SAFETY AND HEALTH IN THE CONSTRUCTION INDUSTRY IN ZAMBIA

by

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DECLARATION

I, **Prisca Tente** do declare that this dissertation is entirely my own work except as specified in the acknowledgements and that neither the dissertation nor the original work contained herein has been submitted to this or any other institution for a higher degree.

Signed:.....

Date:.....

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APPROVAL

This dissertation by Prisca Tente entitled ‘Safety and Health in Construction Industry in Zambia’ is approved as partially fulfilling the requirements for the award of the degree of Master of Engineering in Construction Management of the University of Zambia.

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ABSTRACT

SAFETY AND HEALTH IN THE CONSTRUCTION INDUSTRY IN ZAMBIA

Construction is considered as one of the most accident prone industries across the world. In Zambia, construction is labor intensive and flooded by unskilled workers who migrate within and outside the country. As Zambia modernizes its infrastructure through the construction of roads, bridges, shopping malls, hotels, hospitals, and schools among others; the incidences of on-site accidents and ill-health detrimental to the workers during the execution of these projects is likely to increase thus negatively affecting the nation. Zambia currently lacks a National Occupational Safety and Health Policy and as such the Factories Act is applied to all industries including the construction sector. Despite the use of the Factories Act and company safety and health regulations, accidents are still prevalent in the construction industry. Reported and unreported accidents can be prevented or their effects mitigated if standardized safety and health procedures are adhered to.

The aim of this research is to study the status of safety and health in the construction industry in Zambia. The study also targets to identify measures to improve safety and health in the construction sector in Zambia. Interviews were conducted alongside a questionnaire survey, objectively for data collection. Three sites were used for the purpose of triangulation and verification regarding the interview and questionnaire results. Interviewees and respondents to the questionnaires were construction stakeholders who included clients, consultants, contractors and government organizations. Observations from the data collected highlighted the lack of coordinated safety and health practices in the industry which in-turn translates to a high risk factor for accidents and ill-health. The Factories Act which is used in the industry was found to be relatively adequate but lacked sufficient enforcement.

The results indicated; falling from a height, being hit by falling objects and the collapse of earth as the three most predominate types of accidents. Causes of accidents were identified to result from poor attitude to safety, inadequate safety equipment, poor enforcement of safety and health regulations, lack of safety training, and inclement weather. The common ill-health elements were diarrhea, respiratory disorders and backaches resulting from handling of heavy loads, exposure to dust and chemicals, poor sanitary conditions and poor personal hygiene. Severe weather significantly contributed to unsafe working conditions as more accidents occurred and were recorded during the rainy season accompanied by ill-health due to floods and wet conditions. The common recognized effects of accidents consisted of high costs, disabilities, reduced productivity, job schedule delays and fatalities.

The preventive measures identified included improved attitude to safety and health by all stakeholders, enhanced enforcement of the Factories Act, inclusion of safety and health as an item in all Bills of Quantities, provision of adequate personal protective equipment, training of project teams in Occupational Safety and Health, and the introduction of Occupational Safety and Health subject in curricula of universities and colleges for students pursuing construction related qualifications.

Keywords: Accidents, Construction, Health, Safety, Zambia

DEDICATION

This work is dedicated to my lovely daughter Mariateresa, my wonderful parents Mr and Mrs Linus Mushibwe Tente and my lovely sisters and brothers.

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LIST OF ABBREVIATIONS

ACEZ	-	Association of Consulting Engineers of Zambia
AIDS	-	Acquired Immune Deficiency Syndrome
BOQ	-	Bill of Quantities
BWWI	-	Building and Wood Workers' International
CSO	-	Central Statistics Office
EIZ	-	Engineering Institution of Zambia
EU	-	European Union
GDP	-	Gross Domestic Product
GRZ	-	Government Republic of Zambia
HIV	-	Human Immunodeficiency Virus
HSE	-	Health Safety Executive
ILO	-	International Labour Organisation
IPC	-	Interim Payment Certificate
MLSS-OSHS	-	Ministry of Labour and Social Security, Occupational Safety and Health Services
MoL	-	Ministry of Labour
MWS	-	Ministry of Works and Supply
NAPSA	-	Nation Pension Scheme Authority
NASSC	-	National Association of Small Scale Contractors
NCC	-	National Council for Construction
NGO	-	Non-Governmental Organisation
NOSH	-	National Occupation Safety and Health
OHSA	-	Occupational Health and Safety Act
OSHA	-	Occupational Safety and Health Agency
OSHC	-	Occupational Safety and Health Council
OSH	-	Occupational Safety and Health
PACRA	-	Patents and Companies Registration Agency
PPE	-	Personal Protective Equipment
RDA	-	Roads Development Agency
S & H	-	Safety and Health
SIZ	-	Surveyors Institute of Zambia

SSC	-	Small Scale Contractors
SSE	-	Small Scale Enterprise
UNEP	-	United Nations Environment Programme
VAT	-	Value Added Tax
WCFCB	-	Workers Compensation Fund Control Board
ZEMA	-	Zambia Environmental Management Agency
ZESCO	-	Zambia Electricity Supply Corporation
ZIA	-	Zambia Institute of Architects
ZRA	-	Zambia Revenue Authority

CHAPTER ONE: INTRODUCTION

1.1 Background

Construction comprises of building new structures, renovating old structures and the maintenance and repair of buildings or other engineered structures such as highways or utility systems (Behn, 2008). Furthermore, it is not only limited to building but also embraces a couple of other activites such as painting, landscaping, electrical supply, telecommunications, plastering and paving (Alazab, 2004). The construction industry plays a central role in the national welfare of a country through the development of housing and office buildings, education and health centers, transport infrastructure, industrial plants and the restoration of the nation's infrastructure as well as other public facilities (Kaliba, 2010). In addition, construction is fundamental to all major economic drivers and contributes massively to the economy of a nation as such. For instance, the construction, repairs and maintenance of the nation's physical infrastructure such as roads, houses and workplaces (Behm, 2008).

The construction industry highly contributes to Zambia's Gross Domestic Product (GDP). According the Central Statistics Office, the construction sector was the second highest contributor to GDP in the informal sector with a contribution of 27.4 per cent as of 2014 (Central Statistics Office (CSO, 2014). The United Nations Environment Programme (UNEP, 2003) further alludes that developing countries account for 23 per cent of global construction activities. The UNEP (2003) also noted that the construction industry in developing countries is more labour intensive as compared to that of developed countries. This implies that workers are more exposed to hazards and risks given that most construction jobs are noted to be messy and labour intensive. The work is often dangerous and presents safety hazards of which may maim, injure or lead to poor health in workers if not managed and prevented (Tam, *et al*., 2004). In Zambia, construction is not only labour intensive but involves unskilled workers who migrate within and outside the country with minimal regulation.

Occupational safety and health is one of the pressing concerns for the construction industry experienced by developing and developed nations alike (Solicitors, 2010). Health is described as a state of being free from illness, whereas a safe workplace is an environment where workers' physical, mental and social wellbeing is promoted and maintained to the highest degree (Concise Oxford English Dictionary, 2004). On the other hand, a healthy work place

is an environment where health risks are recognized and controlled if they cannot be removed (Mukhalipi, 2004). In order to abate construction-related occupation safety and health problems, many countries have construction specific laws, regulations and National Occupational Safety and Health (NOSH) policies. However, Zambia has no NOSH policy, which is supposed to be an umbrella policy to all the industries (ILO, 2012). Most industries use the Factories Act Cap 441 (1994) of the laws of Zambia on matters regarding safety and health. This is with an exception to the mining sector, which has its own tailor-made regulations namely The Mines and Minerals Act Chapter 213 of the Laws of Zambia, The Mining Regulations of 1974, The Explosives Regulations of 1974 and The Explosives Act Chapter 115 of the Laws of Zambia as amended by Act No. 14 of 1995 (Chabala, 2005). While the construction industry on the other hand, uses Construction Safety and Health Regulations in the Factories Act (ILO, 2012). The Factories Act was enacted in 1967 and was twice amended in 1974 and 1994, respectively. It was enacted to ensure that workers operate under improved healthy and safe working environments. However the Factories act has its own limitations such as the inadequate provision of risk management and it offers no encouragement of worker participation in safety and health (Jere, 2011).

The Ministry of Labour and Social Security, through the Occupational Safety and Health Services (MLSS-OSHS) is responsible for enforcing the Factories Act at places of work. The basic requirements of the Factories Act include a clean working environment, safe clothing, appropriate head gear and footwear, adequate ventilation, prevention of overcrowding, availability of first aid, sufficient lighting, availability of sanitary facilities, basic training on safety and health and the presence of fire extinguishers and hydrants (Jere, 2011). Nevertheless, contractors are still allowed to have company safety and health regulations provided they are better than provisions of the Factories Act. In 2010, Occupational Health and Safety Act (OHSA) was enacted but is not in use in the industry because it was regarded as non-comprehensive by construction stakeholders. Furthermore, many stakeholders were left out in the drafting and development process (Mwape, 2012). The OHSA was formulated by stakeholders from the Ministry of Health with a strong emphasis on health (Mwape, 2012).

Table 1.1: Accident and Degree of Disablement (2003-2007)

		DEGREE OF DISABLEMENT			
	INDUSTRY TYPE	**FATAL**	**PERMANENT**	**TEMPORARY**	**TOTAL**
1	Agriculture & Forestry	52	394	284	730
2	Banking Finance & Insurance	3	16	20	39
3	**Building Construction**	**58**	**281**	**148**	**487**
4	Charities, Religious, Political	6	47	30	83
5	Chemical Industry	59	171	130	360
6	Educational Services	5	25	21	51
7	Food, Drink & Tobacco	35	194	108	327
8	Glass, Brick Site & Asbestos	0	26	26	52
9	Iron, Steel Industries, etc	39	234	188	461
10	Leather Industries, etc	3	5	1	9
11	Local Authorities	10	47	32	89
12	Medical Services	1	6	1	8
13	Mining, Quarrying Industries	96	954	442	1,492
14	Personal Services, Hotels, etc	35	154	185	374
15	Professional Services, etc	1	25	28	54
16	Publishing, Printing, Paper	1	14	16	31
17	Textile Industries	9	170	206	385
18	Trade & Commerce, etc	31	104	56	191
19	Transport, etc	41	146	74	261
20	Entertainment	0	2	4	6
21	Wood, Furniture Industries	10	92	40	142
22	Unregistered	17	77	32	126
	TOTAL	**512**	**3,174**	**2,072**	**5,758**

Source: ILO-Zambia country OSH Profile Report (2011)

Table 1.1 highlights the accidents and degree of disablement in Zambia from 2003 to 2007 (ILO, 2011). Construction recorded the third highest accidents and incidents behind mining and quarrying and agriculture and forestry sectors out of 22 noted industries. Construction recorded 58 fatalities thus making it the third highest from mining and quarrying and chemical industries. In addition, 281 permanent disabilities were documented in construction which again was the third highest from mining and quarrying and agriculture and forestry industries.

1.2 Statement of the Problem

The construction industry is a very vigorous and thriving industry worldwide, owing to its relatively high contribution to economy of a nation (Abdullah and Wern, 2011). In Zambia, the construction industry has and continues to contribute to the country's economy through completed and ongoing projects. Currently projects such as Link Zambia 8000, Link Lusaka 400, Pave Zambia 2000, rehabilitation of Kitwe-Chingola dual carriageway, construction of health facilities, schools, universities, shopping malls, Mini hydropower stations, bridges and many others continue to significantly add to the Zambian economy. Conversely, this contribution is twofold due to its nature, as such the other unwanted contribution attributed to the construction industry is the high rate of fatalities because of its hazardous nature (Bakri *et al.*, 2006). There is a high prevalence of occupational accidents and diseases in Zambia, particularly in agriculture, mining, construction, health and transport (Jere, 2011). Siziya *et al*., 2010 noted that the risks and hazards result into the high rate of occupational illness and accidents at 69 per cent of the labour force in Zambia.

The benefits of all the ongoing construction projects are directly or indirectly linked to improving the rural economy and employment creation (Road Development Agency, 2015: ZESCO, 2015). These construction projects not only bring about an increase in employment opportunities but also more exposure to hazards and high risks as they differ in execution and magnitude. However as has been mentioned earlier, if there is poor enforcement of appropriate safety and health legislation, the result is not only infrastructure development but also accidents and ill-health. According to Jere (2011), one of the factors which contribute to high occupation accidents in Zambia is inadequate legislation and enforcement of safety and health laws. Despite the social and economical consequences of accidents and ill-health, they can be prevented by taking appropriate measures (Ahn, 2004). The problem is summarized in equation 1.

CP + IE + HR - SH = ID + AI equation (1)

Where;

CP is Construction Project

IE is Increase in Employment

HR is Hazards and Risks

SH is appropriate Safety and Health legislation (enforcement)

ID is Infrastructure Development

AI is Accidents and ill-health and their effects

This research aimed at developing a model to help control hazards by mitigating risks so as to prevent accidents and ill-health in the construction industry in Zambia. The resulting model from the study offers appropriate safety and health measures to prevent accidents and ill-health that have devastating effects on the labour force and the entire industry.

1.3 Rationale

The majority of enterprises involved regarding on-site construction are specialized in terms of the type of work and the locality they operate from. For instance, building materials, plant and equipment are generally purchased or hired from other enterprises. Furthermore, the products of the construction industry are produced or assembled at a particular given point of use thereby implying that the workforce has to be mobile (Building and Wood Workers' International (BWWI, 2010)). It is also worth noting that each construction project is unique and has its own characteristics, method of work, materials employed and technique which vary from project to project (Ligard and Rowlinson, 2005). Construction sites typically have many sub-contractors who perform different types of work in close proximity to each other (Kamar, 2014). The mobile force and unique characteristics of construction projects, pose a danger to the safety and health of workers involved. Workers' safety and health should be as important as adhering to project deadlines as well as delivering high-quality work.

According to the global survey on construction safety and health by ILO, member countries world-wide, recognized construction has one of the most hazardous sectors (Muya, *et al*., 2008). This compelled individual countries to put in place NOSH policies, despite Zambia being a member of ILO however, it has no NOSH policy. Zambia recently ratified the key C-155 ILO Convention on Safety and Health on 23 December 2013, it is therefore essential for developing a NOSH policy to support the Factories Act (ILO, 2014). The NOSH policy and OSH regulations can help towards securing the protection of workers and the general public from incidences arising in the construction industry (Muya *et al*., 2008).

The development of a local construction industry stands as one of the pinnacles of the government's socio-economic development goals. In developing countries particularly, the construction industry is one of the highest significant GDP contributing sector and also impacts on the safety and health of the working population (Ligard and Rowlinson, 2005).

The Zambian government established the National Council for Construction (NCC) through the enactment of Act No. 13 of 2003 to monitor and to improve the construction industry.

Table 1.2: Media Reported Accidents - Causes and Effects

S/N	Site and Media Institution	Type	Causes	Effects
1.	Nkana Mall-Kitwe (Times of Zambia, 06/05/ 2013)	Collapse of earth	Unsafe site and unsafe methods	One open depressed skull fracture and brain coma and the other leg injuries, work suspended
2.	Ibex Hill Lusaka (Lusaka Times, 29/10/2012)	Collapse of earth	Poor attitude to safety, safety equipment not provided, deficient enforcement of safety, lack of safety training and unsafe methods	Five deaths, unnecessary costs - funeral costs and compensation
3.	Kafue Steel Plant (The Post, 01/01/ 2012)	Explosion of Oxygen cylinder	Poor attitude to safety, deficient enforcement of safety, lack of safety training	Ten injured, One leg amputated, unnecessary cost in damage
4.	Konkola Copper Mines (Chingola) civil works (The Post, 27/03/ 2011)	Collapse of earth	Poor attitude to safety, unsafe methods	Four deaths, unnecessary cost-funeral cost and compensation, disruption of production, poor corporate image for the sub-contractor
5.	Kitwe (The Post, 24/02/2011)	Hit by falling object (piece of metal, pierced the neck	Poor attitude to safety, safety equipment not provided, deficient enforcement of safety	One death, disruption of production
6.	Manda Hill - Lusaka (The Post, 27/03/ 2010)	Hit by falling object (pile of glasses carried on wheelbarrow)	Poor altitude to safety, safety equipment not provided, deficient enforcement of safety	One life was lost (death), temporary closure of site (disruption of production and job schedule delays)

The NCC registers, upgrades, downgrades and monitors consultants and contractors across Zambia and in 2013 it was noted that the country experienced massive growth in the construction industry, which accounts for 18 per cent of the total workforce (Rozado *et al.*, 2013). The increase in the number of companies registered by NCC and the existence of the National Association of Small Scale Contractors (NASSC) gives an indication of this rapid growth in the construction industry in Zambia. The growth of the industry entails an increase

in job creation and also exposure to hazards and risks. Therefore, it is essential to develop a safety and health model to protect the workers and create awareness for improved safety and health in the construction sector.

According to Song and Li (2011), occupational accidents and incidents have been on an increase in developing countries and have unpleasant consequences. In support of their finding, even with the use of the provisions of the Factories Act and company safety and health regulations, accidents are still prevalent in the construction industry in Zambia. Some of the reported accidents recorded during the study period from 2010 to 2013 through print media are listed in Table 1.2. Therefore solutions to prevent and mitigate such accidents should be established in order to protect the most important asset in the industry- human resource. This would also help construction stakeholders in avoiding costs resulting from accidents and ill-health.

In 2011, Zambia was reclassified as a middle-income country by the World Bank (Centre for Affordable Housing in Africa, 2014). This status led to an increase in construction projects, due to funding, aimed at modernizing both new and existing infrastructure as well as a shift to the latest mechanization in the industry owing to improvement in technology. The latest machinery which is rather unfamiliar to unqualified workers can be a source of hazards. In addition, client expectations of quick project time delivery can encourage unsafe practices as unconventional methods are implemented in order to save time and costs (Fellows *et al.*, 2002). All these factors are likely to bring about an increase in incidences of on-site accidents as well as ill-health, which is detrimental to workers, projects and the nation at large.

Despite the use of the Factories Act, there has not been much improvement in the area of prevention of accidents in Zambia (Rozado *et al.*, 2013). In an attempt to mitigate and prevent accidents and ill-health and generally improve safety and health in the construction industry in Zambia, a study such as this is important.

1.4 Objectives

1.4.1 Main Objective

The main objective of the study was to investigate and develop a model for improved safety and health in the construction industry in Zambia.

1.4.2 The specific Objectives

In order to achieve the main objective, the following targets were implemented:

i. Analyse the effectiveness of the Factories Act of 1994 in relation to the workers' safety and project delivery in the construction industry.
ii. Investigate the types and common causes of accidents and ill-health and determine methods of prevention.
iii. Establish the impact of accidents and ill-health on construction labour and projects in Zambia.
iv. Develop a safety and health model and recommend ways it could be implemented by all stakeholders in the construction industry in Zambia.

1.5 Research Methodology

The study employed a survey in the form of one-one interviews and a questionnaire. Literature was reviewed as secondary data collected from journal articles, dissertations, books, government and corporate reports and Acts, newspapers and the internet. Whereas the primary data was collected through interviews and a questionnaire survey in the form of semi-structured questions. The targeted respondents were stakeholders in the construction industry and the population was selected from the companies registered with NCC in 2012. The total number of companies which registered was 3,887 (NCC, 2012). The companies were stratified in their respective grades and towns of operation then randomly selected.

Consultants and clients were knowingly selected for the reason that they were linked to projects which were undertaken by the contractors selected for the study. The public safety and health inspectors from the MLSS-OSHS, NCC, Workers Compensation Fund Control Board (WCFCB), The Road Development Agency (RDA) and Ministry of Works and Supply (MWS) were particularly sampled because they worked directly with contractors. The targeted total population was 90, out of which only 78 responded. The data collected was analyzed quantitatively and qualitatively using Excel spread sheets and Statistical Package for Social Science (SPSS).

1.6 Significance of the study

The construction sector is one of the sectors where high risk is widespread in Zambia (Jere, 2011). The unsafe practices in the industry could be verified by the frequency of accidents and ill-health (Table 1.1). According to literature reviewed for this study, no research has been done on this topic in the construction industry in Zambia. Therefore, the study provides

an insight into the safety and health in Zambia's construction sector. Furthermore, the study gives a platform for further research into ways of improving safety and health in the construction industry in the country. The study further highlights the challenges of poor safety and health and their impacts on construction projects.

In addition, the study also promotes the inclusion of safety and health at all stages in the construction project cycle and encourages the involvement of all construction stakeholders in improving safety and health in the industry. Also, the study advocates for the formation of the NOSH policy that would be used to make the work place safe and healthy. The inclusion of OSH in universities and colleges curricula would help in addressing the problem of inadequate training which was identified as one of the root causes of accidents during the course of this study. Accidents do not just typically occur; they are rather triggered by a chain of events and can consequently be prevented. It is also worth noting that prevention is not only convenient but also cost saving in the long run. The proposed safety and health model in this study would help prevent accidents and ill-health and lead to mitigation of their effects, thereby protecting the construction industry's most important asset, human resource.

1.7 Organisation of the dissertation

The dissertation is organised in seven chapters as follows;

Chapter One introduces the background, the rationale and the objectives of the study. Followed by chapter two which covers the literature review of previous studies done on safety and health in the construction industry. The chapter presents researches from other scholars in relation to the objectives of this study. The study methodology is documented in chapter three, offering types of data collection techniques, research instruments, target population and sampling methods. While the results and data analysis from interviews and questionnaire survey can be found in chapter four. Chapter Five presents the proposed safety and health model and explains the stages of the model and how it can be implemented. The allocation of specific roles of all stakeholders in the construction industry in Zambia on the improvement of safety and health is also reported in this chapter. Finally, chapter six offers a thorough discussion of this study's findings and their significance; thereby leading to the conclusions, limitations and recommendations regarding prevention or mitigation of accidents and ill-health in chapter seven. The layout of chapters is presented in Figure 1.2.

1.8 Summary

This chapter gives a general introduction to safety and health in the construction industry both in Zambia and globally. It also presents the background of safety and health in the construction sector in Zambia and also explains the rationale of the research with examples of recent accidents being cited. In addition, objectives of the research have been stated and the adopted methodology to address the objectives. Most importantly, the significance of the study has been clarified with an established target.

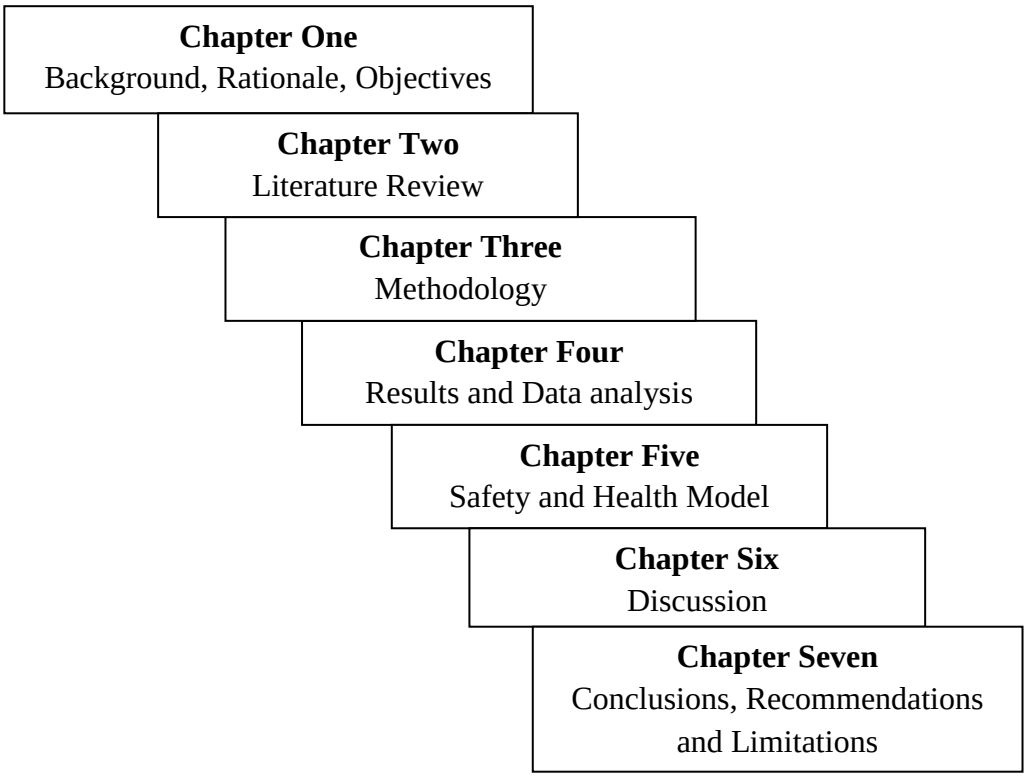

Figure 1.1: Chapter Layout

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The preceding chapter presented an overview of the problem of safety and health in the construction industry, the rationale, research objectives and the layout of Chapters of the study. This Chapter offers a review of literature of some studies done by other scholars on safety and health in construction industry. As well as an overview of safety and health in the construction industry globally and locally, particularly describing types, causes and preventive methods of construction accidents and ill-health. As a final point, this chapter also outlines the benefits of improved safety and health in the construction sector.

2.2 Definitions

Safety is a condition of being protected from or not exposed to danger.

Health is a state of being free from illness (Concise Oxford English Dictionary, 2004).

The National Safety Council (NSC) defines **accident**, **incident**, and **near miss** as follows:

(a) An **accident** is an undesired event that results in the personal injury or damage to property.

(b) An **incident** is an unplanned, undesired event that adversely affects completion of a task.

(c) A **near miss** is an incident where no property is damaged and no personal injury sustained, but where, given a slight shift in time or position, damage/or injury easily could have occurred.

Hughes and Ferrett (2007) define a **hazard** as the potential of a substance, activity, or process to cause harm. Hazards take many forms, for example, chemicals, electricity and working from a ladder. While a risk is the likelihood of a substance, activity, or process to cause harm (Hughes and Ferrett, 2007).

2.3 Overview of Occupational Safety and Health in Construction

Construction plays a part in many economic sectors (ILO Construction OS & H), as the industry contributes more than a tenth of the global GDP and it is believed to employ over 7 per cent of the world's entire workforce (Kayumba, 2013). However, construction is internationally recognized as the most dangerous industry in which to work (Ligard and

Rowlinson, 2005). This is supported by the fact that there are around 340 million occupational accidents and 160 million victims of work-related illnesses annually worldwide (Neale, 2013). For instance, in Asia; China and Japan recorded significant levels of injuries and fatalities in the construction industry (Chan *et al*., 2004). In Thailand, the industry faced high accident and injury rate at the project level. Furthermore, in 2003 Thailand's construction industry accounted for 14 per cent of the total number of 787 deaths at work and 24 per cent of the total seventeen cases of permanent disability (Aksorn and Hadikusumo, 2007). Despite the industry not recording the highest in accident statistics in Malaysia, a worrying increase in the number of accidents was recorded (Abdullah and Wern, 2011)

In South Africa, it has been noted that construction sites continue to be among the most dangerous workplaces in the economy. This is despite the government's initiatives to improve safety and quality performance. According to the Construction Industry Development Board (CIDB, 2004) the construction industry was ranked third after mining and transportation, having recorded seventy-four deaths on sites in 2003. Approximately 160 deaths occurred on construction sites in 2007 and 2008 (CIDB, 2008). In addition, the Department of Labour produced a report in 2012 which indicated that in the period of 2007 to 2010, the construction industry incurred 171 fatalities and 755 injuries.

Regardless of having the necessary legislation in place, construction Safety and Health (S&H) is a major issue in developing countries (Chiocha *et al*., 2011). Research further suggests that in Botswana, construction S&H awareness is low (Musonda and Smallwood, 2008) to the effect that the industry recorded a fatality rate of 0.26 per 1,000 workers which was the highest of all industries (Tau and Seoke, 2013). Similarly, according to Chiocha *et al.* (2011), S&H records in the Malawian construction industry are virtually non-existent and studies emanating from countries sharing similar characteristics with Malawi in the region provide a pointer to what may be occurring in the Malawi. Meanwhile the Tanzanian government has established OSHA, yet occupational safety and health records are still a problem and a majority of workers in several economic sectors are affected (National Audit Office, 2013). The construction operators do not give priority to the safety and health of workers despite workers being important drivers of the sector which contributes to the national economy (Matiko, 2013). Moreover, deaths, permanent disabilities, and severe injuries have been on the increase for building workers through major accidents and poor working conditions in the country (Phoya, 2012).

In Zambia, although the country is committed to providing safe and healthy work environments for all citizens especially those in the construction sector, a year hardly passes without reports of workers striking or getting injured as a result of poor working conditions (Rozado *et al*., 2013). In an effort to address the safety and health challenges, a number of companies involved in safety and health at the workplace in general were formed. Some of the companies formed include Squaremark, Amerex Fire Equipment Zambia and Premium Fire Services (My Wage Zambia, 2012). The mentioned companies are specialized in first aid, environmental health, risk assessment, quality management, occupational health, hazard management and fire safety (My Wage Zambia, 2012).

2.4 Safety and Health Laws, Guidelines and Management

2.4.1 Safety and Health Laws and Guidelines

The OSH laws exist to identify the responsibility of the parties involved in industrial or commercial activities (Lingard and Rowlinson, 2005). It imposes responsibilities on employers to protect the safety and health of their employees within working periods (Lingard and Rowlinson, 2005). The purposes of safety and health laws are intended to protect the safety and health of workers and all involved parties by eliminating or minimizing risks arising from work places and also to encourage organizations take up a constructive role in improving safety and health practices. These laws also assist in providing effective compliance and enforcement measures (Safe Work Australia, 2012).

In Zambia, the Factories Act and other supporting legislation such as the Mines and Minerals Development Act, Chapter 213 of the Laws of Zambia are concerned with the provision of suitable physical conditions under which work has to be undertaken (Mukhalipi, 2004). Phoya (2012) found that in Tanzania under the Factories Act, construction sites were not regarded as workplaces and so their activities were not regulated by health and safety ordinances. This was due to the low level of public awareness of regulations, lack of resources such as personnel and funds, coverage of the regulations, complexity of design, the procurement system, the low level of education, site configuration, and location (Phoya, 2012).

2.4.2 Safety and Health Management

In the project cycle, the most important factors affecting the outcome of a project often reside at the early stages of its life cycle (Hendricks and Au, 2003). Decisions should be based on competent economic evaluation with due consideration to adequate financing, prevalent social and regulatory environment and technological conditions (Hendricks and Au, 2003). Chordhry and Fang (2006) suggested that a Safety Management System (SMS) should comprise all polices, objectives, roles, responsibilities, codes, standards, communications, processes, procedure, tools, data and documents. Nevertheless, a construction work site and the surrounding environment changes daily, making health and safety management difficult in the sector (Muya *et al*., 2008).

Studies on fatal and non-fatal incidences have shown that pre-existing organizational factors and work practices often lay at the genesis of OSH incidents (Gillen *et al*., 2002). These incidents often make employees realize the importance of safety in the workplace and reinforce safe work practices (Mullen, 2004). Muya *et al*. (2008) suggested that the level of protection accorded to workers in any country hinges on the economic status of a country. This implies that the more affluent a country is, the better the measures to protect workers against incidences via OSH policies (Muya *et al*., 2008).

In order to ensure that a construction site is safe for operations, proper site management procedures have to be put in place, considering safety (Elbeltagi and Hegazy, 2002). A straightforward safety and health management system can be effective and successful at a very practical level of enabling managers to develop the understanding and skill to write a policy statement and carry out a risk assessment. It is also absolutely vital to introduce safety and health management as a normal, continuing management function rather than a series of arbitrary rules to be complied with (Walker *et al*., 2004). Rundmo *et al*. (2002) showed that healthy and unhealthy attitudes towards safety and health affected top and middle management decisions which also exerted influence on the conditions under which employee individually made decisions. Consequently, managers should be wholly committed and involved in promoting safety. Barling *et al.* (2002) found that safety specific transformational leadership directly affected perceived safety climate, which significantly influenced safety performance.

Extensive use of sub-contractors in the construction industry may lead to lack of on-site safety and low level of worker commitment (Occupation Safety and Health Council-OSHC, 2001). Champoux *et al.* (2001) observed that small firms have serious problems of safety and health aggravated by limited access to human, economic and technological resources. In fact, construction health and safety culture in small and medium enterprise received little attention (Agumba and Haupt, 2009). The SME managers have little knowledge of the legal framework that governs the safety and health (Kheni et al., 2008)

2.5 Accidents and Ill-health

An accident is an undesirable or unfortunate happening that occurs unintentionally (Concise Oxford English Dictionary, 2004). While the HSE (2006) defines an accident as any unplanned event that may result in injury or ill-health of people, or damage or loss to property, plant, materials or the environment or a loss of business opportunity. Ill- health is a state in which you are unable to function normally and without pain (HSE, 2006).

The construction industry contributes significantly to the statistic of accidents and cases of ill-health (Kheni *et al*., 2005). It is important to note that most of the incidents occur in developing countries, where law enforcement and technological advancement still need improvement (Kayumbu, 2013). However, in 2000, in the United States of America, the construction sector recorded the highest number of fatal work injuries compared to any other industry. The fatality rate in the construction sector was 12.9 fatalities per 100,000 employees and there were 503,500 non-fatal injuries and illness (Arboleda and Abraham, 2004).

Certain accidents that occur in the construction industry involve contact with objects and machinery in motion, injuries resulting from improper handling of heavy items and slips or falls. Furthermore being trapped by collapsing earth, exposure to harmful substances and fire pose pose safety concerns among a myriad of other accidents (Hughes and Ferrett, 2007). According to Phoya (2012), construction hazardous environments include; working at a height, working underground, working in confined spaces and close proximity to falling materials, handling loads manually, handling hazardous substances, noises, dusts, using plant and equipment, fire and exposure to live cables.

2.5.1 Causes of Accidents and Ill-health

Studies suggest that in most cases, accidents arise from decisions by management and failure by supervisors to follow laid down safety procedures (HSE, 2006 and Mukhalipi, 2004). Contractors mostly focus on achieving objectives such as meeting the production schedule, cost control and quality requirement before considering safety (Tam *et al*., 2004). On the other hand, employees fail in adhering to safety and health procedures due to fear of harassment by co-workers and supervisors, as well as a loss of favor from the latter (Mullen, 2004). Asking workers to do more than they can handle may result in them developing high stress levels, especially when high deadline expectations are imposed on them. The pressure from supervisors' may cause subordinates to work unsafely while trying to satisfy objectives, so as to complete the work within unreasonable time schedules (Aksorn and Hadikusumo, 2007).

The root causes of accidents consist mainly of inadequate training, poor enforcement of safety, lack of safety equipment and unsafe methods or sequencing among others. Unawareness of the importance of health and safety is also a major contributor to accidents as well as unsafe site conditions (Arboleda and Abraham, 2004).

Rahim *et al.* (2008) in their survey carried out in Malaysia, attributed the causes of construction accidents to unsafe methods, which included incorrect procedures, knowledge level and disobeying procedures. Lubega *et al.* (2001) discovered that the causes of construction accidents in Uganda were due to lack of knowledge about safety rules, engaging inexperienced workforce and lack of appreciation for safety. It is worth noting that falling from a height, unnatural lifting postures when picking heavy items and can cause construction accidents (Adane et al., 2013).

Additionally, poor behavior of individual employees could often be the primary cause of accidents (O'Toole, 2002). For instance, due to comfort, workers will most likely abandon PPE in extreme temperature conditions (Phoya, 2012). Interestingly however, it has been observed that workers' with a lower risk perception seem to be the highest alcohol consumers (Arezes and Bizarro, 2011). Conversely, the other contributor in the form of environmental factors consist of work site hazards and procedures that contribute to injuries (Taylor *et al*.,

2004). Stress at work may cause strain and affect the capacity to cope with risk (Rundmo *et al.*, 2002).

The major causes of fatalities in trenching operations include working at heights, working with heavy machinery, physical handling of toxic and heavy items and working near existing utilities such as overhead power lines or gas pipe lines (Arboleda and Abraham, 2004). The OSHA (2002) suggested that the fatality rate for excavation works was 112% in the United States of America alone. Remarkably, the main cause of death in construction related to personnel lifts are falls, collapses and electrocution (McCann, 2003). The growing popularity of boom-supported and other aerial lifts could lead to increased numbers of deaths if preventive action is not taken. In addition, the increase in the use of aerial lifts for purposes not intended by the manufacturer such as lifting loads plus personnel exceeding the lift's load capacity increases the risk especially of overturns (McCann, 2003).

2.5.2 Effects of Accidents and Ill-health

Poor safety and health does not only directly affect workers but also the organisation or firms that hire them as well as the community they originate (Arboleda and Abraham, 2004). OSH incidences are often fatal to individuals and lead to high costs to organizations and the economy of a nation, through compensation, equipment damage and materials or facilities and disrupt production processes (Muya *et al.*, 2008). Injuries, accidents and work related illnesses reported on construction sites contribute to additional costs and delays on projects. The high cost associated with work-related injuries included workers' compensation resulting from insurance claims, indirect costs of injuries; and increased liability suits (Elbeltagi and Hegazy, 2001).

It is estimated that annually, one million work days in Brazil's construction industry are lost due to loss of productivity related to workplace accidents that cause temporal sick leave greater than 15 days (Torres, 2013).

2.5.3 Prevention of Accidents and Ill-health

It is possible to curtail a risk, whereas a hazard can be controlled by good management (Hughes and Ferrett, 2007). Therefore due to the complexity of the industry and its hazards, occupational safety and health in construction work should start at the designing stage and

continue throughout the construction phases until the safety and health of end users is ensured (Kayumbu, 2013). A fairly large percentage of construction accidents could have been eliminated, reduced or avoided by making better choices in the design and planning stages of a project (Hecker *et al.,* 2005). At design stage of a construction project, safety at design appears to be critical to enhancing OSH performance. Designers must work and communicate with the principle parties of a construction project in order to make such an approach effective (Charles *et al.,* 2007).

If however, the risk of injury cannot be eliminated by engineering design or reduced by incorporating a safety device, then warnings, instruction, and training are the last resort (Mroszczyk, 2005). Through risk assessment, communication, and control, risks can be managed, minimized, shared, transferred or accepted (Lingard and Rowlison, 2005). Moreover, risk assessment helps to identify safety and health hazards, analyse, and establish the necessary controls on how to manage risks at work (Argenti and Forman, 2002; HSE, 2004). Risk assessment involves five stages namely analysing work activity, hazard identification, risk estimation and characterization, evaluation, and control (Phoya, 2012). During hazard identification, inquiries such as identifying the kind of hazards present, parties at risk and type of risk, risk estimation and characterization involve using probability and severity (risk matrix) to rank risks. Risks can be ranked as extreme, high, moderate or low and also capable of being eliminated, prevented or reduced by either using the likelihood or consequence of an incident (Phoya, 2012).

According to the findings of Elbeltagi and Hegazy (2002), several causes of construction accidents and health hazards such as falls, falling objects, site transportation, site layout and hazardous substances can be controlled through creating an efficient site layout plan. Proper site layout planning, is therefore a good opportunity for managers to address several safety and health issues early in the construction planning phase (Elbeltagi and Hegazy, 2002). Despite PPE being the main item used for risk control on some construction sites in developing countries, its availability is limited (Phoya, 2012). Provision of adequate PPE and use may help prevent accidents (McCann, 2003: Adane, 2013). Accidents and ill-health may also be prevented by creating awareness of risk factors, avoiding overtime and provision of occupational safety and health services (Adane, 2013). Adequate maintenance of personnel

lifts, inspection before use and training in the use of specified models of personnel lifts in use would mitigate deaths related to personnel lifts, (McCann, 2003).

It is important to note that effectiveness depends on worker participation and involvement by company management. This is so because, workers play an active role in collaboration with fellow workers and management thus being as introduction of significant improvements in workplaces (Torres, 2013). Moreover, management should motivate workers to participate in the implementation process of workplace improvements and create a culture of accident prevention (Torres, 2013).

2.5.4 Benefits of Good Safety and Health Standards and Practices

Sustained success in ensuring safety and health at work, demands that everyone recognizes its importance and actively supports the effort (OSHC, 2001). Safety and freedom of health-related concerns are key factors for a productive construction site (Elbeltagi and Hegazy, 2002). The amplification of the importance of safety and health with respect to future organisational profitability and sustainability may shift priorities in the industry (Hallowell, 2010). For instance, when issues relative to safety and health become business priorities for firms involved in construction, a platform for the improvement of safety and health is thus enacted without the need for constant changing of laws and/or regulations (Dulaimi *et al.*, 2004). 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 (Charles *et al.*, 2007).

2.6 Literature Reviewed on Safety and Health

The summary of the literature reviewed is tabulated in Table 2-1.

Table 2.1: Content Analysis of Literature Reviewed on Safety and Health in the Construction Industry

Author(s)/ Year	Title	Objectives	Methodology	Conclusion	Comments, Critique (if any)
Rahmani *et al.* (2013)	Descriptive Study of Occupational Accidents and their Causes among Electricity Distribution Company Workers at an Eight-year Period in Iran	To survey descriptive factors to injury among electricity distribution company workers.	A descriptive surveillance study was done. Documents such as safety and health reports were studied.	Lack of PPE and negligence were the main causes of accidents. High rate of accidents occurred in summer because of warm weather.	The study was limited to an electricity distribution company. However, it contributes to the causes of construction accidents.
Arezes, M.P. and Bizarro, M. (2011)	Consumption and Risk Perception in the Portuguese Construction Industry.	To assess the relationship between the risk perception of a sample of Portuguese construction workers and their reported and measured alcohol consumption	Risk perception and self-reported consumption were evaluated through a questionnaire applied to a sample of one hundred construction workers. blood-alcohol level of all the study subjects was detected.	Workers with a lower risk perception seem to also be the highest alcohol consumers.	The study employed a questionnaire survey.

Author(s)/ Year	Title	Objectives	Methodology	Conclusion	Comments, Critique (if any)
Phoya (2012)	Health and safety risk management in building sites in Tanzania: The practice of risk assessment, communication and control.	To find out the current practice of health and safety risk assessment, risk communication and risk control.	Case study of two construction sites in Dar-es-Salaam	All responsibility on risk management is with the contractor, and it was carried out only during construction phase. No systematic method was used for risk assessment, but rather risks are assessed based on individual judgment guided by experience, educational background and existing regulations. Risk information was communicated through toolbox meetings, informal discussions, and controlled by using PPE.	Thesis-risk management is left to the contractor in the industry.
Brace *et al*. (2009)	Phase 2 Report: Health and safety in the construction industry: Underlying causes of construction fatal accidents – External research	To explore the extent of complementary evidence about underlying causes of construction fatal accidents generated by parties outside HSE. To present some practical strategies that might be adopted for further improvement based on industry needs and stakeholder feedback.	Literature review, international consultation with fifteen overseas construction industry experts from different countries. Phone/email interviews/consultation with twenty-seven UK senior construction industry expert, In-depth face to face interviews with fifteen practitioners from the UK construction industry. Phone interviews with fifteen workers representing the UK's very small, hard to reach organisations.	Root causes of accidents: Immature corporate systems; inappropriate enforcement; lack of accident data; lack of leadership, a lack of influence of trades unions especially for smaller projects; shortage of competent supervisors; lack of individual competency of workers and supervisors; lack of training and certification of competence; lack of ownership of workers and supervisors; poor behaviour; cost pressures; poor equipment or misuse of PPE; site hazards; poor employment practices. Methods of prevention of accidents: enforcement and compliance; competency and training; and culture and mindset.	Report-contibuted on the causes of construction accidents despite the research being conducted in a developed country.

Author(s)/ Year	Title	Objectives	Methodology	Conclusion	Comments, Critique (if any)
Chiocha *et al.* (2011)	Health and safety in the Malawian construction industry	To examine the state of H&S in the Malawian construction industry.	A quantitative survey was conducted among key construction industry stakeholders.	In spite of having the necessary legislation in place, the study confirmed that construction H & S could be a major issue in developing countries like Malawi.	Lesson learnt – construction safety and health is a challenge in developing countries which includes Zambia.
Musonda and Haupt (2009)	A pilot study into Botswana's construction industry on designers' will and capacity to design for health and safety.	To establish construction designers will or motivation and capacity to contribute to construction H & S in Botswana.	A pilot study was undertaken. A structured questionnaire was used for data collection on the sampled firms' projects whether they considered H&S in designs and what the motivation had been on designing for H&S if at all it had been done before.	Designers will and capacity to address H & S in designs is inadequate. Mostly designers are not mandated to design for H&S. Motivation for H & S designing is low. Designers are not compelled by legal framework, professional bodies and the community.	The study focused only on construction designing firms. It contributed on how consulting/designing firms can help in prevention through designing.
Muya *et al.* (2008)	Constructional Safety and Health Polices: How Does Construction Compare With other Sectors Globally?	To find out if the implementation of OSH policies is affected by the economic status and which group is prone to risks and accidents	Review of an international Labour Organisation (ILO) global survey	The paper reviewed that the level of protection of workers depended on the economic status and that the aged, migrant, temporary and self-employed workers remained vulnerable to risks and accidents because they were not covered by OSH policies.	The paper did not suggest how the level of protection of vulnerable workers could be improved.

Author(s)/Year	Title	Objectives	Methodology	Conclusion	Comments, Critique (if any)
Aksorn and Hadikusumo (2007)	The Unsafe Acts and the Decision-to-Err Factors of Thai Construction Workers.	To investigate the major unsafe acts and the decision-to-err factors causing unsafe acts.	A questionnaire survey was conducted to collect data from a total of 214 workers from twenty building construction projects in Thailand.	Failure by workers to wear PPE, improper lifting or handling of materials, keeping sharp objects in dangerous locations were the major unsafe acts in Thailand. The top three most frequent unsafe acts were associated with several decision-to-err factors; lack of management support, management pressure, group norms, overconfidence, being uncomfortable, past experience and laziness.	Preventive measures of unsafe acts and decision-to-err were not dealt with.
Kheni *et al.* (2005)	Safety and Health Management by Small Subcontractors	To develop a model of safety and health management by small subcontractors. To develop an understanding of safety and health operation activities of small subcontractors	A case study was used. Semi structured interviews were, site observations were carried out. Also review of safety and health documents was conducted.	Accidents and occupational illness are more prevalent in small business. Small subcontractors are particularly faced with a more difficult task considering the high-risk nature of the construction industry, safety and health management is more difficult to them.	It contributed to prevention of accidents although it was limited to small firms.
Ligard and Rowlinson (2005)	Occupational Health and Safety in Construction Project Management.	Book	Book	In order to be effective in improving OHS performance, we need to carefully design and evaluate interventions, so as not to waste time or resources in fruitless endeavours. The construction industry must make concerted effort to transform the way that it operates.	Challenges construction stakeholders to find solutions of construction safety a health problems.

Author(s)/ Year	Title	Objectives	Methodology	Conclusion	Comments, Critique (if any)
Cooper and Phillips, (2004)	Exploratory analysis of the safety climate and Safety Behaviour Relationship	To examine the underlying factors structure of an adapted safety climate measure originally developed by Zohar (1980)	A questionnaire survey was done on a population of plant personnel of a packaging production plant.	The study established an empirical link between a limited set of safety climate perceptions and actual safety behaviour. It also established that climate perceptions do not necessarily reflect changes in levels of behavioural safety perfect.	The study was conducted in a manufacturing company.
Alazab (2004)	Work-related diseases and occupational injuries among workers in the construction industry	To define the work-related diseases occurring among workers in the construction industry and to assess the distribution of occupational injuries and common risk factors of these injuries.	Interviews, general medical examination	The most common work-related diseases among construction industry workers in Egypt were eye diseases, respiratory diseases, and cardiovascular diseases.	Lessons were learnt on the common diseases in construction in Africa.
Salminen (2004)	Have young workers more injuries than older ones? An international literature review.	To find out if young workers have a higher risk of occupational injuries and if their injuries are more fatal than older workers.	Review of the literature on the previous studies on nonfatal and fatal injuries	The results showed that young workers had a higher injury rate than older workers and that the former had less fatal injuries compared to the latter.	Despite the study being based on a larger number of previous studies, no study was reviewed from Africa to conclude its universality

Author(s)/ Year	Title	Objectives	Methodology	Conclusion	Comments, Critique (if any)
Walker *et al.* (2003)	Health and Safety in Small Enterprises: An Effective Low Cost Approach	To investigate the effectiveness of an approach used in the UK, designed to help small enterprises set up and operate a simple safety and health management system: an effective low cost approach	Interviews, inspection of premises, document examination and assessment of training and maintenance standards of small enterprises were used	It was found that the approached used was effective because it attracted low-cost both in terms of time demands on the small business manager and the consultant. Moreover, this resulted from the simple management system which was introduced.	The study was conducted in a developed country.
McCann (2003)	Death in Construction Related to Personnel Lifts	To examine deaths of construction workers due to personnel lifts such as boom-supported, scissor lifts, suspended scaffolds and crane platforms.	Examination of data on deaths of construction workers from 1992-1999 from census of Fatal Occupational Injuries, a Bureau of labour static base was done.	The study identified 339 deaths of which 42 per cent were from boom-supported lifts, 26 per cent from suspended scaffolds, 19 per cent from scissor lifts, 5 per cent from crane platforms and 7 per cent from unapproved lifts such as forklift platforms. It was concluded that the main causes of death were falls, collapse/tipovers and electrocutions.	The study was specific to on personnel lifts in construction.
Arboleda and Abraham (2004)	Fatalities in Trenching Operation – Analysis Using Model of Accident Causation.	To analyse the accident causation, fatalities in Trenching Operations using models	Review of fatality reports related to trenching operations from Occupational Safety and Health Administration (OSHA) from 1997 to 2001	The findings showed that small contractors working on small projects tend to have higher fatalities and that the correct application of safety standards deemed to be reliable and could help to prevent fatalities in trenching operations	The study was limited to trenching operations.

Author(s)/ Year	Title	Objectives	Methodology	Conclusion	Comments, critique (if any)
Rundmo *et al*. (2002)	Managers' attitudes towards safety and accident prevention.	To determine attitudes towards safety and accident prevention among managers and to analyse the associations between attitudes, behavioural intentions and behaviour.	Questionnaires were used in the study, participants were from the Management Behaviour Training Workshop in 1997 and 1998, a safety course in Norsk Hydro.	The results supported the conclusion that behaviour may be influenced by attitudes and hence that it in principle also could be possible to change behaviour by measures aimed at changing attitude.	The study was limited to Hydro company managers.
Elbeltagi and Hegazy (2002)	Safety into Construction Site Management; Challenges and Opportunities in Management and Technology	To provide a quantitative approach that will help in maintaining safe and productive construction sites.	A case study of a water treatment plant constructed in Mansoura, Egypt was used to demonstrate concepts.	The study identified three aspects that contribute to safe construction sites and the need to integrate them in to site layout planning. (1) defining the temporary facilities and services needed on site for health and safety reasons. (2) defining proper safety zones around the construction space to minimise or prevent accidents; and (3) using a fuzzy logic approach to quantify facilities closeness relationship based on safety considerations and accordingly optimize the placement of facilities on site.	The study was limited to a water treatment plant. Lessons are learnt on prevention of accidents through site layout.

Authour(s)/ Year	Title	Objectives	Methodology	Conclusion	Comments, Critique (if any)
O'Toole (2002)	The relationship between employees' perceptions of safety and health organisation culture.	To examine the use of an employee perception survey as a predictive tool of successful safety results; to identify factors that suggest a high-level of risk-control effectiveness; to examine the use of an employee perception survey as an alternative measure of an effective and successful safety program; and to identify general factors that influence employee perceptions of a company's management safety process.	An employee safety perception survey was conducted and injury data were collected over a 45-month period from a large ready-mix concrete producer	Management's commitment to safety influences employees' perception of safety management, which in turn influences employees decisions on how to respond to risks on their jobs	
Mullen (2002)	Investigating Factors that Influence Individual Safety Behaviour at Work.	To Investigate the factors that influence individual safety behaviour at work place.	Semi-structured interviews were conducted with participants from a variety of occupations	The organisational and social factors on safety behaviour such as early socialisation and the need to portray a positive image are important factors in identifying the causes of workplace accidents.	The study involved participants from a variety of occupations such as police officer and health care giver.

Author(s)/ Year	Title	Objectives	Methodology	Conclusion	Comments, Critique (if any)
Champoux, *et al.* (2001)	Occupational health and safety management in small size enterprises: an overview of the situation and avenues for intervention and research	To get an overview of the most characteristic OHS representations and practices in small firms.	Telephone interviews with owner -managers of small manufacturing enterprises using a validated questionnaire.	The study suggested that SSM owner-managers are isolated, overworked, do not use the services offered by the OHS sector associations. They appear to be poorly informed and do not realise the extent of their problems.	Telephone interview method produces subjective data especially when the respondent is not required to stipulate the interval at which certain activities are practiced and their effectiveness
(Occupational Safety and Health Council, 2001).	A Survey of Safety Culture in Hong Kong Construction Industry.	To examine people's values, attitude, perception, competencies, and patterns of behaviour that determine the commitment to, and effectiveness of health and safety management in the construction industry in Hong Kong	A survey was done based on a (questionnaires survey and a software developed by the Health and Safety Executive in the United Kingdom) self-administrated questionnaires given to managers, supervisors and front line staff.	The results showed that management and supervisors of principal contractors had positive response to safety while sub-contractors generally have less positive response to safety.	Lesson learnt-which firms adhere to safety and health, large or small scale contractors.

2.7 Summary

This chapter has defined in detail some important keywords with regards to safety and health namely accident, incident, near miss, ill health, hazard and risk. It has been established that safety and health awareness is low in developing countries such as Malawi, Tanzania, Botswana and Zambia. Despite some studies done on the general occupational safety and health in Zambia, no research has been commissioned in the construction industry. The current safety and health legislation used in the construction industry in Zambia, which is the Factories Act, lacks adequate enforcement. The general types of construction accidents identified are being hit by a falling object, slips, trips, collapse of earth and explosions. The common causes of accidents and their prevention has been found to be the opposite. For instance, causes such as deficient enforcement of S&H legislation, lack of training and PPE can be prevented by adequate enforcement of S&H legislation, provision of training and adequate PPE respectively. The effects of accidents include death, costs and delayed project schedules. The benefits of upholding safety were reviewed and lead to increase in production and profitability and alleviation of poverty.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

The previous chapter reviewed existing literature concerning construction safety and health, safety and health laws and guidelines, accidents and ill-health along with the types, causes, effects and prevention. This chapter presents the methodology that was used to carry out the research to address the study aim and objectives. It further covers types of research, research design and data collection techniques that were used in the study.

3.2 Types of research

A research is an investigation to find solutions to scientific and social problems through objectives and systematic analysis (Rajasekar *et al.,* 2006). It is undertaken to explore an idea, probe an issue, solve a problem or make an argument that compels us to turn to outside help (Clarke, 2005). There are different types of research such as basic research, applied research, action research, descriptive research, exploratory research and case study.

3.2.1 Basic research

According to Rajasekar *et al.* (2006), basic research is an investigation into basic principles and reasons for occurrence or existence of a particular event or process. It provides a systematic and deep insight into a problem and facilitates extraction of scientific and logical explanation and conclusion on it. Basic research involves the discovery of new phenomena and new ideas of general interest (Roll-Hansen, 2009). This study investigates the general status of Zambia's construction industry in terms of safety and health.

3.2.2 Applied research

Applied research is concerned with actual life studies such as research on social problems, increasing the efficiency of a machine or gain factor of production of a material or pollution control (Rajasekar *et al.,* 2006). According to Roll-Hansen (2009) applied research helps interpret and refine problems to make them researchable, and then investigate possible solutions. The safety and health challenges facing the construction industry on have been investigated and recommendations have been given in the study.

3.2.3 Action research

Action research is a process of systematic inquiry that seeks to improve social issues affecting the lives of everyday people (Stringer, 2008). It is deals with fact finding to improve the quality of action in the social world (Rajasekar *et al.,* 2006). Clarke (2005)

suggested that action research involves small scale interventions in the functioning of the real world and a close examination of effects of such an intervention. The study seeks to establish the common causes of accidents and ill-health then suggest preventive measures to protect lives of construction workers.

3.2.4 Exploratory research

Exploratory research is done in order to discover something or to learn the truth about something (Rajasekar *et al.,* 2006). The exploratory approach research determines whether or not a phenomenon exists and aims to gain familiarity with such a phenomenon rather than compare it to other phenomenon (Welman and Kruger, 2001). The study attempts to explore the types and impact of construction accidents and ill health in Zambia.

3.2.5 Case study

A case study is used to generate in-depth, multi-faceted understanding of a complex issue in its real- life context (Crowe *et al.*, 2011). It is expected to capture the complexity of a single case investigated in its natural context (Johansson, 2003). Furthermore, it is considered when the focus of the study is to answer the how and why questions (Yin, 2003). Case studies were used only for triangulation in this study. Three construction sites comprising a road, bridge and office block construction in Senanga in Western Province, Solwezi in North-western Province and Kasama in Northern Province respectively, were selected for case studies. This was to have a representation of the construction industry in Zambia respectively.

3.3 Research design

A research design is a plan and the procedure for research that spans the decisions from broad assumptions to detailed methods of data collection and analysis (Creswell, 2008). In order to achieve the set objectives, the study was designed in seven phases specifically problem identification, literature review, data collection, data analysis, discussion of results, development of the model and validation, and findings, conclusion and recommendations. Literature was reviewed comprehensively at Phase 1 and overlapped into other phases in order to incorporate latest information. The study was designed as shown in Figure 3.1.

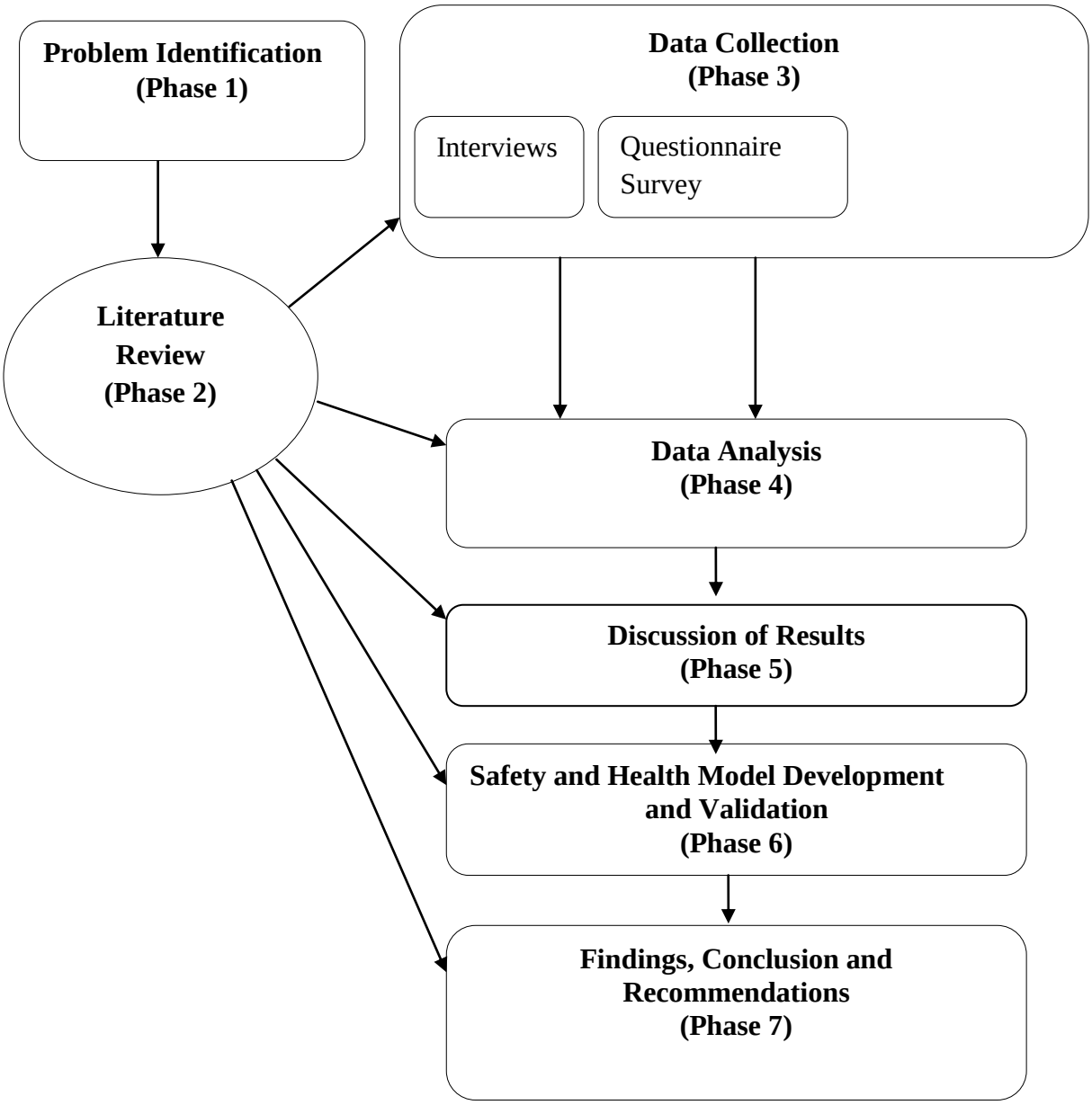

Figure 3.1: Summary of the Study Design

The study employed a survey in order to provide a broad overview of a representative sample of large population (Mouton, 2008). The companies which registered in 2012 were 3,887 and out of these only 90 were targeted. The survey was used because it has the potential to generalize a large population. It is reliable when research tools are properly constructed and have high validity if data collected is properly controlled (Mouton, 2008).

However, the blending of quantitative and qualitative approaches to the study minimized the weaknesses and capitalized on the strengths, which resulted from mixed methods of data collection and analysis. Quantitative approach helped to determine the extent of the problems and qualitative approach dealt with the nature of the problems.

3.4 Data collection

Research data can be classified into primary or secondary data. Primary data is original data collected for a specific goal at hand (Hox and Boeije, 2005). Secondary data is information created by other researchers and made available for reuse (Hox and Boeije, 2005

3.4.1 Primary Data Collection Technique

There are different primary data collection methods such as interviews, questionnaire survey and observations. Interviews, questionnaires and observation schedules were used in the study. Observations in form of case studies were used for the purposes of triangulation. Triangulation was used to cross-check the information in order to increase the credibility and validity as identified by Yeasmin and Rahman (2012). The information obtained from questionnaires was cross-checked with the information from schedules. Triangulation was used in the research because no study had been done on safety and health in the construction industry in Zambia. Three construction sites were used for observation.

The research instruments employed in this study were in-depth interview schedule; questionnaires; and observation schedule. Semi-structured interviews were used to get preliminary data on safety and health in construction industry in Zambia. The interviewees comprised five contractors, three consultants, three clients and one regulator. Interviews gave an insight on safety and health awareness in the construction sector. Interviews also provided additional information that led to the preparation of questionnaires. A pilot study was undertaken using three companies: A consultancy firm; a Grade One Contractor; and a Grade Four Contractor. The Grade contractor was selected to get the experience of large contractors while Grade four contractor the small and medium contractors. The pilot study assisted in determining flaws, limitations or other weakness within the interview design. Moreover, it assisted in necessary corrections (Kvale, 2007).

(a) Interviews

Interviews provide in-depth information pertaining to participants' experiences and viewpoints of a particular topic (Turner, 2010). The interviews in the study assisted in getting information of interviewees' experiences on safety and health. This was important because there were no accident reports in many interviewees' sites. There are three types of interviews: informal conversation, general interviews and standardized open-ended interviews.

(i) Informal Interviews

Informal interviews involve questions that come from the experience at that particular moment (Turmer, 2010). The researcher does not ask any specific types of questions yet relies on the interaction with the participants (McMamara, 2008).

(ii) General Interviews

General interviews are more structured than informal interviews but are more flexible in the composition (Gall *et al.,* 2003). In this type of interviews the researcher can interchange the way the questions are posed (Tuner, 2010).

(iii) Standardised Open-Ended Interviews

Standardised Open-ended interviews are extremely structured in such a way that the responses are open-ended. Participants are asked the identical questions (Gall *et al.,* 2003). The researcher is allowed to ask probing questions as follow up questions and interviewees fully express their views and experiences (Tuner, 2010).

The study employed the standardized Open-ended interviews which were conducted in person, on appointments. Three out of the twelve interviewees hoped to be interviewed on the telephone because they were not available in the offices during the appointment.

(b) Questionnaires

Questionnaires are used to collect primary data. They are used when the sample is large and widely dispersed (Mathers *el, at.,* 2009). There are two types of questionnaires; structured and unstructured (Acharya, 2010). Structured questionnaires involve closed questions which are well defined in a certain sequence. Structured questionnaires are mostly used in

quantitative data collection. Unstructured questionnaires include open ended questions (Acharya, 2010). The study employed unstructured and structured making it to be semi structured.

Questionnaires can either be mailed or delivered in person. The latter, gives a high response rate than the former (Mathers *el, at.*, 2009). Both methods were utilized in the study. The advantage of using questionnaires is that they can be used to collect many different kinds of information. The limitation is that busy people may not want to take the time and others may try to give pleasant answers (Kumar, 2005). This limitation was complemented by interviews and observations on the case studies sites.

(c) Observation Method

Observation method is the systematic noting and recording of events, behaviors, and objects in the social setting chosen for study (Marshall, 2008). Participant observation involves the researcher's involvement in a variety of activities over an extended period of time. The researcher participate in the activities to facilitate a better understanding of those behaviors and activities (Kawulich, 2005). Permission was sought before visiting the sites for observations. Observations were carried out on selected construction sites to verify the data from interviews and questionnaires. Observation method was used in the case studies of three selected sites, for triangulation. The three sites were a road in Senanga in Western Province; a bridge in Solwezi in North-western province; and an office block in Kasama in Northern Province.

3.4.2 Secondary Data Collection Techniques

This is a technique where data which was already collected and analysed by someone else, is used in a study. The secondary data collection technique was used to get the understanding on the knowledge that exists on safety and health in the construction industry that relates to the objectives. Moreover, it gave a better understanding of the subject. The review of the work of other researchers was a guide to the different approaches in the methodologies. Literature review accomplished several purposes such as sharing the results of other studies that are closely related to this study.

(a) Literature Sources

The sources of information used in this study were as follows:

(i) Journal Articles

Safety and health journals were used especially from Elsevier, ILO, African newsletters and Safety and Health at Work (SHAW).

(ii) Theses and Dissertations

Theses and dissertations from the University of Zambia library can be useful sources of information. Only published theses were used in this study.

(iii) Books

Books on safety and health with the latest editions were used to get information for the study.

(iv) Conference Proceedings

Conference proceedings were used in the study to get what was obtaining the latest information in the construction industry.

(v) Government, Corporate Reports and Acts

Corporate reports were used in the study. The Factories Act of 1994 of the Laws of Zambia and Occupational Health and Safety Act of 2010 were used.

(vi) Newspapers

For the interest of this study, newspapers helped to bring out the number of accidents on construction sites and the public views on the status of the construction sector concerning safety and health.

(vii) World Wide Web

The World Wide Web (WWW) is the fastest-growing source of information. It was used widely in this study to get the latest published journals and studies from authenticated journal cites on safety and health in the construction industry.

3.5 Target Population and Size

The targeted population for the study was construction stakeholders. The population size was 90 respondents from 50 companies. The stakeholders included contractors; consultants; public safety and health inspectors from the MLSS-OSHSD; NCC; WCFCB; and government organisations such as the RDA and MWSBD. The NCC classifies contractors in six Grades as ranging from the lowest being in Grade 6 and the highest in Grade 1. The researcher divided contractors divided into two categories like Grades 1 to 4 consisting of large and medium scale contractors; and Grades 5 and 6 consisting of small scale contractors. This was

in done to get experience from large and medium scale as well as small scale contractors. Target groups were directors, project and contract managers, inspectors, regulators, architects, surveyors, engineers, supervisors, safety personnel and site workers.

3.6 Sampling Methods

Sampling methods are classified into probability and non-probability (Latham, 2007). In probability sampling each member in a sample has the same chance of being selected. The probability sampling method that was used in the study was stratified and random sampling while the non-probability was purposive sampling.

3.6.1 Stratified Sampling

Stratified sampling ensures that categories of individuals are represented (Mathers *el, at.*, 2009). In stratified sampling, the researcher firstly identifies the relevant stratums and their actual representation in the population and then randomly samples the subjects from each stratum (Mathers *el, at.*, 2009). All the 3,887 NCC, 2012 registered contractors and consultants were grouped in their respective grades. To get the true representation of Zambia, the contractors after being put in their respective grades, were grouped in the province of operations and then randomly selected.

3.6.2 Purposive Sampling

This is the method of selecting participants who are highly likely to display the process being examined. The NCC, WCFCB and safety and health inspectors from MLSS-OSHS were purposively sampled because they dealt directly with companies. NCC registers and regulates contractors. MLSS-OSHS deals with occupational safety and health at work places and WCFCB compensates workers who get injured or sick while at work. Three construction sites comprising a road; bridge; and office block construction in Senanga in Western Province, Solwezi in North-western province and Kasama in Northern province were purposively selected for case studies. The three sites were selected to get experiences of different projects and in different places. The case study sites served the purpose of triangulation and verification of interview and questionnaire results.

The total number of questionnaires were ninety of which 80 were distributed by hand and 10 were sent by e-mail. The methods of distribution were selected to quicken and broaden the response rate. Furthermore, distribution by hand helped in the case studies because some of the participants were based on construction sites.

3.7 Methods of Data Analysis

The study employed a combination of qualitative and quantitative data analysis approach which is called mixed method.

3.7.1 Qualitative Approach

Qualitative approach focuses on beliefs, understanding and opinions. Qualitative approach is much easier to plan and carryout (Mouton, 2008). The qualitative data which was collected was coded in themes that emerged.

3.7.2 Quantitative Approach

Quantitative approach deals with numbers and measurements. Quantitative approach is an excellent way of finalising results (Mouton, 2008). The quantitative data which was collected was analysed using Excel spread sheets and Statistical Package for Social Science (SPSS).

3.8 Descriptive and Inferential Statistics

Descriptive statistics simply describe what is or what the data shows whereas inferential statistics try to infer from the sample data what the population might think (Trochim, 2006). Inferential statistics draw conclusions on the broader view, from already existing information. In this study, descriptive statistics was used to present the results the survey using Pie charts and bar graphs. The results were then generalise to the construction industry in Zambia. The results were inferred because the population which was used in the study had similar characteristics. Some of the characteristics the population had in similar are; NCC registration, construction projects and the factories Act as safety and health legislation in the industry.

3.9 Summary

This Chapter presented the methodology that was used to get data in order to achieve the objectives of the study. The research in the study was basic, applied, action and explorative in nature. Case studies were used only for triangulation purpose. The primary data was collected from interviews and questionnaires. The secondary data was collected fro books, journals, internet, reports, newspapers and conference proceedings. The sampling methods employed in the study are stratified and purposive sampling. The collected data was analysed using excel and SPSS.

CHAPTER FOUR: DATA ANALYSIS AND RESULTS

4.1 Introduction

The previous Chapter described the methodology used in the study. Chapter four presents the findings from the data collected from structured interviews and the questionnaire survey. The non-quantifiable data was analysed qualitatively from themes that emerged. The quantifiable data was analysed quantitatively using excel spread sheets. The study was conducted in five provinces of Zambia where construction projects were concentrated during the study period. The provinces sampled were Lusaka, Copperbelt, Northern, Western and North-western provinces. Most of the companies sampled had projects in other provinces in the country and thus were national in character.

4.2 Interview Results

The interviews were conducted in February 2012. The targeted institutions were fifteen but only twelve were interviewed. The other three did not confirm the appointments. The interviewees were representatives of stakeholders in the construction industry as shown in Table 4.1.

Table 4.1: Interview Participants

Item	Category	Class	No. of interviewees
1	Employer	Client	3
2	Supervisor	Consultants	3
3	Regulator	Inspector (statutory body)	1
4	Grade 4 contractor	Small scale contractor	2
5	Grade 1 contractor	Large and medium contractor	3
Total			12

The semi-structured interviews were used to get preliminary data on safety and health in the construction industry in Zambia. Interviews gave insights into safety and health awareness in the construction sector. Together with the reviewed literature, interviews provided information that assisted in the preparation of questionnaires. The structured questions in the questionnaire were driven from the semi-structured interviews. To improve the quality and

reliability of the questionnaires, preliminary tests were done to detect any interpretation difficulty. The preliminary test was carried out with seven respondents. The results of the preliminary test were used to re-phrase questions that were not clear to respondents.

4.2.1 Personal information

The personal information of the interviewees who participated were as follows;

(i) Interviewees by Gender

The interviewees comprised ten males and two females.

(ii) Interviewees by Age

Ten of the interviewees were between 20 and 45 years of age representing the group of active personnel in the industry. Two interviewees were above 50 but below 65 years representing the experienced personnel in the construction industry.

(iii) Interviewees by Position Held in the Company

Six interviewees were engineers who included resident engineers; senior engineer; project engineer; and site engineers. Other interviewees included two managers, a company director, a surveyor, a safety officer and an inspector from NCC. Figure 4.1 below illustrates interviewees by position in their companies. All interviewees were familiar with construction sites.

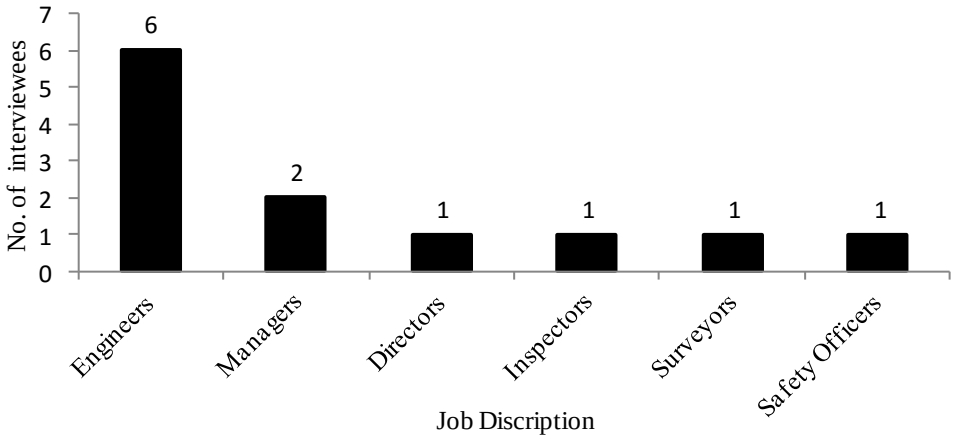

Figure 4.1: Interviewees' Position Held in the Company

(iv) Interviewees' Institution Types

Interviewees were carefully selected to represent all stakeholders in the construction industry in Zambia. In the clientele class, there were three from RDA. During the study, RDA was a client for several construction projects. Five of the interviewees were contractors specialised in both roads and buildings construction. Three were structural engineers and quantity/land surveyors from consultancy firms. One interviewee was from NCC as regulators in the construction industry.

4.2.2 Safety and Health Status

The status of construction sites was measured in terms of how safe and healthy they were. Under safety, signage to warn of danger and provision of PPE were assessed. Health was examined in terms of the provision of clean drinking water, clean toilets and the presence of First Aid boxes on sites.

(i) Safety on Construction Sites

Eight interviewees described the construction sector as relatively safe and two were of the view that it was unsafe. One described it as very safe and the other depicted it as safe. Figure 4.2 below shows interviewees' opinions regarding safety on construction sites.

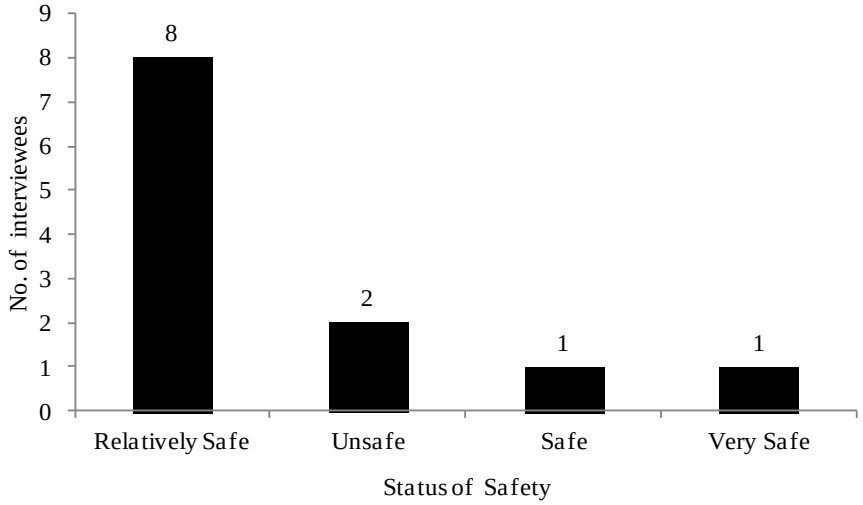

Figure 4.2: Safety of Construction Sites

(ii) Health on construction sites

Figure 4.3 below illustrates the responses on health on construction sites six interviewees depicted construction sites as relatively healthy, three as unhealthy, two as healthy and one as very healthy.

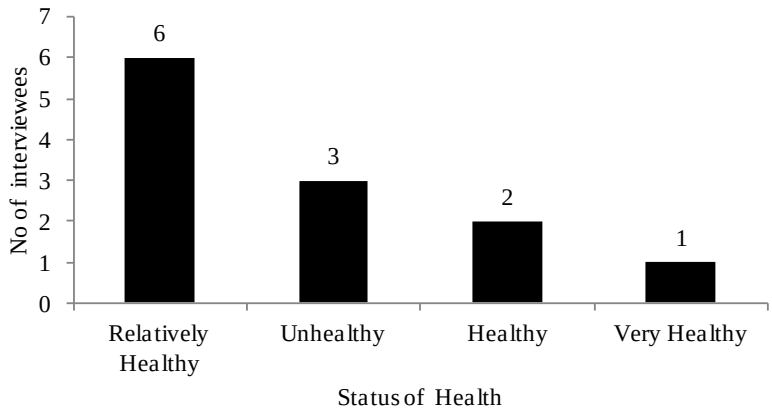

Figure 4.3: Health on Construction Sites

(iii) Reasons for the Status of Construction Sites

The common reason for relatively safe and healthy sites was that basic safety and health requirements such as PPE and First Aid Boxes were provided by many companies. The interviewees who selected unsafe and unhealthy status attributed it to SSC's poor compliance to safety and health. They explained that some SSC did not provide the basic PPE and First Aid Boxes. Few fatalities and no major out breaks were the reasons for the safe and healthy status. One interviewee felt that construction sites were very safe and very healthy because the requirements on safety and health in the contract documents for the projects were followed by many contractors.

4.2.3 Safety and Health Guidelines

The safety and health guidelines were assessed as follows;

(i) Knowledge of Safety and Health Guidelines in Construction

Seven out of twelve interviewees did not know any safety and health guidelines used in the construction industry. Figure 4.4 below shows the results of knowledge of safety and health guidelines. Three interviewees knew the Factories Act while one suggested companies' safety and health policies. In the 'Others' option, two interviewees had knowledge of project contract guidelines on safety and health and NCC Act of 2007.

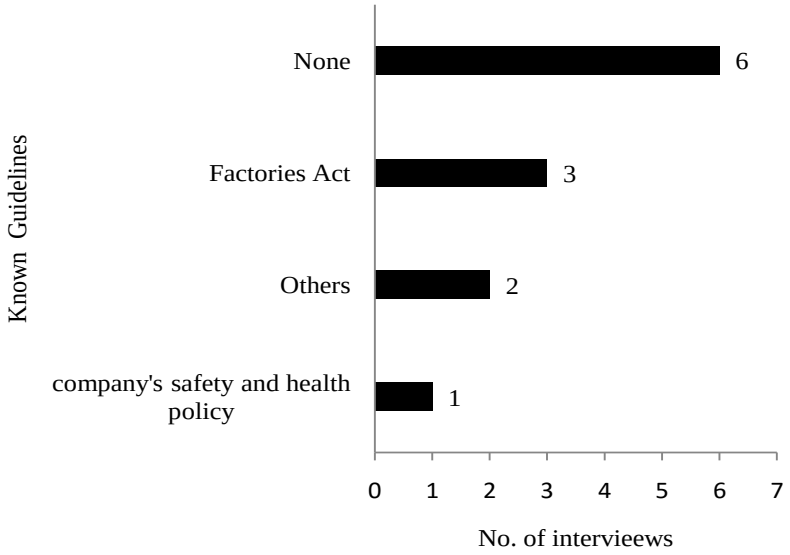

Figure 4.4: Knowledge of Safety and Health Guidelines

(ii) Availability of safety and health policies in companies

Seven interviewees disclosed that their companies did not have safety and health policies. Five interviewees indicated that their companies had safety and health policies.

(iii) Adequacy of Safety and Health Guidelines

Among the twelve interviewees, only five had safety and health guidelines on site. Four interviewees suggested that available safety and health guidelines were relatively adequate. One interviewee revealed that safety and health guidelines were not adequate as shown in Figure 4.5 below.

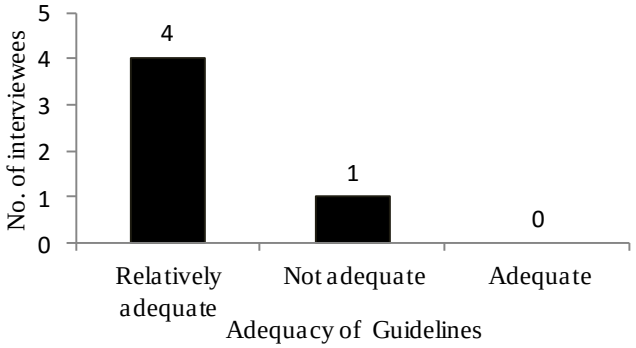

Figure 4.5: Adequacy of Safety and Health Guidelines

(iv) Limitations of the Safety and Health Guidelines

Six interviewees felt that there was need to specify and simplify safety and health guidelines in order to get workers fully involved. Three felt the guidelines were general and were not well known by some contractors. One interviewee suggested that the Factories Act did not cover employees adequately in terms of ‘help' after accidents. Three interviewees advised that safety and health guidelines lacked implementation.

(v) Improvement of Safety and Health Guidelines

Some of the suggested improvements of safety and health guidelines were: involvement of all stakeholders in the industry in implementation; employing of safety personnel; offering safety and health training to all contractors; introduction of penalties on defaulters; and regular inspections.

(vi) Familiarity with the Factories Act in Construction

Figure 4.6 below indicates that seven interviewees were familiar with the Factories Act while five were not.

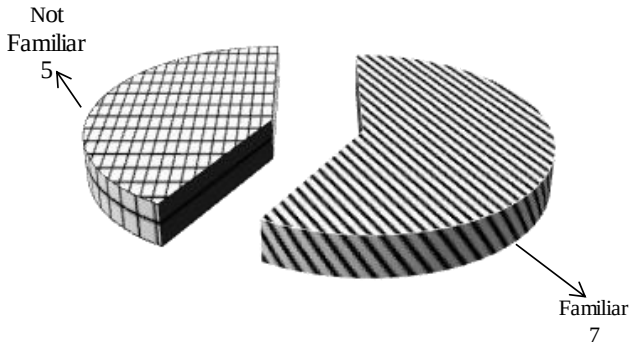

Figure 4.6: Familiarity with Factories Act

(vii) Adequacy of the Factories Act

Five interviewees were not sure if the Factories Act was adequate since they were not familiar with it. Out of the seven interviewees who were familiar with the Factories Act, five described it as ‘needs improvement', one as ‘adequate' and the other as ‘relatively adequate' as shown in Figure 4.7 below.

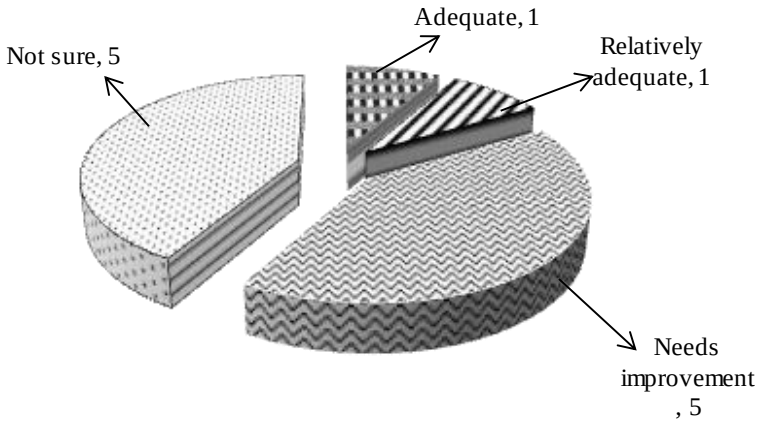

Figure 4.7: Adequacy of Factories Act

(viii) Rating of Factories Act in relation to Safety and Health in Construction

Five interviewees felt that the Factories Act needed improvement since it had not been revised or amended in a long time. Two interviewees suggested that stakeholders in the industry required sensitisation since many were not familiar with the Factories Act. In addition, one interviewee suggested that the Act could have been specific in terms of employees' protection.

4.2.4 Safety and Health Equipment

Safety and health equipment were assessed as follows;

(i) Provision of Personal Protective Equipment

All the twelve interviewees acknowledged that their companies provided Personal Protective Equipment (PPE).

(ii) Variety of Personal Protective Equipment

Basic PPE such as work suits, safety boots and gum boots were provided by all the twelve interviewees' companies. Some companies did not provide safety belts, dust masks, ear plugs and reflectors. Figure 4.8 below shows the variety of PPE provided according to interviewees' views.

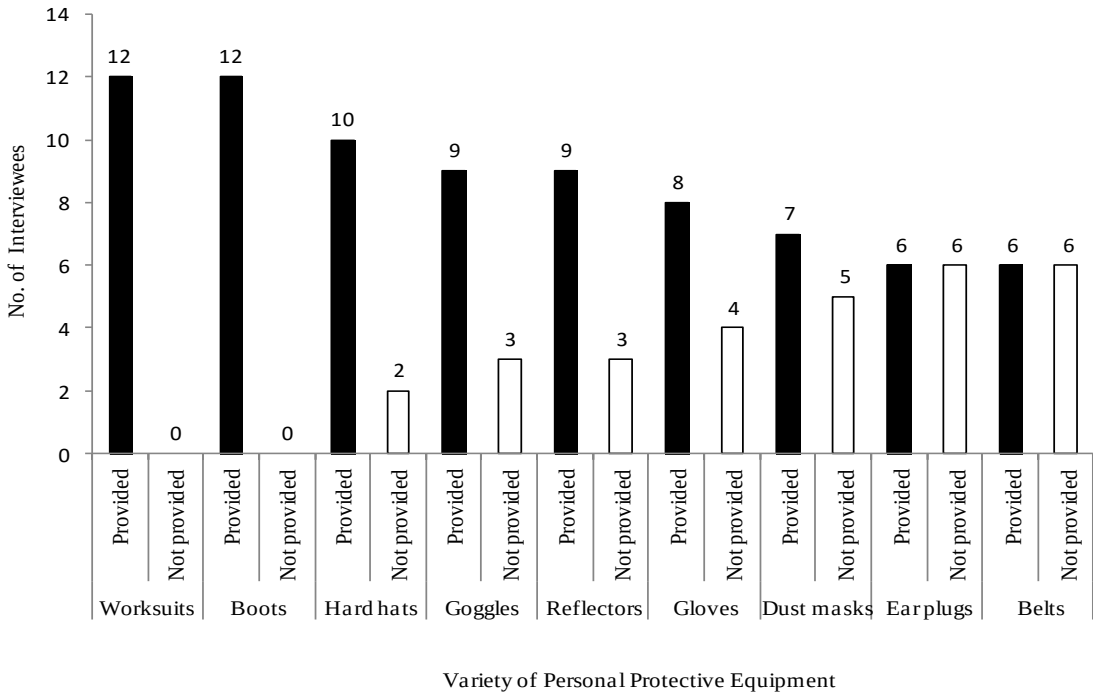

Figure 4.8: Variety of PPE Provided

(iii) Signage on Construction Sites

Six interviewees revealed that signage to warn against danger and give information on construction sites according to the Factories Act was acceptable. Four interviewees acknowledged signage as average while two said it was not acceptable. The results are shown in Figure 4.9 below.

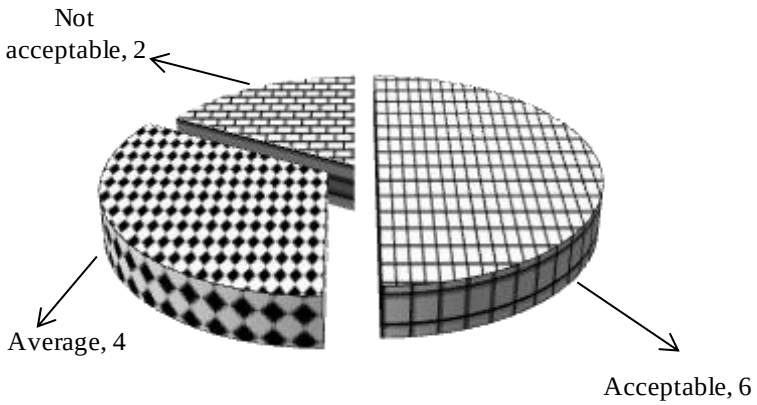

Figure 4.9: Signage on Construction Sites

(iv) Health Facilities Provided by Contractors

Health facilities that were provided on construction sites were clean drinking water, toilets, dining rooms and First Aid Boxes. The most common health facilities provided were First Aid Boxes with ten interviewees agreeing to it and the least provided were toilet and dining rooms as confirmed by six interviewees. Figure 4.10 below shows the health facilities that were provided on sites according to interviewees.

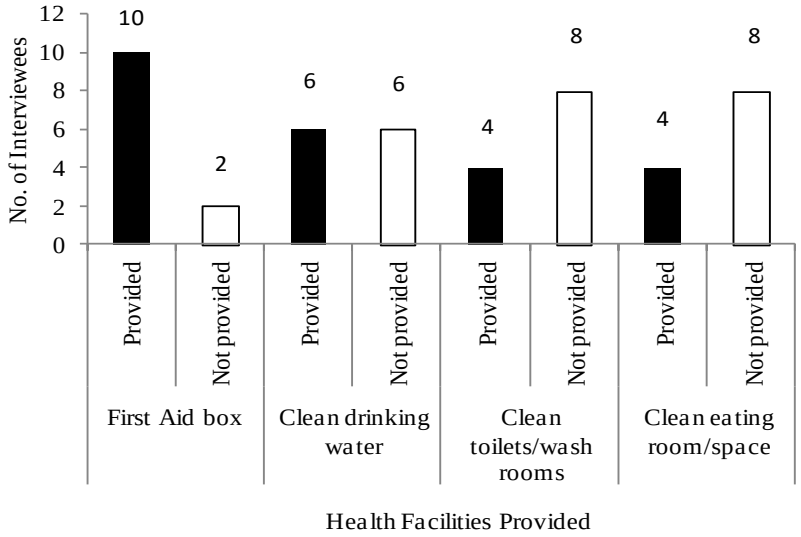

Figure 4.10: Health Facilities Provided

(v) Safety and health programmes on sites

Eleven interviewees indicated that their companies had safety and health programmes on site. However, one admitted that their company held no safety and health programmes on site.

(vi) Interviewees Involvement in Safety and Health Programmes on Sites

From the eleven interviewees who had safety and health programmes on site, nine were involved in the programmes throughmonitoring and enforcing; ensuring compliance; sensitisation and awareness; and providing PPE, first aid boxes and condoms. The other two interviewees were not involved in any safety and health programme.

(vii) Stakeholders Involvement in Implementation of Acceptable Safety and Health

Generally, from the interviewees, it emerge that all the stakeholders in the construction industry should be involved in implementation of safety and health. Twelve interviewees agreed that project managers and site supervisors should be involved. Eleven interviewees agreed that management, safety officers and site workers should be involved as shown in Figure 4.11. Only seven interviewees agreed that clients, consultants, government

institutions, regulators and inspectors should be involved in implementation of safety and health these were in ‘others' group.

Figure 4.11: Stakeholders’ Involvement in Implementation of Safety and Health

(viii) Presence of the Safety Officer on Site

Ten interviewees confirmed that they had a safety officer in charge of safety and health on their sites while two interviewees did not have.

(ix) Reasons for Poor Safety and Health Practices

Half of the interviewees suggested that the main reason why contractors shun safety and health was to maximise profit. This was done by not allocating any money for safety and health issues. Five of the interviewees gave ‘poor management' as the other reason while one advised that safety and health was expensive as shown below in Figure 4.12.

Figure 4.12: Reasons for Poor Safety and Health Practices by Contractors

(x) General Rating of Construction Projects Regarding Safety and Health

Six interviewees suggested that safety and health in construction in relation to accidents and disease occurrences was poor. Five interviewees felt safety and health was average and one rated it as excellent as illustrated below in Figure 4.13.

Figure 4.13: Rating of Safety and Health in Construction Industry

(xi) Adherence to Good Safety and Health Practices

Nine interviewees proposed that big companies big and medium companies adhered more to safety and health guidelines compared to SSC. Three interviewees suggested that both big and medium and SSC adhered to safety and health. The results are presented below in Figure 4.14.

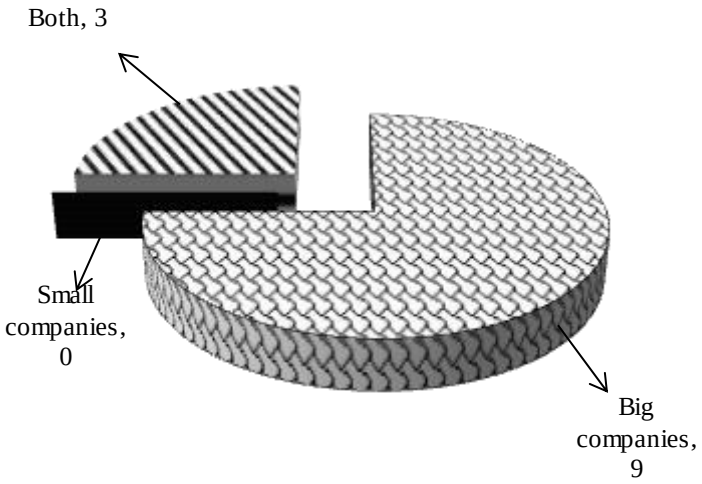

Figure 4.14: Company Adherence to Safety and Health Guidelines

4.2.5 Accidents and Ill-health

The interviewees had to choose from the options given according to their experiences in the industry. The options were from the literature which was reviewed as secondary data.

(i) Types of Accidents

Figure 4.15 below shows the types of accidents that occurred in the construction industry in Zambia in order of frequency from top to bottom. The 'other' category included being hit by moving machinery.

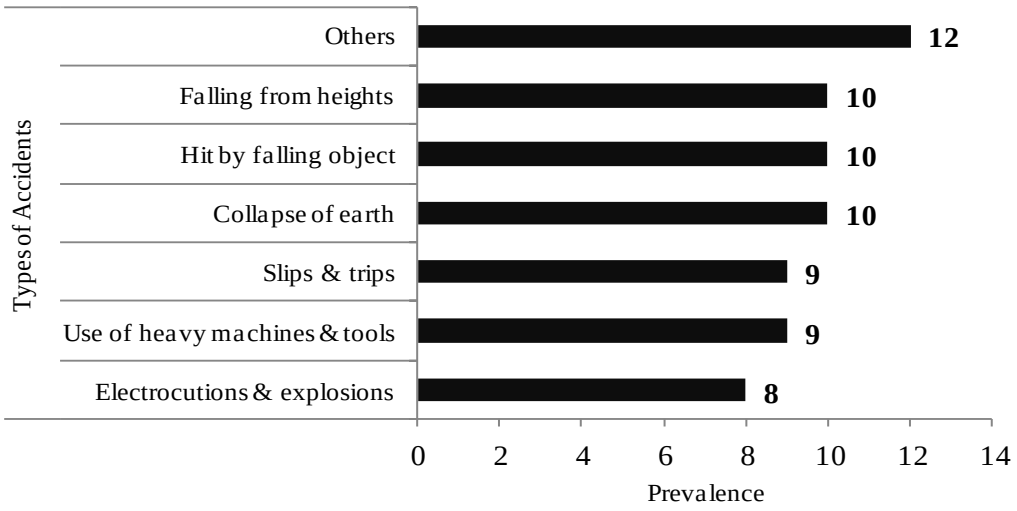

Figure 4.15: Types of Accidents and their Prevalence

(ii) Common Causes of Accidents

The most common cause of accidents was identified to be 'poor attitude to safety'. Figure 4.16 below shows the causes according to the responses from interviewees.

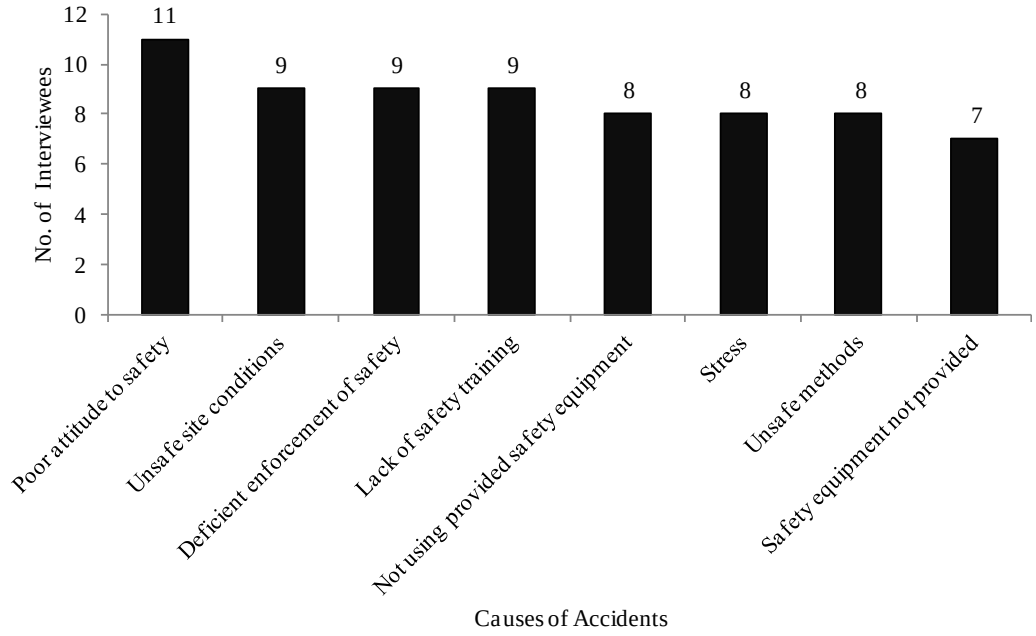

Figure 4.16: Common Causes of Accidents

(iii) Prevention of Accidents

Figure 4.17 below shows methods of how accidents could be prevented in order of preference of interviewees. Good attitude to safety was the most preferred prevention.

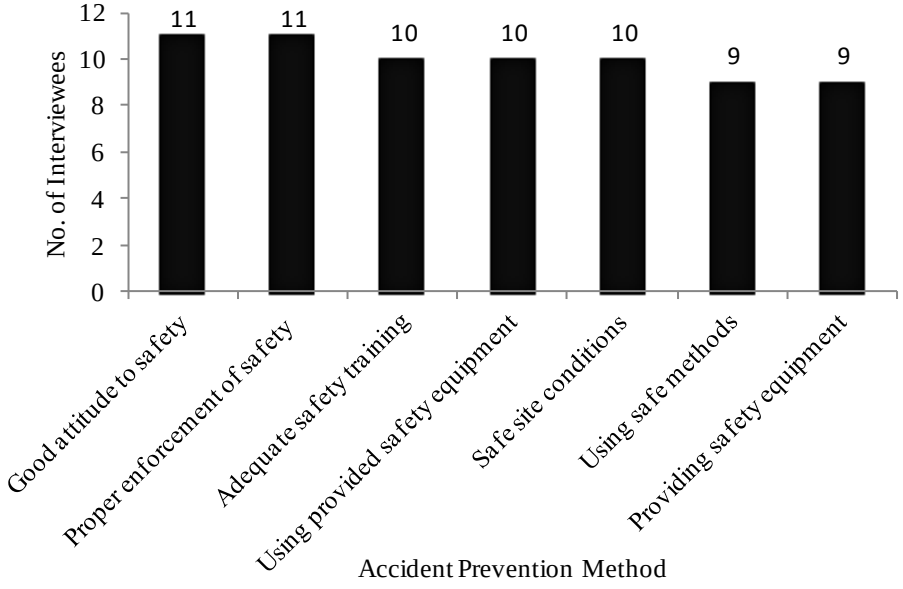

Figure 4.17: Methods of Accident Prevention

(iv) Effect of Accidents on Sites

Disability, psychological trauma, unnecessary costs in terms of medical and insurance costs and loss of morale were identified as prominent effects of accidents as shown below in Figure 4.18. Least prominent effects of accidents were in the 'others' category which included body injuries and damage to property and machinery.

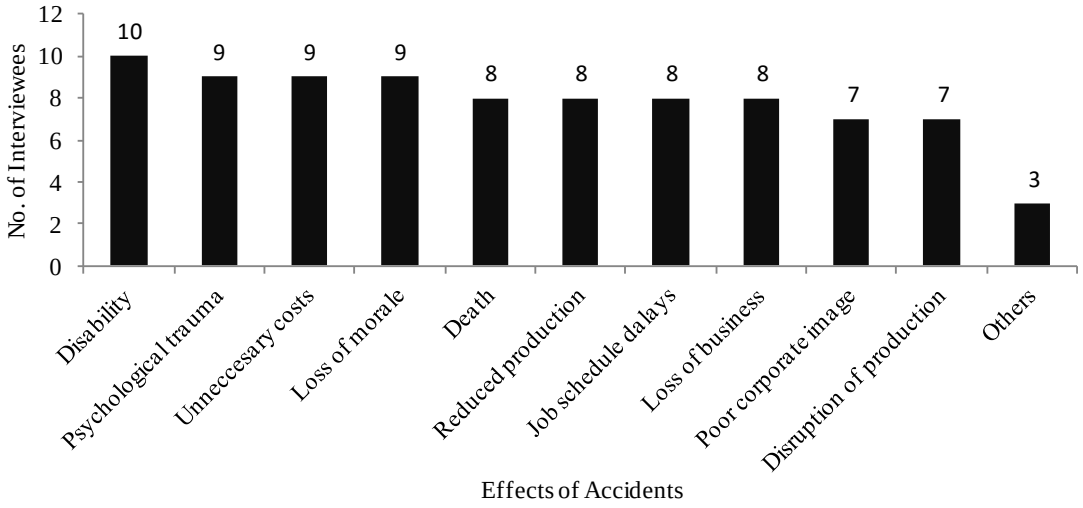

Figure 4.18: Effects of Accidents

(v) Examples of Ill-health in Construction

Diarrhoea was the most common example of ill-health in the construction industry according to the interviewees as evidenced by the results in Figure 4.19 below.

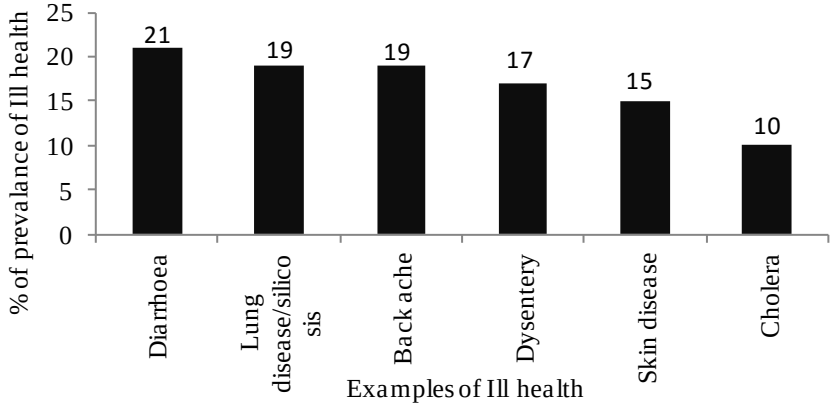

Figure 4.19: Examples of Ill-health in Construction

(vi) Causes of Ill-health in Construction

The causes of ill-health identified by the interviewees as illustrated in Figure 4.20 below ranged from poor sanitary conditions to exposure to dust and chemicals.

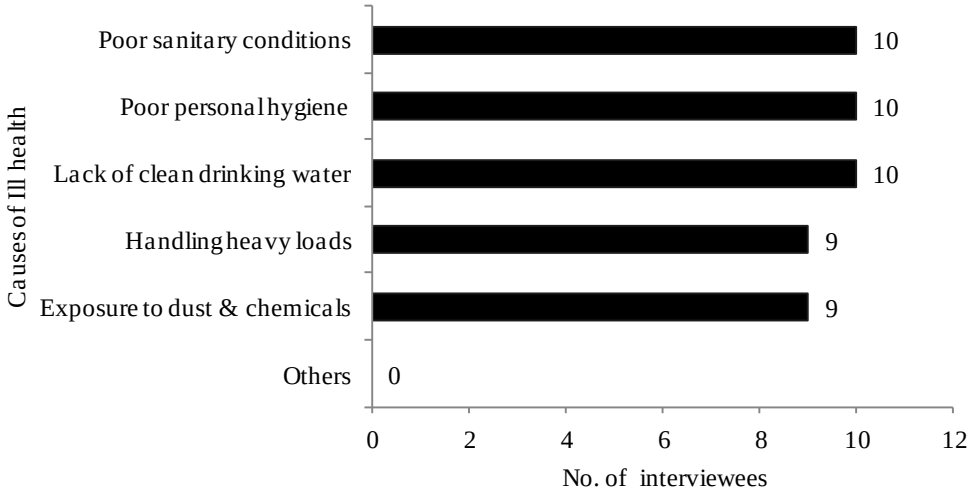

Figure 4.20: Causes of Ill-health in Construction

(vii) Prevention of Ill-health

The most appropriate preventive methods of ill-health suggested by ten interviewees were: provision of good sanitary conditions; good personal hygiene; and provision of clean drinking water. The results are shown below in Figure 4.21. The 'other' category included good housekeeping.

Figure 4.21: Prevention of Ill-health

(viii) Incidence of Accidents by Season

Figure 4.22 below shows that ten of the interviewees proposed that accidents were more prevalent in the rainy season than in any other time of the year. However, one interviewee felt accidents occurred more in the cold season while one considered the hot season to exhibit more accidents.

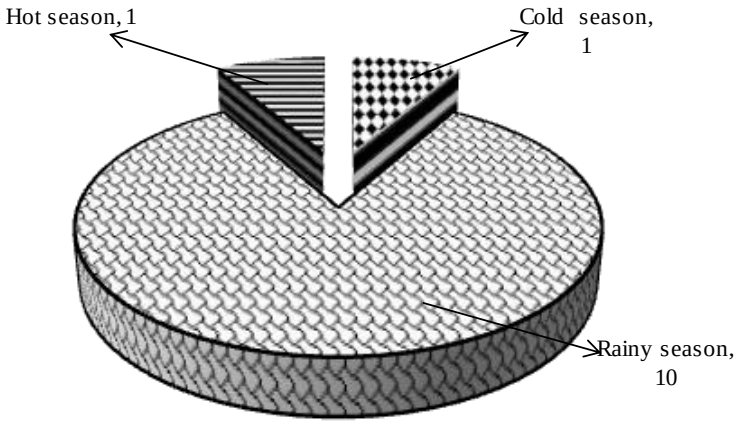

Figure 4.22: Incidence of Accidents by Season

The reasons for the high prevalence rate of accidents during the rainy season were; floods and slippery grounds that made conditions unsafe for construction. Visibility was noted to be challenging during the rainy season, making it unsafe for construction works. Further, water borne diseases are prevalent during the rainy season making it unhealthy for construction activities.

4.2.5 Importance of Safety and Health

The interviews had different views on the benefits of safety and health.

(i) Benefits of Implementing Good Safety and Health Guidelines

Figure 4.23 below shows the benefits of implementation of good safety and health guidelines.

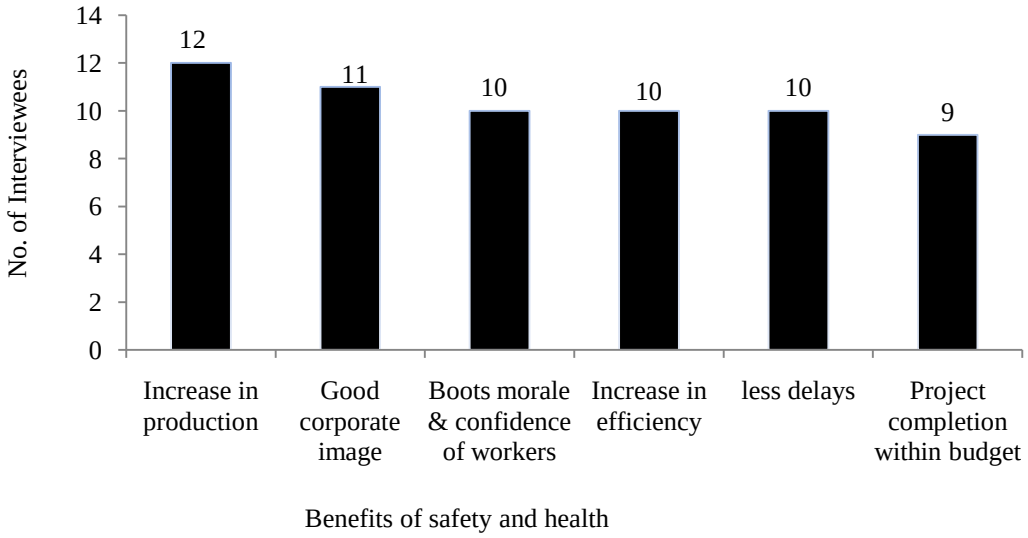

Figure 4.23: Benefits of Good Safety and Healthy Practices

(ii) Other Views on Safety and Health in Construction

Interviewees were asked to give any other views on safety and health in construction industry. The following were some of the suggestions:

(a) the government should put in place deliberate policies to enforce safety and health on all construction sites;

(b) implementation of safety and health strategies should improve; and

(c) the government should not interfere with regulatory bodies such as the NCC and Zambian Environmental Management Agency (ZEMA).

4.3 Questionnaire Survey Results

The questionnaire survey was undertaken between March and June, 2012. Ninety respondents were targeted from a population of companies registered with NCC in 2012 and institutions such as RDA, MWS, WCFCB and NAPSA. The list of companies and number of respondents is in appendix C. Of the targeted ninety, seventy-eight responded to the questionnaires. Twelve respondents did not send back the questionnaires leading to a response rate of 87 per cent. The respondents comprised representatives from clients, consultants, regulators, compensators, contractors and government organisations as stakeholders in the construction sector.

4.3.1 Background Information

The following were the background information of respondents;

(i) Respondents by Gender

The respondents consisted of 90 per cent males and 10 per cent females.

(ii) Respondents by Position Held in the Company

Twenty nine per cent of respondents were directors, followed by 23 engineers who included: resident, senior, project and site engineers. Other respondents included 13 per cent managers, nine per cent inspectors from NCC and WCFCB. Eight per cent were surveyors, six per cent each for site workers and site foremen, three per cent each for safety officers and architects. Site workers included carpenters, steel fixers and general workers. Below Figure 4.24 illustrates respondents by position held in the company.

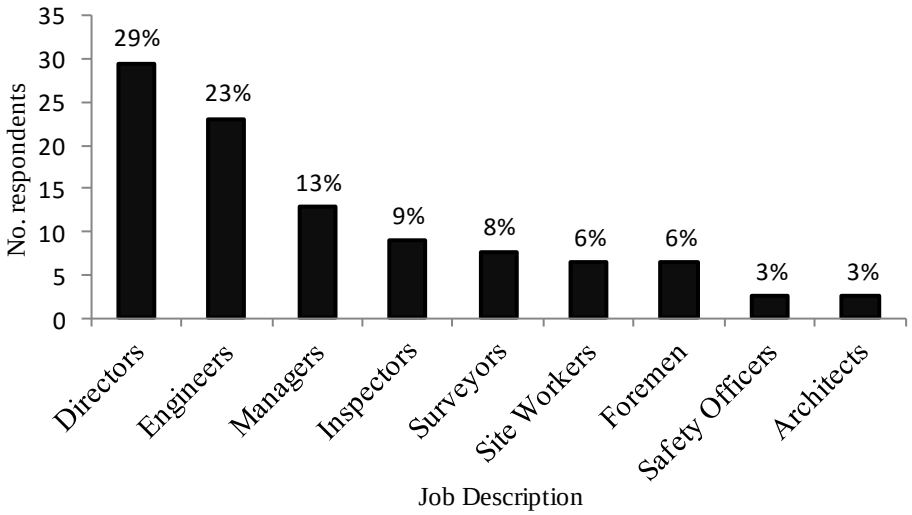

Figure 4.24: Respondents' Position in the Company

(iii) Respondents' Years of Experience

The years of experience of respondents ranged from two to thirty years. Thirty-two per cent of the respondents had five to ten years of experience. Twenty-eight per cent had two to four years of experience in the industry. There were 22 per cent highly experienced respondents with years of experience ranging from twenty one to thirty years, 9 per cent from sixteen to twenty and another 9 per cent from eleven to fifteen years of experience as shown in Figure 4.25.

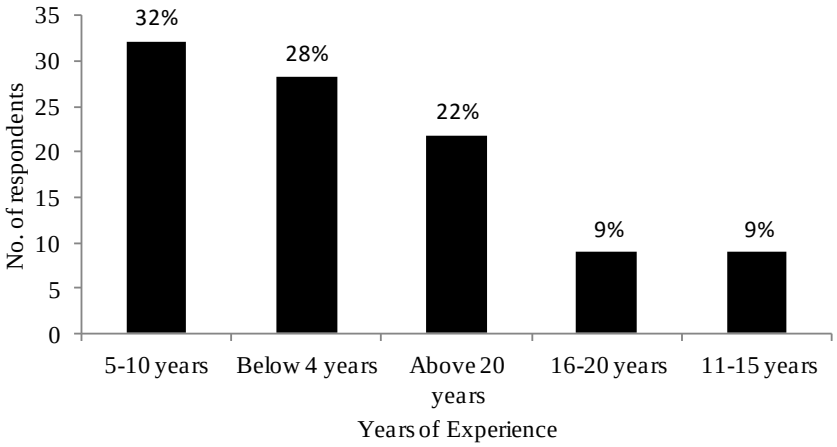

Figure 4.25: Respondents' Years of Experience

(iv) Respondents' Class of Construction

Respondents were carefully selected to represent all stakeholders in the construction industry in Zambia as shown below in Figure 4.26. For the purposes of the study, class of construction shall mean the company's role in the industry. Twenty two per cent of the respondents were contractors involved in both roads and buildings construction. Consultancy was 21 per cent and 'others' group which comprised NCC and WCFCB as regulators in the construction industry, had 18 per cent. Clients were nine per cent and were from government institutions such as MWSBD, National Pension Scheme Authority (NAPSA) and RDA.

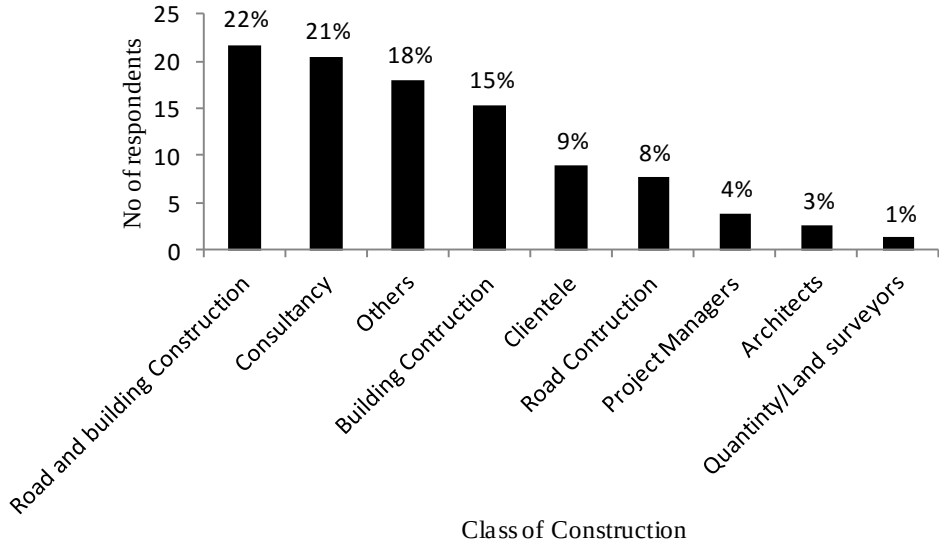

Figure 4.26: Respondents' Class of Construction

4.3.2 Status of Safety and Health

Safety of construction sites were gauged in terms of provision of PPE, number of accidents, proper construction equipment and tools. In the area of health, assessment was done on the provision of clean water, toilets, First Aid Boxes and frequency of disease outs breaks.

(i) Safety on Construction Sites

Fifty six per cent of respondents described the construction sector as relatively safe while 21 per cent were of the view that it was unsafe. Seventeen per cent described it as safe; four per cent were not sure whilst three depicted it as very safe. Figure 4.27 below shows the views of respondents regarding the status of safety on construction sites.

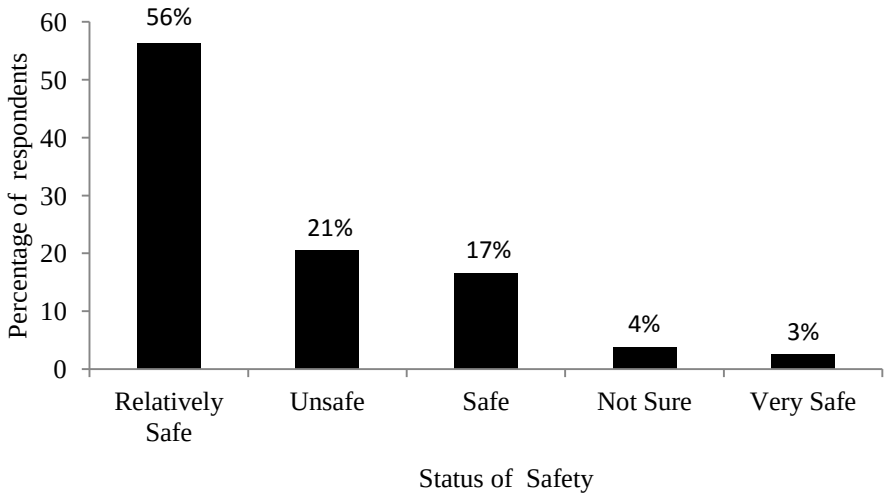

Figure 4.27: Safety on Construction Sites

(ii) Health on Construction Sites

The results in Figure 4.28 below indicates 51 per cent of respondents as the highest number portraying construction sites as relatively healthy followed by unhealthy and healthy with 22 per cent of respondents each. The least was 3 per cent of respondents each who suggested very health and not sure.

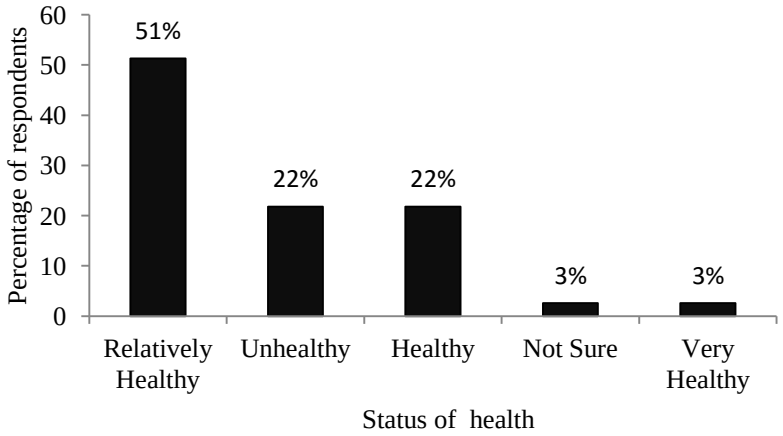

Figure 4.28: Healthy on Construction Sites

(iii) Reasons for the Status of Construction Sites

The reasons cited for relatively safe and healthy status of construction sites were that basic safety and health requirements such as PPE and First Aid Boxes where provided by many companies. As well, some contractors were slowly appreciating safety and health since the basics such as HIV AND AIDS awareness programme were included in contract documents for some projects. Those who were of the view that the construction sites were unsafe and unhealthy cited lack of serious user friendly safety and health policies and lack of enforcement in the industry. Additionally, less or no money was specifically allocated to safety and health by SSC. Few fatalities and no major out breaks were the reasons for the safe and healthy status. Other respondents felt construction sites were very safe and very healthy because they had not experienced accidents or ill-health in the construction industry. Moreover, they were from countries were safety and health were compromised and so felt that Zambia's construction sites were very safe and very healthy.

4.3.3 Safety and Health Guidelinest

The safety and health guidelines were assessed as follow;

(i) Familiarity of Factories Act in construction

Thirty two per cent of respondents were familiar with the Factories Act while 61 per cent were not.

(ii) Rating of Factories Act

Fifty-two per cent of respondents who were familiar with the Factories Act, described it as 'needs improvement', seven per cent as 'relatively adequate' and five per cent as 'adequate' as shown in Figure 4.29 below.

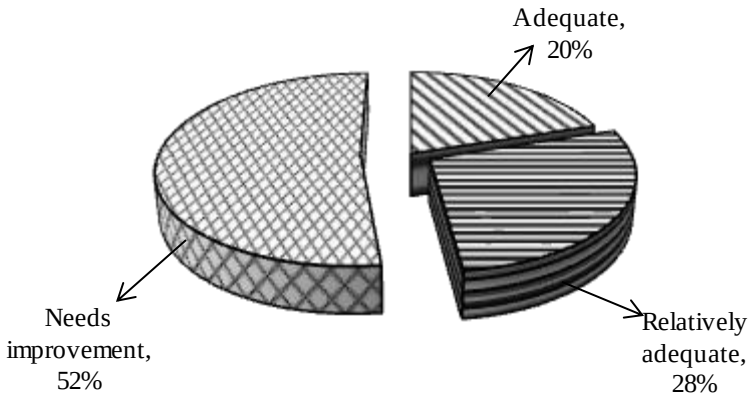

Figure 4.29: Adequacy of Factories Act

(iii) Reasons for the Rating of Factories Act

Respondents who rated the Factories Act as 'needs improvement' suggested that it was not simple to follow and was not known by many people in the industry especially upcoming contractors. In addition, changes in technology required that there should be improvements made to the Factories Act in order to meet the current demands in the Zambian and international construction sector standards. The Factories Act was considered out-dated because it focused more on factory environment as opposed to the construction industry. Twenty-eight per cent of respondents felt that the Factories Act was relatively adequate because it was fair but lacked proper implementation. The other 20per cent suggested that the Factories Act was adequate in the construction sites where it was properly followed and it proved better in terms of upholding safety and health standards.

(iv) Knowledge of Safety and Health Guidelines in Construction

Thirty-six per cent of respondents denied knowing any safety and health guidelines in the industry. Figure 4.30 below shows the results of knowledge of safety and health guidelines. Thirty-three of respondents knew WCFCB regulations, company's safety and health policies, contract guidelines and NCC Code of Conduct Statutory Instrument (IS) 119 of 2008, NCC ACT No. 15 of 2003 in the 'others' category. Thirty-one had knowledge of the Factories Act.

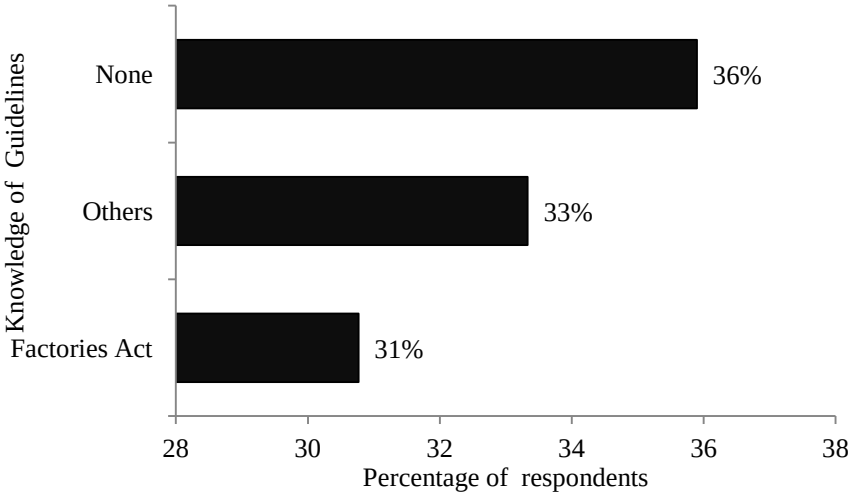

Figure 4.30: Knowledge of Safety and Health Guidelines

(v) Adequacy of Safety and Health Guidelines

According to 56 per cent of the respondents, safety and health guidelines were relatively adequate. Twenty-four and 20per cent of respondents suggested that safety and health guidelines were adequate and not adequate respectively as illustrated below in Figure 4.31.

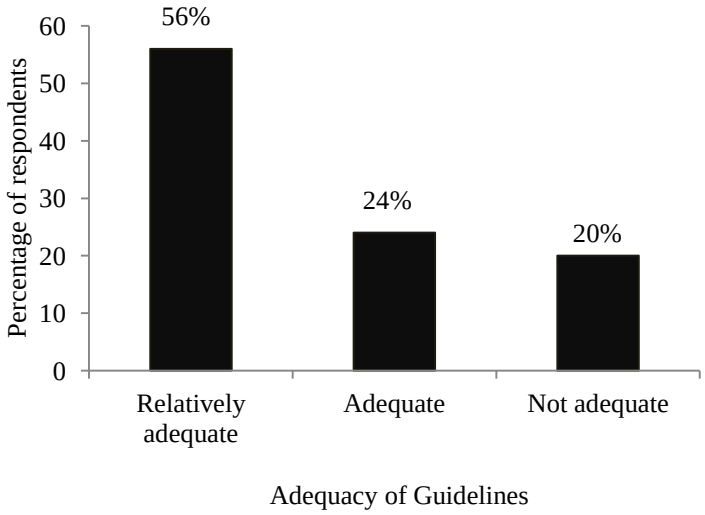

Figure 4.31: Adequacy of Safety and Health Guidelines

(vi) Shortcomings of Safety and Health Guidelines

The respondents suggested that safety and health guidelines were not easy and simple to follow, especially for unskilled workers on sites. The guidelines were not updated to solve the latest challenges being faced in construction sector and enforcement was poor. In most

contract documents, emphasis was on HIV and AIDS programme which was mandatory in most projects.

(vii) Improvement of Safety and Health Guidelines

Respondents suggested that safety and health guideline could be improved by: involving all stakeholders in the industry in implementation; employing of safety personnel; inclusion of safety and health in all contract documents; offering training to all contractors; introduction of stiffer penalties to defaulters; and regular inspections.

4.3.4 Safety and Health Facilities

The safety and health facilities were assessed as follows;

(i) Variety of PPE Provided

Work suits and boots or gum boots were provided according to 85 per cent of the respondents followed by hard hats with 79 per cent. Figure 4.32 below shows the variety of PPE provided on construction sites. Safety belts, dust masks and ear plugs were provided by few companies and a few workers benefitted those who worked in environments that required such equipment.

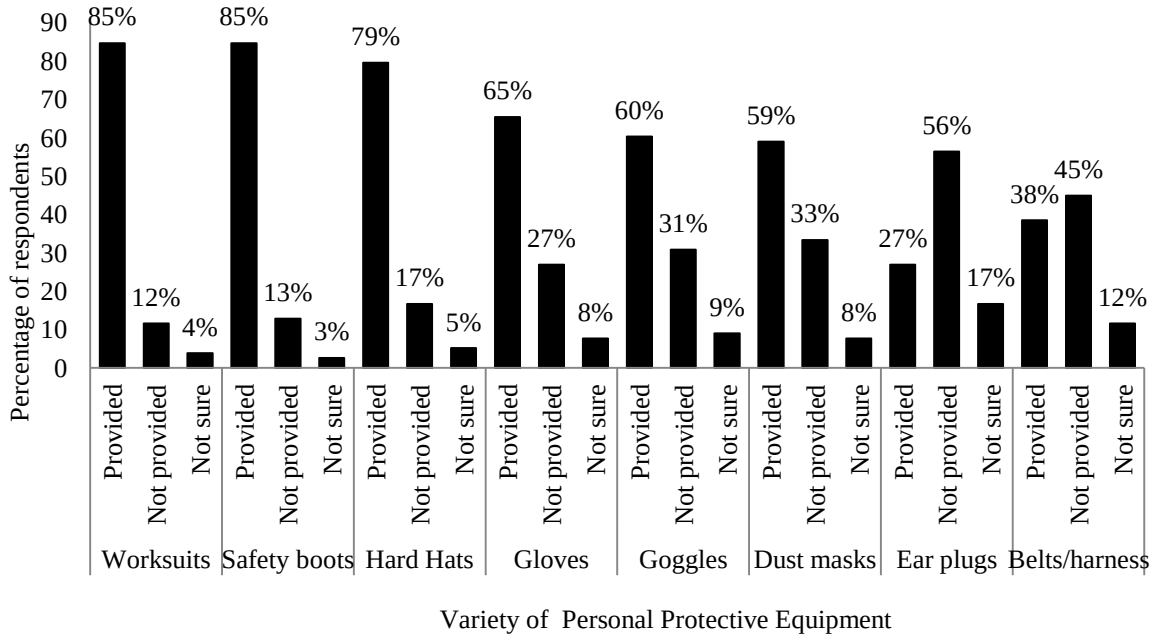

Figure 4.32: Provision of Personal Protective Equipment

(ii) Health Facilities Provided

The most provided health facility was clean drinking water then First Aid boxes with 77 per cent and 72 per cent in that order. Eating space was the least provided. Some respondents were not sure if the facilities were provided on sites. Figure 4.33 below shows the variety of health facilities.

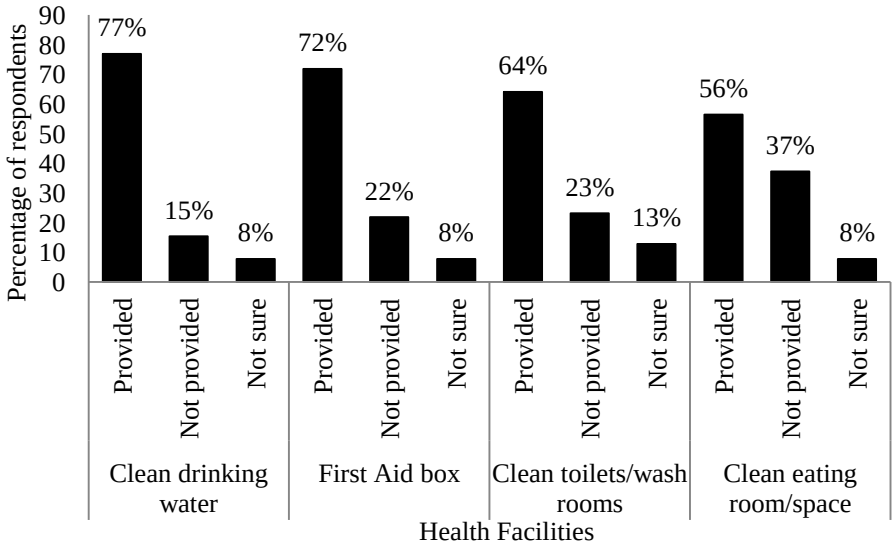

Figure 4.33: Health Facilities Provided

(iii) Signage on Construction Sites

Figure 4.34 below shows that according to 45 per cent of the respondents, signage on sites was relatively adequate while 32 per cent and 23 per cent suggested that it was not adequate and adequate respectively.

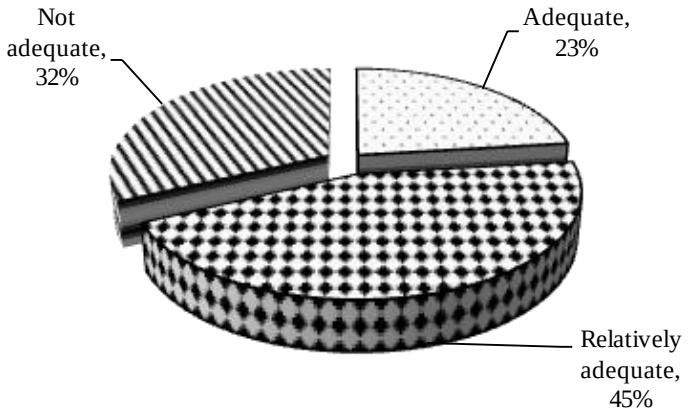

Figure 4.34: Signage on Construction Site

4.3.5 Enforcement of Safety and Health

The enforcement of safety and health was assessed as follows;

(i) Safety and Health Programmes on Sites

HIV and AIDS awareness was the highest program which was being undertaken with 26 per cent of the respondents. Safety orientation was second highest with 23 per cent while general safety and health training had 22 per cent. First Aid training was acknowledged by 17 per cent of the respondents while risk assessment sessions had 10 per cent. In the 'others' group was tool box training which had 2 per cent of the respondents as shown below in Figure 4.35.

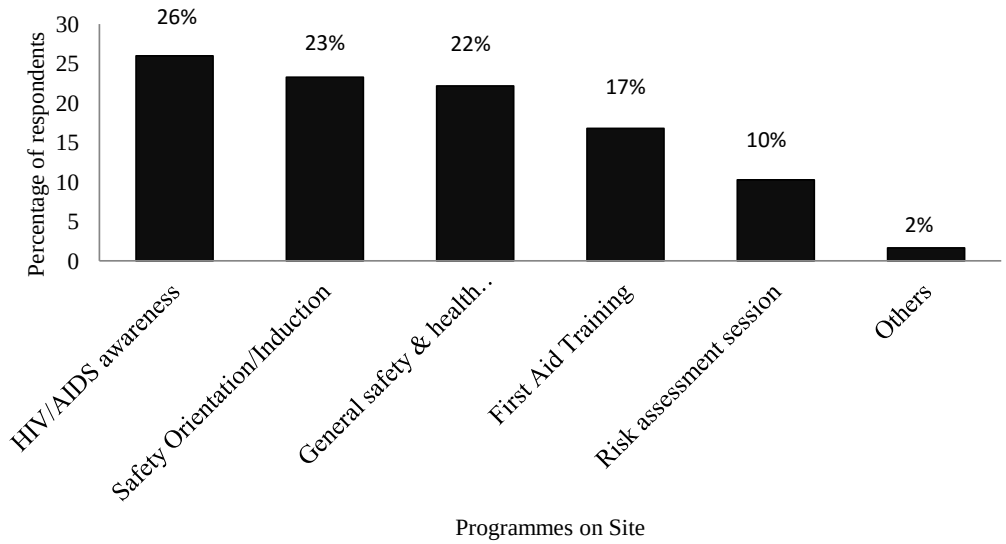

Figure 4.35: Safety and Health Programmes on Sites

(ii) Respondents' Involvement in Safety and Health Programmes

Directors and managers were involved in safety and health through provision of PPE, First Aid boxes and medicines. Safety officers were in charge of First Aid, training monitoring and were role models. Engineers, foremen and supervisors were involved by taking part in training sessions, especially HIV and AIDS and also through implementation of the set safety and health rules on site. Architects and surveyors were not involved in any safety and health programmes. Inspectors were involved in enforcing and monitoring during their routine site inspections especially when an accident happened or a serious near miss.

(iii) Presence of the Safety Officers on Site

Fifty-one per cent of respondents confirmed that they had a safety officer on site while 49 per cent respondents did not.

(iv) Stakeholders Involvement in Improvement of Safety and Health

Respondents strongly agreed that safety officers, contractors, site supervisors, site workers, consultants and clients should be involved in improvement of safety and health in construction industry as shown below in Figure 4.36.

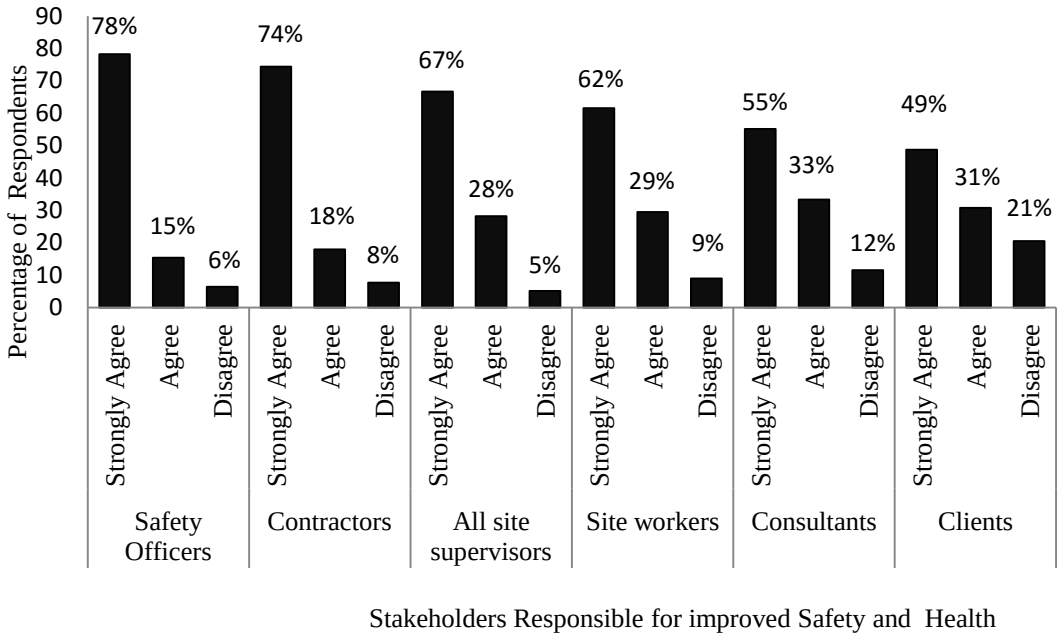

Figure 4.36: Stakeholders' Involvement in Implementation of Safety and Health

(v) Consideration of Safety and Health at All Stages of the Project Cycle

Seventy-two per cent of respondents strongly agreed to the inclusion of safety and health at all stages of the project cycle. Twenty-four per cent of respondents agreed and only four per cent disagreed. The results are shown below in Figure 4.37.

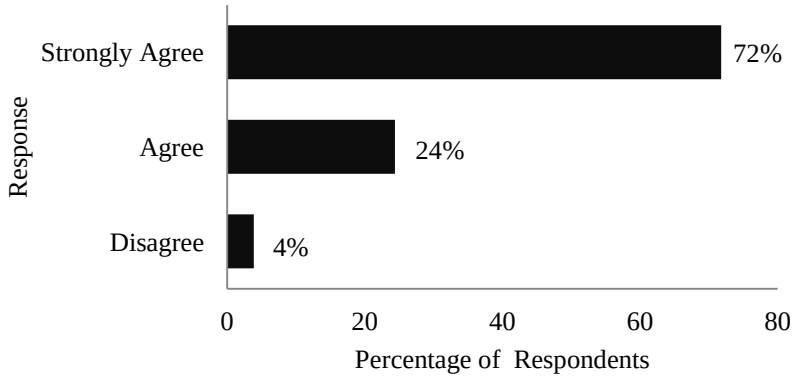

Figure 4.37: Consideration of Safety and Health in the Project Cycle

(vi) Companies Adherence to Good Safety and Health Practices

Sixty-five per cent of the respondents suggested that big companies adhered more to safety and health practices than small companies. According to Figure 4.38 below, 27 per cent of the respondents felt both big and small companies adhered to safety and health. Eight per cent of respondents felt small companies adhere to good safety and health more than big companies.

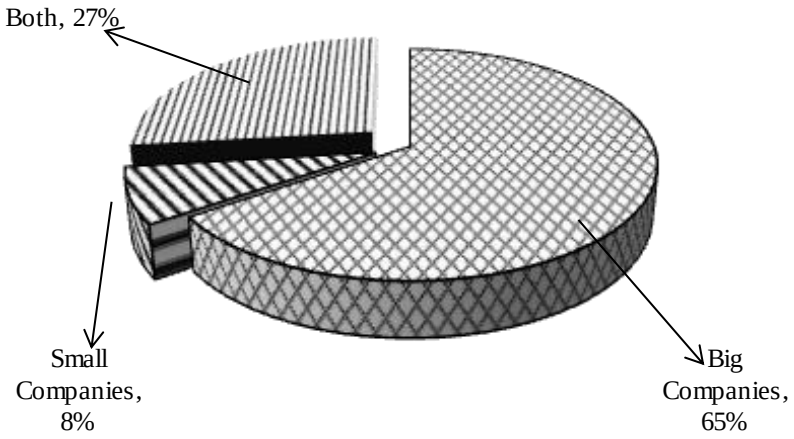

Figure 4.38: Company Adherence to Good Safety and Health Practices

(vii) Reasons for Poor Safety and Health Practices by Contractors

Thirty-seven per cent of the respondents felt that the main reasons for contractors' poor safety and health practices were profit maximisation and poor management as illustrated below in Figure 4.39. Twenty-six per cent of the respondents suggested that safety and health was expensive.

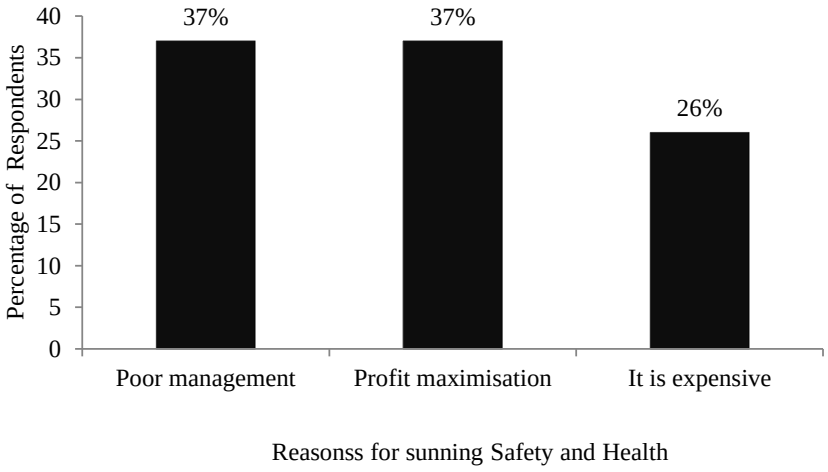

Figure 4.39: Reasons for Poor Safety and Health Practices

4.3.6 Accidents and Ill-health

(i) Category of Accidents

Figure 4.40 below shows categories of accidents in the construction industry in Zambia. From top to bottom, the percentage occurrence of accidents were: falling from heights at 69 per cent; hit by falling object at 64; collapse of earth at 60 per cent; use of heavy machinery and tools at 55 per cent; electrocution and explosions at 51 per cent; and slips and trips at 37 per cent. The least occurrence was 'others' category which had 37 per cent and it included; hit by moving machinery and drowning. The respondents were selecting according to their experience in the industry.

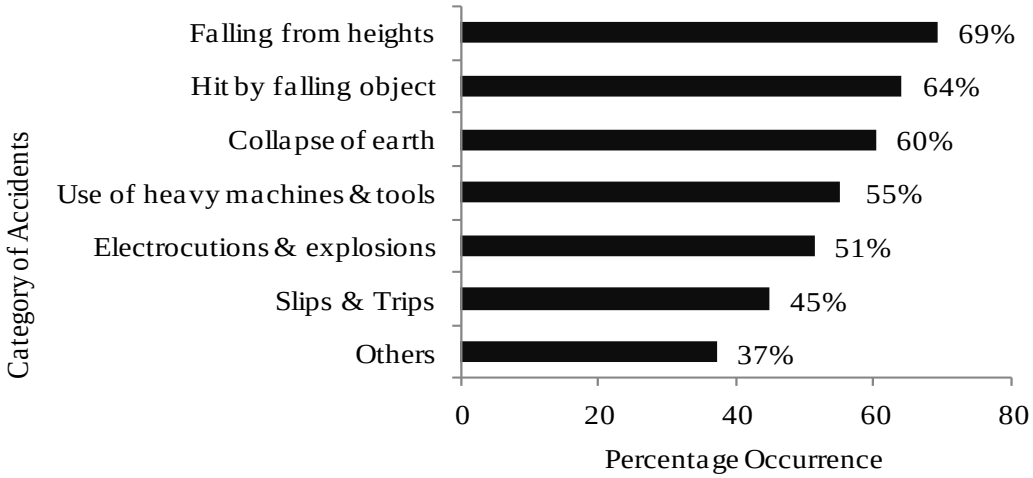

Figure 4.40: Category of Accidents in Construction

(ii) Common Causes of Accidents

The most common identified cause of accidents was poor attitude to safety at 67 per cent occurrence while the least common was stress with 46 per cent occurrence as shown in Figure 4.41 below.

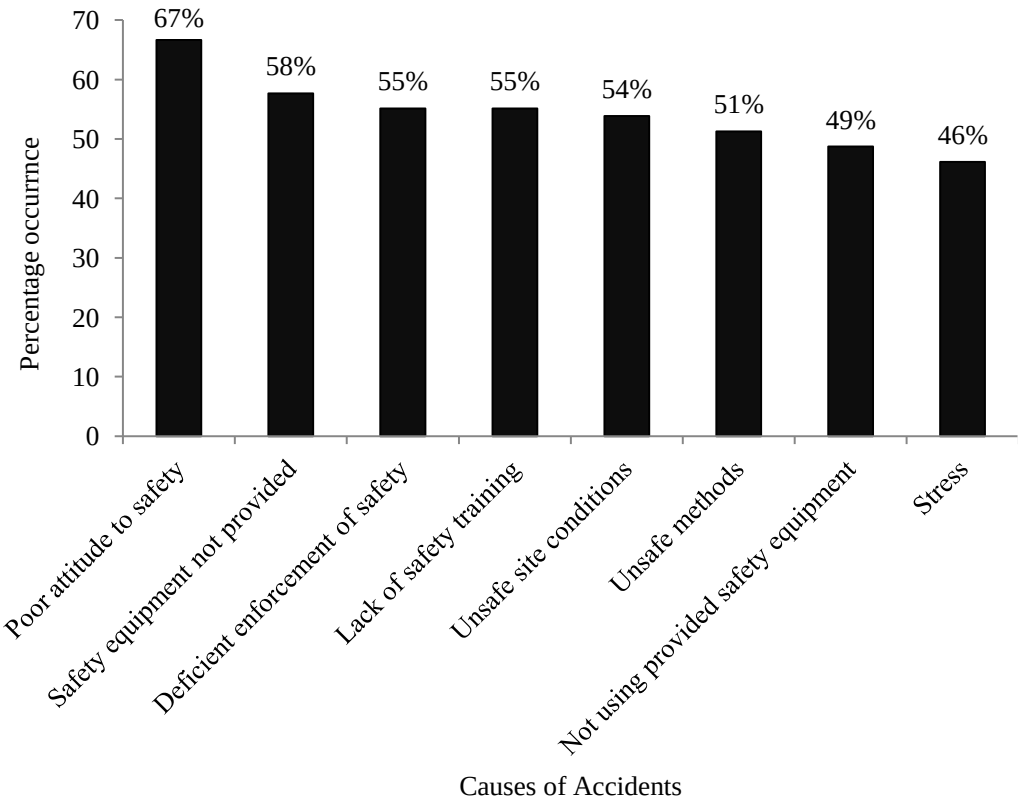

Figure 4.41: Common Causes of Accidents

(iii) Effect of Accidents on Sites

The prominent effects of accidents were unnecessary costs such as medical and insurance; disability; loss of moral; and psychological trauma. The least prominent effect was in the 'others' category which included body injuries, damage to property and machinery and loss of family breadwinners. Figure 4.42 below shows the effects of accidents from left to right in order of the respondent's experiences with accidents in the industry.

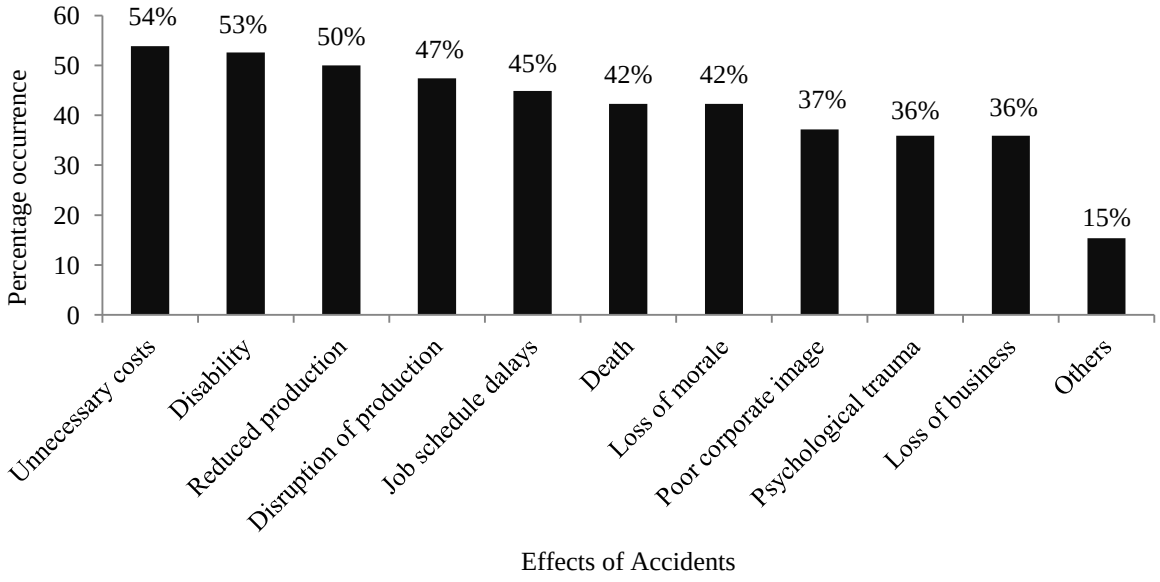

Figure 4.42: Effects of Accidents

(iv) Prevention of accidents

Figure 4.43 below shows methods of how accidents could be prevented in order of preference of respondents. Good attitude to safety was the most approved prevention with 68 per cent of the respondents. The least preventive method with 3 per cent was in the 'others' category which included environmental friendly prevention such as limiting the emissions of hazardous gases, chemicals and dust.

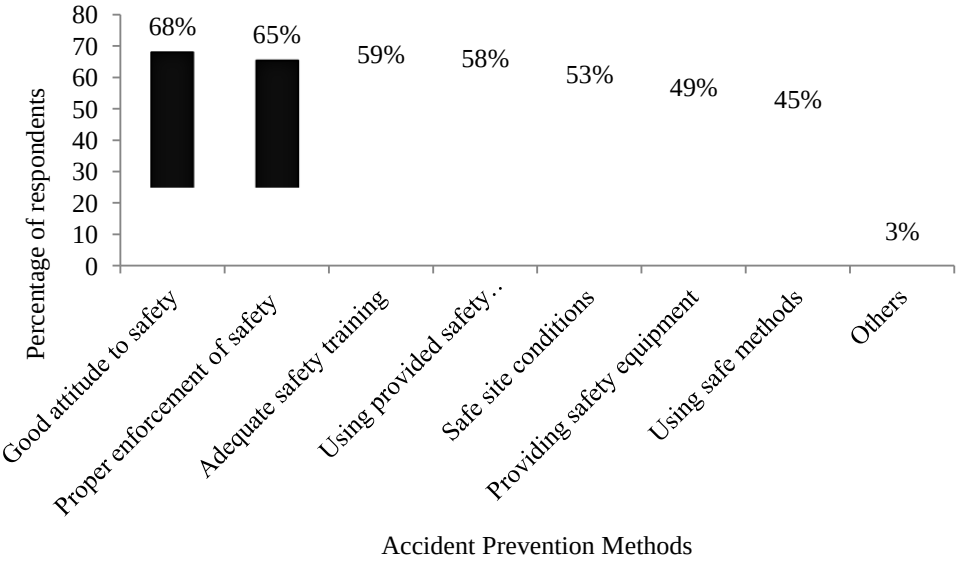

Figure 4.43: Methods of Accidents' Prevention

(v) Examples of Ill-health in Construction

Diarrhoea, backache and lung disease were the most common examples of ill-health in construction according to the respondents as evidenced below by the results in Figure 4.44. Cholera was the least prevalent in the industry.

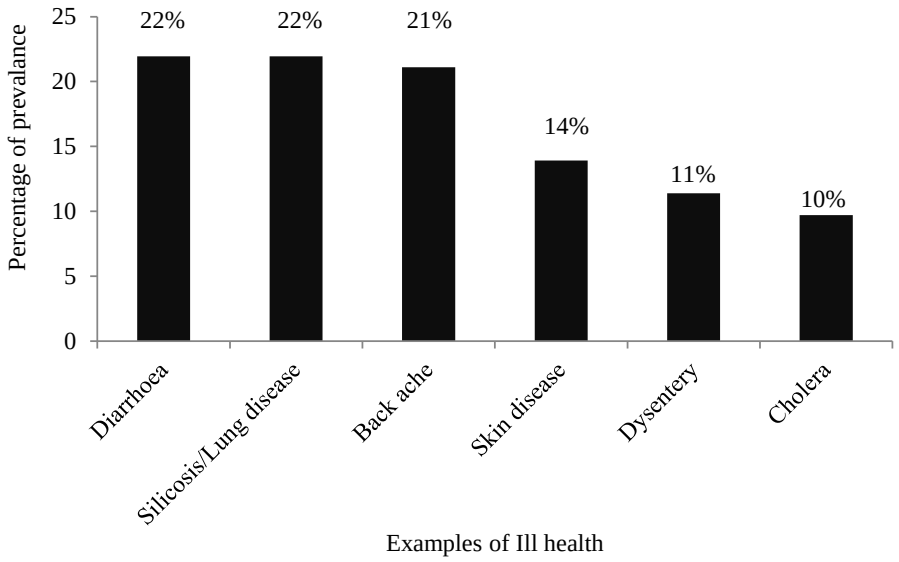

Figure 4.44: Examples of Ill-health in Construction

(vi) Causes of Ill-health in Construction

The causes of ill-health as illustrated in Figure 4.45 ranged from handling heavy loads at 51 per cent occurrence, exposure to dust and chemicals at 50 per cent. Poor sanitary conditions were at 48 per cent, poor personal hygiene at 47 per cent and lack of clean drinking water at 44 per cent occurrence.

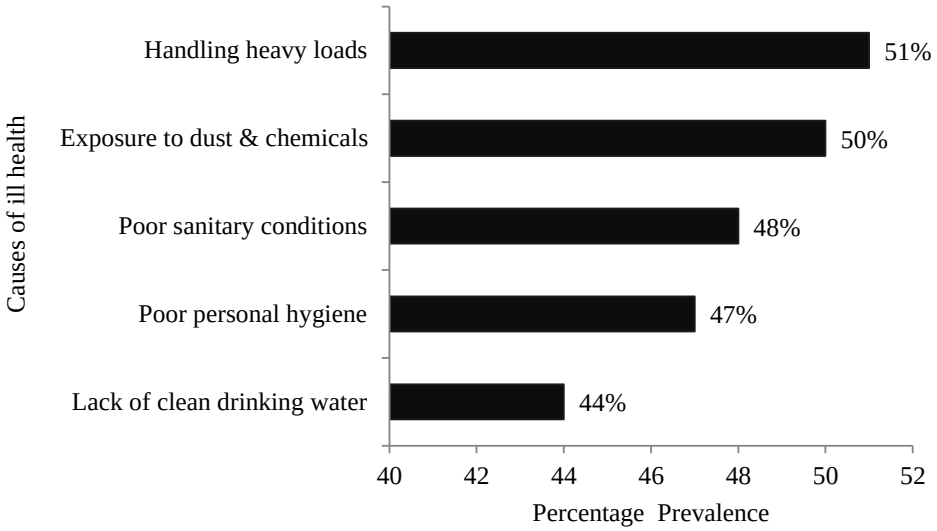

Figure 4.45: Causes of Ill-health in Construction

(vii) Prevention of Ill-health

Fifty-eight per cent of the respondents felt that provision of good sanitary conditions and personal hygiene were the most appropriate preventive methods of ill-health as shown below in Figure 4.46 below. Other methods included proper safety training with 51 per cent of the respondents, providing clean drinking water with 47 per cent and wearing protective equipment with 45 per cent respondents. The 'others' category also included good housekeeping at six per cent.

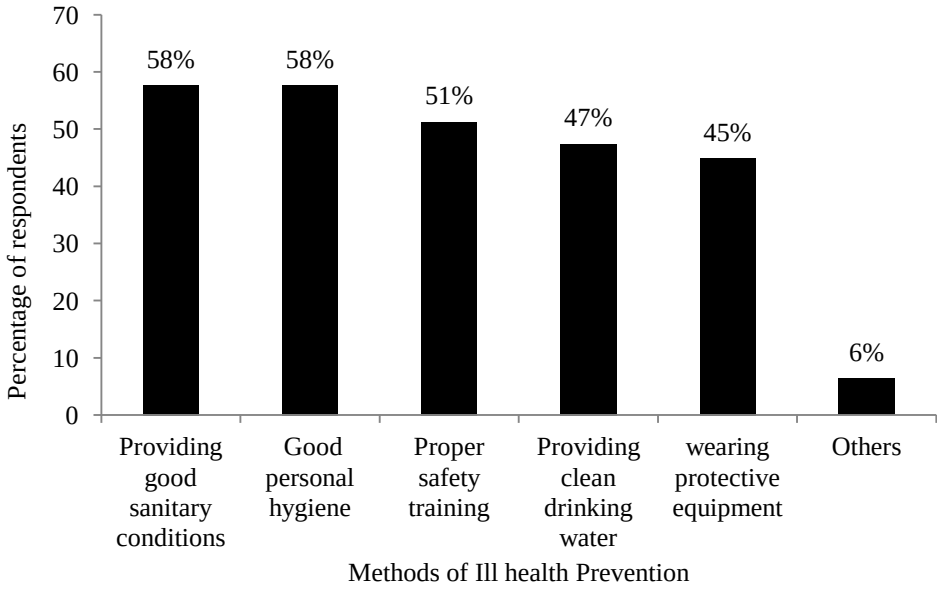

Figure 4.46: Prevention of Ill-health

(viii) Incidence of Accidents and Ill-health by Season

Accidents were most recorded in the rainy season as compared to cold and hot seasons as shown below in Figure 4.47.

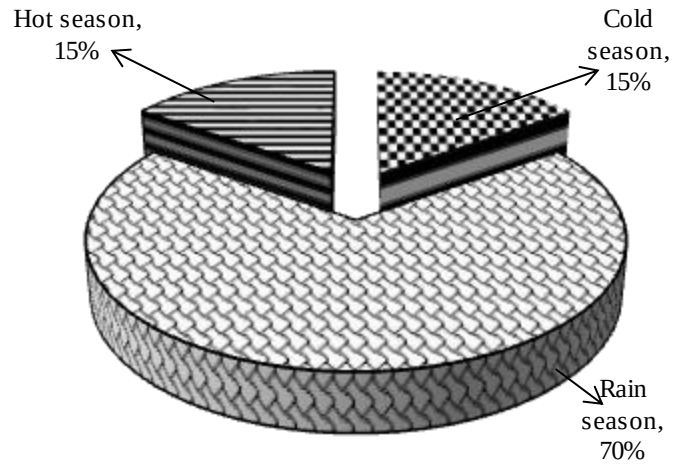

Figure 4.47: Incidence of Accidents and Ill-health by Season

(ix) Reasons for accident prevalence by season

Seventy per cent of the respondents suggested that in the rainy season, floods and slippery grounds makes the conditions unsafe for construction. Visibility is also challenging during the rainy season. There was a lot of 'down time' due to the rains which made workers to slack off when restarting work making them prone to accidents. In addition, water borne diseases were prevalent during the rainy season making it unhealthy for construction activities. However, 15 per cent of the respondents suggested that in hot season, workers removed their PPE which exposed them to accidents. Also construction works were at pick in hot season which contributed to workers fatigue. The other 15 per cent of the respondents proposed that in cold season, fire accidents were prevalent as the workers kept warm using fire, which caused death and damage to property whenever a fire accident occurred.

(x) Rating of Construction Sites Regarding Safety and Health

According to 62 per cent of the respondents, construction sites were relatively safe and health. Thirty three per cent of respondents suggested that safety and health was poor while five per cent felt that safety and health was excellent.

4.3.7 Benefits of Safety and Health Practices

(i) Benefits of Implementation of Good Safety and Health

The most benefit of implementing good safety and health identified was that it boosts morale and confidence of workers with 74 per cent respondents. The least preferred benefit was project completion within budget with 53 per cent of the respondents as illustrated below in Figure 4.48

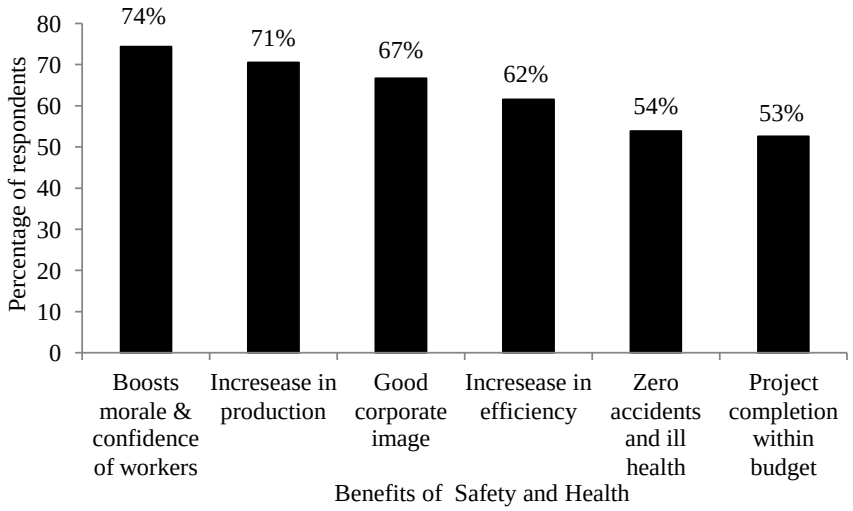

Figure 4.48: Benefits of Good Safety and Healthy Practices

(ii) Other Views on Safety and Health in Construction

Respondents suggested the following on safety and health in the construction industry:

(a) a revised Act is required to strengthen the existing Factories Act;

(b) wages of construction workers must be improved since poor condition of service can lead to poor safety and health;

(c) government should not interfere with regulatory bodies such as NCC and Zambia Environment Management Agency;

(d) safety and health should be budgeted for and included in the BOQs;

(e) the Factories Act should be availed to all contractors by NCC during registration or upgrading;

(f) safety and health should be made compulsory to all contractors; and

(g) all stakeholders should be involved and contribute to the improvement of safety and health.

4.4 Summary

This Chapter gave the findings of the study on safety and health in construction sector from the interviews and the questionnaire survey. The results obtained through observation method were similar to the questionnaire survey. This is because the stakeholders who were involved in the case studies participated in the questionnaire survey and answered according to what was observed. The results obtained through interviews were similar to the results from the questionnaire survey except for the effects of accidents, causes of ill health and benefits of implementation of good safety and health. Findings revealed that the industry was not adequately safe and health as a result of poor attitude to safety and health by stakeholders and poor enforcement of the Factories Act. Furthermore, the effects of accidents and ill-health were detrimental to workers and the project hence the development of the model for improved safety and health as presented in Chapter five.

CHAPTER FIVE: DISCUSSION OF THE RESULTS

5.1 Introduction

The previous Chapter presented the results from interviews and questionnaire survey. This chapter gives the discussion of the research findings and how the findings relate to findings of other researchers.

5.2 Research Findings

The study focused on the safety and health in construction industry in Zambia. Twelve out of the fifteen interviewees and seventy-eight out of ninety respondents participated in the interviews and questionnaire survey respectively. Almost all construction stakeholders were represented during the questionnaire survey because the group of 'Others' represented regulators, compensators and inspectors. However, water and sanitation were not directly represented because of the unreturned questionnaires. It was represented by some engineers whose experience included water and sanitation. Respondents to the questionnaire survey included experienced individuals with eleven to above twenty years in the industry; and youths who had four to ten years of experience. The respondents were 90 per cent males and 10 per cent females. The reason for having few female participants could be attributed to the small number of females taking up 'male dominated' careers such as engineering in the construction industry in Zambia and in Africa. In South Africa, women represent 8 per cent of the building and construction management profile in the formal sector (CIDB, 2004).

The results were similar in the interviews and questionnaires because participants identified similar challenges experienced in the construction industry in the area of safety and health. The results were summarised as follows:

(i) status of safety and health in Zambia's construction industry;
(ii) safety and health guidelines;
(iii) enforcement of safety and health guidelines;
(iv) accidents and ill-health; and
(v) benefits of safety and health and way forward

5.2.1 Status of Safety and Health in Zambia's Construction Industry

Construction sites were relatively safe and healthy. This was a consensus from the interviews and questionnaire survey. The relatively safe and health status of construction sites was attributed to the provision of basic PPE such as work suits, reflector vests, First Aid boxes and sometimes gumboots by some companies; few outbreaks of diseases like cholera; the basic safety and health guidelines that are found in the contract documents; none pricing of safety and health as an item in the Bill of Quantities (BOQs); and the Factories Act not being user friendly. Moreover, there were unsafe and unhealthy practices on some sites. However, some sites were safe and health. The safe and health site belong to big companies such as Lafarge and National Pensions Scheme Authority (NAPSA).

5.2.2 Safety and Health Guidelines

Seven out of the twelve interviewees and 36 per cent of respondents from questionnaire survey, did not know any safety and health guidelines that were used in the industry. Actually, some stakeholders argued that if they knew any guidelines, they could have adhered to them. Some companies had safety and health company polices while others used the safety and health guidelines found in the contract documents. The safety and health guidelines that were used in construction industry were; the Factories Act, WCBCF regulations, company's safety and health policy, safety and health contract guidelines, NCC code of conduct SI 119 of 2008 and NCC ACT No. 15 of 2003. The most used were contract guidelines and the Factories Act. The Factories Act was mainly used on big projects where it was one of the requirements. The contract guidelines were the most used because they were part of the contract documents and contractors were aware of them from tendering stage. On some sites, guidelines were only followed during mobilisation and forgotten thereafter since inspectors were few and could only manage to inspect few times. More so, there were no serious penalties issued whenever contractors contravened.

The Factories Act and other known guidelines such as OHS Act of 2010 were relatively adequate though they lacked enforcement. This is similar to Jere (2012)'s findings. The effectiveness of the Factories Act was measured by how well the Act addressed safety and health in construction industry in terms of risk management and worker safety. How well it was known in the industry and the views of stakeholders who were familiar with it.

Moreover, the effectiveness was measured by the staffing levels of inspectors at MLSS-OSHS.

Lack of enforcement of the Factories Act was evidenced by the few MLSS-OSHS inspectors in charge of safety and health in construction. During the study period, there were two inspectors despite the increase in construction projects. The interviewees and respondents who were familiar with the Factories Act were of the view that it needed improvement to address safety and health challenges in the construction industry such as technology changes that take place every now and then. The innovations in technology have brought about new inputs in terms of materials, equipment and machinery. This means that even the strategies for safety and health should be improved to get the best results. The Factories Act has not been amended for the past 20 years. Furthermore, the Factories Act has general rules which are descriptive in nature. These rules were not up to date with the ever changing technology resulting in new sophisticated equipment, machinery and materials. The shortcomings of the Factories Act that emerged are that it does not carter for 'after accident' issues of workers and does not encourage all stakeholders to participate in safety and health issues. There is need to update provisions of the Factories Act in order to incorporate the sophisticated machinery and materials in a safe and health manner. The factories Act, has to incorporate risk management and worker protection beyond PPE. Like the mining industry, construction industry requires a tailor-made safety and health legislation to suit the sector together with its challenges.

There was a new safety and health Act that was enacted during the study known as the Occupational Health Safety Act (OHS Act, 2010) which was repealed by stakeholders in the construction industry. The OHS Act, 2010 was repealed because it was not an inclusive document. It was done by the Ministry of Health and focused more on health. The stakeholders in the construction sector were not consulted during its development process. If it were inclusive, it would have been used together with the Factories Act to improve enforcement as it highlighted the enforcement part of safety and health. Lessons should be learnt from the repealing of OHS Act, 2010 by the construction stakeholders. The lesson is that during the development of the NOSH policy, all stakeholders should have been involved from the beginning to the end. The same should apply to the construction tailor-made safety and health regulations, all players in construction sector should be included in the development process.

5.2.3 Enforcement and Compliance of Safety and Health

(a) Safety and Health Facilities

Safety and health facilities were expected to be provided during mobilisation and during the course of the project. The interviews and questionnaires revealed similar results on the provision of safety and health facilities. In terms of safety, basic PPE such as work suits, boots, hardhats and reflectors were generally provided by most companies. However, the basic PPE was provided only once in a year or as long as the project lasted, as evidenced by worn out PPE witnessed during observations on the case study sites. The PPE, such as goggles, dust masks, safety harness or belts and ear plugs were rarely provided by many companies. The few companies that provided the rare PPE only gave few workers who worked in the areas where such PPE were needed. Moreover, the rare PPE were exchanged among workers which posed a health risk. It is law that all construction workers should be provided with a full PPE kit by their employers. Unfortunately, the full PPE was deemed as an extra cost hence only the cheapest and poor quality basic PPE was provided.

In the area of health; clean drinking water, First Aid boxes, clean toilets and clean eating rooms were generally provided. However, this was only in the case of big projects with established site camps. Provision of clean toilets and clean eating space were more challenging in road construction projects because of the distance from the working sites to the established site camps. Despite the provision of First Aid boxes, some of these did not contain the necessary first aid medicines and materials. This was because either the materials or medicines got finished and were not replaced or were not bought at all. Some First Aid Boxes were empty and were used only for show during inspections which were rare and were mainly conducted before site meetings.

Signage to warn of danger was relatively enough on many sites. The common signage materials that were used were danger tapes, reflective cones and construction signs such as ‘construction works ahead' and heavy duty machinery at work' in the road projects. Signage was one of the requirements for big projects especially in road and drainage projects. Usually, big projects were inspected by MLSS-OSHSD and so contractors provided the basic safety and health requirements during mobilisation. Moreover, some foreign big contractors provided the required safety and health facilities because of their experience in safety and

health from their countries of origin. Unfortunately, other foreign companies were failing to comply with the basic safety and health guidelines provided for in the Factories Act.

(b) Safety and Health Programmes on Site

The most common safety and health programmes performed on many sites were HIV and AIDS awareness and safety orientation followed by general safety and health training. First Aid training and risk assessment session were mainly done in big projects. HIV and AIDS programme was the most common on sites because it was included in the BOQs as part of the contract and it was conducted by HIV and AIDS based organisations such as *Afyamzuri* and Society for Family Health. Since HIV and AIDS programmes were allocated some money in the BOQs, they were compulsory to both big and small contractors. In addition, the HIV and AIDS programmes were successfully done on sites because clients paid money directly to the organisation in charge and not to the contractor for fear that the contractor would divert the money to something else other than on what it was required in the contract.

Safety orientation, safety and health training, First Aid box and risk assessment sessions were done on big projects and small projects whose clients prioritised safety and health like Lafarge Zambia. Safety orientation was performed to familiarise new workers to the whole site and the basic safety and health rules to follow during their routine jobs. During orientation, workers were shown how to use PPE and safety and health facilities. Risk assessment which is important in accident prevention was carried out on very few sites particularly on big projects. The safety manager, safety officer or representatives were in charge of safety and health on site. Ten out of twelve interviewees and 51 per cent of the respondents from questionnaire survey agreed to having a safety officer or representative on site. This might have been as a result of stakeholders slowly appreciating issues of safety and health in the industry. In addition, other companies might be t learning the importance of safety and health from other companies that had well established safety and health systems.

Stakeholders were involved in safety and health programmes through monitoring, sensitisation, training and provision of safety and health equipment such as PPE and First Aid boxes. Monitoring and sensitisation were rarely done by MLSS-OSHS and NCC during their routine inspections. MLSS-OSHS inspects the safety and health facilities and equipment on sites as provided for in the Factories Act, before the start of construction works. Usually,

inspectors from MLSS-OSHS visited sites when an accidents or a serious near-miss occurred. Their presence on sites was to investigate and decide the way forward, either to close the site or not depending on the seriousness of the incident. Furthermore, they concentrated on big projects and projects which had a duration of more than six months as provided for in the Factories Act. Accidents and ill-health can happen any time even on short term projects because hazards are similar for both short and long term projects. NCC inspectors visited sites to check the quality of construction works as a way to regulate the contractors. Apart from inspecting works, NCC inspectors evaluated safety and health on sites even though they should not make any decisions. One case in point that came to light during the study for MLSS-OSHS and NCC inspectors was that inspectors were not enough to execute their work on all sites and as a result some sites were not inspected.

Contractors mainly provided the basic safety and health facilities and equipment such as PPE, first aid boxes, toilets, drinking water and eating place in some cases. Consultants sometimes monitored whether the contractors provided PPE and health facilities or not. Unfortunately, some stakeholders are not involved at all, either because of being stationed at the head office or they left safety and health matters in the hands of the site management. Interviewees and respondents generally agreed that all stakeholders should be involved in the implementation of safety and health on sites by putting more emphasis on safety officers and contractors. Like the saying goes in the HIV and AIDS pandemic goes, ‘if you are not infected, you are affected'. The same applies to safety and health, if you are not a victim, you are affected in one way or another. This is the more reason why everyone should be involved in upholding safety and health.

Seventy-two per cent of the respondents strongly agreed and 24 per cent agreed with the proposal that safety and health should be considered at all stages of the project cycle in order to realise the full benefits. Safety and health should be considered during the feasibility, design, planning, specifications, construction, usage, and demolition and renovations processes. This is in line with findings of researchers such as Kayumbu (2013), Hecker *et al.*, (2005) and Charles *et al.,* (2007).

(c) Company Adherence to Good Safety and Health Practices

Nine interviewees and 65 per cent of respondents argued that big and medium contractors adhered more to safety and health than small scale contractors. This could be because big and medium contractors:

(i) had resources and so made safety and health a priority;

(ii) had qualified human resources in charge of safety and health;

(iii) cared about their reputation and corporate image; and

(iv) had bigger profit margins than small scale contractors.

In addition, some big and medium contractors that came from countries where safety and health was part of the work culture and so they continued with the same culture even in Zambia. Some of the small scale contractors adhered to safety and health because of their management's knowledge of the benefits of good safety and health contrary to Kheni et al. (2008). The small scale contractor managers or supervisors gained knowledge from big and medium contractors where they had worked before. Three interviewees and 27 per cent of respondents suggested that both big and medium contractors and small scale contractors adhered to safety and health. The argument was that it was dependant on how important the company management perceived safety and health.

Many small scale contractors were subcontracted on big projects by the main contractors. Subcontracting ten per cent of works on all big projects was encouraged by the government which directed construction stakeholders to effect it. This was to empower small scale contractors. Furthermore, it gave small scale contractors an opportunity to learn about safety and health from the main contractors. Safety managers and officers from main contractors made efforts to ensure that sub-contractors followed all safety and health guidelines on the construction sites. These results mean that safety and health in the construction industry in Zambia is slowly being appreciated by stakeholders.

(d) Reasons for Non-adherence to Safety and Health

The results from interviewees and questionnaire survey revealed that companies shun safety and health to maximise profit and because of poor management. This could be common in small scale contractors whose profit margins are minimal and usually have unskilled human resource. Safety and health was also regarded expensive since no money was allocated for

safety and health in the BOQ as argued by the study participants. Despite the efforts of some main contractors to empower subcontractors on safety and health issues, small scale contractors had difficulties in the safety and health management. Some companies hoped to buy poor quality PPE. As the saying goes ‘cheap is expensive' so it is for safety and health facilities and equipment. Poor quality safety and health facilities would not effectively serve their purpose resulting in buying the same PPE several times during the project if completion time of the project was long.

Safety and health was not an item in the BOQ like HIV and AIDS awareness, leading organisation to not allocate any money to safety and health. In addition, some organisations suggested that corruption contributed to the poor adherence to safety and health of small companies because they had to pay back the people who helped them get the contracts. By the time the project started, part of the contract sum would have been paid off in corruption-related issues. Lack of resources, less or no inspections by relevant authorities and no incentives were some reasons for non-adherence to safety and health. Zambia's construction industry was growing fast because there were many developmental projects being undertaken by the government and the private sector. The increase in construction projects saw the influx of many businessmen starting small companies without proper training in any construction skills. These businessmen managed everything on their own which led to shoddy works and less adherence to safety and health as their aim was to make profit at all cost.

5.2.4 Accidents and Ill-health

Accidents and ill health were assessed as follows;

(a) Common Types of Accidents

The most common type of accidents according to interviewees was being hit by moving machinery and drowning while questionnaire respondents suggested falling from height as the most common. The results for the other types were the similar to the interviews and the questionnaire survey except for slips and trips which were third least from the interviews and second least from results in the survey. The questionnaire survey results superseded the interviews because the questionnaire sample size was bigger than the sample for the interviews. The bigger the sample size the more precise the results. Falling from heights was found to be the most common type of accidents. The reasons could be the lack of safety

harness and adequate safe scaffolds which are rarely provided or are even absent on some sites visited. This is similar to the findings of Larsson and Field (2002). Being hit by falling objects was second to falling from heights followed by collapse of earth. Being hit by falling objects type was attributed to unsafe methods preferred by some workers and considered to be faster. Collapse of earth was common in the rainy season because of the wet soils and in places where the ground was unstable. Furthermore, it was associated with unsafe excavation methods and the use of unsafe or substandard ladders.

(b) Common Causes of Accidents

Poor attitude towards safety by stakeholders in the construction industry was established as being the most cause of accidents. This was linked to the reason why the NOSH policy and the construction tailor-made safety and health regulations were not established. Respondents suggested that safety and health was not a priority to some contractors and the workers. Some contractors concentrated on achieving work targets regardless of how it was done. Most casual workers used 'short cuts' which were usually unsafe to complete their work while ignoring safety. This is similar to the findings by Tam *et al*. (2004) and Mukhalipi (2004). Poor attitudes towards safety led to other causes such as not providing safety equipment, deficient enforcement of safety and lack of training.

Causes of accidents such as non-provision of safety equipment, deficient enforcement of safety and lack of safety training seemed to be the responsibility of the contractors. Some contractors did not provide safety training and equipment hence putting workers at a high risk of accidents. Results revealed that despite some contractors providing PPE, it was not adequate. Many workers had the basic PPE which included work suits; safety boots or gumboots; and hard hats. Safety belts, dust masks and ear plugs were rarely provided because these were considered as unnecessary expense. Some contactors alleged that workers were in the habit of losing the few 'rare' PPE that was provided. However, the 'rare' PPE was provided by few well established contractors who prioritised safety and health and appreciated its benefits.

Deficient enforcement of safety was observed during the case study site visitations as some supervisors and workers were not aware of the Factories Act or other safety and health

regulation. Those with the knowledge of the Factories Act argued that it was general and descriptive in nature. They suggested that the Factories Act should be replaced by the NOSH policy and a construction sector tailor-made OSH legislation. The NOSH policy should be an umbrella safe yang health guideline for all industries. Moreover, deficient enforcement could be attributed to the shortage of OSH inspectors in charge of the construction sector. The MLSS-OSHSD construction inspectorate at the time of the study comprised three inspectors. The inspectors were overwhelmed by the increase in the construction projects hence did not manage to inspect all project sites.

Clients were less involved in safety issues on many projects; they were more concerned with quality and the project completion time. Similarly, consultants were less interested in safety and health so long as the contractor was on schedule and works were of good quality. This was revealed during interviews. Large and medium contractors adhered more to safety and health than small scale contractors because they had resources and safety and health was one of their priorities. Furthermore, large and medium contractors engaged qualified human resource to be in charge of safety and health such as safety managers and safety officers. Moreover, large and medium contractors cared more about their reputation and corporate image. The few small scale contractors who adhered to safety and health were subcontractors. It was a contractual requirement by the main contractors. In addition, their managers or supervisors had the experience gained after they had worked for large and medium scale contractors. None of the small scale contractors sampled had qualified safety personnel. This confirmed the findings by Champoux *et al* (2003).

Some of the reasons for non-adherence to safety and health by small scale contractors were poor management; maximisation of profit; and that safety and health seemed expensive to undertake. Furthermore, some respondents attributed poor adherence and enforcement of safety and health to the absence of safety and health as an item in the BOQs. They argued that if safety and health was included in the BOQs as an item, adherence and enforcement would improve. They cited the improvement of HIV and AIDS programmes on all construction projects which was an item in the BOQs.

The fourth cause of accidents was inclement weather. According to respondents, the rainy season recorded more accidents than the cold and hot seasons. The respondents attributed

more accidents in the rainy season to wet and slippery grounds and visibility challenges, making the season unsafe for construction works. In addition, there are more work stoppages because of the rains. To beat the work targets; workers are likely to use unsafe methods in the rainy season.

The last three causes cited were unsafe methods; not using provided safety equipment; and stress were associated with the workers. Unsafe methods included the use of sub-standard scaffolds and excavating deep trenches without a ladder. Some contractors provided PPE but some workers did not use it especially the safety belts, hardhats and gumboots stating that they made them uncomfortable as suggested by Phoya (2012). The respondents revealed that some workers hoped to work over time to get incentives. This encouraged stress which made them less vigilant to accidents as was in the case of Rundmo *et al.* (2003) and Fellows *et al*. (2002).

(c) Common Ill-health

Common examples of ill-health were diarrhoea, lung diseases, backaches, dysentery, skin diseases and cholera. Diarrhoea was the most common because it was prominent in both the rainy and hot seasons. Workers suffered from lung diseases and skin diseases when they were exposed to chemicals and dust for a long period of time because of not having dust masks and gloves. Unfortunately, symptoms of lung diseases such as silicosis typically manifest five to ten years later although in cases of severe exposure, symptoms may manifest within six months. Nevertheless, symptoms manifest within six months with severe exposure to dust and silica. Many construction projects lasted from six months to four years (Mwape, 2012). This implied that lung disease symptoms manifested long after the projects were completed. The affected workers usually suffered without compensation as they could not tell when they contracted the disease. Carrying of heavy loads by workers was common on many sites. This led to workers suffering from backaches which made them less alert to hazards. There is no exact weight limit that is safe. A weight of 25 to 30 kg is heavy to lift for most people, especially if the load is handled several times in an hour (ILO construction OS & H). Since there was lack of safety and health training, several workers handled loads with the body in an unstable posture causing musculoskeletal disorder such as backaches.

The causes of ill-health were poor sanitary conditions, poor personal hygiene, lack of clean drinking water, handling heavy loads, exposure to dust and chemicals. Table 2 shows the common ill-health experienced in Zambia's construction sector and their causes. There was generally poor sanitary condition on the visited sites; the toilets were not very clean and the water quality was questionable. Poor personal hygiene contributed to high cases of diarrhoea. Management of safety and health was challenging to some contractors especially in road projects where works were done far from the established site camps. This is in agreement with Muya *et al.* (2008)'s findings that the work site and its environment changes daily, making health and safety management in the construction sector difficult.

Table 5.1: Common Ill-health and their Causes

Item	Common Types of ill health	Causes
1	Diarrhoea	Poor sanitary condition, poor personal hygiene
2	Lung diseases	Exposure to dust and chemicals
3	Backache	Handling heavy loads
4	Skin diseases	Exposure to chemicals
5	Dysentery	Poor sanitary condition, poor personal hygiene
6	Cholera	Poor sanitary condition, poor personal hygiene

(d) Effects of Accidents

The interviewees suggested that effects of accidents as disabilities, psychological trauma, unnecessary costs, loss of morale, death, reduced production, job schedule delays, loss of business, poor corporate image, disruption of production and body injuries and damage to property. From the survey results the effects of accidents were; unnecessary costs, disability, reduced production, disruption of production, job schedule delays, death, loss of morale, poor corporate image, psychological trauma, loss of business and damage to property.

Unnecessary cost was the most common effect because every time an accident occurred, the end result attracted a cost. The cost was either in form of hospital bills, funeral expenses or loss of production. The well established companies, usually large and medium scale contractors registered with WCFCB, were relieved of some costs like compensation when an accident resulted in a disability or fatality. Nevertheless, costs like hospital bills and funeral expenses were met by the contractors. Fatalities and disability led to other effects such as

disruption of production because work activities were halted or there was temporal closure of sites to pave way for investigations to establish the cause of the accident. The co-workers to the victims lost morale and were psychologically traumatised leading to reduced production and job schedule delays. Contractors who recorded poor safety and health practices on their project sites, experienced poor corporate image and lost business when dealing with clients who prioritise safety for instance Lafarge Cement Zambia and the mines.

Some effects were long term and extended to the victim's family members. The long term effects were poverty and the increase in number of street kids because of loss of bread winners. In most accidents the victims who either died or sustained injuries were breadwinners thereby their deaths or disabilities led to less or no income for the surviving family thus increasing poverty levels. Lack of sponsorship of their children's education and welfare eventually forced the children to go into the streets. The findings on the effects of accidents from the study were similar to Muya *et al*. (2008) and Arboleda and Abraham (2004). The most predominant effect of accidents was unnecessary costs contrary to Tam *et al*. (2004). The difference could have been that Tam's study was conducted in a developed country while this study was done in Zambia which is a developing country.

Safety and health play an important role in the project cycle. It can be deduced from the results on the effects of accidents that safety and health affect time, cost and human resource. This is relationship is shown in Figure 5-1. Unsafe and unhealthy sites may lead to unnecessary costs, reduced production, schedule overrun and disability or death of workers which a very the important resource in the construction industry. Safe and healthy sites on the other hand can protect and prevent workers from injuries and diseases; improve productivity that leads to completion of project on time; and eventually increase profit as there are no or less unnecessary costs resulting from accidents.

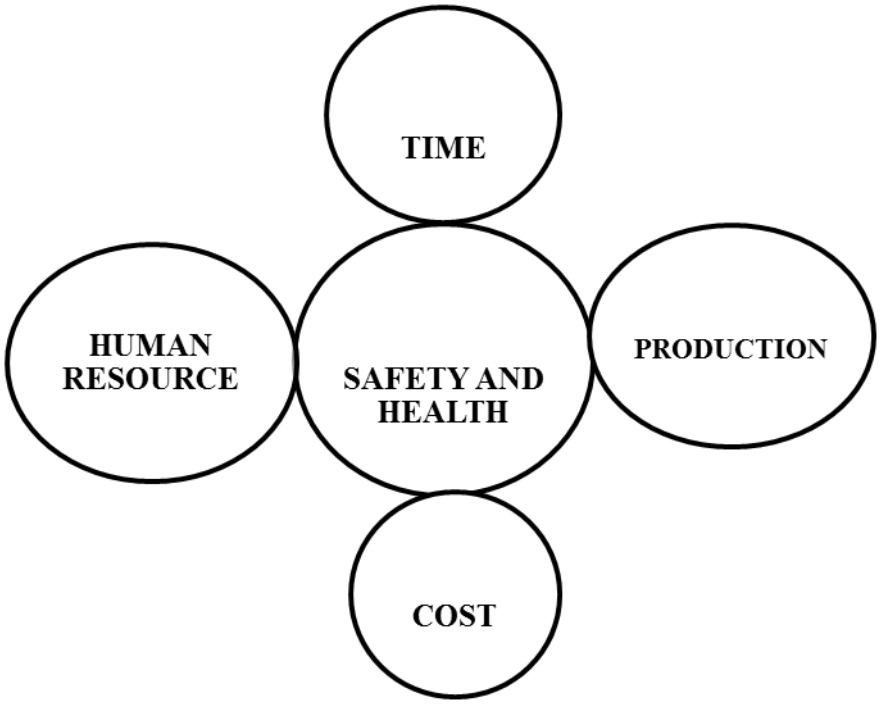

Figure 5-1: Safety and Health – Time – Cost – Human Resource relationship

(c) Prevention of Accidents and Ill-health

Preventing occupational accidents is an important task of human resource management (Rahmani, 2013). The preventive measures of accidents and ill-health were found to be the opposites of the causes. The prevention methods of accidents cited were good attitude to safety; proper enforcement of safety; adequate safety training; using provided safety equipment; safe site conditions; using safe methods; and providing safety equipment. Methods of ill-health prevention were providing good sanitary condition, good personal hygiene, providing clean drinking water, proper safety training, wearing protective equipment and good housekeeping on site camps. This is similar to McCann (2003).

If all stakeholders changed their attitude towards safety and health, took part in proper enforcement of safety and health guidelines such as the Factories Act, accidents and ill-health would be mitigated. Offering adequate safety and health training to the project team and the provision of the safety and health equipment and facilities would greatly prevent accidents and ill-health. Safety and health training empower workers to take care of their own safety and of others, to control risks and eventually prevent accidents. Training would also help

workers to be responsible enough to properly use the provided PPE as some workers do not wear PPE because of discomfort, the weather and work pressure (Phoya, 2012).

When site conditions are not favourable especially when it is raining, work should be stopped to prevent accidents. Improvement of sanitary conditions such as clean toilets and providing clean chlorinated water would prevent waterborne diseases especially diarrhoea. Good personal hygiene would help prevent ill-health and encourage other preventive methods such as good sanitary conditions. Respondents and interviewees suggested other methods of accident and ill-health prevention such as no working over lunch, providing enough lighting, avoiding overcrowding and no work during the industrial break. Creating a safe and health site would greatly prevent accidents and ill-health as Mukhalipi (2004) proposed.

(f) General Rating of Construction Projects Regarding Safety and Health

The general rating of safety and health in construction industry in Zambia was average. The reasons for the average rating could have been that the Factories Act was not up to date and the enforcement was poor. Moreover, contractors only thought of safety when an accident happened or a serious near miss. Considerations on safety and health were mainly done at the beginning of the project and there after forgotten, unless there was any special visit or inspection by authorities. In addition, Zambia lacked the national OSH policy to improve safety and health in all industries. Furthermore, PPE was mainly provided once at the beginning of the project, instead of every six months as required by law. Some First Aid boxes were just a 'show off' for they did not contain the required medicines.

5.2.5 Benefits of Safety and Health

Benefits of implementing good safety and health suggested by interviewees and respondents were increased production; good corporate image; boosts morale and confidence; increase in efficiency; less delays; and project completed within budget. Companies that adhered to good safety and health had their image protected and many business partners liked to associate with them. This meant that they got good business deals because of good safety and health. Implementation of good safety and health led to mitigation of hazards and prevention of accident and ill-health. Prioritising safety and health of workers by creating a safe environment boosted workers' morale and confidence hence their efficiency increased and ultimately production increased. On the sites where good safety and health practices

were performed, work targets were met as production increased because workers were protected. There were no or less delays and so projects were completed within budget and on time. The study also established that on sites where good safety and health was prioritised, other working conditions of workers like the minimum wages were better. These issues were revealed during interviews.

The benefits of safety and health are good to all stakeholders in the construction industry. Just as the outcomes of accidents and ill-health affect all stakeholders, so are the benefits of good safety and health. The cost of safety and health programmes should be seen as the means of protecting the most valuable assert; the human resource. Workers' lives are saved, employers' work targets are met, and consultants deliver the completed projects to client on time and government records improvement in infrastructure. The benefits established in this study are similar to Arboleda and Abraham (2004).

5.3 Summary

This Chapter deliberated on the responses and findings on safety and health in the construction sector in Zambia. Some of the similar findings with other researchers are that; the Factory Act lacks enforcement, falling from height is the common type of accident, poor attitude to safety is the most cause of accidents, inadequate PPE as the main risk control in the industry, unnecessary cost is the most effect of accidents and there are generally low level of safety and health awareness in the construction industry in Zambia.

CHAPTER SIX: DEVELOPMENT OF THE SAFETY AND HEALTH MODEL

6.1 Introduction

The preceding Chapter presented results of the study from interviews and questionnaire surveys. The results revealed that there was poor enforcement of the Factories Act which was attributed to poor attitude to safety and health by all stakeholders in the construction industry in Zambia. This chapter presents the development of the Safety and Health Model for the construction industry in an effort to abate identified challenges. The model promotes the formation of a National OSH policy, inclusion of safety and health at all stages in the project cycle. Moreover, the inclusion of safety and health guidelines during registration of companies in the construction industry will help to mitigate accidents and ill-health. The validation results of the model are presented at the end of the chapter.

6.2 Safety and Health Model

The main objective of this study was to investigate and develop a system for improved safety and health practices on construction sites in Zambia. The findings drew attention to the problems faced in construction sector in the area of safety and health. Zambia has no National OSH policy to guide to regulate occupational safety and health in all sectors of the economy. Among the OSH laws in Zambia, the Factories Act was the one being used in the construction industry. The most significant challenge identified from the results of the study was poor enforcement of and compliance with the Factories Act and other OSH policies such as company policy. Poor enforcement and compliance were attributed to poor attitude to safety and health by all stakeholders in the industry, both from public and the private sectors. Safety and health were observed not to have been a priority at all stages of the construction cycle except on some projects where it was only considered during construction and was left to contractors to handle. In addition, there were unsafe and unhealthy practices which were on case study sites.

Another finding from the study was that safety and health was not an item in the Bill of Quantities (BOQs) for construction projects. Therefore, it was not considered in the tender evaluation process. HIV and AIDS which sometimes appeared in the BOQs, was mandatory and it was the most common activity undertaken on sites in the area of health. Furthermore,

HIV and AIDS programme on construction projects was conducted by independent organisations such as *Afyamzuri* which effectively executed the programme. *Afyamzuri* was a Non-Governmental Organisation (NGO) specialised in HIV and AIDS at work places.

6.3 Model Description

The model presented in Figure 5.1 below was developed from literature review, interviews and questionnaire survey findings and site observations. Sustained success in ensuring safety and health at work, demands that everyone recognises its importance, and actively supports the effort (OSHC, 2001). The model encourages the participation of all construction stakeholders in upholding safety and health issues. It outlines the steps for inclusion of safety and health aspects in the project cycle from the start to finish of a project. It incorporates all construction stakeholders. The model is a construction industry operational cycle. The model proposes the creation of a NOSH policy for improvement of OSH in all sectors of the economy and inclusion of safety and health in curricula of colleges and universities for all technical players in the construction industry. The model is divided into three main sections of project management namely pre-construction, constructions and post-construction (K.S., 2002; Tregenza, 2004).

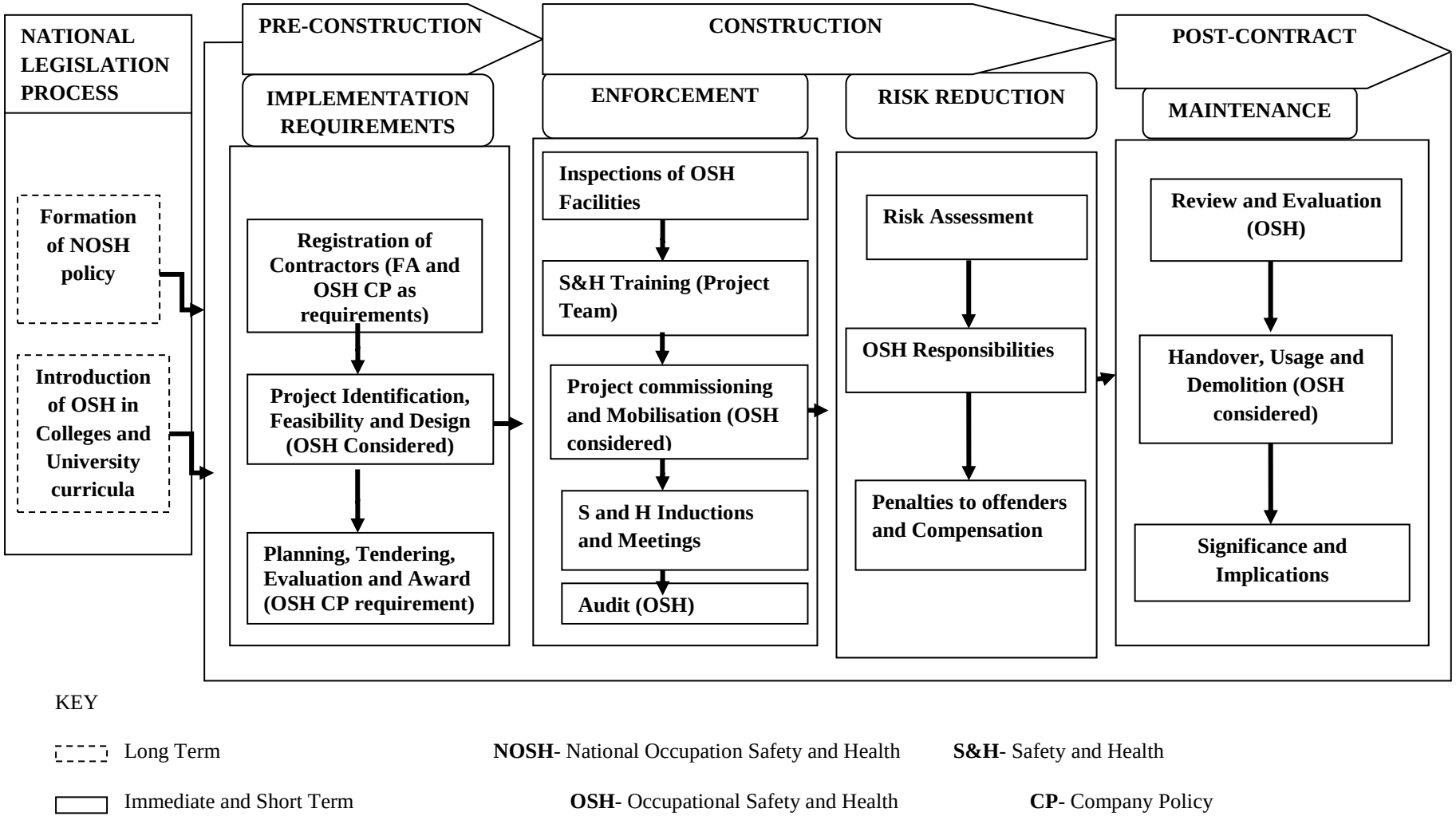

Figure 6.1: Proposed model for Safety and Health In Construction Industry

6.3.1 National Legislation Process

This includes formation of national OSH policy, introduction of OSH in universities and colleges curricula for technical personnel such as engineers. It also include registration of contractors and consultants.

(i) Formation of National OSH Policy

The creation of a NOSH policy would be a very important step that would lead to the improvement of OSH in the country. To make the NOSH policy an inclusive document, the formulation committee should comprise NCC; RDA; MLSS-OSHS; WCFCB; NAPSA; professional bodies such as Engineering Institution of Zambia (EIZ), Zambia Institute of Architects (ZIA), Surveyors Institute of Zambia (SIZ). All the industries should be represented.

Zambia lacks a NOSH policy, which is supposed to be a cornerstone of safety and health for all industries in the country. The formulation and enactment of a NOSH policy may take long yet its urgency is of great help to mitigate accidents and ill-health in construction sector. The NOSH policy should be the safety and health umbrella guideline for all industries in safety and health. The Occupational Health and Safety Act, 2010 was formulated by the Ministry of Health and was enacted on 19 November 2010. The purpose of the Act was to establish health and safety committees at work places (Occupational Health and Safety Act, 2010). This Act was not in use in the construction industry as it was considered not comprehensive. Construction stakeholders were not involved in its drafting and development process. A good lesson should be learnt from the non-comprehensiveness of the OHSA (2010) especially in the developing process of a NOSH policy. All stakeholders from all industries should be involved and given an equal opportunity to participate. The involvement of all stakeholders in the drafting and development process of the NOSH policy would make it comprehensive. The ILO and the European Union (EU) sponsored a workshop in February 2011 to start the process of developing the new comprehensive NOSH policy. Zambia as a member of ILO should follow the organisation OSH guidelines which give guidance on national policy formulation and enactment. ILO recommends that a national OSH system should consider the following for:

(a) legislation and other relevant OSH instrument;

(b) one or more authorities or bodies responsible for OSH;

(c) regulatory compliance mechanisms including systems of inspection;

(d) a national tripartite advisory mechanism to address OSH issues;

(e) arrangements to promote at the enterprise level, cooperation between employers and workers;

(f) OSH information and advisory services;

(g) research on OSH;

(h) a mechanism for the collection and analysis of data on occupational injuries and diseases;

(i) provisions for collaborations with relevant insurance or social security schemes covering occupational injuries and diseases; and

(j) support mechanism for a progressive improvement of OSH conditions in micro, small and medium-sized enterprise and in the informal economy (ILO Construction OS & H).

(ii) Introduction of OSH in Universities and Colleges Curriculum

Engineers, surveyors, architects and other professional players in construction take up management or supervisory positions in the project cycle from start to finish. The technical personnel, after completion of their education, join different organisations such as government, consultancy, architectural firms, contractors, and surveyors. If technical personnel were trained in OSH, they would influence and take initiative and set standards for safety and health throughout the project cycle. The introduction of OSH in colleges and universities curricula would solve the problems of inadequate human resource to effect legislation and improve understanding of OSH responsibilities that would lead to improved attitude to safety. Construction personnel such as engineers, quantity and land surveyors, architects and all those in construction courses should be trained in OSH by the time they reach their final year of study. This is to equip construction personnel with knowledge that would make them fully understand and effectively implement safety and health in the construction industry.

It is important to start at the top of the construction pyramid first rather than only educate the bottom tier of erectors and labourers (Saifulla and Ismail, 2011). Nevertheless, design professionals distance themselves from responsibility due to the lack of safety education and training, lack of safety design tools and they attempt to limit their liability exposure. The need for changes in attitude does not stop at educating erectors to work more safely. It has to go back to the architects and engineers who should not only ask themselves if it can be built, but whether it can be built safely (Hung, 2006). Professional institutions such as EIZ, the Association of Consulting Engineers of Zambia (ACEZ), the Zambia Institute of Architects (ZIA) and the Surveyors Institute of Zambia (SIZ) should encourage their members to adhere to safety and health in their field of specialisation. This could be done through institutional documents such as Codes of Ethics and symposiums because these deal with other issues in their field. For instance, safety, health, and welfare of the public are in the EIZ Code of Ethics under Canons, section 9. The EIZ Code of Ethics under Canons section 9, encourages all engineers to put the safety, health and welfare of the public first.

(iii) Registration of Contractors and Consultants

Contractors and consultants are required by law to register before performing any work in the construction industry and have to renew their certificates every year. There are requirements by NCC before awarding a certificate to a company. Some of the requirements are Patents and Companies Registration Agency (PACRA) certificate, bank statement, Zambia Revenue Authority (ZRA) tax clearance or Value Added Tax (VAT) certification as well as personnel and their academic certificates and curriculum vitae. MLSS-OSHS should sell the Factories Act through NCC during registration, renewal and upgrading of contractors. Contractors should pay for the Factories Act together with the registration, renewal and upgrading fees. The Factories Act should be sold to realise production costs. When the NOSH policy is formulated and is in use, it should be sold in the same way as the Factories Act. Company safety and health policy should be included in the instructions to applicants and should be spelt out in the application form as a requirement for qualification for approval. NCC should approve certificates of contractors who meet all the

requirements including a company safety and health policy and a verification receipt for the purchase of the Factories Act.

6.3.2 Pre-construction Stage

The consideration of safety and health requirements in the early stages of a construction project has been widely recognised as a beneficial approach to OSH (Saifullah and Ismail, 2011). Pre-construction involves project identifications, feasibility study, planning, design, tendering and award of the contract. The results of the study revealed that safety and health is not given serious attention in the early stages until construction stage and that many stakeholders were not involved in safety and health programmes. This may have been as a result of lack of safety and health education in the industry.

(a) Implementation Requirements

The implementation requirements involve the necessary issues that lay at the foundation of the project. Findings from the questionnaire survey established that the Factories Act was not well- known and as such, consideration of safety and health at the core foundation of construction would improve knowledge and awareness.

(i) Project Identification, Feasibility and Design Processes

Many of the common safety and health problems encountered during construction and operation could be avoided if due consideration and effort were invested during the project brief and design phases (Haywood, 2004). Safety and health should be included in the project identification, feasibility and design. Clients should come up with projects and hire consultants to deal with feasibility studies, surveys and designs. Clients as funders of the projects should positively influence project safety and health performance from the start to the end. Feasibility studies should also involve issues of safety and health as to whether the project is achievable safely and healthily. Architects as they design projects should take into consideration the safety and health of the people who would be involved in building the design. According to Flemming (2006), half of OSH issues arise from inadequate design. Quantity surveyors should include safety and health as items in Bills of Quantities and the

basic safety and health requirements should be put in the specifications. Structural, mechanical and electrical engineers should also design putting at the back of their minds that whatever they design should be safe to construct. This will help in the identification of risks and hazards from the design stage in order to mitigate accidents and ill-health during the construction stage. This would constitute prevention through design. Since technical personnel are in charge of feasibility studies, design and pricing, they would have ideas and good understanding of safety and health if trained properly.

(ii) Planning, Tendering, Evaluation and Award Processes

Tender documents should be prepared with an inclusion of safety personnel on the required contract personnel such as Project Manager, Project Engineer, General Foreman and Safety Officer. The Safety Officer's qualifications should be at least a certificate or better in safety and health, First Aid, and HIV and AIDS programmes. Contract documents should also have safety and health as items in BOQs and basic safety and health clauses. The clauses should include well defined penalties such as suspending the works until safety and health issues are rectified, imposing a fine to be deducted directly from the Interim Payment Certificate (IPC). The Factories Act, the Construction (Safety and Health) Regulation and the company safety and health policy and plan should be part of the requirements for submission of bids by contractors. The safety and health plan should be straightforward like a method statement, explaining how safety and health would be handled throughout the project. When the tender documents are ready, tenders should be floated as usual for prospective contractors to bid. Contractors should demonstrate commitment to safety and health for their bid to be considered. It has been observed that in preparation of the tender documents and the tender evaluation process, the issue of safety and health is not given its due significance in developing countries (Phoya, 2012).

When evaluating bids, a safety and health company policy, a qualified safety officer as one of the personnel and GRZ minimum wage should be considered as part of the requirements for responsive bids and award of contracts. The contractor, who meets the requirements for a responsive bid which includes safety and health, should be awarded the contract.

6.3.3 Construction Stage

The construction stage involves the following;

(a) Enforcement

The implementation of NOSH policy, the Factories Act and the company safety and health policy should start at the beginning and throughout the project. Implementation should be done through Inspections and monitoring; safety and health training; project commissioning and mobilisation; and safety and health inductions and meetings.

(i) Inspections and Monitoring

MLSS-OSHS should enforce Factories Act and safety and health guidelines upon the start of works. Inspections should focus on the safety and health facilities, plant fitness certification, company safety and health policy, and the safety and health project plan which should include a risk assessment. At the time of the study, MLSS-OSHS was the only body allowed by law to enforce the Factories Act. The study revealed that there was shortage of inspectors at MLSS-OSHS which contributed to the poor enforcement of the provisions of the Act. The shortage of inspectors could be sorted out by employing more staff and also empowering NCC to help in enforcing OSH laws. NCC would made good inspectors to provide checks and balances in the construction industry.

Furthermore, the model proposes NCC's involvement in the foundation of safety and health through registration of contractors. NCC should ensure that the company policies that contractors submit during registration are effected during the construction period. During enforcement, inspectors should promote and achieve sustainable compliance. They should ensure that all personnel on site adhere to safety and health guidelines. They should also initiate or recommend control measures and in case of breach of the laws, the alleged offender should be sanctioned in one-way or the other.

Inspectors should have a thorough understanding of hazards and risks and control measures associated with construction activities. In addition, inspectors should be empowered to stop work activities until control measures are put in place.

MLSS-OSHS, NCC, and consultants should monitor, and evaluate safety and health on site. Monitoring and evaluation should involve demanding for safety and health reports and making sure that the reports correspond to what is happening on site. Likewise, all safety and health requirements on site should be met and the money allocated to safety and health in the BOQ should be well utilised. MLSS-OSHS, NCC, consultants and contractors should be role models for workers in the area of safety and health.

(ii) Safety and Health Training

Before the start of the project, the project team and workers employed should undergo safety and health training. The training should be conducted by trained MLSS-OSHS, NCC or WCFCB in the short term and by a certified independent, reputable safety and health company in the long term. The WCFCB's responsibilities should not be limited to compensation only but should also take part in accident and ill-health prevention. WCFCB should sensitise trainees on the process of compensation and urge contractors to register with the organisation. Safety and health training should focus on safety and health facilities, PPE, accident, and ill-health prevention, risk assessment, personal hygiene, stress, and fatigue management, First Aid, and safety and health guidelines such as Factories Act, NOSH policy and safety and health company policy.

The safety officer should undertake refresher training for old workers (Charles *et al*., 2007). The team that offered the training at the start of the project should still train the new workers. The safety and health company should be independent and should work together with organisations that offer HIV and AIDS programmes on construction projects so that less construction time is lost. For smooth execution of safety and health training, payment should be paid directly to the trainer as the case for sub-contractors.

Training should be conducted whenever new workers are employed since in construction, employment of workers is an ongoing activity depending on the scope of works. Sub-contractors and suppliers should be part of the training as they are under the main contractor. The people trained should be given certificates as proof

so that they can use them on another site as they could just undergo refresher lessons. Moreover, they would be of great help as safety and health representatives to assist the safety officer as they go about their routine work. The safety and health certificates could be an added advantage for employment in construction.

(iii) Project Commissioning and Mobilisation

During mobilisation, the project team comprising the client, consultants and contractor with the inclusion of MLSS-OSHS and NCC inspectors should inspect safety and health facilities for the project prior to start of works. The important aspects to look out for under safety should be signage, fire assembly points, fitness of machinery, proper PPE; work suits or overalls, safety or gumboots, reflector vests, respirators, ear plugs, safety belts or harnesses for all employed workers according to the work environment. Under health, toilets, drinking water, eating place, First Aid box and safety or First Aid office should be considered. The safety and health requirements should be provided by the contractor using the money provided for in the BOQs on safety and health and from the preliminary and general items. In addition, the contractor should insure property and workers. After the safety and health training and the inspection of facilities on site, induction of workers should take place and thereafter works could start.

(iv) Safety and Health Inductions and Meetings

After the safety and health training and commissioning of the project, workers should be inducted on the first day of starting work. Induction should include distribution of PPE and explaining the use, near-miss and accident reporting, taking workers around site showing them safety and health facilities such as toilets, sources of drinking, the location of the First Aid office or clinic and fire assembly points. Safety and health meetings should be conducted every morning for 20 to 30 minutes before starting work. During meetings, brief reminders of good safety practices and the risk assessment should be conducted. The meetings should also be used as platform for workers to raise any questions and concerns alike. As gang leaders are used to perform a task, safety representatives should be selected to help with safety and health on site. The position of safety representatives should be rotated among workers so that every worker is fully involved to achieve better results. The safety representatives should come up with a daily update report either written or orally to

the safety officer. The inductions and meetings should be for all workers on site including sub-contractors.

(b) Risk Reduction

Construction works present hazards and risks which may cause accidents and ill-health if not controlled. Risk reduction involves the measures to control the hazards and risks that include risk assessment, OSH responsibilities, penalties to offenders and compensation. This is more of an action stage where the actual prevention during construction should take place. All the stakeholders should do their part in upholding good safety and health practices. Clients, contractor management, consultants, project managers, suppliers, sub-contractors and safety and health inspectors should co-ordinate in reducing risks.

(i) Risk Assessment

A hazard is something with a potential to cause harm and the likelihood of that harm occurring in the work place is known as a risk. Some examples of construction hazards are machinery, tools and chemicals. When workers are aware of the hazards and risks associated with their work, they could be more careful and would endeavour to protect themselves.

Risk assessment involves carefully examining of what could cause harm to employees, customers, visitors and members of the public (HSA, 2011). Risk assessment involves four important stages as the follows (Kunimatsu, 2009):

(a) risk identification- process of finding, recognizing and describing risk;
(b) risk analysis - process to comprehend the nature of risk and determine the level of risk using the risk matrix;
(c) risk evaluation- the process of making decisions based on the outcome of risk analysis, about which risks need and priority for treatment implementation ; and
(d) risk treatment- process of selecting one or more options for modifying risks and implement the option. The risk treatment options include transfer, avoid, mitigate and accept.

Risk assessment empowers workers to avoid risk behaviour and practices. It is the best tool to prevent accidents and ill-health if it is put to good use. A safety

statement should accompany a risk assessment, which is a written commitment of how the identified hazards and risks would be controlled. The safety statement should be management's commitment to mitigate accidents and ill-health.

(ii) OSH Responsibilities

Site management and supervisors should ensure that safety and health facilities such as PPE and First Aid boxes are provided. The main contractor should ensure that sub-contractors provide all the necessary PPE to their workers. This should be done to empower sub-contractors in safety and health as they gain experience in construction works. Management and supervisors should be role models for workers. Supervisors should not force workers to work without proper PPE despite the pressure of meeting work targets. Management should introduce incentives like paying workers' wages in good time and award the best gang on safety and health monthly to encourage good safety and health practices. Safety officers should offer safety and health talks such as risk assessment, reminders on accidents or ill-health prevention, importance of PPE, signage, and First Aid and HIV and AIDS briefings every morning before starting work.

Workers should be put in gangs according to their work type and every week they should choose a different safety and health representative. Rotation of representatives would help workers to feel part of the group and would improve workers' altitude to safety and health, which is essential to accident and ill-health prevention. Safety officers should also supervise all safety and health issues on site, which includes PPE distribution, preparation of daily, weekly and monthly safety and health reports. Site workers should follow all the safety and health rules on sites and demand that they are given the right PPE for the job. Workers should attend safety and health training and meetings.

Clients should demand that the project should be constructed safely and be able to verify that safety and health reports correspond to what is happening on site. Consultants have to make sure the design, which they prepared with safety and health in mind are constructed safely and they have to ensure that safety and health is adhered to. Furthermore, consultants have to make sure that the money allocated for safety and health is well utilised by the contractor.

(iii) Penalty to Offenders

Workers who do not follow the safety and health rules on site should be disciplined by being sent off site by the safety officer. If the contractor is not adhering to safety and health or when an accident occurs, works should be stopped either by NCC, MLSS-OSHS or consultants in the same way that works are stopped when shoddy works are observed until everything is rectified. If the contractor is found guilty in the case of a fatal accident, legal charges should be instituted against the contractor. If it is the non-adherence to the laid down safety and health standards, works should be suspended until the contractor rectifies or corrects the problems and/or situation. If the non-adherence continues, the contractor should pay a penalty fee or prosecuted in the courts of law as contained in the safety and health contract clauses or the contract should be terminated immediately.

(iv) Compensation

In the case of an accident or serious ill-health, the contractor should provide the immediate expenses such as medical and funeral costs in the event of a fatality. For insured projects, the insurance company should deal with the damaged materials and machinery. WCFCB should compensate the injured victims and families of the victims who die as a result of accidents and ill-health at work. The process of compensation should be made easy and straightforward.

6.3.4 Post-contract

At post-contract stage, the project is near completion. This is where auxiliary and miscellaneous works are carried out in readiness for project handover. Post-constract involves the maintenance of safety and health which is critical just before the project is completed. Every project has a deadline, and in trying to beat the work targets and the pressure of handover, unsafe and unhealthy practices become common. At this stage, inspectors and those in charge of safety should ensure that the well established good safety and health standards during construction are maintained and that last minute accidents and ill-health are prevented. This is the best stage to gather information which should be used in coming up with the tailor-made safety and health guidelines in the construction sector.

(a) Maintenance

Maintenance involves auditing and evaluation; handover, usage and demolition; and merits of safety and health. Maintenance includes regular check-ups of the safety and health system that has been developed on site and ensuring that it is upheld.

(i) Auditing and Evaluation

Safety and health reports should be reviewed and all safety and health programmes audited according to the initial plan and safety and health statement. The safety and health challenges experienced during the entire project should be evaluated and be used to propose solutions. The review and audit reports should be used as information for research and for further improvement on other projects in safety and health. This would help to bridge the information gap in safety and health in the construction industry in Zambia. After getting the information from different projects, it should be used in coming up with a tailor-made safety and health policy for the construction industry and should be used as construction contribution in the formulation of the NOSH policy.

(ii) Handover, Usage and Demolition

Handovers usually involve the public thus safety and health of the public should be planned well so that there are no accidents or ill-health to be experienced. The safety and health plan used at the beginning of the project should include the handover safety and health plan. Considerations should not be limited to what should be designed and how safe it should be constructed but also how safe it would be used and demolished. The model suggests that auditing and evaluation of safety and health on site should include a plan of safety and health procedures for the usage and demolition of the constructed infrastructure.

(iii) Significance and Implications

After the auditing and evaluation of safety and health of the entire project, inspectors should make a final assessment. In the event that the project experienced any breach, appropriate actions should be taken such as imposing of penalties stipulated in the contract. The evaluated performance should be used as recommendation for new and future projects during tendering, thus creating good corporate image. Good

performance would create employment for the safety and health personnel and improve their experience. Moreover, good safety and health performance on construction projects would improve investments since more investors would be attracted to invest in Zambia because of the safe environment.

6.4 Validation of the Model

The model, after being developed had to be validated in the construction industry in Zambia. The safety and health model was validated by assessing its usability, functionality and usefulness. The validation questionnaire was sent to ten respondents. The list of respondents who took part in the validation process is indicated in Appendix C.1. The questionnaire was accompanied by a cover letter shown in in Appendix C.2 and C.3 respectively.

6.4.1 Respondents Profile

Validation respondents included two consultants; two contractors; two regulators; one government organisation, one architect; a quantity surveyor; and one client as shown below in Figure 6.2. Twenty per cent of respondents were targeted each for consultants, contractors and regulators because they are in contact with the construction sites more often.

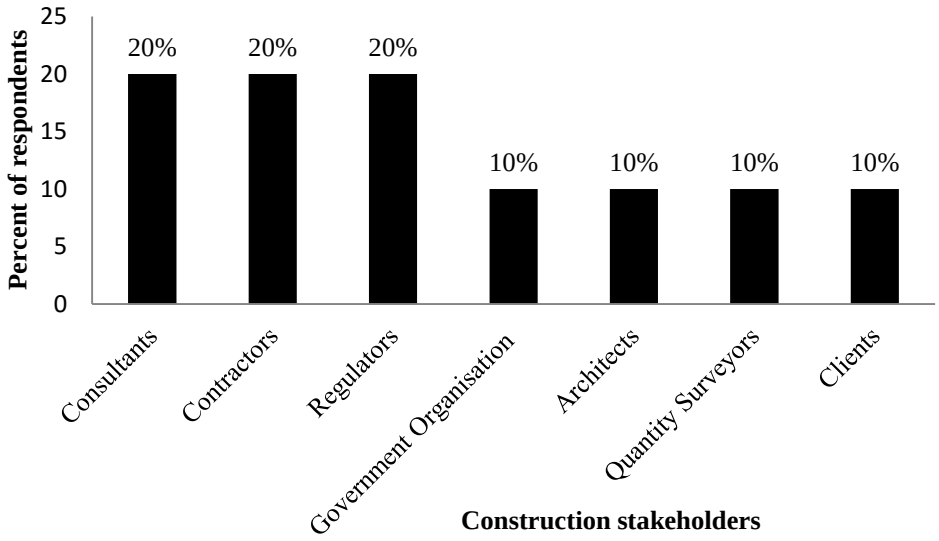

Figure 6.2: Validation Respondents' Construction Sectors

6.4.2 Usability

Usability focused on the extent to which the users were able to use the model without assistance. The question of whether the stages in the proposed model were easy to follow and implement. All the ten respondents agreed that the model was easy to use and implement in the construction industry.

6.4.3 Functionality

Functionality is the degree to which the model is regarded as general and appropriate for safety and health improvement for all project types regardless of size in the construction industry. Seven out of ten respondents agreed that the model could be adopted in the industry.

6.4.4 Usefulness

Usefulness means the model should provide value to the user. Therefore, respondents were asked whether they found the model useful. Seven out of ten respondents were in agreement that the model would be useful and add value to improvement of safety and health in the industry.

6.4.5 Suggestions for Model Improvements

The respondents were asked to give suggestions on how the model could be improved. Respondents advised that the model required a peer review for it to be improved up on. The model was reviewed by EIZ and was presented at the symposium on 18 April 2014. Furthermore, the respondents indicated that there should be proper guidelines, education and enforcement. This is because some construction stakeholders could be resistant to change from their traditional way of working with unsafe and unhealthy practices in the construction industry in Zambia.

6.5 Summary

Chapter Six presented a safety and health model as a solution for improved safety and health in the construction industry in Zambia. The model was validated by ten respondents from seven sectors of the construction industry. The model incorporated safety and health at all stages in the project cycle and involvement of all stakeholders. Respondents provided feedback that the involvement of all stakeholders and inclusion of safety and health at all levels in the project cycle would make it work. The next chapter gives the discussion of the research findings.

CHAPTER SEVEN: CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

7.1 Introduction

The previous Chapter discussed the results and findings of the interview and questionnaire survey. This Chapter gives the conclusions, study limitations and recommendations.

The main objective of this study was to investigate and develop a model for improved safety and health practices in the construction industry in Zambia. The safety and health model which was a result of the study will benefit the construction industry if all stakeholders are to be involved in safety and health matters on all projects. In addition, the model will be of great benefit because it encourages inclusion of safety and health at all levels in the project cycle and this will improve the safety and health standards in the construction industry. The specific objectives of the study were classed as:

i. Analyze the effectiveness of the Factories Act of 1994 in relation to the worker safety and project delivery in the construction industry.
ii. Investigate the types and common causes of accidents and ill-health and how they could be prevented.
iii. Establish the impact of accidents and ill-health on construction projects in Zambia.
iv. Develop a safety and health model and recommend how it could be implemented by all stakeholders in the construction industry in Zambia.

7.2 Effectiveness of the Factories Act in the Zambian Construction Industry

The study established that the Factories Act was relatively effective in relation to the construction industry. Even though it was found to be descriptive, not user friendly and outdated since it was enacted in 1994 and no amendments have been made since then.

7.3 Types and Common Causes of Accidents and Ill-health in the Industry

The type of accidents that are common in the Zambian construction industry were identified as falling from heights, being hit by falling objects and collapse of earth. The common causes of accidents were attributed to poor attitude to safety, inadequate or missing safety attire, deficient enforcement of safety, lack of safety training, unsafe site conditions and unsafe methods. The common ill-health cases recorded were diarrhea, lung diseases and backaches. While the common causes of ill-health resulted from improper handling of heavy loads, exposure to dust and chemicals, poor sanitary conditions and poor personal hygiene.

The major preventive measures of accidents identified included good altitude to safety, proper enforcement of safety and adequate safety training. The rightful use of provided safety equipment, safe site conditions, using safe methods and providing safety equipment also stand as major keys to improving safety and health. On the other hand, the recognized preventive methods of ill-health incorporated providing good sanitary conditions and good personal hygiene as basic necessities. The secondary preventive measures included proper safety training, wearing protective equipment, providing clean drinking water and good housekeeping on site.

7.4 Impacts of construction accidents and ill-health

The common impacts of accidents resulted in unnecessary costs, disability, reduced production, disruption of production, job schedule delays and death. In addition, secondary consequences were noted as a loss of morale, poor corporate image, psychological trauma, loss of business, body injuries and damage to property and machinery.

7.5 Benefits of Upholding Safety and Health

It was concluded from literature review and the study findings that safety and health are very important in the life cycle of construction projects. Good safety and health safeguards lives of the employees, who are the greatest asset in the industry. Other benefits realized would result into work targets being met as a result of increase in workers morale thus leading to an increase in productivity and as a result, projects are completed on time and within budget.

7.6 Safety and Health Model

The model which encourages consideration of safety and health from design through to usage was developed to improve safety and health in the industry. The model does not only promote the integration of safety and health at all stages of the project cycle, but also incorporates all the stakeholders in the industry. The model encourages good safety and health culture for both big and small scale contractors in the industry as it supports the addition of safety and health as an item in the BOQ. The model could be used on a short term basis alongside the Factories Act and long term with the NOSH policy after its establishment. However, the quick formation of the NOSH policy is critical to the improvement of safety and health in the Zambian construction industry and other industries.

It can be concluded from the study that there are low levels of safety and health in the construction industry in Zambia. The current levels of safety and health in the industry can be improved by enforcing the Factories Act, change of attitude to safety and health by all the industry stakeholders. This will help to manage and mitigate construction risks and hazards that cause accidents.

7.7 Recommendations

The challenges of poor safety and health practices in the construction industry in Zambia could be mitigated by many factors, some of which are mentioned later on. The results of the study reported herein could help stakeholders to easily identify hazards and risks and draw up a risk assessment. The effective use of the model developed from this study could improve the status of safety and health in the construction sector in Zambia. The following are the recommendations aimed at preventing and minimizing accidents and ill-health to improve safety and health in the Zambian construction sector;

(a) Short term recommendations include the following:

1. PPE and at least a fully equipped First Aid Box should be a must on all sites.
2. Safety induction and risk assessment should be made compulsory on all sites.
3. Safety and health programmes should incorporate HIV and AIDS sensitization and support on all sites.
4. Safety and Health should be budgeted for in the BOQs.

5. Payment of workers' wages should be in accordance with the recommended minimum wage.
6. A safety officer or manager should be included on the required personnel in all construction contracts.
7. Construction stakeholders such as MLSS-OSHS, NCC and professional bodies should conduct workshops, symposia and sensitization on the importance of safety and health.
8. Employers should limit the working hours of all persons whose work has safety and health risks.
9. The Factories Act should be availed to all contractors by NCC during registration or upgrade at an optimum fee.
10. Implementation and monitoring strategies for safety and health should be improved by MLSS-OSHS by employing more inspectors.
11. All workers should be involved in every aspect of safety and health issues to establish a sense of belonging which in turn could change their attitude to safety and health.

(b) Long term recommendations include the following:

1. The Government should facilitate the development of the NOSH policy to be used as umbrella policy in all industries.
2. Construction stakeholders should come up with a tailor made, user friendly safety and health policy to complement the Factories Act.
3. Introduction of a fine as a penalty to firms that do not adhere to good safety and health.
4. Project teams should undergo safety and health training before the beginning of construction activities and a refresher training should be offered to workers so that new workers can also be trained.
5. Incentives should be introduced in form of awarding teams or workers who uphold good safety and health records as employee motivation. Furthermore, contractors who uphold the most improved safety and health records should be awarded either by MLSS-OSHS, NCC or any construction professional bodies;

6. Government should not interfere with regulatory bodies such as NCC and Zambia Environmental Management Agency (ZEMA) as they perform their work regarding safety and health and the environment.
7. Awarding of tenders for projects should be done on merit with incorporation of safety and health policy as a requirement for the selection criteria.

7.8 Study Limitations and Additional Area of Research

The information for the study was collected based on the respondents' experiences. This was because there were no accident or near miss reports on sampled construction sites and companies. However, the absence of accident reports could have limited the study. This is so because accident or near miss reports could have given the adequate information on the types, causes and effects of accidents. More research is recommended to substantially mitigate effects of accidents and ill-health. This may be done by focusing on topics such as control measures of accident prevention and ill-health

7.9 Summary

Safety and health in the Zambian construction industry, if not improved, could deter the growth of the industry. The effects of accidents and ill-health are detrimental to the construction industry, hence interventions are required in terms of prevention and mitigation of effects. Incorporating safety and health at all stages in the project cycle, involving all stakeholders and formation of national OSH policy to enhance the Factories Act could be effective measures to improving safety and health in the construction industry. Improved safety and health could lead to increased productivity and timely completion of projects and within the stipulated budget. The safety and health model developed herein could be useful in the Zambian construction industry and elsewhere in the world, especially in developing countries, with similar construction safety and health status to that present in Zambia. If adopted, the safety and health model has the potential to improve safety, health and prevent accidents and ill-health and will enable mitigation of effects resulting from poor safety and health procedures.

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APPENDICES

APPENDIX A: Interview Questions

The purpose of this research is to get a clear understanding about safety and health in construction sector in Zambia, find the common causes of accidents and ill-health, their effects and how best to prevent them.

Please note: All information provided will be strictly confidential. Please write the number of your choice in the boxes provided and tick your answer(s) where there are several choices.

Section 1. Personal Information

1. Gender 1=Male 2=Female ☐

2. Age.....

3. Name of the company you work for.....

4. What is your position in the company.....

5. What class of construction is your company involved in?

1=Clientele 2=Consultancy 3=Road Contractor 4=Building Contractor ☐
5=Project Managers 6= Architects 7=Quantity Surveyors 8=Water and sanitation
9=Other (specify).....

Section 2. Safety and health

6. How safe are construction sites in Zambia?

1=Very safe 2=Safe 3= unsafe 4=Not sure ☐

7. How healthy are the construction sites in Zambia?

1= Very healthy 2= healthy 3=unhealthy 4= Not sure ☐

8. What would you attribute to be the factors that lead to your answers in (6) and (7)?

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.....

9. What Safety and Health policies or guidelines/standards do you know that are used in construction sector in Zambia?

1= Factories Act 2=Company's safety and health policy ☐

3=Others, specify.....

10. Does your company have any Safety and Health policies or guidelines in place?

1= Yes 2=No

11. Do you have safety and health programme/sessions on site?

1= Yes 2=No

12. If your answer in question (11) is yes, how are you involved?

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13. (a). Do you think the Safety and Health guidelines that are used on this site or sites you know adequate?

1=Yes 2= No

b) Give reason(s) for the answer in 13(a).

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(c) In your opinion, how can safety and health guidelines/policies be improved?

……

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14 (a). Are you familiar with the Factories Act?

1=Yes 2= No

(b) How can you rate the Factories Act in relation to the construction industry?

1=Adequate 2= Not adequate 3=Needs improvement

(c) Give reason(s) for the answer in 14(b)

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15. (a) Does the company you work for/supervise provide Personal Protective Equipment (PPE) to employees according to the environment you are working in?

1=Yes 2=No ☐

15. (b) Which PPE is provide? Tick your answer(s) in the box.

Work suits/ Overalls ☐ Safety boots/ gum boots ☐ Hard hat ☐

Respirators/ dust masks ☐ Reflectors ☐ Safety harness ☐

Safety goggles ☐ Safety belts ☐ Ear plugs ☐

Others, specify.....

16. Signage (construction signs) to warn against danger on site is

1=Enough 2= Not enough 3=There is none ☐

17. Do you have these things on site? Tick your answer(s) in the boxes provided.

Clean drinking water ☐ Clean toilets/wash rooms ☐

Clean eating room ☐ First Aid Box ☐

18. (a) Who do you think should be responsible for implementation of good Safety and Health practices on sites? Tick your answer(s) in the boxes provided.

Management ☐ Project manager ☐ Site Engineer ☐ Site supervisors ☐

Site workers ☐ Safety officer ☐ Others (specify) ☐

.....

b) Do you have a safety officer or/ and safely representatives on the site(s) where you work?

1=Yes 2= No ☐

19. In your opinion, why do contractors shun away from good Safety and Health practices?

1=It is expensive 2=It is waste of time and resources 3=Poor management ☐

20. (a) How can you generally rate the projects according to your experience on sites regarding safety and health?

1= Excellent 2= Average 3=Poor ☐

(b) Which companies practice good safety and health in the construction industry?

1=Big companies 2=small companies ☐

Give reason(s) for your answer in 20(b).

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Section 3 Accidents and Ill-health

21(a) What types of accidents have you experienced or witnessed? Tick your answer(s) in the boxes.

Falling from heights ☐ Hit by falling objects ☐ Slips and trips ☐

Electrocution & explosion ☐

Collapse of earth (in excavation) ☐ Use of heavy machine and tools ☐

Other (specify).....

21(b) What were the causes of the accidents in question 21(a)?

Stress ☐ Poor attitude to safety ☐

Deficient enforcement of safety by management/supervisors ☐

Lack of safety training ☐ Safe equipment not provided ☐

Not using provided safety equipment ☐

Unsafe site conditions ☐ Unsafe methods ☐

22. How best do you think the causes in question 21(b) could have been prevented?

Good attitude to safety ☐

Proper enforcement of safety by management/supervisors ☐

Adequate safety training ☐ Providing safe equipment ☐

Using provided safety equipment ☐ Safe site conditions ☐ Safe methods ☐

23. What were the effects of the accidents in question 21?

Death ☐ Disability ☐ Psychological trauma ☐

Loss of morale ☐ Reduced production ☐ Job schedule delays ☐

Unnecessary costs (medical, compensation) ☐ Loss of business ☐

Poor corporate image ☐

Disruption in production ☐ Others,

specify.....

.....

24. What ill-health have you experienced or witnessed on sites you have worked on?

Cholera ☐ Skin disease ☐ dysentery ☐ diarrhoea ☐

Silicosis/ lung disease ☐ Back ach ☐ Others, specify.....

25. What were the causes of ill-health you selected in question (24)?

Poor sanitary conditions ☐ Poor personal hygiene ☐ Lack of clean water for drinking ☐

Handling heavy loads ☐ Exposure to dust and chemicals ☐

Others, specify.....

25. How best do you think the ill-health in question (24) could have been prevented?

Providing good sanitary conditions ☐ Good personal hygiene ☐

Providing clean water for drinking ☐ Proper safety training ☐

Wearing proper protective equipment ☐ Others specify

.....

27. What season do you experience more accidents and ill-health?

1=Cold season 2=Rainy season 3= Hot season ☐

28. Explain your answer(s) in question (27)

.....

.....

29. What do you think are some of the benefits of implementation of good Safety and health on construction site?

Increase in production ☐ less delays ☐ Project completed within budget ☐

Increase in efficiency ☐ boosts morale and confidence of workers ☐

Good corporate image ☐

30. What other views do you have regarding Safety and Health on construction sites or in construction sector?

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Thank you very much for answering these questions. All the best in your work.

APPENDIX B: Model Validation

B.1: List of participants for the Safety and Health Model validation

Item	Company Name	Classification	Position
1.	MLN Associates	Quantity Surveyors& Project Managers	Director Projects
2.	Workers Compensation Fund Control Board	Regulators/Compensators	Inspector
3.	Inyatsi Construction Limited	G1 Contractor	Human Resource Manager
4.	PMT Contractors	G5 Contractors	Managing Director
5.	Ministry of Labour Social Security-Occupational Safety& Health	Government Organisation	Chief Inspectors of Factories
6.	Road Development Agency	Client	Principal Engineer Maintenance
7.	CM Architects	Architects	Consultant
8.	WCE (Zambia) Ltd	Consultants	Managing Director
9.	National Council for Construction (NCC)	Regulators/Government Organisation	Principal Construction School
10.	Alione Consulting Engineers	Consultants	Director

B.2 Validation Questionnaire Cover

The University of Zambia

School of Engineering

Dept of Civil & Environmental Engineering

P.O Box 32379, Lusaka.

Cell : 0977344275, E-mail: pmtente@yahoo.co.uk

March, 2013

.....

Dear Sir / Madam,

QUESTIONNAIRE SURVEY ON VALIDATION OF THE PROPOSED SAFETY AND HEALTH MODEL IN THE PROJECT CYCLE FOR THE CONSTRUCTION INDUSTRY

As the research study on **"Safety and Health in Construction Industry in Zambia"** comes to a close, a proposed model was constructed. I am therefore, requesting your participation in answering the attached questionnaire for validation of the model which resulted from my research findings.

The validation will save the purpose of assessing the usefulness and adequacy of the proposed model for of academics.

Thank you for your warm cooperation.

Yours Faithfully,

Tente Prisca (Master of Engineering Student)

B.3 Validation questionnaire- Safety and Health Model

Please note: EIZ- Engineering Institution of Zambia, ACEZ- Association of Consulting Engineers of Zambia, ZIA- Zambia Institute of Architects and SIZ -Surveyors Institute of Zambia.

Write your answers in the space provided and **TICK (√)** your answer where there are several choices.

1 Gender Male ☐ Female ☐

2 Name of the respondent.....

3 Name of the company you work for.....

4 Position in the company.....

5 What class of construction is your company involved in?

Clientele ☐ Consultancy ☐ Contractor ☐ Government organization ☐

Others(specify).....

6 Do you think the proposed model can improve safety and health status in the construction industry?

Yes ☐ No ☐ Not sure ☐

7 Do you think the proposed model can be easily followed by all the parties involved in construction sector?

Yes ☐ No ☐ Not sure ☐

8 Do you think the proposed model can be adopted in the construction industry?

Yes ☐ No ☐ Not sure ☐

9 Do you think the proposed model has incorporated all stakeholders in the industry?

Yes ☐ No ☐ Not sure ☐

10 How do you think the proposed model can be improved up on? Give your views……

……

……

……

THANK YOU VERY MUCH FOR YOUR COOPERATION!

APPENDIX C: Questionnaire Survey

C.1: QUESTIONNAIRE SURVEY COMPANIES PARTICIPANTS

	Name of Company	Class	No. of respondents
1	Sitonga General Dealers	G5	1
2	Raymond Construction	G6	2
3	Mongu Municipal	Client	1
4	My Own Hardware	G5	1
5	Plinth Tecnical works	G1	5
6	Natty construction & Civil works	G1	1
7	Njas Construction	G6	2
8	Road Development Agency (Western Province)	Client	3
9	Road Development Agency (North Western Province)	Client	4
10	Road Development Agency (Lusaka Province)	Client	3
11	UWP Consulting Engineers	Consutants	3
12	China New Era International Corperation	G1	4
13	Curve Contractors and General Dealers	G5	2
14	Kasama Municipal Council	Client	1
15	Vinmu	G6	1
16	Asweswe	G5	1
17	Chibota Contractors	G6	1
18	Pamako Construction Ltd	G7	1
19	E. Bolton Building Contractor	G8	1
20	Chande General Dealers	G6	1
21	Debwe General Construction	G5	1
22	Townmouse Enterprices Ltd	G5	1
23	Defra General Trading	G4	1
24	Crambus General Dealers	G5	1
25	National Council for Construction	Regulators/ inspector	4
26	Inyatsi Construction Ltd	G1	1
27	Jexmak Enterprises Ltd	G4	2
28	BCHOD	Consultant	2
29	Conquest	G5	2
30	Stoutone Investments Limited	G5	1
31	Eastconsult Consulting Engineers LTD	Consultant	2
32	Workers Compesation	Compesation	2
33	PMT Contractors	G5	1
34	Bicon (Z) LTD	Consultant	2
35	Buildings Department	Client/consult	4
36	Civilstruct Consulting Engineers	Consultant	2
37	China Jiangxi	G2	2
38	MLN Associates	Quantity surv	4
39	NAPSA	Client	1
40	Copperfield Mining Services	G4	3
			78

C.2 Questionnaire Survey Cover Letter

The University of Zambia

School of Engineering

Dept of Civil & Environmental Engineering

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March, 2012

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Dear Sir / Madam,

QUESTIONNAIRE SURVEY ON SAFETY AND HEALTH IN CONSTRUCTION INDUSTRY IN ZAMBIA

I am a student at The University of Zambia, pursuing a Master of Engineering degree in Construction Management by research. The topic of my research is **"Safety and Health in Construction Industry in Zambia".**

The study seeks to address safety and health in the construction sector. The aim is to investigate and develop a system for improved safety and health practices on construction sites in Zambia. This survey research results will help to come up with a safety and health system to improve safety and health in Zambia's construction industry.

Attached herewith, is a questionnaire. Based on your experience in construction, kindly spare a few minutes of your precious time to answer all the questions. All the information that will be gathered will only be used for research purposes and will be strictly confidential. For any queries, please do not hesitate to communicate to the undersigned using the address provided above.

Thank you in anticipation for your time and warm cooperation.

Yours Faithfully,

Tente Prisca (Master of Engineering Student)

C.3 Questionnaire

The purpose of this research is to get a clear understanding about safety and health in construction sector in Zambia, find the common causes of accidents and ill-health, their effects and how best to prevent them.

Please note: All information provided will be strictly confidential. Please **WRITE** the number of your choice in the boxes provided and **TICK (√)** your answer(s) where there are several choices.

SECTION 1. BACKGROUND INFORMATION

1.1 Gender 1= Male 2=Female ☐

1.2 Name of the company you work for.....

1.3 Position in the company.....

1.4 Years of experience in construction sector.

1= Below 4 years 2= 5 – 10 3= 11- 15 4=16- 20 5=Above 20 years ☐

1.5 What class of construction is your company involved in?

1=Clientele 2=Consultancy 3=Road Contractor 4=Building Contractor 5=Architects ☐

6= Road and Building Contractor 7=Quantity/Land Surveyors 8=Water and sanitation

9= Project Managers 10= Others (specify).....

SECTION 2: SAFETY AND HEALTH

2.1 How safe are construction sites in Zambia?

1=Very safe 2=Safe 3=Relatively safe 4= Unsafe 5=Not sure ☐

2.2 Give a reason to your answer in (2.1)?

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.....

2.3 How healthy are the construction sites in Zambia?

1= Very healthy 2= healthy 3=Relatively healthy 4=un healthy 5= Not sure ☐

2.4 Give a reason to your answer in (2.3)?

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2.5 Are you familiar with the Factories Act? ☐

1=Yes 2= No

If your answer to question (2.5) is **NO**, proceed to question (2.8).

2.6 How can you rate the Factories Act in relation to safety and health in construction industry in Zambia?

1=Adequate 2= Relatively adequate 3=Needs improvement ☐

2.7 Give reason(s) for the answer in question (2.14).

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2.8 What Safety and Health policies or guidelines/standards do you know that are used in construction sector in Zambia?

☐

1= Factories Act 2=None 3=Others, specify.....

2.9 Which safety and health police or guidelines are in place on construction site(s) you supervise or inspect?

☐

1= Factories Act 2= None 3=Others, specify.....

If your answer to question (2.9) is **NONE**, proceed to question (2.13).

2.10 Do you think the Safety and Health guidelines that are used on your construction sites adequate?

1=Adequate 2= Relatively adequate 3=Not adequate ☐

2.11 Give reason(s) for the answer in (2.10).

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2.12 In your opinion, how can the safety and health guidelines/policies be improved?

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2.13 Which safety and health programmes/sessions take place on your construction site(s)?

Safety orientation/induction ☐ HIV AND AIDS awareness ☐

First Aid Training ☐ Risk assessment sessions ☐

General safety and health training ☐ Others,(specify).....

2.14 How are you involved in the area of safety and health on your site?.....

2.15 Do you have a safety officer or/ and safety representative(s) on your construction site(s)?

1=Yes 2= No ☐

2.16 Does the company you work for/supervise provide Personal Protective Equipment (PPE) to employees according to the environment they are working in on sites? Enter the appropriate code in the boxes .

	1=Provided	**2=Not provided**	**3= Not sure**
Work suits/overalls	☐	☐	☐
Safety boots/ gum boots	☐	☐	☐
Gloves	☐	☐	☐
Hard hats	☐	☐	☐
Safety goggles	☐	☐	☐
Respirators/dust masks	☐	☐	☐
Safety belt/harness	☐	☐	☐
Ear plugs/protectors	☐	☐	☐

2.17 Are the following provided on your construction sites? Enter the appropriate code in the boxes provided.

	1=Provided	**2=Not provided**	**3=Not sure**
Clean drinking water	☐	☐	☐
Clean toilets/washrooms	☐	☐	☐
Clean eating room/space	☐	☐	☐
First Aid Box	☐	☐	☐

2.18 Signage (construction signs) to warn against danger on your construction site(s) is

1=Enough 2= Relatively enough 3=Not enough ☐

2.19 Who do you think should be responsible for implementation of good Safety and Health practices in construction industry?

	1=Strongly agree	**2=Agree**	**3=Disagree**
Clients	☐	☐	☐
Consultants/Project managers	☐	☐	☐
Contractors (Management)	☐	☐	☐
All site supervisors	☐	☐	☐
Safety officers	☐	☐	☐
Site workers	☐	☐	☐

2.20 Do you think safety and health should be considered from the design, quantifying, tendering, building,

Usage, demolishing to rehabilitation stage (Full project cycle)?

1=Strongly agree **2=Agree** **3=Disagree** ☐

2.21 In your opinion, why do contractors shun away from good Safety and Health practices?

1=It is expensive 2=To maximise profit 3=Poor management ☐

2.22 From your experience, how can you generally rate the construction projects regarding safety and health in Zambia?

1= Excellent 2= Average 3= Poor ☐

2.23 Which companies practice good safety and health in the construction industry?

1=Big contractors (grades 1-3) 2=Small contractors (grades 4-6) 3= Both ☐

2.24 Give reason(s) for your answer in question (2.23).

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SECTION 3: ACCIDENTS AND ILL-HEALTH

3.1 In your experience in construction industry in Zambia, what types of accidents have you witnessed/known about and what were the causes? Tick your appropriate answer(s) in the boxes, starting with the type of accidents versus the causes.

Causes of Accidents	Types of Accidents							
	Falling from heights	**Hit by falling object**	**Slips and trips**	**Collapse of earth**	**Electrocutions & explosion**	**Use of heavy machines & tools**	**Hit by moving machinery**	**Drowning**
Stress	☐	☐	☐	☐	☐	☐	☐	☐
Poor attitude to safety	☐	☐	☐	☐	☐	☐	☐	☐
Deficient enforcement of safety	☐	☐	☐	☐	☐	☐	☐	☐
Lack of safety training	☐	☐	☐	☐	☐	☐	☐	☐
Safety equipment not provided	☐	☐	☐	☐	☐	☐	☐	☐
Not using provided safety equipment	☐	☐	☐	☐	☐	☐	☐	☐
Unsafe site conditions	☐	☐	☐	☐	☐	☐	☐	☐
Unsafe methods	☐	☐	☐	☐	☐	☐	☐	☐

3.2 What were the effects of the accidents in question (3.1)?

Death ☐ Disability ☐

Psychological trauma ☐ Loss of morale ☐

Reduced production ☐ Job schedule delays ☐

Unnecessary costs (medical, compensation) ☐ Loss of business ☐

Poor corporate image ☐ Disruption in production ☐

Others (specify).....

3.3 How best do you think the causes in question (3.1) could have been prevented?

Proper enforcement of safety by management ☐ Good attitude to safety ☐

Adequate safety training ☐ Providing safety equipment ☐

Using provided safety equipment ☐ Safe site conditions ☐

Using safe methods ☐ Others ☐

(specify).....

3.4 In your experience in construction industry in Zambia, what examples of ill-health have you witnessed/know about and what were the causes? Tick your answer(s) in the boxes.

	Examples of ill-health					
Causes of ill-health	**Cholera**	**Skin disease**	**Dysentery**	**Diarrhoea**	**Silicosis /Lung diseases**	**Back ache**
Poor sanitary conditions	☐	☐	☐	☐	☐	☐
Poor personal hygiene	☐	☐	☐	☐	☐	☐
Lack of clean drinking water	☐	☐	☐	☐	☐	☐
Handling heavy loads	☐	☐	☐	☐	☐	☐
Exposure to dust and chemicals	☐	☐	☐	☐	☐	☐

3.5 How best do you think the ill-health in question (3.4) could have been prevented?

Providing good sanitary conditions ☐ Good personal hygiene ☐

Providing clean water for drinking ☐ Proper safety training ☐

Wearing proper protective equipment ☐

Others specify.....

3.6 According to your experience, on average, which season records more accidents and ill-health?

1=Cold season 2=Rainy season 3= Hot season ☐

3.7 Give reason(s) to your answer in question (3.6)

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3.8. What are some of the benefits of implementation of good Safety and health on construction site?

Increase in production	☐	Zero tolerance to accidents	☐
Project completed within budget	☐	Increase in efficiency	☐
Boosts morale and confidence of workers	☐	Good corporate image	☐

3.9 What other views do you have regarding Safety and Health on construction sites or in construction
sector.....
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THANK YOU VERY MUCH FOR YOUR COOPERATION!!!!!!!!