ASSESSMENT OF HEALTH AND SAFETY MANAGEMENT ON CONSTRUCTION SITES IN KENYA: A CASE OF CONSTRUCTION PROJECTS IN NAIROBI COUNTY

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Assessment of health and safety management on construction sites in Kenya: a case of construction projects in Nairobi County

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A thesis submitted in partial fulfillment of the requirements for the award of the Degree of Master of Science in Construction Project Management in the Jomo Kenyatta University of Agriculture and Technology

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DECLARATION

This thesis is my original work and has not been submitted for a degree in any other university.

Signature…….. Date…….……..

Kenneth Ngang'a Kibe

This thesis has been submitted for examination with our approval as the university supervisors;

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Signature…….. Date…….……..

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JKUAT, Kenya

DEDICATION

To my family

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ABBREVIATIONS AND ACRONYMNS

DOHSS	Directorate of Occupational Health and Safety Services
GDCF	Gross Domestic Capital Formation
GDP	Gross Domestic Product
HSE	Health and Safety Executive
IDNDR	International Decade of Natural Disaster Reduction
ILO	International Labour Organization
KES	Kenya Shillings
KNBS	Kenya National Bureau of Statistics
NCA	National Construction Authority
OSHA	Occupation Safety and Health Act
PPE	Personal Protective Equipment
USA	United States of America
IT'S	World Health Organization

DEFINITION OF OPERATIONAL TERMS

Accident and Injury: The terms accident and injury refer to separate phenomena, mutually interrelated as cause and effect (exposure and outcome) (Anderson, 1999). An accident is an unintentional, sudden unforeseen event, whereas injury is a collective term for health outcomes from traumatic events (Anderson, 1999)...

Health: Is a state of complete physical, mental and social wellbeing and not merely the absence of diseases (WHO, 2006).

Health hazards: These are aspects of work environment that slowly and cumulatively (often irreversibly) lead to deterioration of health (HSE, 2004).

Risk: Risk is defined as a measure of the probability and severity of adverse effects (Haines, 2009)

Safety: A situation where one is not threatened in any way, that is physically and psychologically. A condition of being protected from occupational accidents and or health adherence**:** Refers to the extent to which secondary constructions have implemented the Ministry of Labor guidelines on safety (ILO, 2005)

Safety Standards: Refers to recommended, guidelines or measures of enhancing safety in constructions by the government immediate and sometimes violet harm or death (Mombeki, 2006).

ABSTRACT

The construction industry is an important part of the economy in many countries and is often seen as a driver of economic growth especially in developing countries. Owing to its relatively labour intensive nature, construction works provide opportunities for employment for a wide range of people skilled, semi-skilled and unskilled. Despite its importance, construction sites are considered risky with frequent and high accident rates and ill-health problems to workers. However, knowledge on health and safety management and related factors on construction sites in Kenya is not well documented. This study therefore, aims to find out the current practice of health and safety management during project implementation. In pursuing this objective, a descriptive case study research design was used where 30 construction sites in Nairobi County were selected through random sampling. Questionnaires were used for collection of qualitative and quantitative data from site supervisors and workers on NCA registered construction sites and descriptive statistics used for data analysis. The main causes of accidents, injuries and ill health on construction sites are falling from heights, slips, falling objects and handling. The kinds of injuries include wounds and bruises (86%), and fractures and broken bones (50%). According to the workers accidents and injuries had a high impact on construction progress while site managers reported abseentism, loss of public confidence and disruption of work as impacting negatively on the project progress. Although Personal Protective Equipment were present in most of the sites (94.7%) their usage was minimal - use of safety belts (12%), use of gloves (7%), use of foot wear (20%), and use of face masks (6.7%). The factors influencing implementation of health and safety measures at the sites include lack of training of workers (96%), lack of employee participation (88%), lack of health and safety committees at the sites (97%), lack of commitment from management (94%) and absence of health and safety

management policy in 95 % of the sites. The study recommends use of a more proactive and integrated management mechanism to enforce the existing safety and health regulations in construction sites, in order to prevent accidents, injuries and ill health on the sites.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Construction is a basic pillar for global competitiveness and foundational enabler to Kenya's Vision 2030. Kenya has experienced a construction boom during the last decade. According to Kenya National Bureau of Statistics (KNBS) construction sector in Kenya contributes 4.9 per cent of the Gross Domestic Product (GDP) (KNBS, Economic Survey Report, 2013). Infrastructure development accounted for 8.7 per cent of the total budget for Financial Year 13/14 of the total budget of KES1.6 Trillion (Economic Survey Report, 2013).

According to the Economic Survey report, 2013, the construction sector has generated new jobs and has grown by 62 % between 2007 and 2013 ahead of other economic sectors. The number of people who worked in construction industry in 2013 stood at 130,300 (KNBS, 2014)

Construction activities are among those consuming the bank credit at the fastest rate in the past few years. In December 2012, construction sector held KES 246 Billion of the total of KES 1.3 Trillion in loans from commercial banks which accounts to 20% (Economic Survey Report, 2013).

When construction industry is compared with other labour intensive industries, construction industry has experienced a disproportionally high rate of disability injuries and fatalities (Hine, 1997). Data available from Directorate of Occupational Health and Safety Services (DOHSS) indicates that in between 2005 and 2009, there were 7769

fatalities across all industry sectors. In 2011, construction industry accounted for 16% of fatal accidents (40 cases reported for 100,000 workers) and 7% of non-fatal cases (DOHSS Annual Report, 2011).

Many workers have met their deaths in construction sites while others have become permanently crippled from construction related injuries. Further, laws on occupational safety and health are not strictly enforced. Safety rules in most construction sites do not exist and if they exist, the regulatory authority is weak in implementing each rule effectively. When accidents occur, they result in both direct and indirect costs. Direct cost includes, medical bills, premium for compensation benefits, liability and property loss. Indirect cost include, time lost while attending burial ceremonies, time lost in investigation, down time on damaged equipment and losses arising from site closure. For example collapsing buildings while still in construction process trapping construction site workers, killing two workers and injuring many was reported at Space in Mombasa in April 2009 when a storey building in construction caved in burying alive many of the workers in a heap of concrete and steel rubble. (Construction risk management. Construction Review, 2009)

Health and safety therefore is an economic as well as humanitarian concern that requires proper management control. Investment in construction health and safety actually increases the profitability by increasing productivity rates, boosting employee morale and decreasing attrition (Mohammed, 2003). Construction safety and health management therefore deals with actions that managers at all levels can take to create an organizational setting in which workers will be trained and motivated to perform safe and productive construction work.

Health and safety at construction sites deals with both physical and psychological wellbeing of workers on construction sites and other persons whose health is likely to be

adversely affected by construction activities. It is of primary concern to employers, employees, governments and project participants. Health and safety therefore is an economic as well as humanitarian concern that requires proper management control. Making changes to improve health and safety standards and reduce accidents and ill health can also: increase profitability; increase productivity; improve recruitment and retention; and improve quality.

The issue of workplace health and safety is extremely relevant, since by failing to adhere to its principles, it affects moral, legal, social, psychological and economics of the society. Workers on construction sites are exposed to health and safety risks, since working conditions are constantly changing. Furthermore, improving the health and safety risk management of the construction projects has repeatedly been shown to save lives, time, and money, and to increase business goodwill and reputations (Bechal *et al*., 2004). At the same time, the right to safe and healthy working conditions in construction industry has been a central issue in the global campaign where current health and safety laws and regulations have separate sections specifically for the construction industry (ILO, 2005; 2007; CRB, 2010). Meanwhile, safer and healthier working conditions make an important contribution to poverty alleviation and sustainable development as construction is labor intensive, particularly in developing countries (Chi, 1997)**.**

It is the function of any government to ensure workers' safety in a modern construction industry. A safe workplace and is central to the ability to enjoy health, security, and the opportunity to achieve success in life. Health and safety at construction sites can be achieved by provision of enough clean water, proper and enough sanitation facilities, health friendly environment, knowledge of handling of machines, plants and equipment and hygienic practices.

Health and safety standards on construction sites are set by the International Labour Organization (ILO) and are based on international conventions and recommendations on occupational health and safety (ILO, 2002). In Kenya, they are enforced through National Workmen's Legislation (Cap 236), the Occupation Safety and Health Act, 2007, the Factories and Other Places of Work Act 1962.

Safety concerns at workplace started in earnest in 1906 in the U.S with the formation of the Massachusetts Board of Health which appointed health officials to inspect factories, work places and such like institutions (Stranks, 2005). In the United Kingdom employees set up their own work place committees elected by the employees with the power to determine health and safety matters with the management. The general duties of the committee are in line with the European wide harmonized requirement of the health and safety directive. Following the Mexico earthquake of 1985, which had profound effects on health care and safety, the United Nations General Assembly launched in 1990 the International Decade of Natural Disaster Reduction (IDNDR), with an objective to implement Disaster Mitigation programs which could in the long run improve safety and health at work places and home (Ridley, 2004).

These concerns for health and safety at workplace aimed primarily at educating employees and the society on high incidences of industrially caused accidents and diseases (Hughes, 2008). The construction industry is associated with health and safety hazards on site such as falls from heights, excavation accidents, electrocution and diseases transmitted by vectors that survive in habitats created at construction sites that are favorable for their breeding such as mosquitoes.

Production of physical infrastructure: buildings, roads, railways, ports, bridges and through the employment created in the process of construction it is faced with health and safety challenges (Smallwood *et al,* 2008).

According to Bechal *et al.* (2004) a safe workplace is central to the ability of workers to enjoy health, security, and the opportunity to achieve success in life. Workers in a construction site may be exposed to various occupational and health hazards such as exposure to physical, chemical and biological agents. Exposure to these substances/agents may result in acute injury, chronic illness, permanent disability or even death. Loss of concentration at work and fatigue arising from poor health site conditions may however increase the risk of accidents.

Nevertheless Hinze (2008) indicated that health and safety at construction sites deals with both physical and psychological wellbeing of workers on construction sites and other persons whose health is likely to be adversely affected by construction activities. It is of primary concern to employers, employees, governments and project participants. Health and safety therefore is an economic as well as humanitarian concern that requires proper management control.

The Occupational Safety and Health Act, 2007, is an Act of Parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. The Act applies to all workplaces and workers associated with it; whether temporary or permanent. The main aim of the Act is to safeguard the safety, health and welfare of workers and non-workers. It is thus recommended that all Sections of the Act related to construction projects, such as provision of protective clothing, clean water, and insurance cover are observed so as to protect all from work related injuries or other health hazards. Workers in a construction site may be exposed to various hazardous substances and physical agents, such as asbestos, lead, silica dust, organic solvents, sewer gases, welding fumes, radiation, noise and vibration. Excessive exposures to these substances/agents may result in acute injury,

chronic illness, permanent disability or even death (Hughes & Ferrett, 2011). Loss of concentration at work and fatigue arising from poor health conditions may increase the risk of accidents. Construction work is featured by high labor turnover, constantly changing work environment and conditions on site and different types of work being carried out simultaneously by several contractors. These features would further increase the health risks of workers.

Construction site hygiene encourages good housekeeping, provides workers with clean drinking water, sanitary restrooms, and washing facilities to clean up. Access to clean water and restrooms encourages good hygiene on the job and helps avoid cross contamination to safeguard worker health and safety (Murie, 2007). In Kenya, the Directorate of Occupational Health and safety services is responsible for ensuring the necessary and adequate provisions at all work places, at all times for prevention of occupational diseases and accidents.

1.2 Statement of the Problem

Construction industry is an important part of the economy in many countries and often seen as a driver of economic growth especially in developing countries. Typically, construction industry contributes to 11% of gross domestic products (GDP) in most developing countries (Giang and Pheng, 2010). Despite this, the sector is accident prone (ILO, 2005). Construction has been regarded as the most hazardous place in which to work with a high level of health and safety risks (ILO, 2005, Lingard & Rawlinson, 2005; Smallwood et al, 2008). ILO estimates that at least 60,000 fatal accidents happen in a year on construction sites around the world, despite the existence of Health and Safety standards on construction sites set by the International Labour Organization (ILO) and based on international conventions and recommendations on occupational health and safety. In the developing world, the risks associated with construction work

are very frequent while available data suggests that they are 3–6 times greater (Jason, 2008). In comparison with developed countries, construction sites in developing countries are ten times more dangerous.

In Kenya though rules and regulations on health and safety management at construction sites by the National Council for Occupational Safety and Health exist, there are reports of injuries, accidents and ill health following construction activities. The reports seen from construction sites indicate the need for better management of health and safety through a paradigm shift and management approach and the development of a health and safety management framework.

1.3 Aim of the Study

The aim of this study was to investigate health and safety management implementation on construction sites approved by National Construction Authority in Nairobi County. The purpose of the study is to form the basis for developing a health and safety framework for construction sites in Kenya.

1.4 Objectives of the Study

The specific objectives of the study are:

1. To establish demographic characteristics of workers at construction sites in Nairobi county

2. To establish the kinds and causes of accidents, injuries and ill health on construction sites in Nairobi county

3. To find out the factors influencing implementation of health and safety management on construction sites in Nairobi County

4. To assess the impact of accidents, injuries and ill health on the construction implementation in Nairobi county

1.5 Research Questions

The study was guided by the following research questions:

1. What are the demographic characteristics of workers at construction sites in Nairobi County?
2. What are the types of accidents and injuries on construction sites in Nairobi County?

3. Which factors influence implementation of health and safety measures on construction sites in Nairobi County

4. What is the impact of accidents, injuries and ill health on the construction implementation in Nairobi County?

1.6 Significance of the Study

The findings of this work will form the basis for policy formulation on implementation of health and safety management on construction sites in Kenya. Additionally, the results have been used to develop a framework as a guide for health and safety management on construction sites. The study findings will be valuable in the

construction industry as they will depict the factors that are associated with health and safety hazards on site, this will assist stakeholders in the building industry in designing preventive measures that address the health and safety of workers hereby improving work performance.

The findings will further contribute to the pool of knowledge available in libraries which is vital for the present and future scholars in regard to workplace health and safety.

1.7 Study Justification

In Kenya, the construction sector plays a major role in the country's economic development through its contribution to gross domestic product (GDP), gross domestic capital formation (GDCF), creation of employment and production of capital facilities and assets required for production in other sectors (UNCHS, 1996). Despite its importance, construction industry is considered as being risky with frequent and high accidents rate and ill health problems to workers, practitioners and end user. In the developing world, the risks associated with construction work are much greater. In comparison with developed countries, construction sites in developing countries are ten times more dangerous. When construction industry is compared with other labour intensive industries, construction industry has experienced a disproportionally high rate of disability injuries and fatalities (Hinze, 1997).

1.8 Scope and Limitations of the Study

The scope of this study was limited to National Construction Authority registered sites in Nairobi County. Ethical clearance by NCA could only be obtained for registered sites. Construction sites were selected randomly. Only a sample of workers were interviewed

at each site. There could be limitation of access to sites by contractors and recall bias among the workers. If sites were inaccessible, they were replaced randomly.

1.9 Assumptions of the Study

The contractors and the workers will cooperate and provide honest information. However research instruments included an observation check list and desk reviews of reported cases to corroborate the responses.

CHAPTER TWO:

LITERATURE REVIEW

2.1 Introduction

Construction health and safety risks are a grave concern for both practitioners and researchers all over the world.

This chapter presents a review of related theories and related literature to the study. Literature review refers to the account of what has been published on a topic by accredited scholars and researchers (Mugenda & Mugenda, 2003). Borg and Gall (1993) contend that literature review is a comprehensive survey of existing research and theoretical informational about the proposed research area. It is an evaluative report of recorded information on the selected area. The purpose of the review is to identify knowledge gaps, methodological weaknesses, to develop a theoretical base and refine the research problem.

2.2 Importance of Health and Safety on Construction Sites

Assessment of occupational hazards as well as assurance of occupational safety at a construction site is an extremely important question to be analyzed. It has been estimated that every third occupational fatality or injury occurs at a construction site. Also, in comparison to other areas of economic activities, many more violations of regulatory enactments on health and safety are registered in the construction sector (ILO 2006).

Scientific and legal literature largely focuses on solutions to different issues pertaining to health and safety at work. Easter, Hegney and Taylor (2004) emphasize teamwork as the key strategy for accident prevention in construction crews. Holt (2001) analyzed ergonomic aspects of workers executing daily construction tasks. Parker (2006) analyzed the occupational accident patterns and propose the strategies for improving safety. It is emphasized that more investigations should be undertaken to reveal options for improving education and training effectiveness of construction workers in the area of health and safety (Bentley *et al,* 2006).

In general, accidents at construction sites could be qualified as defects of the health and safety management system, which occur due to a number of aspects, including technical, technological, organizational and other types of factors (Dessler, . 2008). Such multiple criteria aspects of risk and safety in construction or reconstruction works have been analyzed by Bechal *et al.* (2012) and Parker. (2006). besides, any unwanted construction event is usually related to health and safety solutions established in technological work cards of the construction technology project

Despite the documented positive gains brought by the construction industry, there are negative attributes which are associated with construction work. Construction work is dangerous, the International Labour Organization (ILO) estimates at least 60,000 fatal accidents a year on construction sites around the world that is one in six of all fatal work related accidents. The global trade union federation puts the figure much higher at 108,000 with construction responsible for 30% of all work related accidents. In Britain for example a study report 2010/11 by Health and Safety Executive (HSE) states, the construction industry accounts for 27% of fatal injuries to employees and 9% of reported major injuries.

The International Labour Organization (ILO) in an effort to improve and maintain safe working environment at work places has held general conferences through the years since 1937 deciding and adopting conventions and recommendations geared towards health and safety in construction works. One such is convention C167 cited as the Safety and Health in Construction Convention, 1988 which revised and adopted the Safety Provisions (Building) Convention of 1937.This Convention carries provisions which apply to all construction activities. Accordingly, each Member Country which ratifies this convention undertakes that it will, on the basis of an assessment of the safety and health hazards involved, adopt and maintain in force laws or regulations which ensure the application of the provisions of the Convention through technical standards or codes of practice, or by other appropriate methods consistent with national conditions and practice. (Safety and Health Convention in Construction, 1988)

Articles 8 and 10 of the convention require that the principal contractor, or other person or body with actual control over or primary responsibility for overall construction site activities shall be responsible for coordinating the prescribed safety and health measures and, in so far as is compatible with national laws and regulations, for ensuring compliance with such measures. Further, the national laws or regulations shall provide that workers shall have the right and the duty at any work place to participate in ensuring safe working conditions to the extent of their control over the equipment and methods of work and to express views on the working procedures adopted as they may affect safety and health and comply with the prescribed safety and health measures. (Safety and Health Convention in Construction, 1988)

Generally, the convention outlines the preventive and protective measures to the effect that appropriate precautions shall be taken to ensure that all workplaces are safe and without risk of injury to the safety and health of workers. Emphasis is also made in so

far as information and training is concerned to the effect that workers shall be adequately and suitably informed of potential safety and health hazards to which they may be exposed at their work place and instructed and trained in the measures available for the prevention and control of, and protection against, those hazards. Reporting of accidents and diseases is important, hence national laws or regulations shall provide for the reporting to the competent authority within a prescribed time of occupational accidents and diseases. On implementation the convention directs that each member shall take all necessary measures, including the provision of appropriate penalties and corrective measures, to ensure the effective enforcement of the provisions of the Convention and provide appropriate inspection services to supervise the application of the measures to be taken in pursuance of the Convention and provide these with the resources necessary for the accomplishment of their task, or satisfy itself that appropriate inspection is carried out. (Safety and Health Convention in Construction, 1988).

2.3 Global Situation of Health and Safety Hazards on Construction Sites

Construction health and safety risks are always a grave concern for both practitioners and researchers all over the world. Thus, construction has been regarded as the most hazardous place in which to work with a high level of health and safety risks (ILO, 2005, Lingard and Rawlinson, 2005; Smallwood *et al,* 2008). ILO estimates that at least 60,000 fatal accidents happen in a year on construction sites around the world. In the same vein, occupational health and safety statistics presented by different researchers (Lingard & Rawlinson, 2005, Smallwood et al, 2008, Hinze, 2008), revealed that, the injury and fatality rate in construction projects is very high in comparison with other sectors of industry in the majority of countries. Moreover, it has been acknowledged that 25–40% of fatalities in the world in occupational settings are contributed by

construction (ILO, 2005). Based on fatality statistics, different countries show that the construction industry produces 30% of fatal industrial accidents across the European Union (EU), yet it employs only 10% of the working population. In the United States of America (USA) the sector accounts for 20% of fatal accidents and only 5% of employment, and in Japan construction fatalities account for 30-40% of industrial fatal accidents (ILO, 2005). In the developing world, the risks associated with construction work are much greater. Available data would suggest they are 3–6 times greater (Jason, 2008). In comparison with developed countries, construction sites in developing countries are ten times different approach to solve it. Improving health and safety in the construction industry therefore continues to remain a priority.

2.4 Construction Rules and Regulations in Kenya

Health and safety standards on construction sites are set by the International Labour Organization (ILO) and are based on international conventions and recommendations on occupational health and safety (ILO, 2002). In Kenya, they are enforced through National Workmen's Legislation (Cap 236), the Occupation Safety and Health Act, 2007, the Factories and Other Places of Work Act 1962.

In Kenya, the National Council for occupational Safety and Health makes rules and regulations for health and safety on construction sites. The National Construction Authority oversees the construction industry and is guided by the National Construction Authority Act of 2011. The County governments provide the building codes and approve construction drawings. Consultants prepare all construction documents. The client appoints the contractor to undertake construction of the buildings according to approved drawings.

2.5 Concept of Health and Safety Measures

According to Balkin, Cardy and Mejia (2007), in managing workplace safety and health, the most recent data from bureau of statistics indicate that in 2003, more than 4.3 million people were injured on the job and 5559 were killed. Currently, the national average per 100 workers is 2.6 workplace injuries or illnesses that are serious enough to result in loss workdays. The cost of occupational accidents was estimated to total and 49.6 million in 2002. All level of government has passed numerous laws to regulate workplace safety. Many of these laws include detailed regulations dealing with work hazards in specific industries such as coal mining and railroads.

However, two basic sets of workplace safety laws affect most workers the various workers compensation laws at the state level and the occupational safety and health Act (OSHA) of 1970 at the federal level. The objectives, policies and operations of these two sets of laws are very different. OSHA is a federal law designed to make workplace safer by ensuring that the work environment is free from hazards (Price, 2004)

According to Murie (2007), health is an employee's freedom from physical or emotional illness. The provision of any health program will vary according to the location and size of the organization, the kind of work performed, and whether employees include women as well as their proportion in various age brackets. An ideal health program would include the following features. stated health and medical policy adequate health facilities according to size and nature of the organization; these may include first aid and an emergency dispensary; a registered nurse and a doctor or part time services of a doctor; medical consulting services periodic examination of employees exposed to health hazards in and out patient schemes; medical insurance covers for immediate defendants (Reese, 2003)

Safety is the protection of employees from injuries due to work related accidents. These accidents are unplanned and uncontrolled events which can result in damage both human being and property. Since organizations provide the work and the physical plant, office, or establishment, it should be committed to doing everything either reason to protect employees from risks associated with spending their working days in those premises (Armstrong, 2010).

Each, employer must become familiar with and comply with specific occupations standards. (OSHA‟S rules deal with specific occupations rather than with industries); and must make certain than employees comply as well and to keep records of occupational injuries and illness (DeClercq, 2004). Under OSHA, employers must keep records of any occupational injury and illness resulting in death, lost work time, or medical treatment and retain these injuries and illness must be recorded on OSHA forms and posted annually on an employee bulletin board for all to see. These records must also be made available to OSHA compliance officers, and annual summarizes must be prepared (Moore, 2001).

According to Dessler (2008), OSHA primary responsibility for enforcing OSHA rules and regulations to develop occupational standards, grants variances to employers, and conducts workplace inspections and issues citations and penalties. Example of development of standards is OSHA'S proposed National ergonomics standards. The national institute for occupational safety and health reported in 1997 that musculoskeletal disorders related to the neck shoulders, elbow, hand, whist and back generated at least and 13 million a year in workers, compensation costs. Further, the Bureau of labour statistics reported that the incidence rate for cumulative trauma disorders per 10000 fulltime workers jumped from 6.3 in 1985, to 335 in 1996.based on

these and other findings, OSHA began looking seriously at developing ergonomics standards (Easter *et al*, 2004).

For all areas of human activity, a balance has to be made between benefits and costs of risk taking. In the case of OSHA, this complex balance is influenced by many factors such as rapid scientific and technological progress, a very diverse and continuously changing world of work, and economics. The fact that the application of the OSHA principles implies the mobilization of all social and scientific disciplines is a clear measure of the complexity of this field. The concepts of hazard and risk and their relationship can easily lead to confusion (Walters, 2009).

According to International Labour Organization (2011), a hazard is the intrinsic property or potential of a product, process or situation to cause harm, adverse health effects on someone or damage to something. It can come from a chemical (intrinsic properties), working on a ladder (situation), electricity, a compressed gas cylinder (potential energy), a fire source or more simply a slippery floor. Risk is the likelihood or probability that a person will be harmed or experience adverse health effects if exposed to a hazard or that property will be damaged or lost. The relationship between hazard and risk exposure, whether immediate or long term needs to be ascertained.

2.6 Strengths and Limitations of Occupational Safety and Health Management Systems (OSHMS)

It is now recognized that the management systems approach brings a number of important advantages to the implementation of OSH, some of which have been already identified further above. The systems approach also adjusts the overall safety and health

program over time so that decisions on hazards control and risk reduction improve progressively. (International Labour Organization (ILO, 2011).

Other key advantages are: the possibility of integrating OSH requirements into business systems and aligning OSH objectives with business objectives, thus resulting in a better taking into account of implementations costs related to control equipment's and processes, skills, training and information; harmonizing OSH requirements with other related requirements, particularly those pertaining to quality and environment , providing a logical framework upon which to establish and run an OSH programme that tracks all the elements requiring action and monitoring; streamlining and improving communication mechanisms, policies, procedures, programmes, and objectives according to a set of rules applied universally; Applicability to differences in cultural and national regulatory systems; establishing an environment conducive to the building of a preventative safety and health culture; strengthening social dialogue; distributing OSH responsibilities along the line management, involving all: managers, employees and workers have defined responsibilities for an effective implementation of the system; adapting to the size and activity of the organization, and to the types of hazards encountered establishing a continuous improvement framework; and, providing an auditable baseline for performance evaluation (Wright, 2008).

According to International Labour Organization (ILO), (2011), while the potential of OSHMS for improving safety and health is undeniable, there are many pitfalls which, if not avoided, can very rapidly lead the exercise toward failure. The usefulness of OSHMS has been questioned in several studies on the subject, and a number of potentially serious problems have been underlined, such as: the production of documents and records needs to be controlled carefully to avoid defeating the purpose of the system by drowning it in excessive paperwork. The focus on the human factor can be easily lost

if the emphasis is more on the paperwork requirements of a formal OSHMS than people (Reese, 2003).

Imbalances between management processes (quality, OSH, environment) must be avoided to prevent dilution of requirements and inequalities in focus. The lack of careful planning and full communication prior to the introduction of an OSHMS programme can raise suspicions about and resistance to the change. OSHMS usually puts greater emphasis on safety rather than health and with the risk of missing the onset of occupational diseases. Occupational health surveillance of workers must be incorporated in the system as an important and effective tool for monitoring the health of workers over the long term (Walters, 2003). Occupational health services, such as defined in the ILO Occupational Health Services Convention, 1985 (No. 161) and its accompanying Recommendation (No. 171) should be an integral part of OSHMS (International Labour Organization (ILO, 2011).

2.7 Theories of Health and Safety at the Workplace

2.7.1 System Thinking

A system is considered to be a complex whole in which the components continually affect each other over time and operate toward a common purpose (Cascio, 2006). These elements can be best understood in the context of their interactions and also their relationship with other systems rather than in isolation (Mombeki, 2006). Systems thinking recognize the multiple, mutual and recursive causation that exists in a complex, dynamic system thereby acknowledging that a change in one area of the system can have a drastic influence on other parts of the system. Stephenson (1991) defines a construction system as the composite of people, procedures, plant and hardware working within a given environment to perform a given task. Following this line of thinking,

construction sites are complex system involving multiple and mutual components. Thus construction sites have multiple participants such as clients, design teams and contractors, who have different roles from conceiving to commissioning a typical construction project. Construction are guided and regulated by different regulatory boards, professional societies, policies and regulations in both the designing and construction process. Stephenson (1991) states that the foundation on which safety management systems are based is that all project participants (clients, designers, subcontractors, contractors) be included in considering safety systematically, stage-by-stage from the outset of the project.

2.7.2 Understanding Risk

Systems theory understands risk as a fundamental social construct that is closely linked to the particular rationalities of societal subsystems. The setup of construction projects in construction sites is based on the hierarchical nature of the system where there are levels and sublevels that influence one another. A construction site is a system that is the part of a larger system such as the building industry in which the process of risk management is undertaken. The building industry is part of the wider system that operates and is influenced by the nature of the specific country, such as the political and market context and its regulations. Risk assessment and communication will follow the same trend in relation to the market and political context, and regulations (Mombeki, 2006).

2.7.3 Nature of the Client

Similarly, construction sites operate and are influenced by the nature of the client, the client's brief, the design process and procurement system, which also influence risk assessment and communication. On the other hand, the nature of the construction firm and its management system also influence the construction process, while at the same

time influencing risk assessment and communication. Meanwhile individuals on the site, such as site managers, foremen and workers, as well as the work environment, influence the process of risk assessment and communication. From the systems perspective, individuals within a system do not make decisions or take action solely on their own as their decisions are motivated and driven by other factors within the system at other levels. Thus, individuals on the construction site will make decisions depending on the political system and regulations in the county, the nature of the client, the nature of project and the way project has been designed, the design team, the management culture of the firm and the work environment itself (Mombeki,2006).

2.8 Risk Theories

Generally risk assessment, communication and control has been conceptualized under three broad approaches each contributing different but overlapping perspectives on the assessment, communication and control of risk namely, the technical/engineering, psychological and social-cultural approaches.

2.8.1 Psychological Risk Approach

The Psychological approach to risk examines individual cognitive perceptions of risk to explain risk judgments. Thus the approach focuses on the individual perspective, investigating perceptions, attitudes, behavior and underlying beliefs and values that are incorporated in an individual's assessment of risk (Perry, 2003). Psychometrics studies have found differences between expertise and risk judgments and they point to a concept of risk that is multidimensional and considerably more complex than the statistical or actuarial concept of the technical analyst (Occupational Safety and Health Administration, 2002). The main argument in this approach is that the way risks are assessed, judged and communicated depends greatly on how an individual involved in

the process perceives risk. Consequently, perception of risk is the central focus of risk assessment and communication. When an individual does an estimate of probabilities, it is the experience and heuristics of that person that are used. The way a person perceives the world is also the way the same person makes judgment, evaluates information and make decision. According to Holt (2001), the perception of assessing and controlling risk is a determining factor in these judgments. The authors argue that the processes of risk judgment are initiated by a qualitative decision as to whether the risk is controllable by human intervention.

2.8.2 Risk Judgment

Risk perception studies utilizing risk rating methods have identified qualities of risk that influence risk judgments and decisions (Occupational Safety and Health Administration, 2002). These include knowledge about the risk-the extent to which the risk is known and personal control of the risk-the degree to which personal qualities and skills can be used to protect the individual. The quality of personal control of risk has emerged as an important dimension in risk-rating studies of lay judgments on technological and environmental risks. However, the main critics of the psychological approach to risk have failed to address broader social contexts of risk judgments and argued that social contexts influence the perception of risk (Ridley, 1986). The concept of risk perception is applied in this research to show how individuals on the construction sites perceive different health and safety risks there. Construction sites are inherently exposed to a lot of health and safety hazards and their assessment and communication will depend on how individuals perceive those risks.

2.8.3 Socio-Cultural Risk Approaches

The socio- cultural approach explores how meanings of risk are constructed within social groups and how a person understands and perceptions of risk are shaped by social

factors and experiences. The main argument of this approach is that risk assessment, judgment and communication are not formed independently from the social context. They are part of an evolving social debate about feelings, knowledge, power relations, past experiences, and the culture of the society (Ridley, 2004). The social theory of risk has been adopted in this approach and both individualism and conceptualism play an important role. Based on the social perspective, the individualism paradigm has been based on the knowledge and personality perspectives. Thus people respond to risk on the basis of the knowledge, information they have and the individual traits (Smallwood, 2008). In line with this argument, the experience and knowledge of construction project participants are vital for assessing the level of risk. Therefore, the opinions of experts with many years' experience in construction projects serve as the major input for risk analysis when historical data is insufficient or unavailable. On the other hand the contextualism paradigm is based on the social structure, institutional form and cultural elements. The main argument of this view is that social institutions and 16 organizations have an important influence on how risks are produced and perceived (Easter & Taylor, 2004).

Based on the organizational perspective, it has been argued that all organizations operate with a variety of beliefs and norms with respect to hazards and their management, which might be formally laid down in rules and procedures, or more tacitly taken for granted and embedded within the culture of everyday working practices (Steve, 2006). Some studies on health and safety management have shown that the relationship between employers and employees is unequal because employers have more power to control the conditions of work, including hiring and firing, than employees (Lingard & Rawlinson, 2005). For instance, in the legal context, occupational health and safety laws in many countries place the primary responsibility for health and safety on employers whose degree of willing compliance with occupational health and safety law may vary

according to their conception of risk relation to health and safety. Heinrich (1931), for example, argues that an employer may find it more cost effective to leave health and safety risks uncontrolled than to pay accident related costs, for example, the loss of skilled personnel and workers' compensation premiums. Whilst employers may find benefits in hazardous workplaces, employees experience these as risks to health and safety. On the other hand, Bentley, (2006) argue that, a key factor in risk assessment and communication is the extent to which the manager and/or communicator is known and trusted by the targeted stakeholders.

2.9 Theories and Models on Causes of Accidents and Injuries on Construction Sites

An accident can be defined as an unplanned, undesirable, unexpected, and uncontrolled event. An accident does not necessarily result in an injury. It can be in term of damage to equipment and materials and especially those that result in injuries receive the greatest attention (Hinze, 1997). All accidents, regardless of the nature of the damage or loss, should be of concern. Accidents that do not cause damage to materials or equipment or injury to personnel but may foretell future accidents with less desirable results.

2.9.1 Accident Causation Models

The objective of this model is to provide tools for better industrial accident prevention program (Abdel Hamid & Everett, 2000). As described by Heinrich (2000) accident prevention is an integral program, a series of coordinate activities, directed to the control of unsafe personal performance and unsafe mechanical conditions, and based on certain knowledge, attitudes, and abilities. The famous models that were developed that relate

to accident causation are namely domino theory that was invented by (Heinrich 2003) and multiple causation theory that was developed by Petersen in 2001.

2.9.2 Domino Theory

Accident causation model was pioneered by Heinrich in 1930, which discussed accident causation theory, the interaction between man and machine, the acts, the management role in accident prevention, the costs of accident, and the effect of safety on efficiency Heinrich developed the domino theory (model) of causation that consist of five dominoes namely ancestry and social environment, fault of a person, unsafe acts and condition, accident, and injury. This five dominoes model suggested that through inherited or acquired undesirable traits, people may commit unsafe acts or cause the existence of mechanical or physical hazards that result in injury (Abdelhamid & Everett, 2000).

This theory has pointed two main things; first, people are the fundamental reason of caused accident. Most of the accident occurs are caused by wrong doer of the worker. Secondly, the management should be responsible for the accident prevention. The management should provide workers with safety facilities to prevent the workers from hazardous environment.

Heinrich's domino sequence was a classic in safety and health thinking and teaching for over 30 years in many countries around the world. However, in the late 1960s the domino sequence was updated by Bird to reflect the direct management relationship involved with the causes and effects of all incidents and accidents, which could downgrade a business operation (Heinrich et al, 1980). Theory put forward by Bird has the same concept of illustrated dominoes as Heinrich's but the five elements were different. Bird's updated domino elements are lack of control management, basic

cause's origins, immediate cause's symptoms, incidents contact, and people property loss. Bird's approach has emphasized more on the management role to prevent losses.

In addition to that, Armstrong (2009) had also put forward the updated version of the domino theory. Adam had the same view as of Bird's but emphasized more on the organizational structure of the management. The objective of an organization, how certain works were being planned and executed would certainly have an impact on accident prevention (Heinrich et al, 1980).Weaver had put forward the same concepts of elements or factors as of Henrich's. However, he stressed on the important to recognize the root of unsafe acts or conditions which eventually emphasized on bigger management roles in preventing accidents (Heinrich *et al.* 1980).

2.9.3 Multiple Causation Theory

This theory was presented by Petersen in 1971 that has totally different concept with the domino theory that influenced many researchers during Heinrich time. This theory was inspired by his belief that many contributing factors, causes, and sub-causes are the main culprits in an accident scenario. Under this concept, the factors combine together in random fashion, causing accidents. By using multiple causation models, the surrounding factors to the accident would be revealed (Abdelhamid & Everett, 2000). The set questions will be used to identify the root causes of the accident. For example for stepladder accident, the question would be "why the defective ladder was not found in normal inspection, why the supervisor allowed its use, whether the injured person knew that he should not use the ladder, and so on". The questions asked is not pointed only to the injured person, but also to the management, supervisor, and other person or department that relate to the accident. The answer of these questions could be used to identify the root cause of the accident, and also can be used as an improvement tools for inspections, supervisions, training, better definition of responsibilities, and pre-job

planning by supervisors. Multiple causation model also pointed out that the root causes of accident normally relate to the management system such as management policy, procedure, supervision, effectiveness, training, etc. (Abdelhamid & Everett, 2000).

2.9.4 Human Error Theories

According to this theory the worker is the main factor of the accident. This theory (Abdelhamid, 2000) studies the tendency of humans to make error under various conditions and situations, with the blame mostly fall on human (unsafe) characteristics only. But this theory does not blame the workers as the main cause of accident, other factors such as design of workplace and tasks that do not consider worker (human) limitation also take part as the reason why accident happened (Abdelhamid & Everett, 2000). In general, the overall objective of human error theory is to create a better design workplace, tasks, and tools that suitable with human limitation.

There are some theories that are related to the human error theory such as behavior model, human factor model, and Ferrell theory. Most of these theories address the human (worker) as the main problem that makes an accident happen such as permanent characteristic of human, the combination of extreme environment and overload of human capability and conditions that make human tends to make mistake (Abdelhamid & Everett, 2000).

2.10 Causes of Accidents and Injuries on Construction Sites

Accidents are viewed as originating from a technical or human error (Chi *et al*, 2005; Murie 2007). The multiple accidents causation theory postulates that there are many contributory causes leading to an accident (Heinrich 1931). The causes are categorized into behavioral and environmental factors. Behavioral factors include attitudes, skills

and knowledge. Environmental factors include Worksite hazards and procedures that contribute to injuries (Taylor et al., 2004). A similar view is held by Lubega, Kiggundu and Tindiwensi (2001), who found that the causes of construction accidents in Uganda include a lack of knowledge about safety rules, engaging an inexperienced workforce, and lack of respect for safety.

Tam, Zen, and Deng (2004) concurs with this view and suggests that the main factors affecting safety in China were managers' poor safety awareness, lack of training, reluctance to commit resources to safety, and reckless operations. Furthermore, Dessler (2008) conducted a study in the Lithuanian Republic and identified that the major reasons for serious and mortal accidents are inexperienced employees, lack of qualifications and understanding risk on a construction site.

Raymond, Revitt, and Samelson (1997) carried out a survey in Malaysia to identify the causes of accidents on construction sites; they found that unsafe methods, including incorrect procedures, knowledge level, and disobeying procedures are the most frequent reasons for accidents on construction sites.

In addition to these causes, Holt (2001) argued that, secondary causes of accidents centered on management pressures, such as financial restrictions, lack of commitment, inadequate policy and standards, deficient knowledge and information, restricted training and task selection, and poor quality control systems. He further emphasized that incomplete structural connections, temporary facilities, tight work areas, varying work surface conditions, continuously changing work-sites, multiple operations and crews working in close proximity are common causes of construction-related deaths and injuries.

To conceptualize the literature (above) on sources of accidents and ill-health problems on construction sites, it is observed that the causes of construction accidents can generally be classified into the five most influential factors namely, site conditions, equipment and materials, human, management and job factors (building/task itself).

The five main sources of accidents on construction sites include site conditions such as the nature and physical layout of the work, location and weather, equipment and materials specification such as paint and asbestos that have the potential to cause ill-health problems. The human factors include human behavior, competence, attitude and management such as leadership and safety culture of the organization. The job factors include the nature of the task, design, detail, duration and the size of the structure itself. Kartam and Bouz (2008) did a study in Kuwaiti construction and noted that the causes of accidents were due to worker turnover and false acts; inadequate safety performance; improper cleaning and unusable materials; destiny; low tool maintenance; supervisory fault; and misplacing objects. Abdelhamid and Everett (2000) conducted a more comprehensive study in the USA and classified the causes into human and physical factors. Human factors were due failed to secure and warn; Failed to wear personal protective equipment (PPE); horseplay; operating equipment without authority; operating at unsafe speed; personal factor; remove safety device; serviced moving and energized equipment; took unsafe position or posture; used defective tool or equipment; and other unsafe action. While, physical factors were due to; unsafe act of another person(s); disregard known prescribed procedures; defects of accident source; dress or apparel hazard; environmental hazard; fire hazard; hazardous arrangement; hazardous method; housekeeping hazard; improper assignment of personnel; inadequately guarded; public hazard; and other unsafe conditions.

Lubega *et al.* (2000) in a study in Uganda and concluded the causes of accidents were mainly due to lack of awareness of safety regulations; lack of enforcement of safety regulations; poor regard for safety by people involved in construction projects; engaging incompetent personnel; non-vibrant professionalism; mechanical failure of construction machinery/equipment; physical and emotional stress; and chemical impairment.

Kartam and Koushki (2000) in a study in Thailand construction sites and classified the causes into the most influential factors i.e. unique nature of the industry; job site conditions; unsafe equipment; unsafe methods; human elements; and management factors. They further concluded that major immediate causes were due to failure to use personal protective equipment; improper loading or placement of equipment or supplies; failure to warn co-workers or to secure equipment; and improper use of equipment.

Toole (2002) in a study in the USA and suggested that the causes of accidents were due to lack of proper training; deficient enforcement of safety; safety equipment not provided; unsafe methods or sequencing; unsafe site conditions; not using provided safety equipment; poor attitude toward safety; and isolated and sudden deviation from prescribed behavior. Tam et al (2004) did a study in China and noticed that the causes of accidents were due poor safety awareness from top leaders; lack of training; poor safety awareness of project managers; reluctance to input resources for safety; reckless operation; lack of certified skill labor; poor equipment; lack of first aid measures; lack of rigorous enforcement of safety regulation; lack of organizational commitment; low education level of workers; poor safety conscientiousness of workers; lack of personal protective equipment (PPE); ineffective operation of safety regulation; lack of technical guidance; lack of strict operational procedures; lack of experienced project managers; shortfall of safety regulations; lack of protection in material transportation; lack of protection in material storage; lack of teamwork spirits; excessive overtime work for

labor; shortage of safety management manual; lack of innovative technology; and poor information flow.

2.11 Hazards

Various researchers have divided health and safety hazards into two categories, namely the physical injury hazards and the Ill-health hazards (Grice, 2004). Hazard of physical injury include death consequences. Hazard of ill-health can only be notified after a long period and shall cause sickness or death after a certain period of time (Grice, 2004). The following are common hazards on construction sites.

2.11.1 Height

The main hazards associated with working at height are people and objects falling onto people below. Falls from height have been viewed as the one of the most frequent killers of the workers on construction sites. Statistics indicate that nearly 1,000 construction workers are killed each year at their work places. Of these, one-third or over 300 deaths are a result of construction site falls (ILO, 2005). The study from different countries for example, New Zealand, indicates that, falls from heights are the leading cause of occupational injuries on construction sites (Bentley et al., 2006). In China's construction industry, falls account for approximately 51% of injuries (Yung, 2009). In Hong Kong, work-related falls from heights represented more than 47% of all fatal incidents (Chan *et al.*, 2008).

Chi and Wu (1997) reported that more than 30% of fatalities in Taiwan can be attributed to falls. As a result, falls are the most costly occupational hazard in many countries. Common construction site falls include roof-related falls, crane falls, scaffolding falls, elevator shaft falls, falls resulting from holes in flooring, and falling objects. These may

occur as a result of inadequate edge protection, or from objects in storage being poorly secured. Workers at risk of falling from a height include painters, masons, decorators and window cleaners and those who undertake one-off jobs without proper training, planning or equipment.

2.11.2 Slips and Trips

Slips and trips are seen as the most common workplace hazards and contribute to over a third of all major injuries (Hughes & Ferret, 2011). Over 10,000 workers suffered serious injury because of a slip or trip last year. They occur in almost all workplaces and 95 % of major slips result in broken bones (HSE, 2004). According to statistics from the Health and Safety

Executive (HSE), slips and trips are the single most common cause of injuries at work, and account for over a third of all major work injuries (HSE, 1998). They cost employers over Ksh.51, 200M a year in lost production and other costs and account for over half of all reported injuries to members of the public.

The study done by Tindiwensi et al (2000) on the USA revealed that slips account for 18% of all injuries and 25% of workers' compensation payments. Slips contributed to 85% of falls on the same level and over 30% of falls from height as well as a significant number of musculoskeletal injuries sustained after slipping (Ibid). They can also be the initial cause of a range of other types of accidents, such as falls from heights. Slips and trips are caused when materials are scattered everywhere haphazardly, the floor is wet or greasy, inappropriate footwear is worn, mainly by casual employees and visitors, something large or heavy is being carried, reducing one's balance, and when the lighting is poor.

2.11.3 Equipment, Machinery, Tools and Transport

Vehicles are necessary for transporting goods and people. However, many people die and are injured due to being struck and crushed by equipment and machinery at construction sites, especially by reversing machinery, site machinery falling in the excavation area, machines overturning due to travelling down a steep slope, and material falling from construction equipment especially haulage trucks, hitting people behind it or nearby (HSE, 2004). Crush injuries can have a wide range of serious effects, including fractures, internal injuries, head and brain injuries, and back injuries. In some cases, a crush injury may result in amputation and permanent disability of the affected worker.

Meanwhile, many people are injured due to being chopped and cuts by equipment and hand – held working tools such as chisels, screwdrivers, knives, saws, harmers, nails and drilling machines. The greatest hazards posed by hand tools results from misused and improper maintenance.

2.11.4 Electricity

Electricity is widely used on construction sites but has the potential to be very hazardous with possible fatal results. Someone coming into contact with a live electrical conductor will get a shock that may lead to injuries or even death. In the UK, for example, 2% of all fatalities at work are caused by electric shocks (Hughes & Ferrett, 2011). Most injuries and deaths from electricity are due to, using poorly maintained electrical equipment, working near overhead high tension lines or domestic electricity supplies, contact with underground power cables during excavation work and working without appropriate safety gear.

2.11.5 Fire

Fire is one of the many hazards that construction workers could face on site. Although fire hazards are not seen as such as a high risk compared with falling from a height and slipping, tripping and falling, fire hazards need to be considered at all stages of the building process (HSE, 2000). Every year on many construction sites, workers are killed or injured as a result of fire. There are about 400 construction fires annually in United Kingdom (UK) and about 100 of them cause over £50,000 worth of damage and can result in the incomplete dislocation of the project schedule **(**Hughes & Ferret, 2011). Fires on site are caused by braising work carried out by plumbers, gas lines for underground work, power lines, power leads and tools, machinery requiring petrol and diesel, and hazardous chemicals.

2.11.6 Manual Handling

Manual handling is defined as the movement of a load by human effort alone (Hughes & Ferret, 2011). It can include any activity requiring the use of force exerted by a person to lift, push, pull, carry or otherwise move or restrain any moving or stationary object (HSE, 1998).

It has been argued that lifting bricks, cement blocks and cement bags weighing 50 kilos has been regarded as risky activities on construction sites (Hughes & Ferret, 2011). Back injuries and emasculatory disorders, sciatica, hernias and slipped discs are often the most serious of construction site injuries (Ibid). In the study by Smallwood (2008) it was revealed that in construction, 25% of injuries are back injuries. Almost 30% of all construction workers complain of back pain that requires over thirty days off. The average number of days of work missed by a construction worker is higher than in other fields of employment.

2.11.7. Noise

Occupational noise-induced hearing loss is defined as hearing impairment arising from exposure to excessive noise at work, which is also commonly known as industrial deafness the NOHSC National Code of Practice (2004). Exposure to hazardous noise levels is so widespread as to be routine, and occupational deafness is very common among building workers. Some activities on construction sites are notoriously noisy, for example, rock breaking during demolition work or the operation of a jack hammer. The use of vibrating wacker plates, electric tools, explosive powered nail guns and vibrators during concrete pours; all cause specific noise problems for the operators and workers in the vicinity in relation to maintaining their hearing ability. Noise comes from the operation of plant, machinery and power tools, the movement of vehicles and deliveries of materials (HSE, 1998).

2.11.8 Chemical Substances

Construction activities involve using chemicals which pose health and safety risks to workers. For example solvents of many different kinds are used in paints, varnishes, pesticides used to treat timber, bonding agents, lacquers and adhesives (HSE, 1998). At the construction site, workers might be exposed to chemicals by breathing them in, ingestion and absorption through the eyes or skin (Murie, 2007). Chemicals at work sites can cause headaches, eye irritation, dizziness, faintness, sleepiness and affect judgment and coordination. They can damage to the central nervous system and can harm the skin, liver, kidneys and cardiovascular system. Some solvents increase the likelihood of cancer (Hughes & Ferrett, 2011). Solvents can also cause reproductive problems. They can reduce fertility and cause birth defects and miscarriages (Murie, 2007). Some paints and varnishes, bonding agents and resins, can cause asthma and dermatitis. Welding fumes – which may include a cocktail of metal fumes, can cause

serious health problems in the long term. The respiratory system is affected and, as chemicals are absorbed, they can slowly affect the brain and internal organs (Hughes & Ferrett, 2011).

2.11.9 Dust

Dust is a common hazard on roads and building works at many sites. The health risks associated with a dusty jobs depend on the type of dust (physical, chemical and mineralogical), which will determine its toxicological properties, and hence the resulting health effect; and the exposure, which determines the dose. If dust is released into the atmosphere, there is a good chance that someone will be exposed to it and inhale it. If the dust is harmful, there is a chance that someone will suffer an adverse health effect, which may range from some minor impairment to irreversible disease and even life-threatening conditions (Hughes & Ferrett, 2011). There are higher death rates from respiratory disease and from lung and stomach cancers in dusty trades. At construction sites cement, silica and wood dust and dust from medium-density fibre board poses particular risks.

2.11.10 Aggression, Violence and Bullying

Aggression and violence occurs when people are verbally abused, threatened or assaulted in circumstances relating to their work. At construction sites aggression and violence are manifested through the use of foul language and physical attacks (HSE, 1998). Where there is aggression and violence, human dignity is debased. Violence and aggression may come from superiors or workmates. Bullying occurs when workers feel that they are being singled out for unfair treatment by a boss or colleague. For example, a worker is constantly criticized instead of being instructed, being demoted and being

shouted at by workmates or superiors. Aggression, violence and bullying can contribute to other risks such as stress (Hughes & Ferrett, 2011).

2.12 Impact of Injuries on Construction Sites

An immediate impact of workplace injury and work-related illness (aside from the human suffering) is the impact on business in terms of lost working time due to sickness absence. In 2014/15 an estimated 1.7 million working days (full-day equivalent) were lost in the construction sector due to workplace injury (0.5 million) and work-related illness (1.2 million). That is the equivalent of 0.8 working days lost per worker, broadly similar to the average days lost per worker across all industries (0.9 days). Assuming a full-time working year equates to 225 working days, this is equivalent to around 7,000 full-time workers being absent from the workforce for the whole year in the Construction sector in 2014/15

Workplace injury and ill health impose costs: both financial (for example in terms of lost output and healthcare costs) and non-financial (the monetary valuation of the human cost of injury and illness in terms of loss of quality of life, and for fatalities, loss of life). Taken together, this gives the total economic cost to society. The total economic cost of workplace injury and new cases of work-related illness in Construction in 2013/14 is estimated to be £0.9billion (£0.5 billion injury, £0.4billion illness), accounting for around 7% of the total cost across all industries - £14.3billion). In the Construction sector, injury accounts for a larger share of the total cost as compared to all industries (over half of the total cost in Construction is from injuries, compared to around a third across all industries). This cost is shared between individuals (e.g. the monetary valuation of the human costs), employers (sick pay costs) and government/taxpayers (healthcare costs).**2.13 Management of Health and Safety on Construction Sites**

2.13.1 Training

According to Grice (2004), OSHA‟S extensive website provides an enormous amount of practical, easy to read and understand information for employees and employers. Regulations are clearly defined and compliance and inspection procedures are explained in simple terms. Education and training are a major emphasizes of the OSHA website and include handbooks for small business, email newsletters training program information and interactive online training called “e tools” that covers dozens of occupational safety and health tops. According to Armstrong (2010), managers have a vital role in helping their people to learn and develop. Most learning takes place on the job but it will be more effective if managers provide the coaching, guidance and support peoples‟ needs. To do this they need to know about induction training how to ensure continuous learning, and personal development planning processes. In induction training you are involved in helping people to learn every time you welcome new employees, plan how they are going to acquire the knowhow required, preferably as recorded in a learning specification, provides for them to carry out and see that the plan is implemented.

According to Perry (2003), people should never be allowed to operate machines, appliances and equipment’s until they know how to operate them safely. Safety training is designed to prevent physical harm to both people and organizations property. This would include physical measures such as how to maintain plant, machines, appliances, equipment and buildings. Training and development may also include career development activities and employee counseling to help people make better choices about their careers and to achieve their desired goals (Cascio, 2006).

According to Taylor (2005), safety training has three major purposes; employees should be told about and understand the nature of the hazards at the place of work; employees

need to be aware of the safety rules and procedures; and the need to be persuaded to comply with them. Safety training need to be carried out in three setting; at the induction, on the job and in refresher courses. A variety of training techniques can be employed, including lectures, discussions, films, role playing and slides. These methods are sometimes supplemented by poster or other safety awareness campaigns and communications, and disciplinary action for breaches of the safety rules (Easter, Hegney & Taylor, 2004).

According to Michael (2003), learners should access intensive induction and continuous tailor-made training programs, designed by professional curriculum developers, to new and potential workers in the labour market. It is proposed that the costs for employees and expert training be met from increased budgetary allocations, training levy, World Health Organization (WHO) collaborating centers and International Labour Organization (ILO) centers. Adequate resources should be allocated for staff training and development at the Occupational Health and Safety (OHS) as the most desirable proactive measures to prevent Occupational injuries and associated costs. The costs should be met from all stakeholders (Holt, 2001).

2.13.2 Leadership

According to Armstrong (2009), leadership is the process of inspiring people to do their best to achieve a desired result. It can also be defined as the ability to persuade others willingly to behave differently. The function of team leaders is to achieve the task set for them with the help of the group. According to Nzuve (2007), to a large extent the attitude of the rank and file towards safety is a reflection of the attitude of their supervisors. Line managers should set examples not merely by telling but by demonstrating the seriousness of safety and health measures. Accidents are partly the fault of individuals, partly of technology and partly of the result of such factors as group

attitudes and improper supervision. In light of this, safety must be considered as the responsibility of the whole organization (DeClercq, 2004).

Safety program could succeed through formulation of safety policy that aims at making the place of work safe in all aspects. Such a policy should be in writing and issued as an official statement by top management, safety education for all levels accident analysis and enforcement of safety rules. Dohery and Tyson (2000) argue that managers are not innocent by standers with regard to employee health and wellbeing: their actions such as choice of production processes and substances, work speed –up extra work hours and performance based pay have adverse effects on employees work life balance, and their physical and mental wellbeing. A major challenge to managers is clearly to provide a safe and Health work environment for employees. Economic and moral reasons dictate such a policy, but there is also a persuasive portfolio of legislation, regulations, codes of practice and guidance notes dealing with the occupational Health and Safety, and, as with other employment law, the HR practitioner has taken on the role of advising managers on the content and legal obligations of this (Bratton & Gold, 2009).

Health and Safety policies work better if senior managers set examples and show that they are committed to their upkeep (Ferrett, 2011). The policy will not be enforced if managers set a bad example. To avoid this they should involve staff in the health and safety process, through consultation with unions or workplace committees, ensure that employees are aware of the policies (Kaplan Financial Times, 2009).

According to Hall Taylor and Torrington (2005), the Health and Safety Regulations 1996, require employers to consult collectively with the employees about Health and Safety matters irrespective of whether a trade union is recognized. Consultation is defined as discussing issues with employee representatives, listening to their views and taking into account when decisions are being made which have Health and Safety

implications (Holt, 2001). Management's first duty is to formulate a safety policy. Its second duty is to implement and sustain this policy through a loss control program such a program has four components; a safety budget, safety records, Managements personal concern and management's good example (Cascio, 2006).

2.13.3 Employee Participation

Participative managers consult with their employees, bringing them in on problems and decisions so that they work together as a team. Participation is the mental and emotional involvement of people in-group situations that encourages them to contribute to group goals and share responsibility for them. This definition entails three important ideas; involvement, contribution and responsibility.

According to Dessler (2008), there are two good reasons to get involved in designing the safety Program. First, the employees are often management's best source of ideas about what the potential problems are and how to solve them. Second, employee involvement tends to encourage employees to accept the safety program. According to Balkin, Cardy and Mejia (2007) effective safety programs often include the information of a safety committee and participation by all departments within the company or organization. Employees participate in safety decisions and management carefully considers employees suggestions for improving safety. Companies with comprehensive safety programs are likely to be rewarded with fewer accidents, fewer worker's compensation claims and lawsuits, and lower accidents related costs. Keep in that OSHA considers employee involvement a key feature of a successful safety program Organizations often involve employees by establishing a safety committee (HSC/DETR, 2000).

Top managers can generate commitment to safety and health programs by explaining to supervisors and others the rationale for the relevant safety and health practices. For

example, it is important that everyone understand the costs of accidents to the organization. Further costs (such as fine) for violating safety and health standards should be clearly explained to employees at all levels (Casio, 2006). Once people understand the linkage between safety measures and the business bottom line, résistance to safety programs should largely disappear of course, removing human resistance to any kind of program can be difficult and delicate process that requires time and commitment (Dyck, 2002).

Full workers' participation is strongly promoted in all ILO OSH standards, and particularly in the ILO Convention on Occupational Safety and Health, 1981 (No. 155) and its accompanying, recommendation (No. 164), as well as in the ILO Guidelines on OSHMS. For joint OSH committees and similar arrangements to be effective, it is important that adequate information and training is provided, that effective social dialogue and communication mechanisms are established, and that workers and their representatives are involved in the implementation of OSH measures (International Labour Organization, 2011).

Although participation in OSHMS is usually understood to refer to employers and workers in the organization, participation in the sense of information exchange and communication should also concern out-sourced and external stakeholders in the implementation of measures. These may include regulators, subcontractors, neighboring communities and organizations, clients and enterprises in the supply chain, insurers, shareholders and consumers, as well as international standard setting bodies (Jason, 2008).

OSH related training at all levels, from managers to workers, is a major element in implementing any OSH programme. This training has to be carried out on a continual basis to ensure knowledge of the system and for instructions to stay up to date with

changes in the organization. In this context communication channels between the different levels of the organization must be effective and go both ways, meaning that OSH related information and concerns conveyed by shop floor workers should be given due consideration and allowed to reach higher management. This is an example of what is meant by the need for the system to focus on people (Institution of Occupational Safety and Health, 2009). OSHMS should not be regarded as the panacea or solution for increasing the performance of the organization in ensuring and sustaining a safe and healthy working environment.

As any method, OSHMS has both advantages and weaknesses, and its effectiveness is very much defendant on how it is understood and applied (Cullen, 2002). While most organizations will probably benefit from a full OSHMS, some might consider using a scaled down, less formal approach to the management of OSH. The decision of moving to OSHMS may be sometimes difficult to justify as the distinction between a program and a system is a potentially weak one (Jason, 2008).

Programmatic approaches, such as that promoted in the ILO OSH Convention, 1981 (No. 155) do in fact contain systems, features and similarly, systems approaches do in fact contain programmatic features. This is also the case in a large number of national OSH legislation. However, systems management brings to OSH the possibility of establishing mechanism for not only continual assessment and improvement of OSH performance, but also for the building of a preventative safety and health culture, as defined in the ILO Global Strategy on OSH (2003) and the ILO Convention on a Promotional Framework for Occupational Safety and Health, 2006 (No. 187).The performance of an OSHMS can only be as good as the performance of the overall management of the organization. Like all methods, it has both strengths and weaknesses which should be known (International Labour Organization, 2011, April, 28). OSHMS

is a management method and not an OSH program in itself (Jason, 2001). Therefore, a management systems‟ approach is only as good as the OSH framework or program in place in the organization. OSHMS program must function within the national OSH legislation framework and the organization must ensure that the system include a review of regulatory requirements and is updated accordingly to integrate them (Walters, 2003).

2.14 Approaches to Health and Safety in Organizations

Health which refers to the employees' freedom from physical or emotional illness and Safety programs may be designed to accomplish their purposes in two primary ways. The first approach is to create a psychological environment and attitudes that promote safety. A strong company policy emphasizing safety and health is crucial. The second approach to safety program design is to develop and maintain a safe physical working environment (Reese, 2003).

According to Armstrong (2009), on safety programs, it has become clear that optimal health can generally be achieved through environmental safety, organizational changes, and different lifestyles. Developing Safety Programs organizational safety programs require planning for prevention of workplace accidents. Plans may be relatively simple or more complex and highly sophisticated in order to fit the organization's size. Top management's support is essential if safety programs are to be effective. Tremendous economic losses can result from accidents. The main goal of safety and health professionals is to prevent job-related injuries and illnesses (Everett & Frank, 1996).

According to Armstrong (2009), health and safety policies and programs are concerned with protecting employees and people affected by what the company produces and does against the hazards arising from their employment or their links with the company .Safety programs deal with the prevention of accidents and with minimizing the

resulting loss and damage to people and property. They relate more to systems of work than the working environment, but both health and safety programs deal with the prevention of ill health arising from working conditions. They consist of two elements, that is occupational medicine, which is a specialized branch of prevention of health hazards at work and dealing with any ill health or stress which as occurred in spite of preventive actions, and occupational hygiene, which is the province of the chemist and the engineer or ergonomist engaged in the measurement and control of environmental hazards.

According to Hughes (2011), matters relating to occupational safety and health never used to be as prominent in the minds of most Kenyans. Many Kenyan companies and organizations are now keen to know more about issues appertaining to occupational safety and health.

OSHMS cannot function properly without the existence of effective social dialogue, whether in the context of joint safety and health committees, or other mechanisms such as collective bargaining arrangements. Workers and their representatives should be given the opportunity, through direct involvement and consultation, to fully participate in the management of OSH in the organization. A system is successful only when all the stakeholders are given defined responsibilities in running it. A major principle of OSHMS is the establishment of a line management responsibility, including the meaningful involvement of all employees at all levels in the organization, and with defined OSH responsibilities (International Labour Office, 2008). The implementation of OSH, and even more of OSHMS, can be successful only when all stakeholders participate fully in this implementation through dialogue and cooperation. In the case of OSHMS, a system run solely by managers without input from workers at lower levels in the hierarchy is bound to lose its focus and fail (Dohery & Tyson, 2000). A number of

studies suggest an association between lower lost-time injury rates and the presence of joint OSH committees and trade union involvement in the organization. Other studies indicate that participatory workplace arrangements lead to OSHMS practices resulting in improved OSH performance, and this is even more so in unionized workplaces (Walters, 2003).

According to Balkin, Cardy and Mejia (2007), effectively managing workplace safety and health requires far more than reducing the number of job related accidents and injuries. In practice, legal and ethical issues, many of which involve a careful balancing of individual rights (particularly the right of privacy).with the needs of the organization, because these issues often give rise to legal questions.

According to Armstrong (2009), Health and Safety training is a key part of the preventive program. Safety training spells out the rules and provide information on the potential hazards and how to avoid them. It is important to recognize that in addition to these direct challenges, there is also the challenge of employees‟ commitment to safety and health programs. Many organizations face the problem of employees ignoring and even being hostile to safety and health measures. The reason, employees often view safety and health measures as intrusive and inefficient (Kartam, 2000).

2.15 Safety Hazards at the Workplace

The safety hazards at the workplace include: poorly maintained equipment, unsafe machinery, exposure to hazardous chemicals among others. Potential injuries include: Loss of hearing, eye sight or body like cuts, burns, bruises, broken bones and electric shock ILO (2002).

Njuguna (2007) reports that providing a safe environment and minimizing potential risk are both the moral and legal responsibility of the organization and that a safety culture

should be maintained at workplaces. Joy (2005) also suggests that a positive safety culture at work can be developed through the allocation of praise, promotions and cash to employees who behave safely. This implies that when workers are well motivated to behave safely at the work place this minimizes the human error that may cause or create unsafe working environment.

Raymond *et al,* (1997) argue that experts are in agreement on the importance of human element in processes that culminate in work related illnesses, injuries and deaths. This argument is supported by Telford (2004), and Ritz (2004) who contend that people have watched others doing blatantly unsafe things at work despite "Knowing better".

Good investigations of accidents, where it takes place tends almost invariably to show that failures to prevent them are rooted either in weaknesses in risk assessment or in the implementation of control measures Ridley (2004). The employer has a responsibility of training workers on safety practices Njuguna (2007) good construction industry supervision is also needed

2.16 Conceptual Framework

The health and safety status in any construction shows the level of adherence to the safety standard guidelines. An affective safety and Health construction system has several critical components. These include: Government Policy, Administrative factors, Provision of education and training in safety and health issues and availability of emergence facilities. These components are inter-related as illustrated in figure 2.1

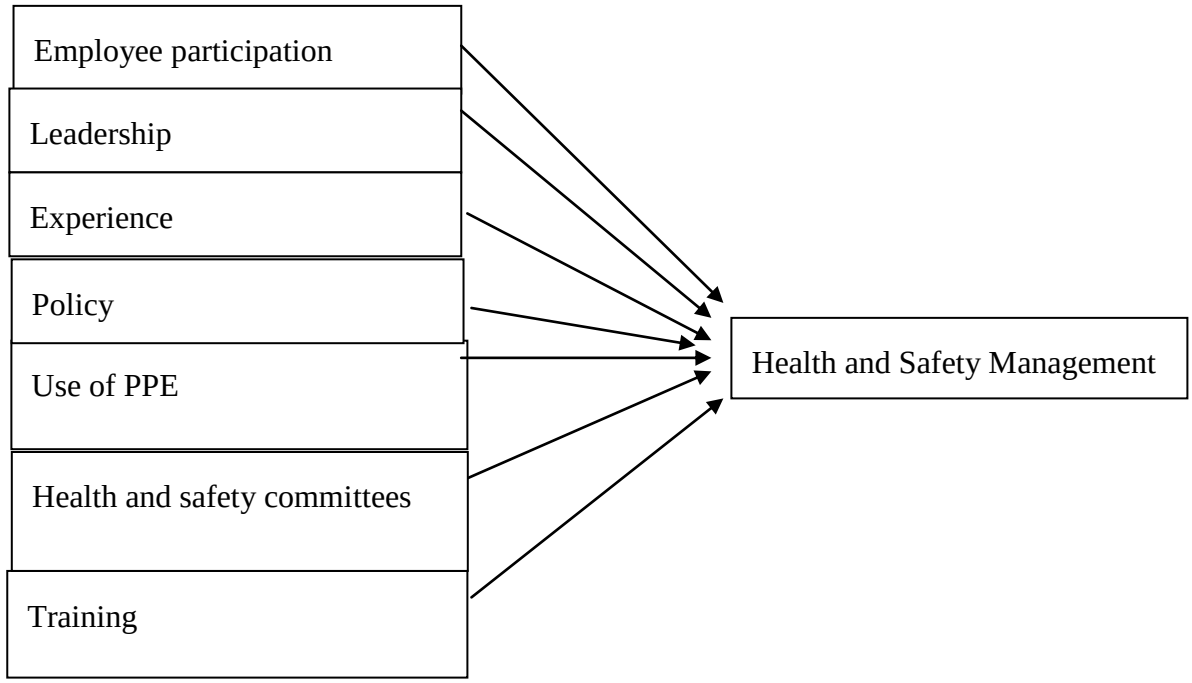


Figure 2.1: Conceptual Framework

The figure 2.1 illustrates safety and health as the dependent variable and others as independent variables of the study. The implementation of these requirements will expedite the achievement of an effective safety- and health program for construction staff in any construction. Once safety and health needs of the staff are met, they were motivated to work harder to achieve competence and recognition which are higher needs as per Maslow's hierarchy of needs.

Safety and health preparedness is an indication of the safety and health concern in construction and it's determined by a number a number of factors. One of the factors is the government through the various policies which give direction concerning safety and healthy in all educational institutions which if implemented could significantly improve

safety in constructions. It's then the responsibility of the construction administrators to ensure that the government safety and healthy guidelines are adhered to. The leadership style determines the workers and even staff behavior towards health and safety guidelines Workers will also not be involved in incitement. Another administrative responsibility is to check against the vice of drug abuse which, as revealed by the Task Force Report on staff performance (2001) shows health safety as the cause of employees poor performance in construction and in the process endangering not only their own lives, but also the lives of the community

CHAPTER THREE:

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research design, study population and sample, sample size and sampling technique, data collection tools and data management and analysis. This cross sectional descriptive study sought to establish health and safety management at construction sites approved by the National Construction Authority in Nairobi County and factors influencing implementation of health and safety guidelines.

3.2 Research Design

The study was carried out in Nairobi County due to the high levels of construction that are taking place. The study used both survey and descriptive designs. The survey technique was found suitable in gathering information from site supervisors and the workers on the construction sites by use of questionnaires and/or interviews. Descriptive research was used for this study since it helped to assess health and safety management on the construction sites and to evaluate factors influencing implementation of health and safety measures on construction sites as practiced in Kenya.

According to Gathuthi, Kosgei and Ng'ang'a (2009), in descriptive study designs, the researcher describes or presents a picture of a phenomenon or phenomena under investigation. The possible approaches include participants‟ observation where the

researcher interacts naturally with the respondents in a natural setting making and recording his or her observations without undue influence on the respondents.

Descriptive research design involves measuring a variable or set of variables as they exist naturally. It is not concerned with the relationship between variables but rather with description of individual variables. According to Mugenda and Mugenda (2003), descriptive studies are also undertaken to understand the characteristics of organizations that follow certain common practices.

3.3 Study Population and Sample

Cochran and William (1997) stated that a population is the total collection of elements about which we wish to make some inferences. The collection of all possible observations of specified characteristics of interest is called a population, while a collection of observations representing only a portion of the population is called sample.

There are 500 NCA registered construction sites in Nairobi County, However only 300 sites that had more than 50 workers were used for data collection. Simple random sampling was used to select 10 % of the sites (30) in line with Mugenda and Mugenda (1999). The study was carried out on workers and site managers on construction sites registered by the National Construction Authority in Nairobi County, Kenya. In this study, the respondents consisted of workers on construction sites. These included: site managers, foremen, skilled and unskilled laborers.

Inclusion Criteria

- Construction sites approved by National Construction Authority
- Construction sites with more than 50 workers
- All workers on the construction site for more than one month.

- All consenting workers.

Exclusion Criteria

- Construction sites not approved by National Construction Authority
- Construction sites with less than 50 workers
- Workers at the construction sites for less than one month.
- All workers who did not consent to participate in the study.

3.4 Sample Size and Sampling Technique

For the purpose of this study, random sampling was used to select 30 construction sites in Nairobi County. The study population was divided into strata according to trade. Stratified random sampling was used to select workers at each site. A random sample was selected in such a way that each member of the population has an equal chance of being included in the sample. This enables the researcher to generalize results to the population on the basis of the sample size determined statistically (Mugenda & Mugenda, 2003). A total sample of 300 respondents from the construction sites was used for data collection. The sample size was determined using stratified random sampling. This technique divides the population into two or more groups taking into account the heterogeneous nature of work at construction sites. The questionnaires were distributed proportionately among the sites.

3.5 Data Collection Instruments

Quantitative data was collected on the demographic characteristics of the respondents, kinds and causes of accidents, injuries and ill health on construction sites, impact of accidents and injuries and factors influencing implementation of health and safety

measures on construction sites. Interviews were used for collecting primary data. The interviews were held with site managers, clerks of works and both skilled and unskilled workers.

Questionnaires were used as the main tool for data collection. They were administered to the site managers and both skilled and unskilled construction workers. The questionnaires were self- administered whereby they were hand delivered to the respondents.

Direct observation was also used which involved guided visits to construction sites to observe and document the identified hazards, work practices and equipment and tools being used

The data collection instruments were piloted for validity. The purpose of pilot testing is to assess the clarity of instrument that is validity and reliability of each of the items in the instrument as well as suitability of the language used in the instrument (Borg and Gall, 1993). Pilot testing was conducted with construction workers in sites outside the study area.

According to Kothari (2004), a questionnaire consists of a number of questions printed or typed in a definite order on a form or set of forms. The questionnaires adopted in this study had open e closed ended questions, and a likert scale. According to Mugenda & Mugenda (2003), this procedure requires a higher level of inference on the part of the observer since it involves observation and evaluation. Closed ended questions help the respondents to make quick decisions to choose among the several alternative before them.

3.6 Validity and Reliability of Data Collection Instruments

Validity and reliability of data collection instruments is essentially to minimize bias in the study findings.

3.6.1 Reliability of Data Collection Instruments

Reliability of data collection instruments refers to the accuracy and precision of the measuring procedures. In order to ensure reliability of the data collection instruments, the researcher carried an out pilot testing by randomly selecting a few building construction sites, 10 in number, administered the questionnaire and observed the response to note if the questions were understood, and if the answers were relevant to the study. Observed weaknesses in the data collection instrument were noted and corrections made.

3.6.2 Validity of the Data Collection Instruments

This refers to the relevance of the data collection instruments in relation to the anticipated outcome of the study. To ensure validity of the data collection instruments the researcher formulated simple easy to understand questions whose answers had a critical bearing to the variables under investigation so as to guide the study achieve its purpose.

3.7 Data Analysis And Presentation Methods

Data collected was analyzed quantitatively using the SPSS and Excel computer software and results presented in tables as percentages and frequencies.

3.8 Ethical Considerations

This concerned the confidentiality of the information obtained from the respondents for the purpose of this study. The respondents were guaranteed of confidentiality of the information they divulged in case they felt the questions were personal or sensitive in nature. The researcher had to bring to light the fact that the study was basically academic for the purpose of fulfilling the requirements of the degree, and that the report was not to be published for public consumption. In this respect an introduction letter from the University administration was a necessity. Clearance to carry out the study was obtained from the National Construction Authority and the managers at the sites. Authority to carry out the study was also obtained from National Commission for Science Technology and Innovation. (NACOSTI), the county commissioner and the county director of education, Nairobi County. Verbal consent was obtained from all the respondents to participate in the study. Participation was voluntary.

CHAPTER FOUR:

DATA ANALYSIS , RESULTS AND DISCUSSION

4.1 Introduction

This chapter reports data obtained from workers and site supervisors at selected construction sites in Nairobi County to explain health and safety management and the factors influencing the implementation of health and safety measures at the construction sites.

4.1.1 Response Rate

Out of the 300 questionnaires issued 224 were returned. This represents 75% of the sampled population. Mugenda and Mugenda (2003) recommend that a response rate of 50% is fairly adequate, therefore a response rate of 75% in this case was considered to be representative of the study population.

4.2 Demographic Characteristics of the Respondents

4.2.1 Age of the Respondents

Majority of respondents (200, 89.2%) were male as most activities on construction sites are done by men in Kenya. Respondents' ages ranged between 18 and 60 years, with the majority (89, 40%) being 31 years to 40 years old, followed by 67 (30%) respondents ranging between 41 and 50 years of age (Fig 4.1).

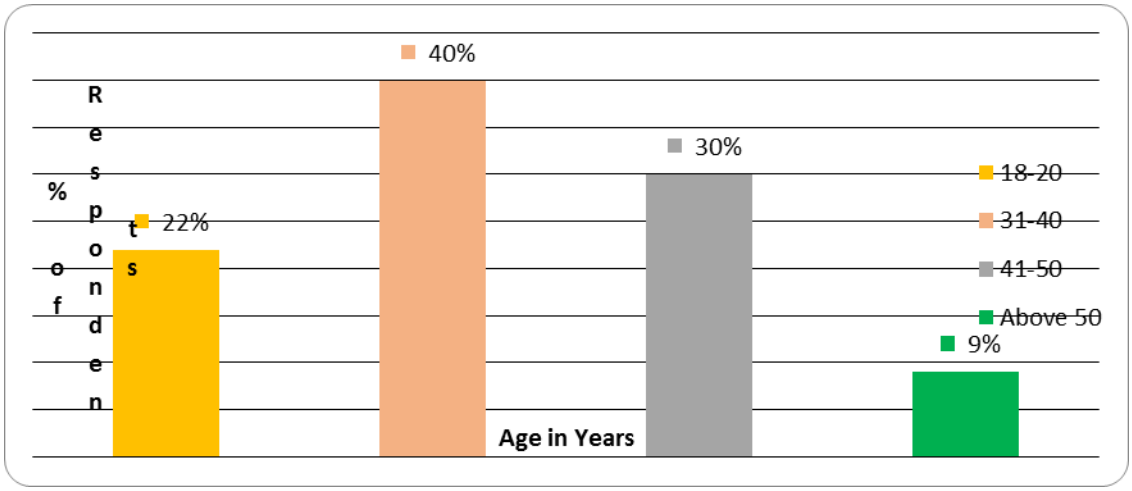


Figure 4.1: Age of the Respondents

4.2.2 Education Level of the Respondents

Almost half of the respondents (48.7%) had only primary school level of education, followed by 38.7% who had primary education with vocational training, 6.3% each had lower secondary education and university education. This result revealed that the majority of workers have very low level of formal education, which can be a challenge to communication and the way they perceive health and safety management.

4.2.3 Nature of Workers Employment

Figure 4.2 indicates that the majority of the workers (69%) were employed by the main contractor while 31% were employed by sub-contractors.

The majority (70%) were casual employees, only 17% were full-time employees and 13% were employed on a contract basis.

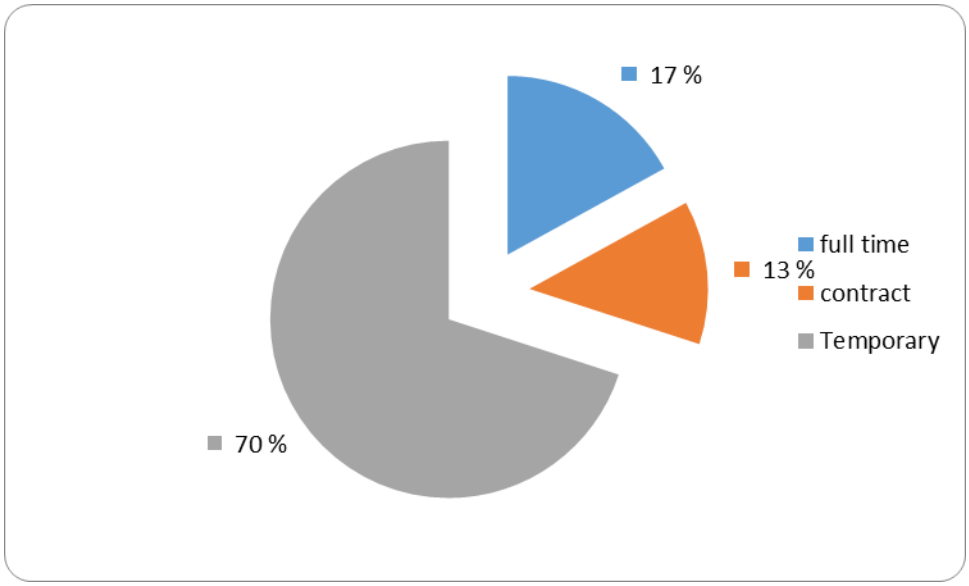


Figure 4.2: Nature of employment among the respondents

These results are consistent with the study done by ILO, (2005) on the nature of large construction sites in Kenya. The study found that the majority of workers were employed on a casual basis. The nature of workers' employment has been reported as the one of the challenges to implementing health and safety management on construction sites.

Majority of the respondents had been on construction sites for 1-5 years (45%) with only 15% with more than 10 years' experience (Figure 4.3). Working experience is likely to influence health and safety management implementation as workers with long experience are more conscious of health and safety risks associated with construction works. This result is in agreement with reports by (Phoya, 2012) on construction sites in Tanzania. A similar view is held by Lubega et al. (2001), who found that the causes of

construction accidents in Uganda include lack of knowledge about safety rules, engaging an inexperienced workforce

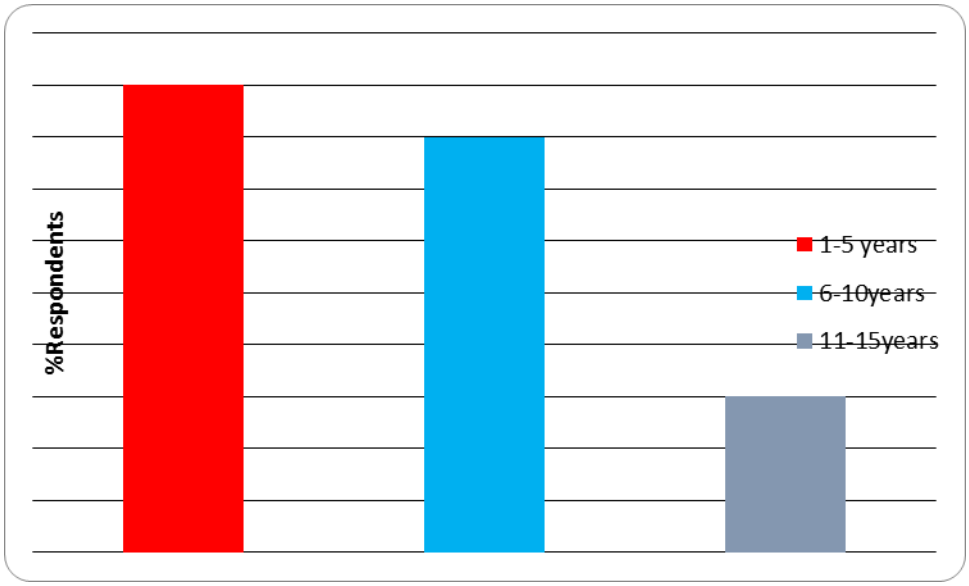


Figure 4.3 Working experience of respondents

4.3 Kinds and Causes of Accidents, Injuries and Ill Health on Construction Sites Reported by Respondents

Table 4.1 presents the most common health and safety hazards and their source on construction sites. The results indicated that these include: working at height which resulted in falls and slips, manual handling with resultant back pains, machinery and equipment which caused cuts and amputations, fire, noise and dust. The findings are similar to those found by HSE, (1998) and Murie, (2007). Falls from heights are the leading cause of occupational injuries on construction sites (Bentley *et al*., 2006). In China's construction industry, falls account for approximately 51% of injuries (Yung, 2009).

Table 4.1 Kinds and Causes of Accidents, Injuries and ill health on Construction Sites reported by respondent

Type of hazard	Consequence	Cause
Working at a height	Falling from height	Carelessness of the workers(reluctant to use safety belts) Improperly fixed scaffolding Not using PPE (not supplied by management or supplied but workers not wearing it) Collapse of the formwork Unprotected edge Ignorance of workers about of risk Weather,
Falling object	Hit by falling object Trip and fall	Overcrowded sites, Confined sites, Unprotected feet (safety shoes) ignorance (most workers have very low education level) Unreliable income (willing to risk no matter what) lighting might be a problem, sometimes car lights have been used to light up the sites) Improper tools
Manual handling	Muscles pain, back pain	Manual handling Working for long time, twisting, bending Crowded sites for movement/equipment Carrying heavy loads
Equipment/ Plant/ Tools	Crush/hit/cut by object such as equipment, car, working tools and Plants	Wrong operating attitude of the users, improper Maintenance
Chemicals	Health problems such as headaches, eye Irritation, dizziness, faintness, sleepiness and affect judgment and coordination	Material specification, cement and paints, fumigation pesticide, timber treatment chemicals
Dust	Health problem such as respiratory disease	Present on sites where demolition, excavation, Concrete mixing takes. Plastered walls scored ready for painting
Noise	Health problem such as hearing loss	Equipment noise, activity noise such as excavation, drilling, welding, piling, roofing. Most of the workers (concreting) Grinding, cutting, mixing concrete, piling and workers noise workers(concreting)
Bending and twisting	masculo-skeleto disorder	Bending and twisting for long time, too much manual handling,
Fire	Burns	Electrical defects Flammable materials such as oil paints, petroleum products

From the results in Table 4.2, the hazard consequences ranked by site managers from one to ten according to their probability of occurrence. The probability of falling from height was ranked as the important hazard consequence as it had the highest score of eight (8), while the second consequence 7 was a hit by falling object , number three was back pain, muscular pain due to manual handling. Health problems due to chemicals, dust and noise had the same score of five (5). The finding indicates that there is high probability of falling from height due to the fact that most of workers are exposed to the height on high rise buildings. These may occur as a result of inadequate edge protection, in this study workers at risk of falling from a height include painters, masons, and window cleaners and those who undertake one-off jobs without proper training. Similar results have been reported by Murie (2007).

Table 4.2: Health and safety hazard consequences as ranked by site managers

	Cause	**Average Ranking**
1	Falling from height	**8**
2	Hit by falling object, trips and fall	**7**
3	Back pain, muscular pain, due to manual handling	**6**
4	Health problem caused by chemicals	**5**
5	Health problem caused by dust	**5**
6	Health problem caused noise	**2**
7	Crush by moving equipments, cuts by equipments and hand-led tools	**4**
8	Health problem caused by bending for too long and twisting	**4**
9	Injury from fire and other disasters	**3**
10	Covered by earthwork during excavation of basement and trenches	**2**

4.4 Most Common Causes of Injury Among the Respondents

The most common cause of injuries is tools and equipments, falling from heights, slips and over extortion respectively, with fire explosion and electricity and transport related accidents being less likely to cause injuries and accidents.

4.4.1(A) Tools and Equipment

Tools and equipment accounted for majority of injuries and had at a rate of 76% per week, 18% per month and 6% occurrence once every 2 months (Figure 4.4).

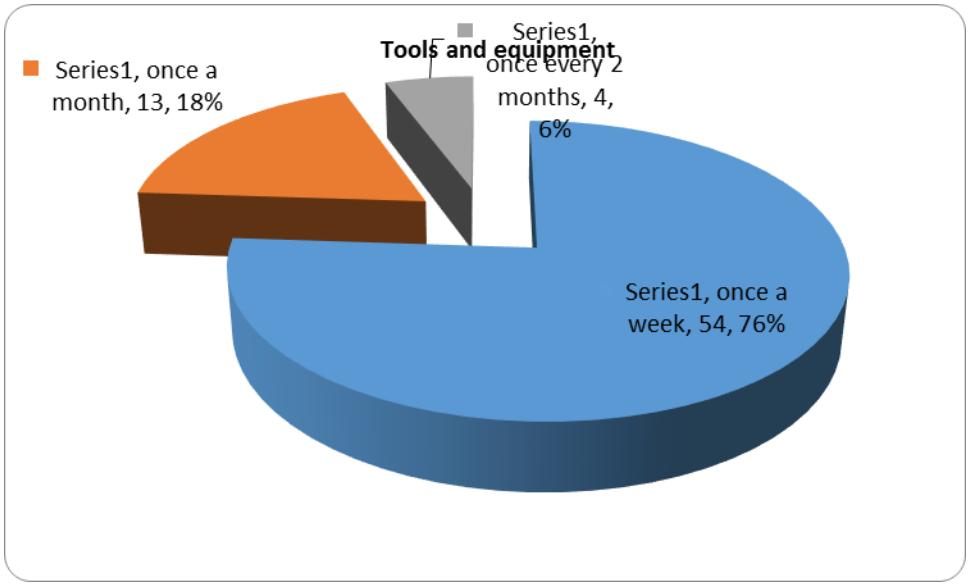


Figure 4.4 Likelihood of accidents and injuries caused by Tools and equipment

Crush injuries can have a wide range of serious effects, including fractures, internal injuries, head and brain injuries, and back injuries. In some cases, a crush injury may result in amputation and permanent disability of the affected worker. These results concur with (HSE, 2004) who stated that many people are injured due to being chopped

and cuts by equipment and hand –held working tools such as chisels, screwdrivers, knives, saws, harmers, nails and drilling machines. The greatest hazards posed by hand tools results from misuse and improper maintenance.

4.4.1(b) Slips

Slips were found to likely occur once a week at a rate of 65%, 33% once a month and 5% once every two months. This result concurs with (Hughes & Ferret, 2011). Slips and trips are seen as the most common workplace hazards and contribute to over a third of all major injuries. They occur in almost all workplaces and 95 % of major slips result in broken bones (Figure 4.5).

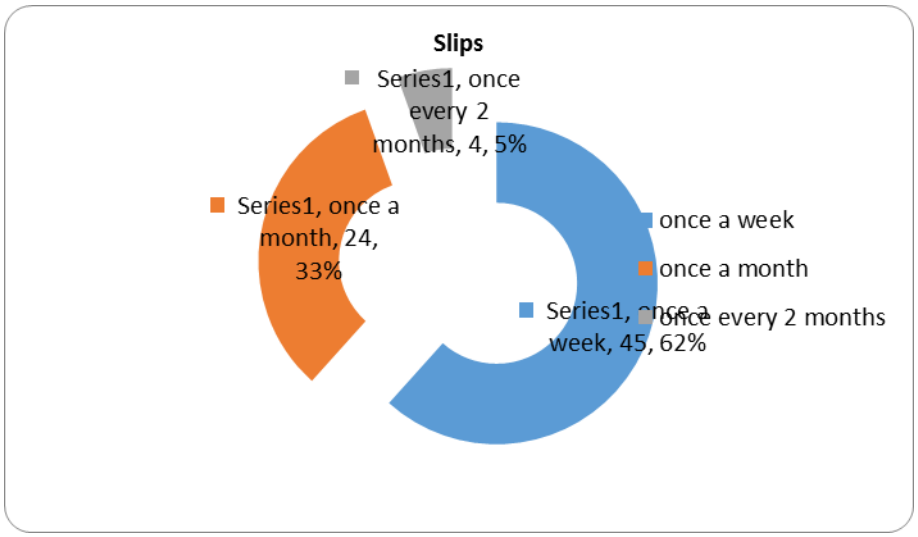


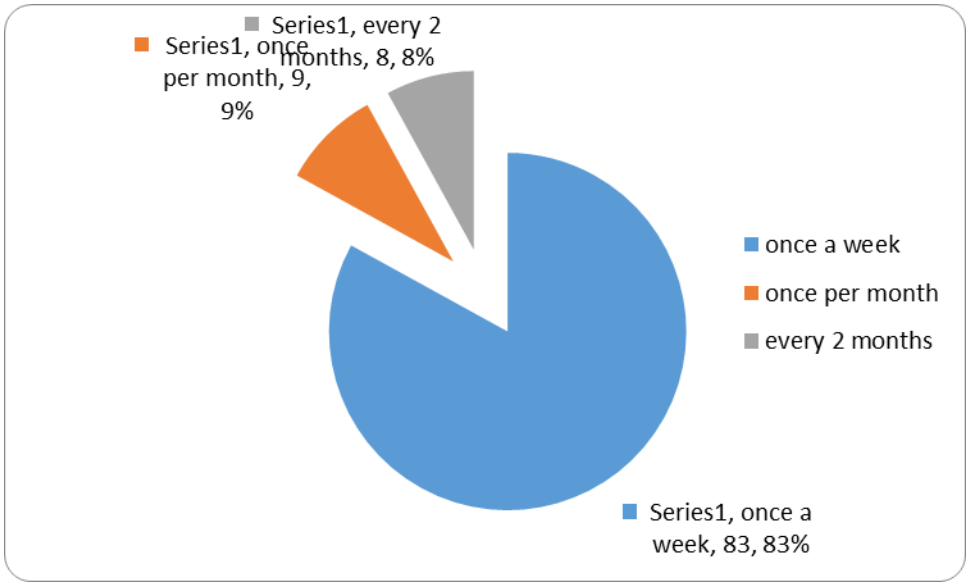
Figure 4.5 Likelihood of slips among construction workers

4.5 Most common Types of Injuries Among the Respondents

The researcher sought to know what kinds of injuries are associated with construction sites and the likelihood of occurrence. Wounds, bruises, cuts and fractures were found to be the most common types of injuries asssociated with construction sites in Nairobi county.

4.5.1 Likelihood of Wounds and Bruises Among Construction Workers

Wounds and bruises were the most likely injuries to happen with rating of 86% likelihood of occurrence per week, 7% per month and an equal chance of occurrence once every two months (Figure 4.6)



4.6 Likelihood of Wounds and bruises among workers on construction sites

4.5.2 Fractures and Broken Bones

The researcher found that fractures and broken bones were the second most likely injuries to occur among workers on construction sites in Nairobi county. This was supported by over 50% likelihood of occurrence weekly ,35% monthly and 8 % once every 2 months and a 7% likelihood of no occurrence (figure 4.7). Fractures and broken bones occur in almost all construction workplaces and 95 % of major slips result in broken bones (HSE, 2004). According to statistics from the Health and Safety Executive (HSE), slips and trips are the single most common cause of injuries at work, and account for over a third of all major work injuries.

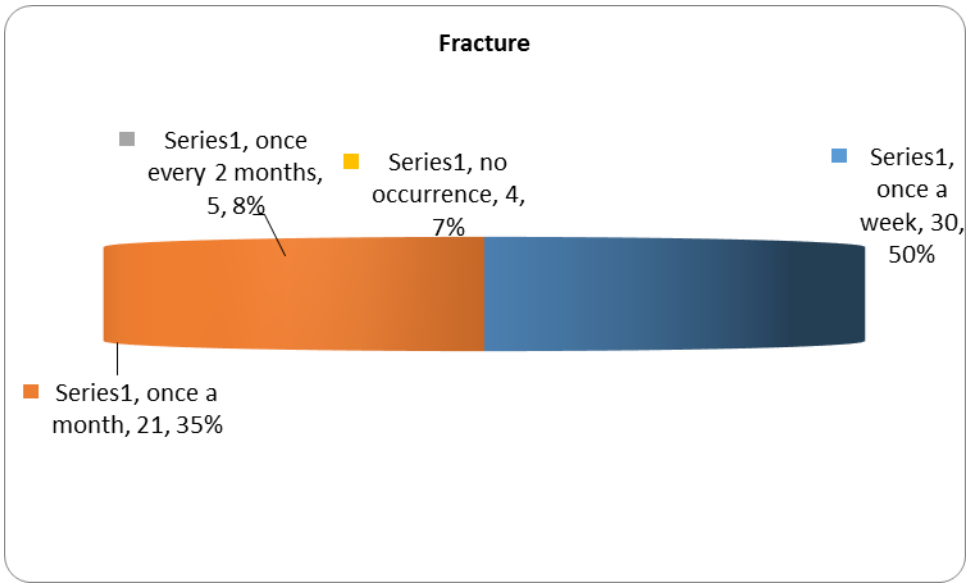


Figure 4.7 Likelihood of occurrence of Fractures and broken bones among workers on construction sites

4.6 Impact of Accidents and Injuries

The researcher sought to determine the impact of various injuries sustained during construction works. In this respect the researcher examined the impact on two perspectives,that is impact to the workers and impact to the construction project progress.

4.6.1 Impact of Injuries and Accidents Reported by Workers on Construction Sites

The reseracher sought to know what impact the injuries sustained had on family income of the workers.

4.6.1 (a) Impact of Accidents and Injuries on Family Income

From Figure 4.8 below injuries have a high impact on family income .This was reported by 61% of the respondents. Only 12% of the respondents thought that injuries have no impact on family income. Injuries result in loss of family income in medical costs.

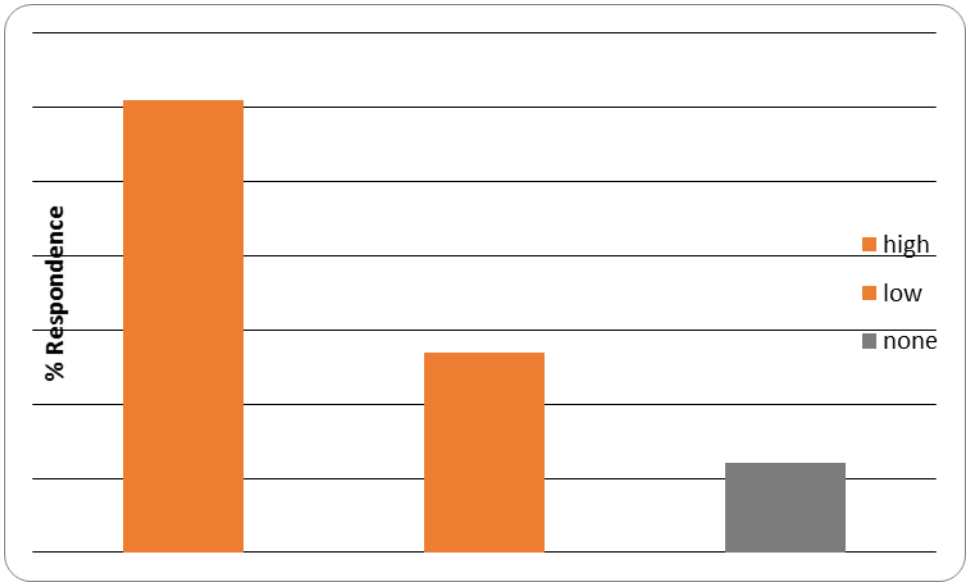


Figure 4.8 .Impact of accidents and injuries on family income

4.6.1(b) Impact of Accidents and Injuries on Standard of Living

Despite the fact that majority of the respondents reported that injuries have a high impact on family income, majority of them thought that it had a little to do with standards of living. This is supported by 40% and 33% of the respondents who thought that injuries sustained had nothing to do with standard of living and had low impact on standards of living respectively. Only 27% of the respondents thought injuries sustained had a high impact on standards of living (Figure 4.9)

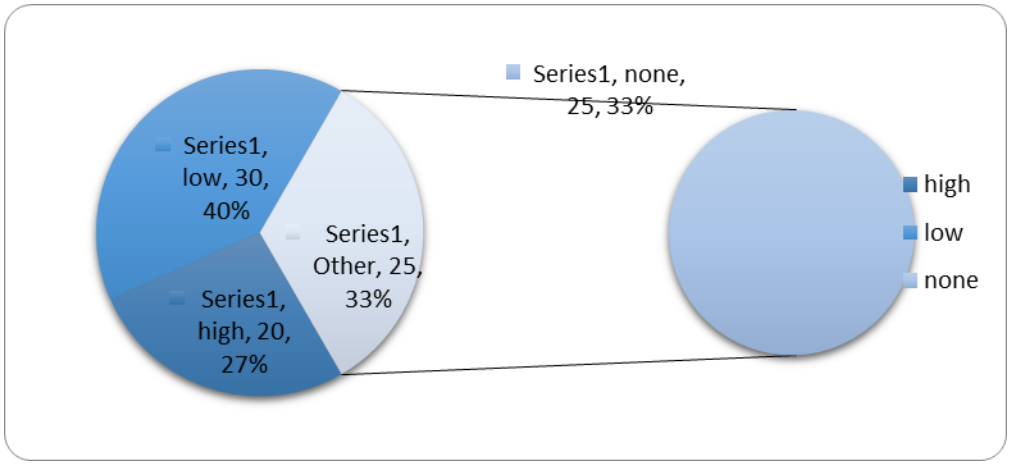


Figure 4.9 Impact of accidents and injuries on standard of living

4.6.1(c) Depression

Injuries sustained in construction sites are less likely to cause depression. From the study only 31% said were in favor of injuries causing depression. 28% of the respondent said injuries sustained during construction works had a low probability of causing depression while 41% said injuries sustained during construction works did not cause depression (Figure 4.10)

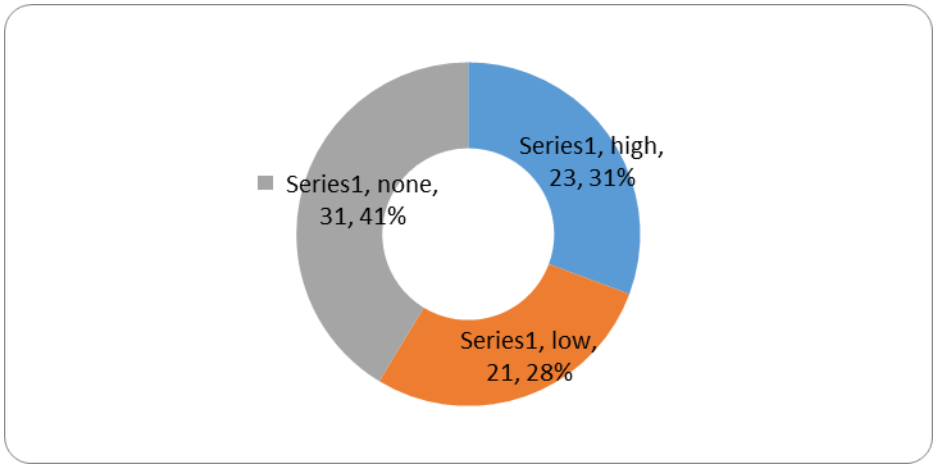


Figure 4.10 Depression as a result of injuries and accidents

4.6.1 (d) Disability

Injuries sustained during construction works are not likely to cause disability. This was reported by 58% of the respondents who said that injuries sustained during construction works did not because disability only 15% of the respondents said injuries sustained during construction works cause disability (Figure 4.11)

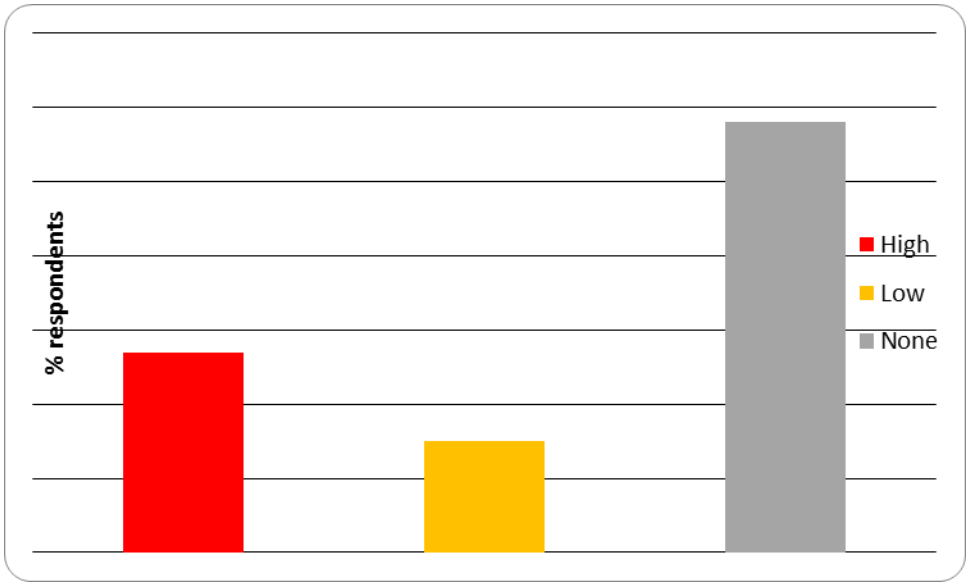


Figure 4.11 Disability as a result of accidents and injuries

4.7 Impact of Accidents and Injuries in the Construction Project

The reseracher sought to know what impact the injuries sustained had on the project interms of abseentism from work, loss of morale by workers,loss of workers and loss of public confidence.the results are illustrated in table 4.3

Table 4.3. Impact of Accidents and Injuries on the Construction Project as Reported by Site Supervisors

		High	Low	None
1	Absenteeism of workers	23 (76.6%)	5 (16.6%)	**2 (6.6%)**
2	Compensation costs	1 (3.3%)	2 (6.6%)	**27 (90%)**
3	Medical costs	4 (13.2%)	2 (6.6%)	**24 (80%)**
4	Property loss	5 (16.6%)	4(13.2%)	**21 (70%)**
6	Loss of public confidence	18 (60%)	12 (40%)	**0 (0%)**
7	Company image	21 (70%)	7 (23.3%)	**2 (6.6%)**
8	Loss of morale among employee	15 (50%)	13 (43.3%)	**2 (6.6%)**
9	Death of workers	4 (13.2%)	2 (6.6%)	**24 (80%)**
10	Legal costs	3 (10%)	2 (6.6%	**25 (83.3%)**
11	Disruption of work	21 (70%)	9 (30%)	**0 (0%)**

From table 4.3 accidents and injuries sustained at construction sites had a high impact on worker absenteesim as reported by 76.6% of the site supervisors, company image (70%), disruption of work (70%) and resulted in low morale of the employees (50%). However site supervisors reported no impact on compensation costs (90%) since workers are rarely compensated, and no impact on legal costs (83.3%) since workers rarely sue, and medical costs (80 %). Abseentism of workers, disruption of work impact negatively on the construction project progress.

4.8 Factors Influencing Implementation of Health and Safety Measures as Reported by Respondents

The research sought to establish the factors that influence implementation of health and safety measures in construction sites in Nairobi County. In this area the researcher paid much attention on health and safety management policy, training of employee on health and safety, leadership commitment and employee participation.

4.8.1 Employee Participation

The study aimed at finding out whether the employee participation influences the implementation of health and safety measures at construction sites in Kenya**.** 64 % of the respondents reported that employee participation influenced implementation of health and safety measures on construction sites (Figure 4.12).

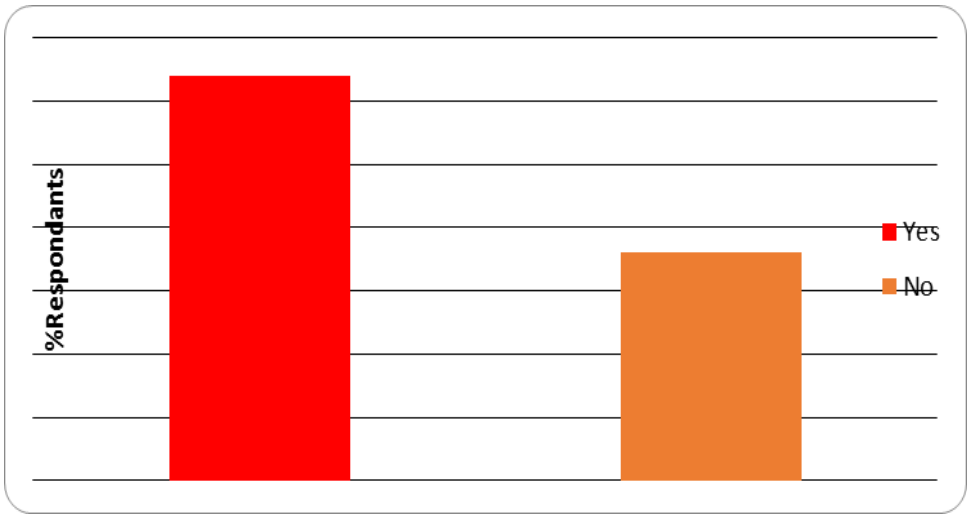


Figure 4.12 Employee participation

Majority (64%) of the respondents, were of the opinion that employee participation influences the implementation of health and safety measures in construction sites in Nairobi county while few(36%), indicated that employee participation did not influences the implementation of health and safety measures. The study findings concur with Price (2004), who stated that employees should be aware of what constitutes safe working practices as they affect them and their fellow workers; while management and managers have the duty to communicate and train, individuals also have the duty to take account of what they have heard and learned in the ways they carry out their work.

4.8.2 Leadership Attitude Towards Health and Safety Management

The study further sought to find out from the respondents the attitude of managers towards safety at construction sites. The data findings are as shown in Figure 4.13 below.

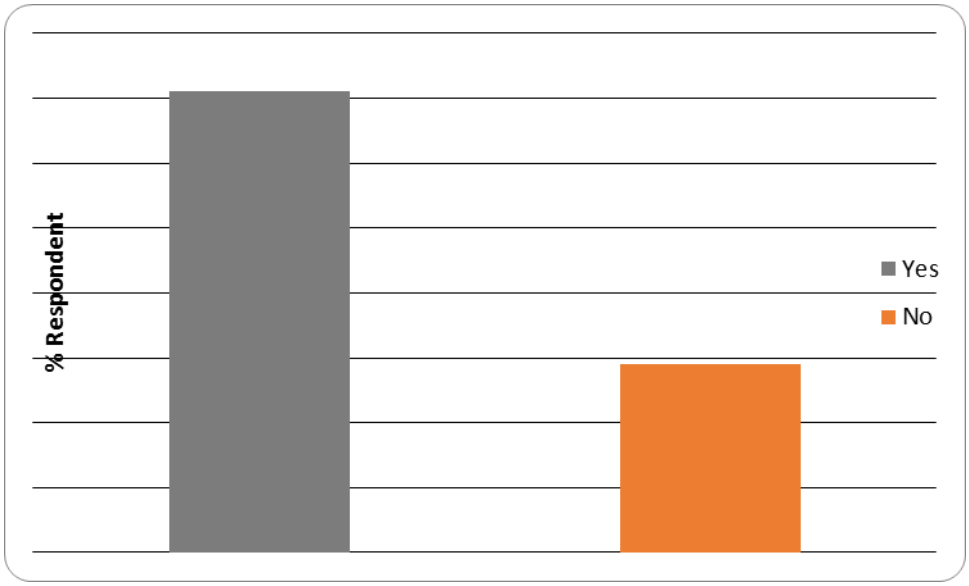


Figure 4.13 Leadership Attitude towards Health and Safety

Majority (71%) of the respondents stated that leadership attitude influences implementation of health and safety measures on construction sites while 29% did not. This is in line with Armstrong (2009), stated that leadership is the process of inspiring people to do their best to achieve a desired result therefore the leader must be positive in all tasks they wish their staff to undertake. According to Nzuve (2007), to a large extent the attitude of the rank and file towards safety is a reflection of the attitude of their supervisors. It therefore shows that the management had a positive attitude towards safety. This implies that it was easy to reinforce safe practices and implementing a safety incentive program.

4.8.3 Employee Training

The study also sought to find out whether training influenced the implementation health and safety measures in construction sites in Kenya. Majority (90%), of the respondents and few (10%) of the respondents reported that training influenced the implementation health and safety measures (Figure 4.14). Lack of training implies therefore that the employees‟ goals may fail to be achieved (Holmes, 1998). It therefore indicates that, lack of training on health and safety measures affects performance and productivity of the employees to large extent.

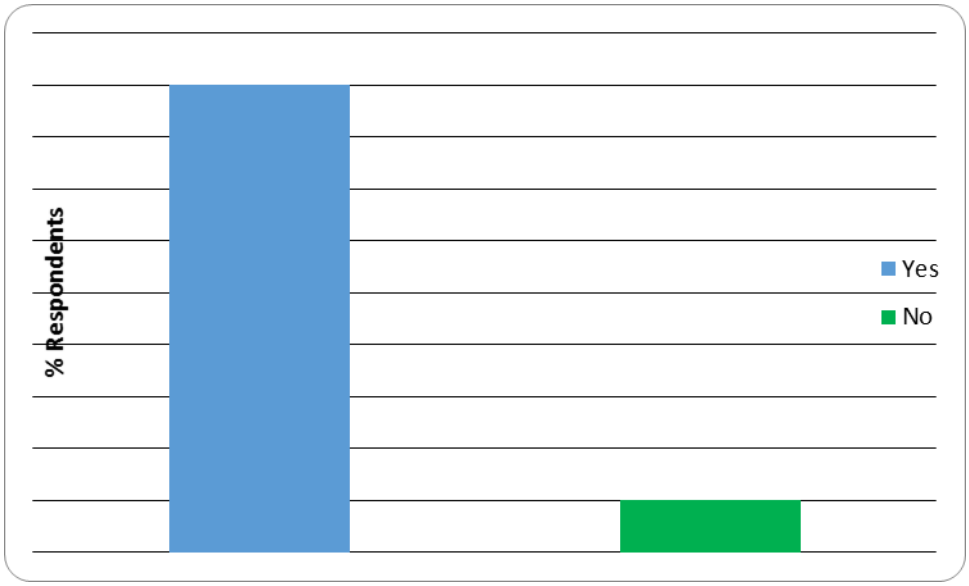


Figure 4.14 Employee Training

4.8.4 Health and Safety Policy

The study sought to find out whether health and safety policty had an influence on health and safety implementation in constructionsites in nairobi county.as illustrated in the figure 4.15 below, 53% of the respodents were of the opinion that health ad safery policy had a positive impact on implementation of health and safety measures, 47% of the respondents were of a contrarry opinion (Figure 4.15). The findings of this study are in agreement with Armstrong (2009), Health and safety policies and programs are concerned with protecting employees and people affected by what the company produces and does against the hazards arising from their employment or their links with the company. Safety programs deal with the prevention of accidents and with minimizing the resulting loss and damage to people and property.

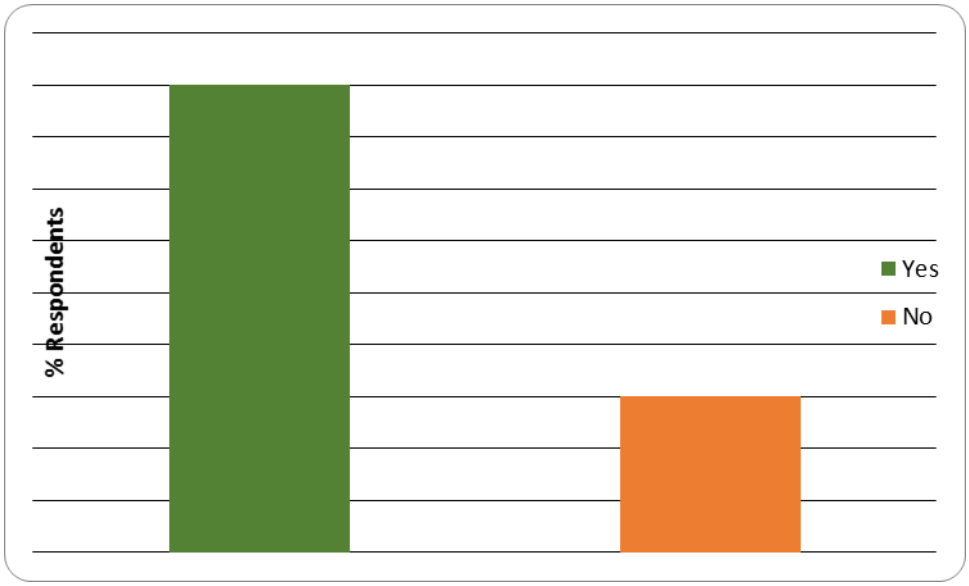


Figure 4.15 Health and safety policy

4.9 Health and safety measures at construction sites

Although Personal Protective Equipment were present in most of the sites (Table 4.4) their usage was minimal (use of safety belts (13.4%), use of gloves (6.6%), use of foot wear (20%) . use of face masks (6.7%). First Aid kits and fire fighting equipment were present in all the sites.

Table 4.4 Health and safety measures at construction sites

Health and safety measure	Present		Absent	
	N	%	N	%
Ladders securely anchored	27	90%	3	10%
Use of face masks	2	6.7%	28	93.3%
Use of boots	6	20%	24	80%
Use of helmets	15	50%	15	15%
Use of safety belts	4	13.4%	26	86.6%
Presence of guard rails/safety mesh	17	56.7%	13	43.3%
Scaffolding properly erected	24	(80%)	6	20%
Insulated electric wires	27	(90%)	3	(10%)
Use of reflective clothing/vests	15	(50%)	15	(50%)
Ue of marker pegs and banners on excavations	16	(53.3)	14	(46.7%)
Use of gloves	2	(6.6%)	28	(93.4%)
Use of hoisting machines	5	(16.7%)	25	(83.3%)
Foot paths provided	1	(3.3%)	29	(96.7%)
Warning devices on vehicles	2	(6.6%)	28	(93.4%))
First Aid Kits	30	(100%)	0	(0%)
Fire Fighting Equipment	30	(100%)	0	(0%)
Safety and health precautions	1	(3.3%)	29	(96.7%)

4.10 Factors Influencing Implementation of Health and Safety Measures on Construction Sites in Nairobi

The study established that at the majority of the construction sites, mechanisms to enhance health and safety management implementation were absent and there was no evidence of leadership and management commitment in ensuring health and safety of workers (Table 4.5)

Table 4.5 Factors influencing implementation of health and safety measures at construction sites in Nairobi

	Present	Absent
a) Health and safety management policy	2 (5%)	28 (95%)
b) Fire Drills	1 (3%)	29 (97%)
c) Training of employees on health and safety	1 (4%)	29 (96%)
d) Employee participation	4 (12%)	26 (88%)
e) Health and safety management guidelines	8 (25%)	22 (75%)
f) Routine machinery maintenance schedule	8 (25%)	22 (75%)
g) Leadership and management commitment	2 (6%)	28 (94%)
h) Health and safety committee	1 (3%)	29 (97%)
g) Availability of PPE	(80%)	(20%)
i) Usage of PPE	(10%)	(90%)

CHAPTER FIVE :

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary of the study findings, discussion, conclusions, recommendations and suggested research.

5.2 Summary of the Study Findings

The findings of the study show that majority of the workers (89.2 %) on construction sites are male, with 40% being 31-40 years old. The majority of workers (48.7%) have only primary school level of education and are employed by the contractor (69%) as casuals (70%). Different researchers have pointed out the impact of education level on health and safety risk management. Mombeki (2006) observed that employers with a low level of education found it difficult to interpret contract documents and health and safety laws. This therefore leads to a poor understanding of many issues concerning the health and safety of workers. Phoya *et al* (2011) on the study on the perception of risk of site managers and workers at construction sites in Tanzania observed that those with higher education are more aware of health and safety risks than those with a low level of education.

In this study the most significant causes of accidents, injuries and ill health on construction sites are tools and equipment (76%), slips (65%), fall from heights (80%) and over extortion (72%) respectively, with fire explosion, electricity and transport related accidents being least likely to happen. Falls from height have been viewed as the

one of the most frequent killers of the workers on construction sites. Statistics indicate that nearly 1,000 construction workers are killed each year at their work places. Of these, one-third or over 300 deaths are a result of construction site falls (ILO, 2005). Studies from different countries for example, New Zealand, indicate that, falls from heights are the leading cause of occupational injuries on construction sites (Bentley et al., 2006). In China's construction industry, falls account for approximately 51% of injuries (Yung, 2009). In Hong Kong, work-related falls from heights represented more than 47% of all fatal incidents (Chan et al., 2008). Chi and Wu (1997) reported that more than 30% of fatalities in Taiwan can be attributed to falls. As a result, falls are the most costly occupational hazard in many countries. Common construction site falls include roof-related falls, crane falls, scaffolding falls, elevator shaft falls, falls resulting from holes in flooring, and falling objects. These may occur as a result of inadequate edge protection, or from objects in storage being poorly secured. Workers at risk of falling from a height include painters, masons, decorators and window cleaners and those who undertake one-off jobs without proper training, or equipment (Murie, 2007).

Wounds and bruises, (86%) cuts and fractures (50%) were found to be the most common types of injuries associated with construction sites in Nairobi. Wounds and bruises were the most likely injuries to happen with rating of 86% likelihood of occurrence per week. The researcher found out that fractures and broken bones were the second most likely injuries to occur in Nairobi county construction sites. This was supported by over 50% likelihood of occurrence weekly.

According to the workers accidents and injuries had a high impact on construction progress while site managers reported abseentism, loss of public confidence and disruption of work as impacting negatively on the project progress. The study found out that injuries sustained had a high impact on worker absenteesim.this was reported by

66% of the respondents. Loss of public confidence was least likely to be affected as a result of workers sustaining injuries . This was reported by 60% of the respondents. .Howeve,opinion was divided on whether injurie sustained are likely to cause loss of employee. 46% of the respondent said that injuries sustained did not affect loss of workers with 46% of the respondents saying they had a high impact not withstanding chances are high that morale of the employees is likely to be affected by injuries sustained during construction works.this is suported by 52% of the respondents.

Furthermore, improving the health and safety risk management of the construction projects has repeatedly been shown to save lives, time, and money, and to increase business goodwill and reputation. At the same time, the right to safe and healthy working conditions in construction industry has been a central issue in the global campaign where current health and safety laws and regulations have separate sections specifically for the construction industry (ILO 2005; ILO, 2007; CRB, 2010). Meanwhile, safer and healthier working conditions make an important contribution to poverty alleviation and sustainable development as construction is labour intensive, particularly in developing countries (Chapman, 2005).

The factors influencing implementation of health and safety measures at the sites include lack of training of workers (96%), lack of employee participation (88%), lack of health and safety committees at the sites (97%), lack of commitment from management (94%) and absence of health and safety management policy in 95 % of the sites. This is in line with Armstrong (2009), who states that leadership is the process of inspiring people to do their best to achieve a desired result therefore the leader therefore must be positive in all tasks they wish their staff to undertake. The study also sought to find out whether training influenced the implementation health and safety measures in construction sites in Kenya. 56% of the respondents reported that training influenced the

implementation of health and safety measures. The study sought to find out whether health and safety policty had an influence on health and safety implementation in construction sites in Nairobi county, 53% of the respondents reported that a health ad safery policy had a positive impact on implementationof health and safety management.

Lubega *et al*. (2000) did a study in Uganda and concluded the causes of accidents were mainly due to lack of awareness of safety regulations; lack of enforcement of safety regulations; poor regard for safety by people involved in construction projects; engaging incompetent personnel; non-vibrant professionalism; mechanical failure of construction machinery/equipment; physical and emotional stress; and chemical impairment.

Although Personal Protective Equipment were present in most of the sites (94.7%) their usage was minimal (use of safety belts (12%), use of gloves(7%), use of foot wear (20%) . use of face masks (6.7%). These findings agree with those in the study by Mombeki, (2005) on compliance on 70 construction sites in Tanzania, where the majority of workers never wore PPE, using the excuse of loss of productivity.

5.3 Conclusions

Three main conclusions can be made in this study as follows: -

1. The most common causes of injuries are tools and equipments, slips and over extortion respectively. Slips were found to occur more likely more than any other accidents. Majority of the accidents at construction sites were minor injuries and likelihood of fatal injuries was minimal. Wounds, fractures and broken bones are the common types of injuries associated with construction sites. Personal protective equipment was present in majority of the sites but their usage was low. Accidents and injuries impact on family income and are

likely to cause delays in completion of the project. Commitment of leaders, training of workers, lack of a health and safety policy, lack of health safety committees are likely to influence implementation of health and safety measures on construction sites.

2. Employee participation influences the implementation of health and safety measures in construction sites to a large extent. Participatory approach can result in improvements of health and safety; it is therefore important for managers to share information with employees, creating individualized relationships with employees on health and safety management.

3. Health and safety rules and agencies exist in Kenya. However, the health and safety management operations are not well coordinated; the agencies do not work jointly. Therefore, teamwork amongst the agencies can produce a better integrated health and safety management framework. On the basis of the findings in this study, a framework may be constructed as shown in Figure 5.1 overleaf. The management mechanism encapsulated in this framework is more proactive and participatory, and should be initiated and maintained for every construction site, by the National Construction Authority of Kenya

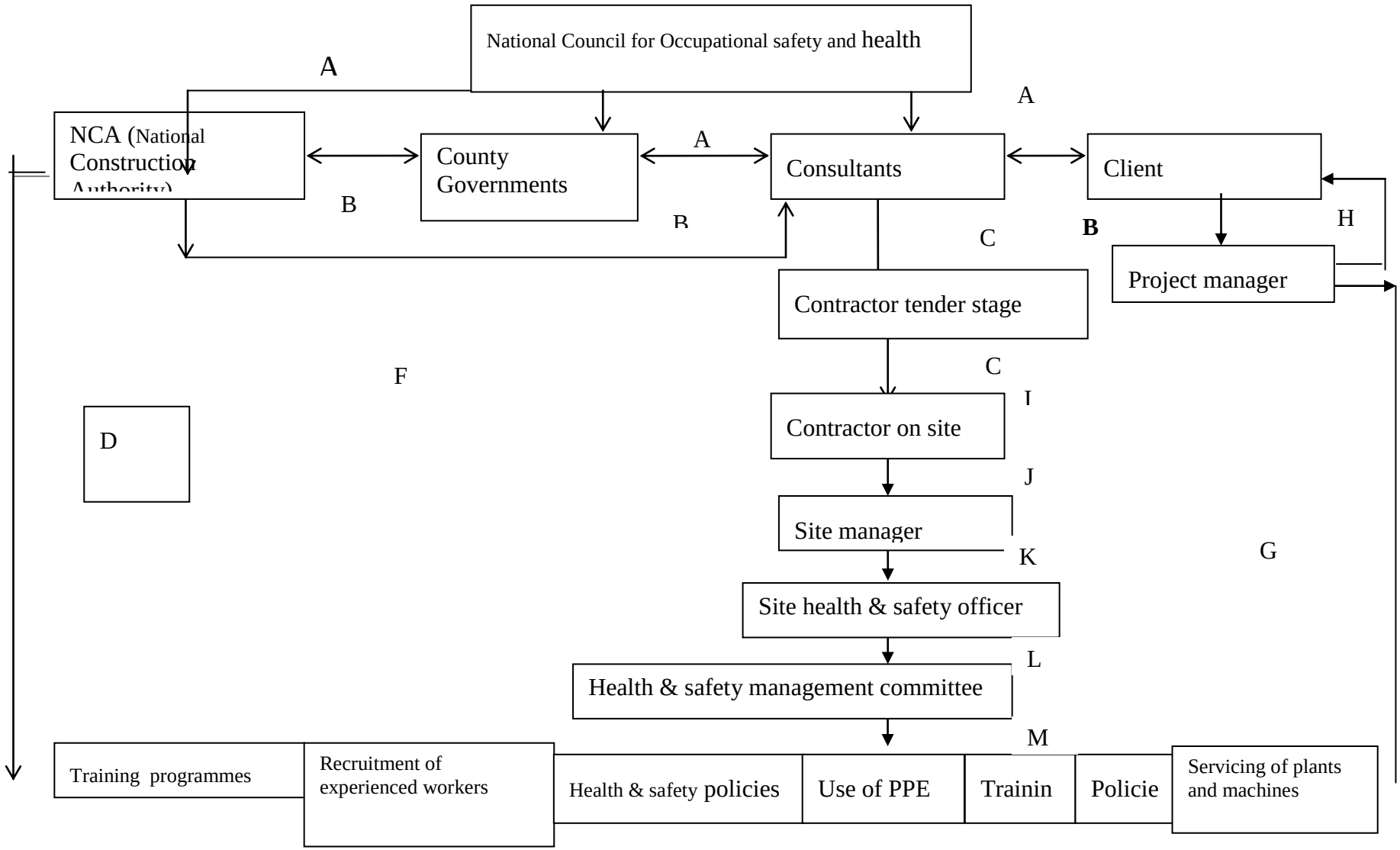


Figure 5.1 Proposed Framework for Health and Safety Management on a Construction Site

KEY

A- Provision of Nation Council for occupational safety and health rules and regulations

B- Consultations before tender stage.

C- Inclusion in tender & pricing

D- Enactment

E- NCA inspection and certification

F- NCA reports after inspection

G- Determination

Description of the Proposed Safety and Health Management Framework for a Construction Site in Kenya

1. **National Council for occupational safety and health**

Provide practical guidance on health and safety for construction sites with respect to any provisional of the occupation safety and health act of 2007.

2. **National Construction Authority**

To oversee the implementation of the safety and health guidance at the construction sites and give advice and recommendation.

3. **County Governments**

Consult with National Council for occupational safety and health and project consultants on safety and healthy for project before approval of the drawings.

4. **Consultant**

To include safety and health guidance as a preliminary item in the bills of quantities

5. **Contractor at tender stage**

To price for the safety and health preliminary item

6. **Contractor on site**

To adhere to the safety and health guidance on the construction process

7. **Client**

To determine the contract on advice of the National Construction Authority through the project consultant if safety and health guidelines are not followed.

5.4 Recommendations

In view of the stated findings and conclusions the study makes the following recommendations:

1. Workers need to wear their personal protective equipment properly and as directed by their employer or comply by the person in control of the site.

2. Massive education campaigns need to be launched to arouse awareness among all parties with direct or indirect bearing on accidents occurrence and their prevention. The Directorate of Occupational Health and Safety services should incorporate an information and education wing in which a data bank of educative materials on health and safety measures can be kept and practical methods of disseminating them to relevant parties developed.

3. The Directorate of Occupational Health and Safety services must ensure that the construction sites are inspected regularly for health and safety as provided in OSHA

4. In order to enhance the role of management in health and safety, the existing legislation should be amended to put more emphasis on role of management.

5. Provisions should be made to make it a statutory duty for every contractor to have a safety management program on site. Contractors should be compelled to draw up safety responsibilities and authority structure which should be available in every site to inform all parties as to their responsibilities as far as health and safety is concerned.

6. The National Construction Authority should use the proposed health and safety management framework constructed from the observations made in this study.

5.5 Suggestions for Further Research

Further research need to be undertaken on construction site accident investigations, reporting and records so as to advice the government on policy improvement and implementation of health and safety on construction sites. This study confined itself to the construction sites in Nairobi County, Kenya.

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APPENDICES

Appendix I: Questionnaire

A) Demographic characteristics of respondents

1. Gender of respondent Male [ ] Female [ ]

2. Age in years (Please tick)

18 – 30 [ ]

31 – 40 [ ]

41 and above [ ]

3 Experience in managing projects

Manager		No. of years
a)	Site manager	[ ]
b)	Contractor	[ ]
c)	Foreman	[ ]
d)	Mechanical Engineer	[ ]
e)	Architect	[ ]
f)	Structural engineer	[ ]
g)	Civil engineer	[ ]

Objective 1 Kind of Accidents and Injuries

What are the kinds and likely causes of accidents and injuries on construction sites? On a scale of 1 – 3 Indicate the likelihood of the accident (Use a tick √)

1. Once every week (Most likely)
2. Once every month (Likely)
3. Once every 2 months (Least likely)

Accidents	**1**	**2**	**3**
Falling from heights			
Falling objects			
Lifting objects			
Tools & equipments			
Electricity			
Fire			
Explosion			
Transport (Hit by vehicle)			
Chemical			
Slip			
Over exertion			

Types of injuries common in construction sites

On a scale of 1 – 4 indicate the rating of occurrence of the type of injury/accident

1 Once every week (Most likely)

2 Once every month (Likely)

3 Once every 2 months (Least likely)

4 Never

Types of injuries (Rating of occurrence)	1	2	3	4
Suffocation				
Amputation				
Wounds /bruises				
Fractures				
Allergy				
Bruises				
Burns				
Electrocution				
Cuts				

Objective 2 Impact of Accidents & Injuries

On a scale of 1-3 rate the impact of the accident/Injury (1) none (2) Low, (3) High

a) Impact on Worker / Family

		1	**2**	**3**
1	Decrease in family income			
2	Loss of family income			
3	Decrease in standard of living			
4	Education & school expenses of children affected			
5	Increase in medical bills			
6	Increase in debts			
7	Depression			
9	Disability			

b) Impact on the project

		1	**2**	**3**
1	Absenteeism of workers			
2	Compensation costs			
3	Medical costs			
4	Property loss			
6	Loss of public confidence			
7	Company image			
8	Loss of morale among employee			
9	Loss of workers			
10	Legal costs			
11	Disruption of work			

Observation Check List

Health and safety measure	Present	Absent
Ladders securely anchored		
Use of face masks		
Use of boots		
Use of helmets		
Use of safety belts		
Presence of guard rails/safety mesh		
Scaffolding properly erected		
Insulated electric wires		
Use of reflective clothing/vests		
Ue of marker pegs and banners on excavations		
Use of gloves		
Use of hoisting machines		
Foot paths provided		
Warning devices on vehicles		
First Aid Kits		
Fire Fighting Equipment		
Safety and health precautions		

Objective 3. What are factors influencing implementation of health and safety measures at construction sites in Nairobi?

j) Health and safety management policy	Yes	No
k) Fire Drills	Yes	No
l) Training of employees on health and safety	Yes	No
m) Employee participation	Yes	No
n) Health and safety management guidelines	Yes	No
o) Routine machinery maintenance schedule	Yes	No
p) Leadership and management commitment	Yes	No
q) Health and safety committee	Yes	No

5. In your opinion what are the challenges and suggestions on improvement of health and safety on construction sites?

Challenge	**Suggested improvement**

Appendix I Letter of Approval

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MOBILE: 0708-602225

REF: JKU/ BPS /AB343-0705/2013 **17th October, 2014**

Mr. Ng'ang'a Kenneth Kibe
C/o Construction
JKUAT

Dear Mr. Ng'ang'a,

RE: APPROVAL OF MSc. RESEARCH PROPOSAL AND SUPERVISORS

Kindly note that your research proposal entitled: **"An investigation of health safety management on construction sites in Nairobi. A case of public building projects"** has been approved. The following are your approved supervisors:-

15. Dr. Stephen Diang'a
16. Dr. Githae Wanyona

Yours sincerely

PROF. MATHEW KINYANJUI
DIRECTOR, BOARD OF POSTGRADUATE STUDIES

Copy to: Dean, SABS
COD, Construction

/rl

Appendix II Letter of Authority

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20th July, 2015

NACOSTI/P/15/6553/7081

Kenneth Nganga Kibe
Jomo Kenyatta University of Agriculture
And Technology
P.O. Box 62000-00200
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Investigation of health and safety management on construction sites in Nairobi the case of public building projects,"*** I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for a period ending **30th November, 2015.**

You are advised to report to **the County Commissioner and the County Director of Education, Nairobi County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

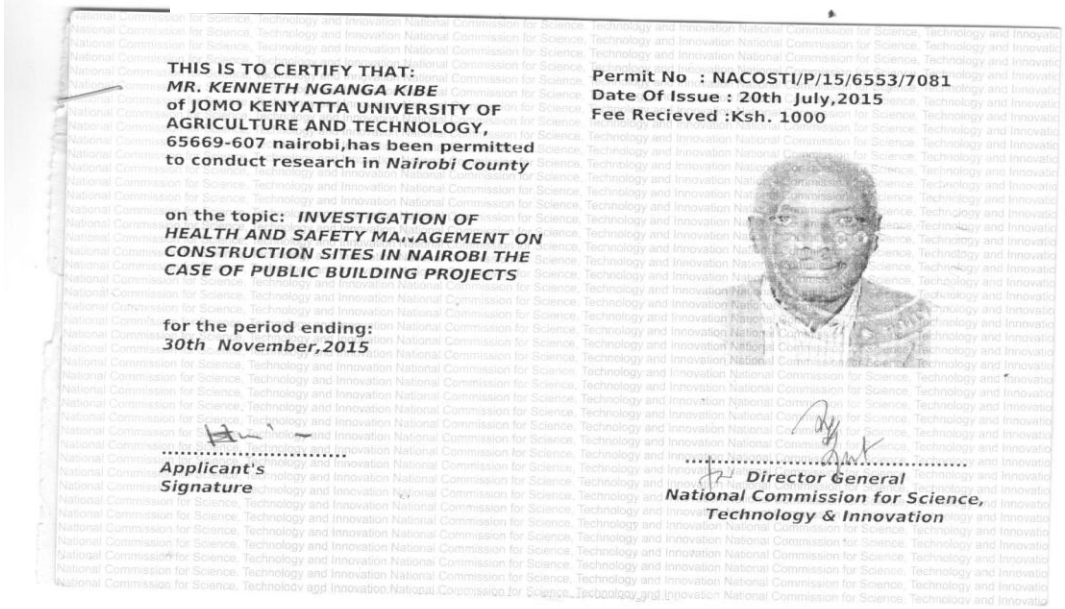
DR. S. K. LANGAT, OGW
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Nairobi County.

The County Director of Education
Nairobi County.

Appendix III NACOSTI Certificate



THIS IS TO CERTIFY THAT:
MR. KENNETH NGANGA KIBE
of JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY,
65669-607 nairobi,has been permitted
to conduct research in *Nairobi County*

on the topic: *INVESTIGATION OF HEALTH AND SAFETY MANAGEMENT ON CONSTRUCTION SITES IN NAIROBI THE CASE OF PUBLIC BUILDING PROJECTS*

for the period ending:
30th November,2015

.....
Applicant's Signature

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Date Of Issue : 20th July,2015
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.....
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Authors Name: KENNETH NGANGA KIBE, Dr STEPHEN DIANGA, Dr GITHAE WANYONA.

Corresponding Author's Name: KENNETH NGANGA KIBE Address BOX 65669-00607 NAIROBI.

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Dear Authors: Kenneth N. Kibe

Paper ID:	F2761015616
Paper Title:	Assessment of Health and Safety Management on Construction Sites in Kenya

This is to inform you that above draft paper is reviewed by the experts in this research area and **strongly accepted by the board of committee of 'Blue Eyes Intelligence Engineering and Sciences Publication Pvt Ltd'** for the publication in **'International Journal of Soft Computing and Engineering™ (IJSCE)'** which is proposed to publish at **Volume-5 Issue 6, January 2016**:

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CERTIFICATE

This certifies that the research paper entitled **'Assessment of Health and Safety Management on Construction Sites in Kenya'** authored by **'Stephen Diang'a, Wanyona Githae, Ng'ang'a Kibe'** was reviewed by experts in this research area and accepted by the board of 'Blue Eyes Intelligence Engineering and Sciences Publication Pvt. Ltd.' which has published in **'International Journal of Soft Computing and Engineering (IJSCE)'**, ISSN: 2231-2307 (Online), Volume-5 Issue-6, Page No.: 1-3, January 2016.

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Appendix VIII: Publication

Assessment of Health and Safety Management on Construction Sites in Kenya

Stephen Diang'a, Wanyona Githae, Ng'ang'a Kibe

Abstract- The construction industry is an important part of the economy in many countries and is often seen as a driver of economic growth especially in developing countries. Owing to its relatively labour intensive nature, construction works provide opportunities for employment for a wide range of people skilled, semi-skilled and unskilled. Despite its importance, construction industries are considered risky with frequent accidents rates and ill health problems to workers, practitioners and end users. However, knowledge on how health and safety risks are managed on public construction sites in Kenya is limited. This study therefore, aims to find out the current practice of health and safety management on public construction sites in Nairobi County, Kenya, A cross sectional descriptive study was carried out in randomly selected public construction sites. Questionnaires were used for collection of qualitative and quantitative data from contractors and workers on public construction sites. Descriptive statistics was used for data analysis. The study concludes that the most common cause of injuries is tools and equipments, slips and over extortion respectively, with fire explosion and electricity and transport trailing the list, the management teams were commitment toward implementing the safety measures. Training influences the implementation health and safety measures

Keywords: - industry, Owing, countries, implementation, Descriptive statistics, respectively, Kenya

I. INTRODUCTION

A. Background of the study

The function of any government is to ensure workers' safety in a modern construction industry is safe workplace and is

central to the ability to enjoy health, security, and the opportunity to achieve success in life. Health and safety at construction sites can be achieved by provision of enough clean water, proper and enough sanitation facilities, health friendly environment, knowledge of handling of machines, plants and equipment and hygienic practices. Health and safety standards on construction sites are set by the International Labour Organization (ILO) and are based on international conventions and recommendations on occupational health and safety (ILO, 2002). In Kenya, they are enforced through National Workmen's Legislation (Cap

236), the occupation Safety and Health Act, 2007, the Factories and Other Places of Work Act 1962. Safety concerns at workplace started in earnest in 1906

Revised Version Manuscript Received on December 04, 2015.

Dr. Stephen Diang'a, Academic Professional Qualification, B. ARCH

(U.O.N), M. ARCH (U.O.N), PhD (Kwazul Natal), RSA, Specialization, Construction Project Management, Construction Contract Documentation, Project Risk Management, Architecture, Kenya.

Dr. Wanyona Githae, Academic Professional Qualification, B.A BLDG ECONS (U.O.N), M. Engineering (Kyoto University, Japan), PhD (UCT), RSA, Kenya.

Mr. Ng'ang'a Kibe, Academic Professional Qualification, B. PHIL. IN CONSTRUCTION MANAGEMENT (U.O.N); MSC IN Construction Project Management – (On Going) (JKUAT) Specialization, Construction Project Management, Kenya. In the U.S with the formation of the Massachusetts Board of Health which appointed health officials to inspect factories, work places and such like institutions (Stranks, 2005).

In the United Kingdom employees set up their own work place committees elected by the employees with the power to determine health and safety matters with the management. The general duties of the committee are in line with the European wide harmonized requirement of the health and safety directive. Following the Mexico earthquake of 1985, which had profound effects health care and safety, the United Nations General Assembly launched in 1990 the International Decade of Natural Disaster Reduction (IDNDR), with an objective to implement Disaster Mitigation programs which could in the long run improve safety and health at work places and home (Ridley, 2004).

B. Objectives of the study

The specific objectives are:

1. To establish the kinds and causes of accidents and injuries on construction sites in Nairobi county

2. To assess the impact of accidents and injuries on the construction process in Nairobi county

3. To determine factors influencing implementation of health and safety measures on construction sites in Nairobi County

4. To prepare a framework for ……. determine factors influencing implementation of health and safety measures on construction sites in Nairobi County.

II. SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

A. Introduction

This chapter presents summary of the study findings as guided by the research objectives, discussion of the findings, conclusion, recommendations and suggested further research.

B. Summary of the Study Findings

Establishing and maintenance of health and safety management system in a working environment is critical in cultivating a health and safety culture among the employees in an establishment, more so in building construction where the levels of accidents are documented to be higher than most other work places, ILO report (2010) as we observed in the literature review. The researcher established that the most common cause of injuries is tools and equipments, slips and over extortion respectively, with fire explosion and electricity and transport related accidents receiving a vote of least likely accidents to happen. Slips were found to likely occur once a week at a rate of 65%, 33% once a month and

5% once every two months. Tool and equipment accounted for majority of injuries and hand an accordance rate of 76%

Per week. 71. % of the respondents have recorded accidents in their construction sites. Though the accidents were mainly minor injuries in nature with only 7% being fatal and severe respectively, this shows the level of danger construction site workers encounter in the course of carrying out their tasks. Wounds and bruises cuts and fractures were found to be the mostcommon causes of injuries associated 50% likelihood of occurrence weekly. The researcher sought to know what is the impact of various injuries sustained during construction works. In this respect the researcher examined the impact on two perspective, that is impact to the workers and impact to the construction project. From the study it was evident that injuries have a high impact on family income. This was supported by 61% of the respondent. It was interesting however to note that despite the fact that majority of the respondent thought that injuries have a high impact in decreasing family income, majority of them thought that it had a little to do with standards of living. This is supported by 40%. 58% of the respondents who said that Injuries sustained during construction works did not cause disability. Also Injuries sustained in construction sites are less likely to cause depression. From the study only 31% said were in favor of injuries causing depression

The study found out that injuries sustainedhad a high impact on worker absenteesim.this was supported by over 66% of the respondents whith no respondent in favouref a no impact verdict.loss of public confidence was least likely to be affected as a result of workers sustaining injuries . this is supported by 60% of the respondents .howeve,opinion was divided on whther injurie sustained are likely to cause loss of employee. 46% of the respondent said that injuries sustained did not affect loss of workers with the same number saying they had a high impact not withstanding chances are high that morale of the employees is likely to be affected by injuries sustained during construction works.this is suported by 52% of the respondent

The researchers sought to know the factors that influence implementation of health and safety measures in construction sites in Nairobi County. In this area the researcher paid much attention on health and safety management policy, training of employee on health and safety, leadership commitment and employee participation.

64% of the respondents, were opinion that employee participation influences the implementation of health and safety measures in construction sites in Nairobi. 71% of the respondents stated that the management showed a good attitude towards workers safety. This is in line with Armstrong (2009), stated that leadership is the process of inspiring people to do their best to achieve a desired result therefore the leader therefore must be positive in all tasks they wish their staff to undertake. The study also sought to find out whether training influenced the implementation health and safety measures in construction sites in Kenya.

56% of the respondents supported this to a large extent that

training influenced the implementation health and safety measures. The study sought to find out whether health and safety policty had an influence on health and safety implementation in constructionsites in nairobi county53% of the respodents were of the opinion that health ad safery policy had a positive impact on oimplementationof health and safety measures.

III. CONCLUSIONS

The study concludes that the most common cause of injuries is tools and equipments, slips and over extortion respectively, with fire explosion and electricity and transport trailing the least. Slips were found to occur more likely more than any other injuries majority of the accidents at construction sites were minor injuries and likely hood of fatal injuries was minimal. Would fractures and broken bones are the common types of injuries associated with construction sites.

The study sought to establish whether leadership influences the implementation of health and safety measures in construction sites in Kenya. The study found out that leadership influences the implementation of health and safety measures. The management teams were commitment toward implementing the safety measures. On whether employee training influences the implementation of health and safety measures in supermarkets on Kenya, the study concluded that training influences the implementation health and safety measures. Lack of training on health and safety measures affects performance and productivity of the employees to a large extent. The study concluded that Employee participation was shown by the study to influences the implementation of health and safety measures in construction sites to a large extent. Participative approach can result in improvements on health and safety, it is important for managers to share information with

employees, creating individualized relationships with employees on health and safety and the respondents believed in the value of providing greater autonomy to employees.

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