that, most of the respondents had a secondary education those who attained O-level secondary education were 51.25%, and who attained A-level secondary education were 07.5%, primary education were 21.25%, college education were 10% and university education were 10%. Table 4.3 shows the summary of the education level of the respondents.

Table 4.3 Education levels of respondents

Education Level	Frequency	Percentage
Primary Education	17	21.25
Secondary Education (O-level)	41	51.25
Secondary Education (A-level)	6	07.5
College Education	8	10.0
University Education	8	10.0
Total	**80**	**100.0**

Source: Field research, 2013.

Generally formal education sensitizes people on environmental hygiene and the dangers of improper waste disposal. The findings indicate that the education level of respondents from Morogoro textile industry had basic education thus the information obtained from the respondents who had basic education were reliable.

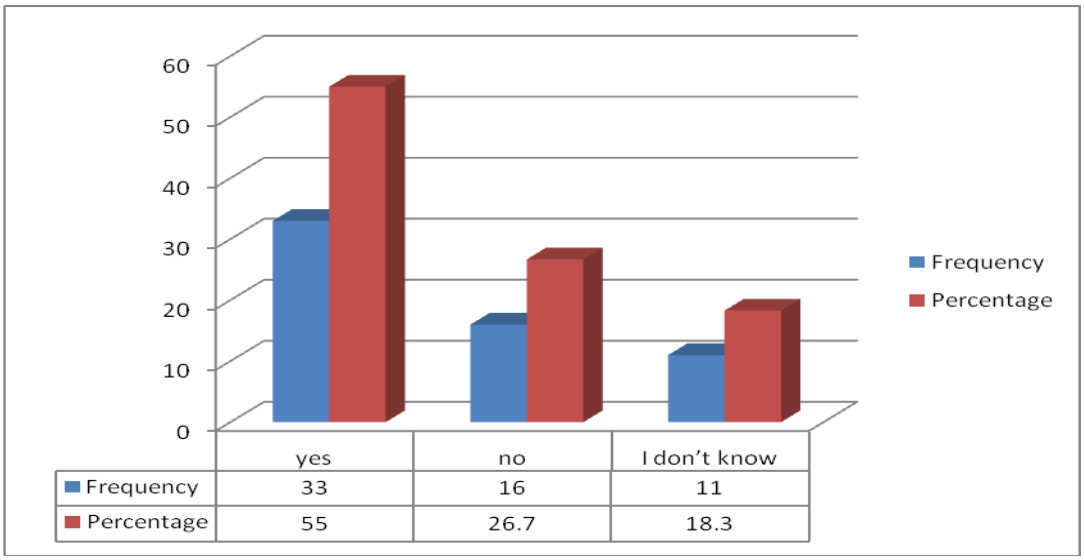
4.2 Existing Governance Instruments in Management of Liquid Waste Management at Morogoro Textile Industry

The proper management of liquid wastes in textile industry depends on the types of instruments applied. The governance instruments to study were; Environmental Standards, Recycling, Environmental policy, Environmental Acts, Environmental regulations, and industrial Bylaws.

When respondents were asked if there is any governance instruments existing in the textile industry, the findings indicates that 18.3% of respondents from Morogoro textile industry said they “don’t know” anything about the presence and/or existence of any governance instruments, programs or bylaws for liquid waste management, 26.7% of respondents said there was no any governance instruments or bylaws

dealing with liquid waste management and 55% said both governance instruments and bylaws are present. With this unfamiliarity with the environmental governance instruments and bylaws, it is not surprising that industrial administrators are violating them. The figure 4.3 gives the summary on the presence of governance instruments enhancing liquid waste in textile industry.

Figure 4.3: Presence of governance instruments enhancing liquid waste in textile Industry



Source: Field research, 2013.

For the present governing instruments, the researcher wanted to know if they are in practice or no, so he asked the workers if they are practiced or not. The results in table 4.4 on present governing instruments shows that, 60% of the 60 textile industry respondents from Morogoro textile industry responded that they are not in-practice while 28.3% said that, they are practiced and 11.7% respondents they did not know whether they are in practice or not.

Table 4.4 Response on governing instruments from Morogoro Textile Industry

Respondents	Frequency	Percentage
No	36	60
Yes	17	28.3
I don't know	7	11.7
Total	**60**	**100**

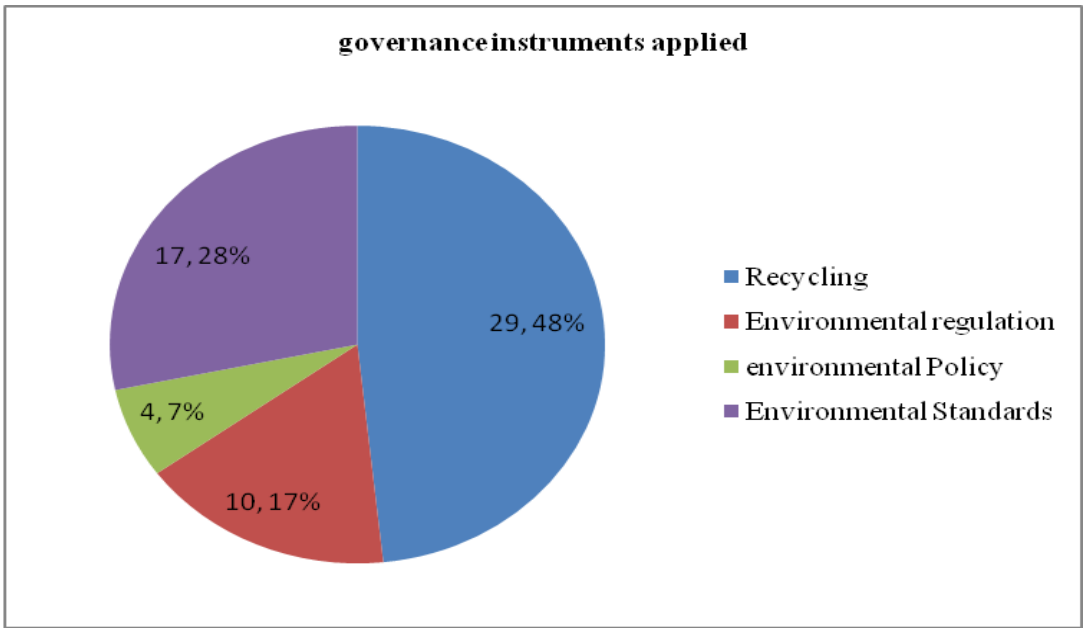
Source: Field research, 2013.

Generally there are many governance instruments as proposed by the government under NEMC but very few are applied in the Morogoro textile industry and the applied one is not effectively applied. Due to this most urban industries produce a lot of liquid waste for they don't apply the proposed governance instruments in managing liquid wastes thus causes most of industrial urban areas of Tanzania to be affected from liquid wastes produced. This may be due to failure of the governmental authority to have regular check up on how the industries implement this governance instruments. Therefore, the authority in place should have regular check up in industries on how they implement policy instrument in managing liquid wastes.

From the findings above it shows that most of the industrial administration doesn't also implement programs of liquid waste management for the reason of high cost. The respondents mentioned the management as the reason of not implementing programs for liquid waste management for the management of the industry does not show efforts to manage wastes although the standards are in place as many liquid wastes are managed poorly and most of the industrial areas are dirty with wastewater flowing around as it was observed during field research. This was also supported by the Municipal environmental officer that the textile industry is mainly having the waste stabilization pond for liquid waste treatment but it does not implement the other governing instruments for liquid waste management.

A researcher asked the textile industry employees about the instruments used for liquid waste management; the aim was to reveal the type of instruments applied for liquid waste management in the Morogoro textile industry of which they were working with. The textile industry respondents mentioned the following governance instruments which are used/ in practice in the industry, 48.3% respondents mentioned recycling, 16.7% mentioned environmental regulations, 6.7% mentioned environmental policy and 28.3% mentioned environmental standards. But among of the four, environmental standards, environmental policy and environmental regulations were not satisfying only one was addressed as effective that is in practice which was recycled through liquid waste treatment and enzymes dosing program.

Figure 4.4: Instruments used in liquid waste management in Morogoro Textile Industry



Source: Field research, 2013.

The study showed that the industry is only implementing recycling, environmental standards, environmental policy and environmental regulation and not in a sufficient manner. Despite the existence of comprehensive by laws on waste management in the industry, there is hardly anything on the ground to show that it pays to have by-law the government role in enforcing laws has been undermined. The environmental officer of the industry also added that, the other governing instruments are just presented in papers that are written but actual use of them is not there.

The researcher wanted to know the amount of period a staff has been working in the industry differs among the respondents. The correlation between the years of working with the structured questions gave a quick look into how well or organized the liquid waste management is. The experience one gains ensures the efficiency and effectiveness of the system. The senior staffs will be more familiar with the liquid waste management system in the Industry as they are in the service in a long period of time and they will give more information on the situation of liquid waste in the industry, also about the present49programs/governance instruments if they

are applied effectively in a satisfactory manner and the impacts of liquid waste which they have observed. The table 4.5 shows the respondents' period has been working in the industry.

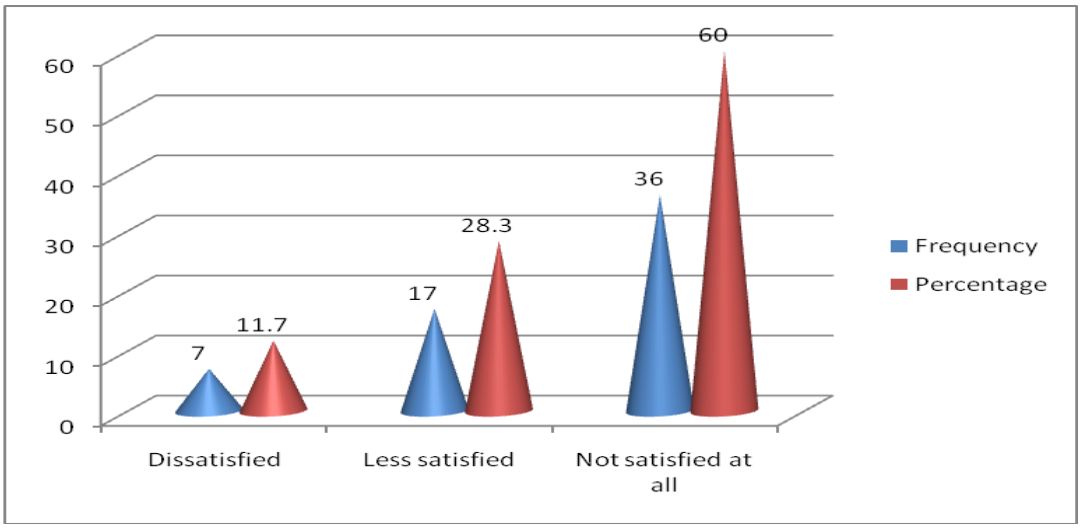
Table 4.5: Time respondents worked in the Industry

	Frequency	Percentage	Cumulative Percentage
0-5 years	31	51.7	51.7
5- 10years	16	26.7	78.3
More than 10years	13	21.7	100.0
Total	60	100.0	

Source: Field research, 2013

A researcher introduced the idea of satisfaction to know worker's satisfactions in liquid waste management in Morogoro textile industry. Respondents were required to respond by showing their satisfaction. Despite there was a program available to deal with liquid waste management, most of the workers were not satisfied with the situation of liquid waste management practices in the industry. The findings show that 60% of workers responded that the situation is not satisfied, 28.3% responded that the situation is less satisfied and 11.7% respondents were dissatisfied with the situation of liquid waste management practices in the industry. Figure 4.5 provide summary of worker's satisfaction in the way liquid wastes were managed.

Figure 4.5: Satisfaction level of liquid waste Management practices

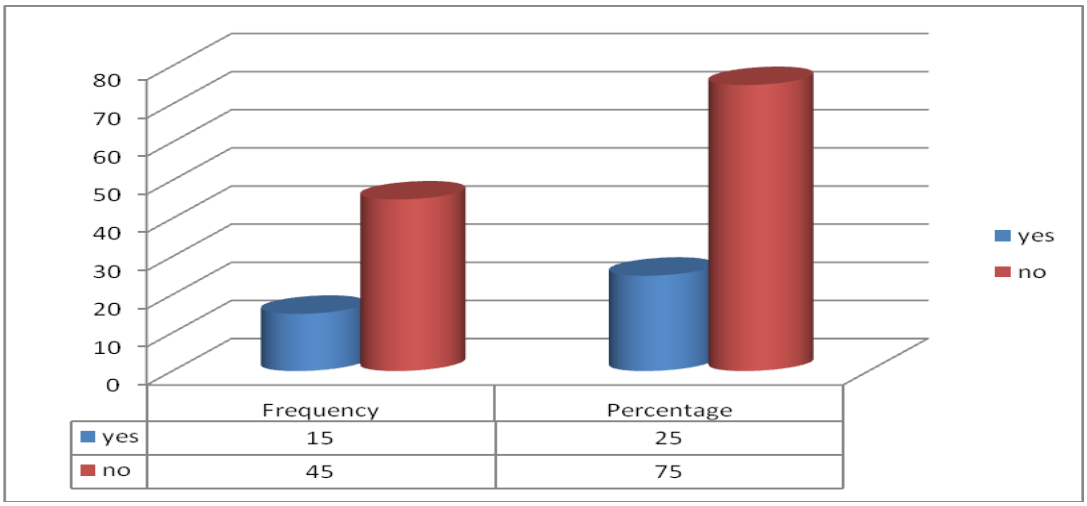


Source: Field research, 2013.

Figure 4.5 shows that many workers are not satisfied with the way liquid wastes were managed. To the issue of effectiveness of the programs conducted to manage liquid waste in the industry and in keeping the environment clean, the textile workers responded as follows, out of 60 workers, 25% said yes the present programs are effective and efficient in keeping the environment clean and 75 % said no the present programs in the industry is not effective and efficient in keeping the environment clean.

From the findings above, that is 75% respondents said that the present programs in the industry is not effective and efficient in keeping the environment clean and 60% were not satisfied with the program. It shows that there are no effective policy directives or programs requiring the industry to implement liquid waste management programs in proper ways. As a result industrial authority implements liquid waste management programs in ways that suit them rather than in a manner that promote environmental integrity and the health of workers and residents. This in an indicator that the authorities do not take strong measures or take action when the industry doesn't adhere to the rules and regulations that govern the management of liquid wastes and maybe there is a smell of corruption between the owner of the industry and the authority thus the industry just manages wastes in accordance to their will. Corruption inhibits effective supervision and law enforcement as some of the law enforcers are closely related to the industrial owners.

Figure 4.6: Effectiveness and efficiency of the existing liquid waste management



Source: Field research, 2013

The workers were not satisfied with the way recycling of liquid waste is done in the textile industry. Twenty respondents said there is effluent/waste water recycling but the situation is not/less satisfactory for liquid waste are chemically treated to pH of 8-8.5 which is still large pH and the machines used are outdated.

The laws and governance instruments to regulate waste management in Morogoro industry are not comprehensive enough to ensure sustainable waste management practices in all local authority areas. The problem of liquid waste management is severe even though the entire national environmental laws, environmental policy, governance instruments and bylaws exist. This clearly shows that the problem is one of inadequate enforcement rather than the absence or ineffectiveness of the environmental policy and laws. This can be related by a study done by Onibokun, A & Kumuyi, A (1999) has also noted the inability or unwillingness of municipal officials to enforce existing laws on environmental sanitation including the insufficient legislation on waste disposal. This situation is particularly grave in the major cities where there is a general lack of public compliance with waste disposal laws if they exist at all (Ogawa, 2002).

The present liquid waste practice/ programs mentioned and observed was treatment of liquid waste by aeration and enzyme dosing but the situation is not/less satisfactory as stated above and not enough time for effluent treatment.Therefore, out of 7 governance instruments researched only four were being applied in the Morogoro textile industry. And 83.3% of the respondents about the present Morogoro textile liquid waste management programs, bylaws and governance instruments if they are effective and efficient in keeping the environment clean, they said it is not effective and efficient hence not satisfactory and 16.7% they said it is satisfactory. Table 4.6 gives the summary of the findings

Table 4.6: Satisfaction level of governance instrument operations in Morogoro Textile Industry

Level of satisfaction	Frequency	Percentage	Cumulative Percentage
Satisfactory	10	16.7	16.7
Not satisfactory	50	83.3	100.0

Total	60	100.0

Source: Field research, 2013.

There are many governance instruments but very few are applied in the Industries and the applied one are not effectively as it can be seen from the table 4.4 and table 4.6. This may be due to failure of the governmental authority to have regular check up on how the industries implement this governance instruments. Therefore, the authority in place should have regular check up in industries on how they implement governance instrument in managing liquid wastes.

In the report of their African Development Bank (ADB) sponsored literature-based study of solid waste management options for Africa, Palczynski and Scotia (2002: iv) noted that "no country has a specific waste management legislation even though legislation is being drafted now in some countries". Ogawa (2002) has also observed that legislation related to solid waste management in developing countries is usually fragmented and several acts (such as public health, local government and the environmental protection acts) include clauses relating to solid waste management).
This shows that there is poor enforcement of environmental policy and laws, while local government can bring court cases under legislation pertaining to the environmental issues, often, such cases are delayed for months and even years, no formal mechanism exists to hear such cases. This has caused the industrial owners to be reluctant to implement environmental governance instruments and laws in managing liquid waste as they cannot be punished.

Non-enforcement of waste disposal laws gives rise to a lack of fear of the law among the industrial administrators and encourages negative waste handling practices. Such practices worsen the waste disposal situation and increase the burden like diseases of people and loss of fertile land for agriculture as the respondents mentioned the diseases caused by improper liquid waste from the industry which are skin diseases 45%, chest pain 18.7%, eyes 10%, and stomach diseases 26.3%.

The capability of the law enforcers, especially in the industrial urban areas is inadequate and lacks efficient monitoring capacity. Example, a case of North Mara

Barrick Gold mines discharging water to the Thigite River and the regional government including NEMC failed to institute a case before the court against the company. This issue has two faces if critically analyzed one is a corruption and second lack of effective and efficient enforcement mechanisms in the country as far as liquid waste is concerned. Therefore a number of problems lie in the political structure of the country, the government authorities and in the inadequate enforcement of environmental legislation (EMA, 2004).

There is a strong need to put in place strict enforcement provisions for ensuring that the current legislation is enforced. It includes public education and awareness campaign programs on the existing environmental policy, laws and bylaws on liquid waste management. A thorough education campaign on the environmental policy and laws governing liquid waste management would assist in promoting sustainable liquid waste management practices.

4.3 The Impacts of Liquid Wastes on Flora, Fauna and the Settlement around the Industry

The idea here was to determine the impacts of industrial liquid waste from Morogoro textile to plants and animals as well as settled areas around the industry. Awareness on the impact of liquid waste on plants and animals' health, well-being and the environment is very important across different communities, as evidenced by the extent of impacts mentioned due to existing flow of industrial liquid waste.

4.3.1 Impacts of Liquid Wastes on Flora

Due to the chemicals used in different textile processes, liquid waste has different impacts on plants. Forty four percent (44%) of the 80 respondents said that 'textile liquid waste affected plants by reducing maize crop production in large', for people have reduced maize cultivation which was important food crop and have stated to construct blocks, 6.7% of respondents said 'grasses for grazing has dried up in most of areas affected with liquid waste', 11.3% of respondents blamed about stunted growth of plants, 9% of respondents said there is loss of water for irrigation that is they are no longer usefully for irrigation hence irrigation scheme has been

reduced for water for irrigation contain color from textile industry and 2% of respondents said liquid waste has affected plants by being a breeding areas for vectors of different plants diseases but 27% of respondents they said liquid waste has very little impacts on plants, without mentioning the impacts they added saying that crop yield has reduced due to change in weather condition and lack of capital. Although the data given by respondents lacks supporting data from the extension officer and ward community development officer for they lack documented data so as to know to what extent the effects of liquid waste has affected maize cultivation crops and irrigation farming, but extension officers supported by saying that most of people have stopped maize cultivation and they have been depending on buying food crops

Respondents mentioned liquid waste affected the good soil for farming. Soil pollution results in a disturbance in the balance of flora and fauna inhabiting in the soil, decrease in soil fertility and hence decreases in the soil yield. Normally crops cannot grow and do well in a polluted land, although some crops manage to grow, then these crops might have absorbed and bio-accumulated the toxic chemicals in the soil and might cause serious problems to primary consumers.

Topsoil is an important part of the land, when liquid waste from the textile industry flow on it, it increases soil pH as well as the salt contents left after the water has evaporated affect growth of plants for plants may wilt due to increase in salt concentration also the soil loses some of its nutrients that are needed by plants. This is because the toxicity of industrial liquid waste limits the ability of decomposers to break down waste in soil. Chemicals used in textile processes do not decompose easily. They may kill the plants such as contaminants in soils that reduce the productivity of land or affect the quality of food.

4.3.2 The Impacts of Liquid Wastes on Fauna

The researcher aimed at finding the effects of liquid waste from the textile industry on animals and man inclusive.

Respondents from both, industrial

workers and community living near the industry mentioned the diseases which have erupted and affected them due to spread of liquid wastes in the textile industry to both workers and community living around respondents mentioned the diseases caused by improper liquid waste from the industry which are skin diseases 45%, chest pain 18.7%, eyes 10%, and stomach diseases 26.3% as it has been shown in a figure 4. 7and table 4.7 shows that most of people are affected by malaria, water born diseases and chest diseases. This shows that liquid waste has also contributed to eruption of these diseases by increasing breeding areas for pathogens.

However, respondents said children were vulnerable and victims of the liquid waste since they tend to swim in near streams and river Morogoro which are contaminated by industrial liquid waste. The problem was that the children are not very much aware of the health impact of industrial liquid waste. Impacts of waste can go as far as from plants to animals including man through the food chain. Animals lack grasses, safe water for drinking and they become prone to diseases as they graze near the liquid waste areas.

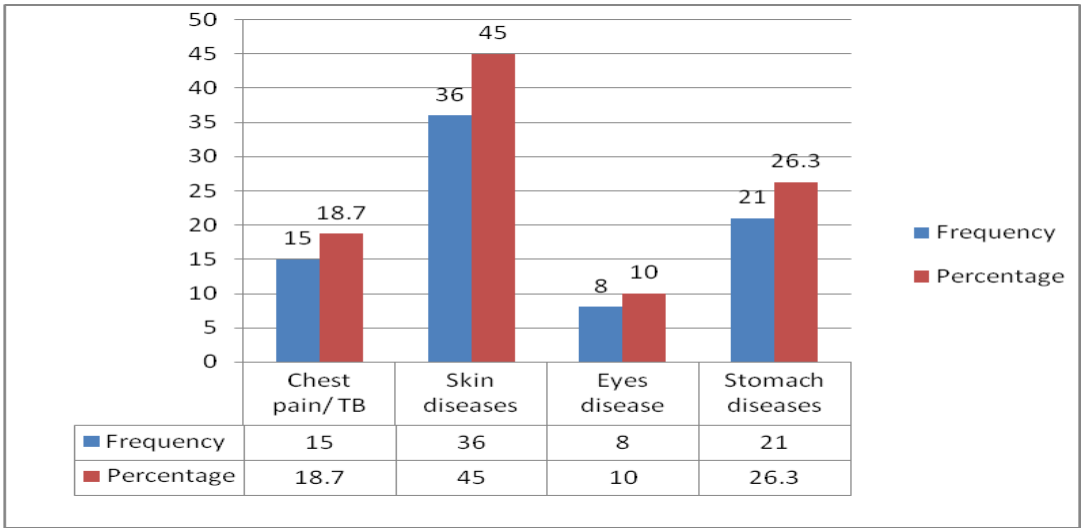
Livestock in the area graze on natural pastures and shrubs for their nutritional needs. This was explained by Mr. Solomon who is dealing with waste stabilization ponds that, previously liquid waste was allowed to flow to the shrub and near bushes where the plants died after a certain period of time and he further reported that they were told not to allow liquid waste to flow again randomly for some of grazed livestock were found with several diseases affected from wastes.The table 4.7 shows the number of people attended medical treatment at the Kihonda dispensary for the year 2011 for the diseases named by the respondents.

Table 4.7 People affected by diseases in the study area for the year 2011

Diseases	Frequency
Skin	32
Water born	2433
Eyes	46
Chest	647
Malaria	2103

Source: Kihonda Dispensary

Figure 4.7: Diseases caused by spread of liquid wastes in the Textile Industry to man



	Chest pain/ TB	Skin diseases	Eyes disease	Stomach diseases
Frequency	15	36	8	21
Percentage	18.7	45	10	26.3

Source: field research, 2013.

Most of people living near the Morogoro textile industry are farmers, so their activities are affected by the spread of this liquid waste and it reach them through the food chain. Land fertility is lost; river water can no longer be used for domestic use and for irrigation as liquid waste enters to water sources. This could result in the volatilization of chemicals in the effluents and release of heavy metals as particulates due to their adsorption on the effluent solids.

The waste management problem is more pronounced in squatter settlements, where 70-80% of the urban population resides without the necessary infrastructure and social services. Consequently, over 70% of diseases attended in health centers and/or hospitals in the country are water and sanitation related (MoH, 2003). There is a high rate of waterborne diseases within polluted river catchments. As it was stipulated by municipal environmental officers and supported by a ward executive officer, numberless of children reported sick with diarrhea due to pollution of river water from liquid waste from the industry.

Industrial liquid waste has been seriously affecting the life of humans, plants as

well as animals. The eco-system of rivers, streams, lakes, seas and oceans is also getting deteriorated due to the contamination of water through industrial liquid waste.

Industrial processes produce toxic wastes containing heavy metals and they are mostly directed into water bodies, when the heavy metal filter into water that's when it become fatal to marine and human life. Mwanza city is dominated by a number of industries which include food processing industries, fish processing industries, textile industry and construction industries (NEMC Report, 2009).

The uncontrolled textile industrial liquid waste has the potential for transporting pathogens (Disease producing organisms) which can cause significant adverse impacts on human health and the environment. Liquid waste accumulation breeds bacteria and is a good breeding area for vectors e.g. Mosquitoes. With domestic animals being allowed to graze in areas affected with liquid waste or having liquid waste, there is the added risk of reintroducing pathogenic micro-organisms into the food chain. Industrial liquid wastes are having chemicals so they pose environmental pollution problems when they are discharged into the environment because they are poisonous to many species. Some chemicals remain active for long periods or may break down into more toxic compounds.

Effluent generated by the industries is one of the sources of pollution. Contaminated air, soil, and water by effluents from the industries are associated with heavy disease burden (WHO, 2002) and this could be part of the reason for the current shorter life expectancy in the developing countries (WHO, 2002) when compared to the developed nation. Pollutant in the water will alter the overall chemistry of water, causing change in acidity, temperature and conductivity. These factors all have an effect on the marine life, also marine food sources are contaminated by water pollution which leads to shortages of food to the marine life thus disappearance of some species in the river. Not only toxic chemicals have effects but also, nutrients-pollution driven blooms of non-toxic can also cause the problem by reducing water clarity, making it harder for marine animals find food and blocking the

sunlight needed by water grasses, which serve as nurseries for many important fish species such nutrient effluents are mostly discharged from industries. Also nutrients pollutant can trigger unusual outbreak of fish diseases for instance scientists have found that ptiesteria, a tiny marine pathogen, can thrive in nutrient-polluted by waters.

The effects of industrial waste into water bodies are far-reaching and affect not only the environment but human beings and animals as well. Water pollution affects our oceans, lakes, rivers and drinking water making it a widespread and global concern. Numerous diseases, health problems and even fatalities have been associated with water pollution. Fresh fish are staple menu items for people around the world. Humans are affected by the heavy metals ingested by fish and causing health problems and sometimes death. The heavy metals in water have also been linked to severe birth defects, a damaged or suppressed immune system, cancer, fertility problems and developmental problems in children.

Diseases can spread via polluted water, infectious diseases such as typhoid, cholera and dysentery can be contracted from drinking contaminated water. The human heart, liver and kidney can be adversely affected if polluted water is consumed regularly. Other health problems associated with polluted water are poor blood circulation, skin lesions, vomiting and damage to the nervous system.

4.3.3 The Impacts of Liquid Wastes on Settlement areas

Liquid waste from the industry destruct of the beauty and tranquility of the settlement and a polluted environment is deadly and, it is also a retarding agent to the socioeconomic development of a nation. Respondents mentioned the following impacts on settlement, 11% bad smell hence they can't establish investments like tailoring, cafe, canteen or restaurant, 27% said it increases breeding areas for flies especially house flies and mosquitoes, 33% mentioned waterborne diseases hence the areas become unsafe for settlement purposes and industrial environmental officer

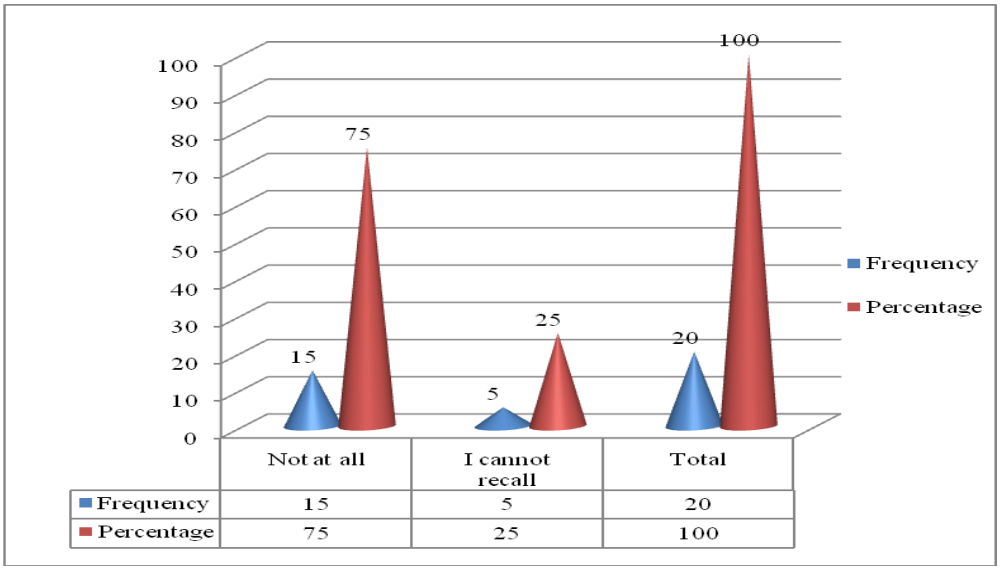
said the chemicals add salt to the soil which affect the walls of the house by corroding them.

Inadequate industrial liquid waste treatment and disposal creates a range of environmental problems in the Morogoro textile industrial area and residential areas. A considerable amount of liquid waste ends up in open dumps, drainage system and land areas threatening environmental quality, and causing over flooding which provides a breeding ground for diseases - carrying pests.

Seepage from overflowing trench and broken sewage reticulation systems it causes contamination of both surface and ground water and emitting unhygienic and unhealthy smells hence the area become not favorable for settlements and other social economic activities. Normally, it is the liquid waste that decomposes and releases a bad odor. The bad odor affects the people settled near to the liquid waste producing areas, which clearly shows that the liquid waste have serious effects to people settled around or next to them.

The researcher asked the respondents residing near the industrial areas if they have ever been given education program on the effects of industrial liquid waste. About 75% of the community responded that, no any environmental education concerned liquid waste was provided to them, while 25% they cannot recall if there was environmental education provided to them. This has increased un-awareness of people towards liquid waste and its effects to both environment and living organisms. Community mentioned the following method they used to protect themselves against the dangers/health impacts of liquid waste produced from the industry, boiling water.

Figure 4.8: Environmental education program being conducted in the community



Source: field research, 2013.

The finding shows that respondents were aware with the risks associated with inadequate management of liquid wastes. Despite of their awareness, it was observed that the industry does not comply with environment governance instruments in managing liquid wastes before disposing of. This situation may threaten the human health and the environment around and beyond the industry area. Also it implies that there was no accountability among the industry management in managing liquid wastes.

From the study, it was observed that the industry does not comply with environment governance instruments involved in treating and managing liquid waste before disposing off without harming human health and the environment. There is no fairness, transparency and accountability in the adoption and implementation of governance instruments and measures in liquid waste management.

Just by respondents mentioning the diseases erupted due to spread of textile industrial liquid wastes, it proves that the industry doesn't care the health of the organisms that is plants and animals as well as the environment at large.

About 75% of the community responded that, no any environmental education concerned liquid waste was provided to them, while 25% they cannot recall if there was environmental education provided to them. Inadequate of public education on industrial liquid wastes and its effects thus people establish their settlement very near the industrial areas. And this is mostly in urban industrial areas. The government should review land policy and specification on areas of industries. People should not be allowed to build near the industrial areas or establish their economic activities.

In addition, from field research, it shows that the policies have not been communicated effectively to the local authorities themselves with the government thus they do not have programs aimed at raising public awareness among industrial workers and residents on the existence of these policies thus 23.3% of workers were not aware of on the impacts of industrial liquid waste. The people living near the industry mentioned that; industrial trench blockages and overflowing industrial trench which cause liquid waste to overflow to the human settlement, path and farms causing the bad smell and breeding area for mosquitoes. Therefore the industry should do regular maintenance of their trench.

Most communicable diseases are caused by defective liquid waste management. Unfortunately, most of industrial liquid waste stabilizing ponds is substandard thus liquid wastes just flow to residential areas as there are infested with flies (due to bad smell) and provide favorable places for breeding of mosquitoes. Women and children are most affected by inadequate liquid waste management; waterborne diseases are responsible for illnesses and deaths of many people. It was observed that, there is an increasing trend in the daily liquid waste generated daily due to increase in production of goods in the industry as it was elaborated by Mr. Munis (the industrial production manager). So, the rate of liquid waste generated is inversely proportional to the rate of wastewater treatment and disposal. The study identified that the current liquid waste disposal system is not environmentally friendly and socially acceptable. Hence, environmentally feasible and socially acceptable waste disposal site should be identified and implemented.

4.4 The Challenges of Liquid Waste Disposal facing the Industry

The idea was to know the challenges facing the Morogoro textile industry in implementing governance instruments to manage liquid waste produced. About 57 respondents from Morogoro textile industry mentioned the following challenges facing liquid waste disposal as follows:

About 53% respondents mentioned financial problems (cost) for liquid waste treatment and governance instrument implementation, 17% absence of appropriate technologies and modern facilities which include poor recycling technology, inadequate treatment facilities as well as irregular collection and disposal procedures,7% said the laws and regulation in place are friendly, 10% lack of expert for most of workers are of low education level (most of them are form fours because of payment reasons) which is quite different from the statement of Environmental Management Act number 20 of 2004, that, every Region in Tanzania should have a regional environmental management expert who is responsible for advising local authorities on matters relating to the environmental management Act. Furthermore, each city, municipality, district, town council and even township, ward, village and neighborhood should appoint an environment management officer responsible for implementation and monitoring of the act through bylaws and regulations including fines. According to Pallangyo (2007) however, local authorities dealing with environmental management often have very few resources including environmental experts and funds to implement activities. Many local authorities therefore struggle to internalize these new environmental officers in their organization.

Another 2% said failure of color reduction to a satisfactory level, as it is also discussed by Ayad and Mohamed (2008) in the National Journal of Chemistry, volume 31,455-465 that, color removal from textile effluents has been the subject of great attention in the last few years, not only because of its toxicity but mainly due to its visibility. Before directing these waters away from the industry, they should be treated to remove organic wastes and coloring agents.

Eleven percent of respondents mentioned absence working instruments / protective equipment like masks, apron, gloves and eyes goggles as challenges facing the textile industry. The industry authority does not care about the health of the workers and environmental issues for its aim of gaining more profit than the coast of operating it.

Table 4.8 Challenges facing the Industry

Challenge	Frequency	Percentage
Financial problem	30	53.0
Absence of appropriate technology	10	17.0
Laws and regulations are friendly	4	7.0
Lack of expertise	6	10.0
Failure of color reduction	1	2.0
Absence of working instruments	6	11.0
Total	57	100.0

Source: Field research, 2013.

Also challenge the industry face to implement its programs in liquid waste management as mentioned by industrial and municipal environmental officer was poor land use plan in relation to industrial specifications. They further added that the government has failed to restrict people from the building near the industrial areas. The industrial development strategy in Tanzania was pursued without environmental regulations for a long-time and consequently many industries do not have liquid waste treatment facilities. Untreated or poorly treated effluents are being discharged into water bodies or near residential areas and there is no systematic monitoring or quantification of industrial liquid wastes that has been taking place. As a result of enforcement of environmental policy and laws, some industries have installed liquid waste treatment facilities after operating for quite sometimes without them or others are functionless. They are there just to show to authority during inspections and most of them are outdated and less satisfactory.

Research and development in liquid waste management technology are limited in Tanzania. However, research is being conducted on the treatment of wastewater, recycling and reuse of liquid wastes and disposal in some academic and research institutions, but research on how the environmental laws, policy and governance instruments are practiced in industries is very low thus there is little information on how most of the industries are implementing laws and governance

instruments in managing liquid waste. This builds a gap of information on how the Tanzanian industries use/implement these governance instruments to manage liquid wastes in their areas

Similarly in a study conducted by the Namilyango College in Kampala (2001), the researchers attributed the root cause of the waste problem in the Ugandan capital to "poor government attitude towards waste management". From the citizens' point of view, according to the study, "it is realized that little attention is paid to environmental sanitation in Kampala so very few resources are committed to waste management". The researchers therefore blamed the issue of poor waste management on the lack of political interest in the sector.

4.5 The way the firm is addressing the challenges of liquid waste disposals

The aim was to know how the industry is addressing the challenges they face in implementing and managing liquid waste they produce. Mr. Munis, the production Manager who is acting as an industrial environmental officer reported that "there is effluent/waste water recycling through liquid waste treatment and enzymes dosing program by effective monitoring of liquid waste system at all levels of production" and he added that more research is going on also the Morogoro textile industry uses the following strategies to improve liquid waste management system and its impacts as it was mentioned by workers, 13% improving effluent treatments, 6% through proper storage of liquid waste, 17% by reducing color and liquid waste production and 11% improving waste stabilization pond and chemicals used in waste water treatment, 3% observing the rules and regulations from NEMC,9% of respondent mentioned that recycling activities is encouraged together with education on the safe way and precautions to adhere in dealing with industrial liquid waste, and 11% by improving infrastructure of waste collection and treatment plant, 7% by effective and continuous treatment of the liquid waste by aeration and enzymes dosing. About 1% workers they use protective equipment like masks, apron, gloves and eye goggles and 5% said by taking milk daily which is provided by the industry to some workers, 13% of workers said by not drinking or use water from the industry especially that path through as a stream.

Apart from the respondents mentioning the way they use to tackle the problems they face, respondents mentioned some recommendation to be made so as to reduce and improve the situation of liquid waste in textile industry. Authorities such as OSHA, NEMC to make periodic check up on how the Industry manage liquid waste. Municipal Council should create an awareness education to the people to get periodic feedback of any liquid waste impact if at all present. Establish sensitization programs. Create or employ the enforcement mechanisms to the existing environmental standards, laws for it was observed that laws or regulations in place are friendly. Therefore more effective and efficient framework that will adequately deal with liquid management issues is needed.

There is a high need of government supervision on all industries in the country together with the establishment of public education and awareness campaigns about industrial liquid wastes and their impacts to the community and all stakeholders is highly recommended. This will help to minimize the production of industrial liquid wastes and their social and economic consequences. Controlling improper handling and reducing unpopular impacts of industrial liquid wastes by establishing important procedures for managing liquid wastes and coordinating all stakeholders in industrial liquid waste industry can resolve the problem at hand.

There is a need of establishing specific local policy, bylaws and enforcement tools in every industry in the country which will manage emphasize and enforce liquid waste produced in order to improve management of industrial liquid waste. This policy, bylaws, regulations must emanate from the National environmental policy which govern environmental issues. Apart from establishing, the government authority should make regular check up on how these policies, regulation and bylaws are implemented.

Waste management can also be seen as an issue of good governance, which is supposed to include transparency, effectiveness, openness, responsiveness and accountability. Therefore the government should show these aspects in dealing

with liquid waste in the industries. Industries must encourage steps that prevent and minimize liquid waste flows. These include recycling and the extraction of raw materials and energy for re-use of waste. Also the industries must ensure that waste is disposed of without endangering human health and without harming the environment, and in particular without risk to water, soil, plants and animals, without causing a nuisance through odors, without adversely affecting the places of special interest'. In addition, local authorities are required to formulate detailed waste management plans, either individually or regionally.

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Summary

The finding from the study it shows that, the Morogoro textile industry does not implement the governing instruments for waste management, thus liquid waste produced is not well treated and disposed of improperly. There is an eruption of diseases due to spread of industrial liquid wastes in residents of people as well as in industrial environment due poor waste management and poor infrastructures.

5.2 Conclusions

Liquid waste management, like many other environmental issues in Tanzania, is multisectoral in nature and encompasses policy making, strategic thinking, and the efficient development and effective legal-institutional and administrative management. Liquid waste management is often hindered by insufficient or lack of national policy direction with no clear allocation of responsibilities and little or no national level planning to develop integrated liquid waste management policies and strategies. Based on the observation made during the field study, the liquid waste management system or programs adopted by Morogoro textile industry is less effective and efficient.

Education about effects of liquid waste was not provided to the community who live nearby the industrial area and there was a low level of implementation of rules, laws, policy instrument and guidelines for the industrial administration about proper handling of liquid waste to their working positions. There were low commitments to the leader who have the responsibility of supplying the working facilities and in handling of liquid waste. Therefore there must be improved in information, environmental education and public awareness. This environmental education has to play a vital role in building public awareness. The existing technologies need to be updated to minimize liquid wastes. Recycling and re-use of liquid wastes and adoption of cleaner or low liquid waste technologies should be emphasized. Rehabilitation packages should include[68]methods for treating final wastes and the

training of plant operators in the reduction of liquid waste.

5.3 Policy implications

To date there is no policy for liquid waste management at the national level rather there are scattered pieces of legislation on liquid waste management in different policies like environmental, health and Industrial policies and city or municipal bylaws which are for that matter not supported by a principal law or policy on liquid waste management. Owing to the state of affairs, the industry authorities in the country handle liquid waste management issues according to bylaws they set for themselves.

Therefore, government should formulate a liquid waste management policy accompanied by the enabling legislation, to regulate the operations in liquid waste management. As proposed by Parvathi C (2013) that 'Cleaner production is an attractive approach to tackle environmental problems associated with industrial production and poor material efficiency. Since the cleaner production approach has been successfully implemented in some areas in the textile sector, it shows that significant financial saving and environmental improvements can be made by relatively low-cost and straightforward interventions. This improves the quality of products and minimizes the cost of production, enabling the branch to compete in the global market. Moreover, cleaner production also improves the company's public image by highlighting the steps it has taken to protect the environment'.

The following are among the recommended actions for improving liquid waste management in Tanzania especially in urban industrial areas taking into consideration the identified weaknesses as well as the key issues identified;

To conduct research surveys and disseminate research findings as it was also suggested by the firm. There is a need to strengthen the link between research and industrial liquid wastes that will provide practical solutions and technologies. This will enhance the capacity in the management of environmental wastes.

Through raising awareness by formal/informal education on

environmental options, solutions, enforcement and monitoring, involving Non Government Organizations (NGOs) and the informal sector in championing industrial liquid wastes and its effects as well as local environmental concerns. Magash (2011) proposed that, awareness of the effects of discarded liquid waste to the environment and human health should be created at all levels of government and the general public by making information available through appropriate means (e.g. Web-sites, workshops or seminars, campaigns,); and by identifying target groups (e.g. Schools, universities, vocational institutions, informal sector, government, retailers, etc.) with tailor made solutions towards sustainable liquid waste management.

To educate the community so as to be aware of liquid waste and its effects as well as how to protect themselves from its effects, to build/establish their settlement far from the industrial areas and by creating a buffer zone by planting trees around their homes that will absorb some chemicals. Also by improving policy interventions and making strategic choices; this can include such tools as economic and regulatory instruments, property rights, land management instruments, and information or education.

Development of a formal and efficient liquid waste recycling sector: As suggested by Magash (2011) that, there is a need for developing a formal liquid waste recycling sector by documenting tested and best available processes and practices. This includes developing and improving skills and competencies of entrepreneurs and other stakeholders through training, business models for prep-processing technologies, such as manual dismantling operations, should be established on a local level. Emphasis should be put on the continuous improvement of the infrastructure through the establishment of standards and auditing procedures. Building institutional capacity; through upgrading local technical and management capabilities with the accent on operational management and to develop a policy framework which harmonize environmental-related laws and institutions. The existing institutional framework can support liquid waste management. However,

there is a need for strengthening the existing institutional framework in terms of technical, human and financial capacities to enable them to handle liquid waste management effectively and efficiently.

Also, by developing legal framework because the existing Environmental Management Act (2004) and its regulations on hazardous liquid waste of 2009 includes provisions for liquid waste management but its enforcement is still a challenge. There is therefore a need for strengthening the relevant institutions in terms of both technical and financial capacities to enable them to effectively play their part in the implementation of EMA (2004).

To ensure that all units within industrial departments have clear roles and mandates, with sufficient trained staff and resources to implement and monitor their responsibilities effectively and efficiently not to employ untrained staff (like form fours) to deal with sensitive issues like waste management which affected/threatens the life of the people by giving reasons that they are not able to pay trained staff.

Government institutions on the other hand have limited their involvement mainly to the regulation of liquid waste management but have not come up with feasible programs to alleviate the waste management situation in the industrial urban centers, therefore there is a need for a system of incentives and penalties designed to entice industrial authorities to manage their liquid waste sustainably. Multi-stakeholder participation in legislative review is important and as such provision of grants to municipalities for capacity building initiatives in legislative and policy reviews and drafting is necessary.

The liquid waste management falls under the scope of hazardous waste management. A further study on this topic is suggested on how the government plays its role to facilitate the implementation of environmental laws and governance instruments in managing liquid waste in industrial areas. A study on the awareness of the public towards the liquid waste management also can be carried out so as to protect themselves from dangers exposed by liquid waste.

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APPENDICES

Appendix I: Research questionnaires for Household

Preliminary information

Name of respondent……

Ward…….

Streets…….

1. Age of respondent

i.18 Years and below II. 20-39 Years iii.40-59 Years iv. 60-79 Years and above ( )

2. Sex

(i) Male (ii) Female ( )

3. Level of education

(i) Primary education, (ii) O-level education, (iii) A-level education

(iv) College education, (v) University education ( )

Guiding questions for Household:

1. Are you aware of the impact of the spread of industrial liquid waste on human health and environment?

(i) Yes (ii) No ( )

2. If YES, what is your effort in avoiding and managing of these wastes?

(i)…….

(ii)……

3. How often has an environmental education program been conducted in your area?

(i) Once per month (ii) twice per month

(iii) Three times per month (v) Not at all (6) can't recall ( )

4. What are the impacts of liquid waste on plants and animals? Mention

…….

……

5. Are there any outbreak of diseases related to the spread of industrial liquid wastes?

(i) Yes (ii) No (iii) I do not know ( )

6. If YES, what are they?

(i)……..

(ii)…….

(iii) …….

7. What were the diseases erupted/caused by spread of Liquid Wastes in your areas to human health? Tick

a) Chest pain/ TB b) Skin diseases

c) Eye disease d) Stomach diseases

"Thank you for your co-operations"

Appendix II: Research questionnaires for Industrial Workers

Preliminary information

Name of respondent……

Position……

1. Age of respondent

i. 18years and below ii. 20-39years iii. 40-59years iv. 60-79years and above [ ]

2. Sex of respondent

(i) Male (ii) Female [ ]

3. Level of education

(i) Primary education, (ii) O-level education, (iii) A-level education

(iv) College education, (v) University education [ ]

Guiding questions for workers of the Morogoro textile industry

1. For how long you have worked in this department?

(i) 0-5 years (i) 5- 10years (iii) More than 10years [ ]

2. Are you aware of the dangers associated with exposure to industrial liquid wastes?

i. Yes…. If yes what are those? ……

ii. No [ ]

3. How do you protect yourself from those dangers?

(i) ……..

(ii) …….

4. Are there recycling/ reuse program for liquid waste within Textile Industry?

(i) Yes (ii) No (iii) Not sure [ ]

5. How satisfied are you with the situation of liquid waste management practices?

(i) Satisfied (ii) Dissatisfied (iii) Much satisfied

(iv) Less satisfied (v) Not satisfied at all [ ]

6 Do you know that the government has issued governance instruments to be applied by industries in liquid waste management?

Yes [ ] No [ ]

7.Are the Textile industry has any governance instruments for enhancing liquid waste management?

(i) Yes [ ] (ii) No [ ] (iii) don't know [ ]

8. If yes, are they in practice?

(i) Yes [] (ii) No [ ] (iii) don't know [ ]

9. Which governance instruments/ by law are used for liquid waste management in Morogoro Textile Industry? Tick

a) Environmental Standards [ ] b) Recycling [ ]

c) Environmental regulation [ ] d) Environmental Act [ ]

e) Polluter pays principle [ ] f) Tax relief and subsidies.[ ]

10. How are they operated?

(i) Satisfactory (ii) Not satisfactory [ ]

11. What were the diseases erupted/caused by spread of Liquid Wastes in the Textile Industry? Tick

a) Chest pain/ TB [ ] b) Skin diseases [ ]

c) Eyes disease [ ] d) Stomach diseases [ ]

12. What are the challenges of liquid waste disposal mechanisms used in Morogoro Textile Industry to the workers and community?

……

……

……

13. What strategies could be used to improve liquid waste management system?

……

……

14. Is the present Morogoro Textile liquid waste management programs effective and efficient in keeping the environment clean?

(i) Yes (ii) No [ ]

15. Suggest strategies to be undertaken/ that are usually undertaken to overcome these challenges

(i)……

(ii)……

(iii)……

16.What are the impacts of liquid waste on plants and animals? Mention them

…….

……

"Thank you for your co-operations"

Appendix III: Check List for Key Informants

Do you have governance instruments used to manage liquid wastes in industries?

Which governance instruments are used in Mororgoro Textile Industry?

How do the governing instruments use in managing liquid waste in the Industry?

What challenges are facing the industry to implement the governance instruments in managing liquid waste?

What do you think might be the solution to overcome the situation?

What are the main diseases that affect the people from Morogoro Textile industry?

Are there any other enforcement mechanisms to control liquid wastes in industries?

"Thank you for your co-operations"