AN INVESTIGATION OF THE COST OF CONSTRUCTION ACCIDENTS IN ZAMBIA

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A dissertation submitted to the University of Zambia in partial fulfilment of the requirements for the degree of Master of Engineering in Construction Management

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DECLARATION

I, **Tamara Namonje** declare that this work is my own, and that to the best of my knowledge, it has never been produced or submitted before in this university or any other institution for academic purposes, and that all sources of information have been duly acknowledged.

Author's Full Name: Tamara Namonje

Signature …….

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CERTIFICATE OF APPROVAL

This dissertation by Tamara Namonje entitled 'An investigation of the cost of construction accidents in Zambia' is approved as partially fulfilling the requirements for the award of degree of master of Engineering in Construction Management of the University of Zambia.

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ABSTRACT

The construction industry contributes significantly to national economic growth and offers opportunities for job creation. However the industry has continually been plagued by workplace incidences and accidents. Despite governments and organizations maintaining an on-going commitment towards establishing a working environment free of injury and disease, a great deal of construction accidents continue to frequent projects. This study aimed at determining the costs incurred as a result of construction accidents in Zambia. A combination of a case study and survey approach was adopted. The questionnaire was distributed to contractors and employees involved in construction projects in Zambia. The data collected from the survey was analyzed through the use of SPSS version 11 and Microsoft excel. The results of the study revealed the following as some of the main costs of construction accidents; medical, burial, communication, compensation, funeral, hospitalization, lost salary, sick pay and transport. The costs of construction accidents reveal that construction accidents present a substantial cost to employers. Moreover the research study confirmed that if the firm pays all the cost components associated with a fatal accident it will incur an average of ZMW 21,880.00 while if it pays all the cost components associated with a major and minor accident it would incur an average of ZMW 8,122.36 and ZMW 3,976.92, respectively. Over half (35 out of 50) employees did not lose any money. 15 employees lost money with the loss varying between ZMW4.00 to ZMW 2,001.00 per accident/incident. The average loss of these 15 employees was approximately ZMW 399.00. Where employees lost money, the largest proportion, approximately 40%, was due to lost salary. In addition five employees lost their lives as a result of the accident and their compensation was given at an average of ZMW 10,800.00. The research therefore recommends that enough awareness is done to sensitize people on costs implications that come along with accidents and come up with ways of avoiding them. Moreover, contractors should provide appropriate health and safety information to their employees on construction job site. Furthermore, relevant law enforcing agencies should be proactive conducting regular site inspections to check on contractors' compliance with the existing legislations governing H&S.

DEDICATION

This thesis is dedicated to my late father Mr. Jim Mudoya Sichone for having endured so much for us. Your sacrifice was worth it. It is also dedicated to my mother, Susan Phiri, my husband, Mr. Lutangu Ingombe, my siblings, my daughters Sitali Ingombe and Sibeso Ingombe, my son Mubita Ingombe for their sacrifice during this work. May this work bring joy to you.

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ABBREVIATIONS

CS	Case Study
CDC	Constituency Development Committee
GDP	Gross Domestic Product
H&S	Health and Safety
HSE	Health and Safety Executive
ILO	International Labour Organization
PPE	Personal Protective Equipment

CHAPTER ONE: INTRODUCTION

1.1 Background

An accident can be defined as an unplanned event that results in injury or ill health of people, or damage or loss to property, plant, materials or the environment, or a loss of a business opportunity (Hughes &Ferret, 2011). In most cases, many people have not realized the extent of economic damage that these accidents have. These accidents represent an economic burden to the employees, employer and society as a whole. A lot of publication on health and safety has been done yet accidents are still experienced. Despite governments and organizations worldwide maintaining an on-going commitment towards establishing a working environment free of injury and disease, a great deal of construction accidents continues to frequent society (Pillay, 2014).

Workers on construction sites are more at risk of accidents and poor health due to the nature of the construction activities. Given the high rate of construction accidents experienced, employers are not entirely mindful of the actual costs of construction accidents, especially when considering the hidden or indirect costs of accidents (Safe Work Australia, 2012a).

From a nationwide perspective, industrial accident costs have a huge impact on the national economy. In Australia, the cost of workplace injury and illness for the 2008–09 financial years was $60.6 billion, approximately 4.8% of the Australian GDP (Safe Work Australia, 2012a). The construction industry accounts for $6.4 billion or 10.6% of the total cost of workplace injury and illness. It is important to recognize that this cost is borne by workers, their families, the broader community, and employers (Safe Work Australia, 2012b).

Accidents that occur on construction projects have a major impact on not only the victim involved but the business at large. Many stakeholders have not realized the costs implication that these accidents have on their business and economy at large. Whenever accidents occur, they not only tarnish the image of the industry and make it difficult to attract skilled labour, but from a business point of view, they tend to be very expensive. Accidents usually give

rise to serious costs which are hidden and others are seen. These accidents have major financial impact especially on small and medium construction companies.

Apart from the pains and discomfort to workers and their families and friends as well as their colleagues, death and permanent disability, accident costs can also be quantified in terms of the financial losses to contractors. The ones directly affected by these accidents are the employers and workers. The results of these accidents may cause death, injury or illness which cost workers their present and extended health and by extension, it affects their families as well (Pillay, 2014).

1.2 Significance of the study

This study is significant in the following ways

i. The research findings will assist employees, employers, stakeholders and society in Zambia to understand the critical effects of construction accidents and they will be aware that accidents do not just occur but have a cost implication.
ii. Stakeholders and role players will be able to identify and classify accidents that occur on construction sites in Zambia
iii. It will contribute to the existing body of knowledge on the cost effects of construction accidents.

1.3 Problem statement

In Zambia, to date nothing has been done relative to quantifying the actual costs of construction accidents. The health and safety record shows the construction industry as the second worst industry when it comes to health and safety as compared with other industries.

1.4 Aim

Despite the importance of construction H&S, no research has been done to determine the costs that are incurred when these construction related accidents occur in Zambia. This aims to determine the costs incurred as a result of accidents on project so as to assist in coming up with measures to mitigate the adverse effects of these costs.

1.5 Research questions

The research questions (RQs) arising from the problem statement is as follows:

1. What are the most common accidents on construction sites?
2. What are the associated average costs related to these accidents occurring on these sites?
3. What is the proportion of firms that typically pays for these costs in Zambia?
4. Are these costs in any way related to the size of the firm?

1.6 Objectives

1. To identify and classify the accidents that occur on construction sites.
2. To determine the costs associated with identified accidents.
3. To find out if all firms pay for accident costs.
4. To use the findings in contributing to the levels of awareness. This will eventually help on project performance.

1.7 Research methodology

This research was undertaken through different methods and techniques which were supported by an extensive literature review of the studies and published materials. However, in this research qualitative and quantitative designs were used in order to answer the research questions as well as ensure that the research objectives are met.

1.7.1 Qualitative Research

In this method, data was collected mainly in form of descriptions. This included structured interviews that were done with employees that have been involved in construction accidents. The information gathered through the interviews and discussions were used to gain deeper insights on the costs of construction accidents.

1.7.2 Quantitative Research

Quantitative research approach was used through the use of the questionnaire structured surveys that was conducted to the population that was selected.

Data collection started with literature review of published and unpublished materials which mainly involved desk study that helped in guiding the developing of the discussions and survey tools used in the research. Structured questionnaires were used and applied to a selected population. The questionnaire was aimed at collecting as much information as possible regarding costs of construction accidents.

1.7.3 The study population and sample

The participants involved in the study comprised of two groups namely;

(1) Employers (contractors) from different companies ranging from grade one (1) to six (6) and registered with the National Council for Construction in Zambia.

(2) Employees from construction companies who have been involved in an accident.

1.7.4 Data collection instrument

Data collection techniques included interviews, questionnaires and discussions with specific individuals.

1.7.5 Data collection procedure

The procedure involved getting permission from relevant authorities and offices to conduct individual and group discussions as well as structured interviews. For the employers, structured questionnaires were sent and delivered.

1.7.6 Ethical considerations

The research was conducted with honesty, earnestness and to conform to acceptable engineering standard for purpose of professional conduct. The ethical consideration in this research took into account several factors which included; privacy, proper citing and acknowledging of different authors whose work had contributed to the literature review. For all the participants in the research questionnaire, the obligation was that their input was kept confidential and only used for academic purposes. Moreover, respondents to the questionnaire had the right not to answer questions that they felt were not applicable.

1.8 Data analysis

Data was collected using questionnaire survey and interviews. The data collected was analyzed through the use of various techniques which included the Microsoft package of Excel and Statistical Package for Social Science (SPSS) package which facilitated the interpretation of collected data.

1.9 Chapter Synthesis

The compilation of the entire research project is organised as follows

Chapter one provides the background to the subject. It also communicates the significance of the study, statement of the problem, and guiding questions that will be investigated. The methodology, objectives, and importance of the study will also be presented in this section.

The second chapter presents a survey of related literature from books, journal papers, conference papers and the internet. The chapter on literature review is presented relative to guiding questions of the study. It explores previous studies that have been done by other researchers pertaining to the cost of construction accidents. The various associated costs relative to the quantified categories will be discussed.

Chapter three discusses the tools and methods to be used for data collection, treatment of the data, population and sampling design and the interpretation of results. Challenges faced during the data collection will also be discussed in this chapter.

Further, chapter four presents findings and results of the empirical study. The findings are presented as statistical measures in literature, tables, charts and graphs.

Further chapter five presents the discussions and analysis of the findings which are presented relative to the guiding questions.

Lastly, chapter six summaries the conclusion and recommendations of all findings from the literature, as well as the case study and the survey.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

This chapter comprehensively reviews relevant literature on costs of accidents. Several researchers and academics (Ikpe, 2009; Pillay, 2014; Zou and Sunindijo, 2015) have researched and written about the costs of accidents in developed countries. According to Hinze (2006) "If the true costs of injuries were well defined, management would be in a better position to make informed decisions concerning health and safety. Rather than addressing health and safety solely from an altruistic point of view, owners should also consider health and safety from a more purely economic perspective".

It is very important that people get to carefully understand the implications of costs of these accidents as a way of helping them have proper management policies. In the 1980's, authors such as Leathers and Williams (1984), Laufer (1987), Leopold and Leonard (1987), Klen (1989) argued that studies on the cost of accidents would motivate more dynamic efforts at accident prevention by employers. Employers in most construction companies have ignored the aspects of proper health and safety as a way of cost saving not knowing that it is actually not profitable.

2.2. Construction industry safety performance

Accidents in the construction industry represent an ongoing cost implication on the employer, employee and society as a whole. Many parties have and are still trying to carry out research on how to reduce injury and fatalities on construction sites. Much emphasis has been placed on investigating problems on documentations and legislation (Hinze, 2006; Ikpe, 2009; Pillay, 2014).

Despite efforts being done on the awareness of health and safety, knowledge being gained from various acts and regulations, a lot of serious accidents continue to occur. In Zambia, to date nothing has been done relative to quantifying the actual costs of construction accidents. The health and safety record shows the construction industry as the second worst industry when it comes to health and safety as compared with other industries. (Egan, 1998; Bomel,

2001). According to the 2002 Safety Index of Liberty Mutual in the United States, of the total financial impact of costs such as lost productivity and overtime has been estimated to be as much as $240 billion. Direct workers compensation costs were estimated to be $48.6 billion for the most disabling workplace injuries and illnesses in 2006. By adding the indirect cost of workers' compensation claims to the $38.7 billion in direct costs, the total economic burden of workplace injuries and illness is far greater, with estimates ranging between $125 billion to $155 billion. According to the Health and Safety Executive (1997) the typical cost to employers of a serious or major injury was about £17, 000 to £19, 000.

In the United Kingdom, five studies were undertaken by the Health and Safety Executive on accident costs using a total loss approach (HSE, 1997). This approach found that eight (8) percent of the studied accidents had the potential for more serious consequences, namely fatalities, multiple injuries or catastrophic losses. These accidents had the potential for being significantly more serious than they actually were. In most cases, accidents would cause both property damage and personal injury did not have the potential to cause harm but still had costs implications.

While this is true, some injury accidents were unlikely to cause property damage. Despite some accidents causing property damage, they did not have the potential to cause harm but still had costs implications.

It has been recognized by different authors through different studies carried out that the costs of accidents were expensive (Pillay 2014; Zou and Sunindijo, 2015). Construction accidents are costly, both in terms of human suffering and financial loss, and should be avoided. (Jallon, Imbeau and de Macellis-Warin, 2011). Pillay (2014) endorsed this view by suggesting that preventing occupational accidents made good economic sense for society as well as being good business practice.

Whenever accidents occur, they not only tarnish the image of the industry and make it difficult to attract skilled labour, but more importantly from a business perspective, they

tend to be very expensive. Accidents can give rise to serious costs and have major financial impact particularly on small and medium construction companies.

Musonda (2012) summarized on the health and safety performance in the construction industry and stated that the construction industry still lagged behind other industries and its position remained among the worst health and safety performer. Further, the ILO (2003) estimated that 4% of the gross domestic product for developed countries was lost due to accidents and work related injuries. This estimate for developing countries could even be much higher than 10% of the gross domestic product. (Musonda, 2012).

Losing skilled or specialist construction workers, even for a short period of time, could have a greater effect on productivity. Many organizations have not taken the issue of health and safety seriously and have little mitigation measures against accidental losses. A serious accident might possibly have substantial cost and other implications on an organization even resulting in it losing business or going out of business. Moreover, additional measures must be introduced to reduce the rate of accidents and subsequently help improve health and safety performance.

2.3. Accident classification

There are different types of accidents in the construction industry. HSE (2006). Accidents in the construction industry are classified under the following headings:

2.3.1. According to severity of injury

Injuries on construction sites can be severe to the extent that they to vary the rate of recovery from one injury to another. Below are the category of injuries that occur on different construction sites**.** These include minor, major and fatal injuries.

Minor injury- These are injuries that are work related and involve the affected party to be absent from normal duties for a period of less than five days. There are a lot of such accidents which include slips, trips, hammering of hand when doing carpentry works, etc.

Whenever such an accident happens, one might be absent from work for a short period of time and in some cases, others still continue to work despite the minor injury.

Major Injury- These are injuries that usually make someone to be absent from work for a long term period, partial incapable of returning to work and in the worst incidences can make one permanently incapable of returning for work.

Long term absence

- One is unable to report back for work for a period of more than six days but less than six months. These are cases of hand injury, leg injury, cuts and burns etc.

Partial Incapacity

- This is an accident or injury that usually makes one to be absent from work for more in certain incidences, a worker can be made to return for work after six months upon leaving work. Whenever one is partially incapable of returning for work, they are usually replaced by other colleagues because in such cases, the employers don't really know that one would return for work. These involve cases of falls were one affect their backs and legs etc.

Permanent incapacity

- This is a work-related injury which results in the individual being permanently unable to return to work. This injury greatly affects an individual due to the fact that he is unable to ever perform his normal duties again. Not only does such an injury affect the person involved but also his family and society at large. Such accidents involve losing of hands from a grinder, blindness as a result of specks of object entering the eyes, breaking of back due to falls etc.

Fatal injury- This is a work related injury which results in death. In most cases accidents that lead to death are electrocution, falls from heights, being struck by an object etc (HSE 2006).

2.3.2. According to the nature of injury

Whenever an accident occurs on any construction site, the results of that accident can either leave an individual temporarily, partially or permanently disabled.

Temporary disablement

This is any condition that causes an individual to be unable to work for a short period of time. These incidences mostly occur on construction sites from time to time due to poor health and safety measures (HSE, 2006).

Permanent disablement

This is an injury that leaves a person unable to work in their own or any occupation for which they are suited by training or experience. This is a lasting disability that affects one's ability to earn a living. Whenever such an incidence happens to an individual, the employer offers some benefits to help replace wage loss (HSE, 2006).

Partial disablement

This disability makes an individual not to be able to perform at full physical capacity. This involves the loss of the use of a part of the body and good examples are hearing loss, amputation and back injuries (HSE, 2006).

2.2.3. According to the cause of accident

Accidents are caused by a lot of factors which include the following;

Equipment fault

Accidents are usually caused by equipment fault. Most people have found themselves injured due to the fact the equipment develops faults while in operation.

Construction site falls

These are the common type of accidents that occur on sites. Individuals fall from heights and injure themselves. Construction site falls are as a result of many factors which include negligence by the individual to comply with proper health and safety rules. These falls have led to individuals losing their lives or becoming disabled.

Trench collapse

This has also been a factor that has caused accidents on sites. Whenever workers are excavating, trenches collapse due to poor support systems which in worst cases have buried people alive (HSE 2006).

2.4. Causes of accidents on construction sites

In 2011, 738 construction workers were killed on the job due to accidents at their worksites. On any given day, there are almost 6.5 million people working on construction sites in the United States (Bureau of Labor Statistics, 2011).

Out of those 6.5 million workers, the Bureau of Labor Statistics reports that 190,000 injuries are suffered every year due to work-related accidents. It stands to reason that if proper safety precautions were always taken, accidents could be severely cut back. This in future would potentially save hundreds of lives every year.

The Department of Labor and Industries (2011) reported that 95% of construction injuries are due to six different types of accidents:

- Getting caught in, under or between an object(s): Any part of the body can be caught in a piece of heavy machinery, crushed underneath falling materials, etc.
- Falls from a high surface: Whether falling off scaffolding or from a cherry picker or another high location, falls are an extremely common way construction injuries occur.
- Slips, Trips & Falls: Different from falls that occur from heights, a slip, trip or fall accident occurs at ground level. These can be caused by tripping over an object, slipping in a liquid, etc.

- Being struck by something/someone: Getting hit by a piece of equipment or machinery, or having a part of your body collide against something both fall under this category.
- Motor vehicle accidents: Whether a construction worker is hit by a piece of moving machinery or struck by a vehicle while they are working on the roadway, vehicle accidents are a serious danger to workers.
- Musculoskeletal Disorders: Often caused from overexertion by repetitive motion or from lifting, squatting, etc. These types of injuries most frequently affect the knees, ankles, feet, neck, back and arms.

Construction site accident injuries are often caused by employer negligence, whether they are negligent in safety training or negligent in observing practices on the site, workers can get injured simply because the people in charge don't do their jobs properly and don't pay close enough attention.

Injuries also occur due to co-worker negligence. If a co-worker is tired or overworked, or if they get lazy and don't observe proper safety protocol, injuries can occur because a co-worker misuses machinery, drops materials, spills fluids, etc.

No matter what type of injury a construction worker obtains on the job, it is still the employer's responsibility to make sure that worker is cared for properly, taken to receive prompt and appropriate medical care, and given the proper compensation for the injuries received.

2.5. International studies on accident costs

Heinrich (1931) is perhaps the first who systematically studied accident costs. He pioneered this in the United States during the 1920's when he surveyed thousands of cases and concluded that management underestimated the real cost of injuries in the workplace because many of the costs were hidden. These hidden or indirect costs could be as much as 75% of the total costs of an average occupational accident.

Unfortunately, many of the claims of the studies were not very accurate and the cost categories not very clearly defined. Almost no comprehensive Zambian research efforts have attempted to quantify the true costs of worker injuries.

A study conducted among South African general contractors by Smallwood (1999) investigated the impact of fifteen (15) accidents. Various categories of direct and indirect costs were recorded relative to the primary construction cost Centre's, namely labour, material, plant and equipment, subcontractors, and overheads. The lowest total cost of accidents was R405.00arising from a worker stepping on a nail protruding from a piece of timber. The highest total cost of an accident was R296, 000arising from a motor vehicle related accident. The mean total cost of accidents of the 15 accidents studied was R53, 514. The findings of this study confirmed the findings of all preceding studies, namely that the indirect costs of accidents are greater than the direct costs of accidents.

Another study in South Africa was also done by Pillay (2014). In his study, he conducted an analysis of a sample of 100 construction accident reports in order to establish, as far as practically reasonable, the total costs of limited types of construction accidents. The costs of construction accidents for the sample of 100 were analyzed and estimated as R 32 981 200. Of this total, R 10 087 350has been attributed to direct costs and R 22 893 850 has been attributed to indirect costs. The findings also confirmed that indirect costs were found to be more than 100% greater than the direct costs. The direct costs constituted about 30.59% of the total cost of 100 accidents while the indirect were about 69.41% of the total costs of 100 accidents

In the United States of America (USA) a daily average of 9,000 workers sustained disabling injuries on the job. Approximately 153 died due to either injury or work-related diseases with a direct cost of about $40.1 billion and indirect cost of over $200 billion a year (CDC, 2004; NIOSH, 2004).

According to Odile Quintin (2004), despite there being legislation in place, there was insufficient enforcement of regulations to prevent employers from neglecting their health

and safety obligations to their construction workers. An estimate of about 800,000 construction accidents in the European Union where reported each year, causing 1,200 deaths and costing more than €75 billion

2.6. Cost of construction accidents

An accident can be defined as unplanned event that results in injury, ill health of people, damage or loss to property, plant, materials or the environment and loss of a business opportunity (Hughes &Ferret, 2011). From a nationwide perspective, industrial accident costs have a significant impact on the national economy. In Australia, the cost of workplace injury and illness for the 2008/09 financial year was $60.6 billion, approximately 4.8% of the Australian GDP (Safe Work Australia, 2012). The construction industry accounts for $6.4 billion or 10.6% of the total cost of workplace injury and illness (Safe Work Australia, 2012).

Everett and Frank (1996) in Pillay (2014) characterized the true costs of accidents in many ways and suggested the following:

1. direct costs of injuries and fatalities that included workers' compensation, public liability and property insurances
2. indirect costs of injuries and fatalities that included loss of productivity, disruption of schedules, administrative time for investigations and reports, training of replacement personnel, wages paid to then injured workers and others for time not worked, clean up and repair, adverse publicity, third-party liability claims, and equipment damage.
3. costs of health and safety programs that include salaries for health and safety, medical and clinical personnel, health and safety meetings, inspections of tools and equipment, orientation or induction sessions, site inspections, personal protective equipment, health programs, and miscellaneous supplies and equipment.

Poonetal (2008) provided a comprehensive classification of the costs of construction accidents as given below:

1. Financial costs of construction accidents, Loss due to the injured persons; loss due to the inefficiency of the workers who have just recovered from injury and resumed

work; loss due to medical expenses; loss of productivity of other employees; loss due to damaged equipment or plant; loss due to damaged materials or finished work; loss due to idle machinery or equipment; other costs.

2. Social costs of construction accidents: These costs are calculated on the basis of the type and severity of accidents, the age of the injured person, and other related situations and conditions.
3. Human pain and suffering costs of construction accidents: These include funeral expenses.

2.7. Components of accident costs

It is always very important to identify the proportion of costs borne by workers, employers and the community. The distribution of the burden of costs is achieved by defining the major aspects of total costs and assigning the proportion of these cost groups to each of the economic agents (employees, employers and the community). The six cost classifications are identified as follows:

1. Production disturbance costs (PDC) – costs incurred in the short term until production is returned to pre-incident levels.
2. Human Capital Costs (HCC) – long run costs, as loss of potential output, occurring after a restoration of pre-incident production levels.
3. Medical Costs (MEDC) – costs incurred by workers and the community though medical treatment of workers injured in work-related incidents.
4. Administrative Costs (ADMINC) – costs incurred in administering compensation schemes, investigating incidents and legal costs.
5. Transfer costs (TRANC) – deadweight losses associated with the administration of taxation and welfare payments, and
6. Other Costs (OTC) – includes costs not classified in other areas, such as the cost of careers and aids and modifications.((Safe Work Australia, 2012):

The six conceptual groups can be further divided into many cost components that borne by employees, employers and the community. Some of the cost components are considered as indirect costs, which need to be estimated individually under each severity category. The

detail cost components under each conceptual group and their distributions are summarized in Table 2.1.

Table 2.1: Summary of the cost items and their distributions by severity ***(****Safe Work Australia, 2012)****.***

Conceptual group	Cost Items	Borne by agent	Direct/indirect costs	Distribution by severity
Production disturbance costs	Cost of overtime and over-employment.	**E**	**I**	**ALL**
	Employer excess payments.	**E**	**I**	**ALL**
	All Staff turnover costs	**E**	**D**	
	Staff training and retraining costs	**E**	**I**	PI, FI, FP
	Loss of current income.	**E**	**I**	-
	Production disturbance costs	**W**	**I**	PI,FI,FT
	Compensation payment	**C**	**I**	
Human capital costs	Loss of future earnings	W	I	LA,PI,FI,F
	Loss of government revenue Social welfare payments for lost income earning capacity	C	I	PI,FI,FT
		C	D	LA,PI,FI,FT
Medical costs	Threshold medical payments Medical and rehabilitation costs	E	D	-
	Rehabilitation Medical costs	W	I	ALL
	Health and medical costs	C	D	-
		C	D	-.
Admin costs	Legal fines and penalties	E	D	-
	Investigation costs.	E	I	ALL
	All Travel expenses.	W	I	ALL
	All Legal costs.	W	I	FI,FT
	Funeral costs.	W	D	-
	Inspection and investigation costs	C	D	-
	Travel concerns for permanently incapacitated workers	C	D	-
Transfer costs	Deadweight costs of welfare payments and tax losses	C	D	-
Other costs	Careers costs	W	I	FI
	Aids and modification	W	I	FI

E= Costs borne by employer, W=Costs borne by worker, and C=Costs borne by community

D=Direct cost, I=Indirect cost

SA=Short absence, LA=Long absence, PI=partially incapacity, FI=Full incapacity, FT=Fatality, All=All severity categories

These six cost groups could be further divided into many cost components. Some of the cost components are considered as indirect costs, which need to be estimated individually under different severity categories. Safe Work Australia (2012b) classifies incidents into five severity categories as shown in table 2.2.

Table 2.2: Definition of different types of accidents and severity category (Source: Zou and Sunindijo 2015).

Accident type	Definition	Severity levels
Short absence	A minor work-related injury or illness, involving less than 5 working days absence from normal duties, where the worker was able to resume full duties	Less than 5 days off work
Long absence	A minor work-related injury or illness, involving 5 or more working days and less than 6 months off work, where the worker was able to resume full duties.	Five days or more off work and return to work on full duties
Partial incapacity	A work-related injury or illness which results in the worker returning to work more than 6 months after first leaving work..	Five days or more off work and return to work on reduced duties or lower income
Full incapacity	A work-related injury or disease, which results in the individual being permanently unable to return to work	Permanently incapacitated with no return to work
Fatality	A work-related injury or disease, which results in death.	Fatality

2.8. Direct costs

Direct cost is the actual costs that can be directly attributable to injuries and fatalities (HSE, 2004; Tang et al. 2004). It refers to expenditure when accidents occur including insurance, damage to buildings and equipment or vehicles, damage to the product, expenditure on medical care, cost of investigation, legal costs, death, permanent disability; worker illness;

losses of current production; pains as well as discomfort associated with accidents (HSE, 2006; Ferret and Hughes, 2007; Ikpe, 2009; Zou and Sunindijo , 2015).

In most cases, direct costs of accidents are those costs incurred due to treatment of an injury that are normally refunded by insurances such as workers compensation. Other examples of direct costs include premiums for workers, medical costs, lost wages, sick leave administration, temporary disability payments and hospitalization compensation insurance, liability and property losses. (Kapp et al, 2003; Ikpe 2009 and Pillay, 2014). According to Griffin (2006) direct costs were those costs that were directly associated and payable by the employer or the insurance on behalf of the employer. These costs were normally easy to identify and quantify.

2.9. Indirect costs

Construction accidents are more expensive than most people think. This is mostly because of the indirect costs also described as the hidden costs of accidents. Organizations have not accurately evaluated the true costs of accidents that occur, and certainly do not know how costly these accidents actually are. Indirect costs refer to costs that may not be covered by insurance and are the less tangible costs that result from accidents (Ferret and Hughes, 2007). These costs are mainly incurred by the diversion of time to deal with the consequences of an accident, and usually affect productivity. These costs are less evident expenses and are commonly known as hidden costs which are usually several times greater than the value of the direct costs. (Hinze 1994; Hughes 2007 and Pillay 2014). In most cases, indirect cost information is not easily quantified due to the fact that cost data is usually difficult to access and often not captured.

Given that indirect costs of accidents always exceed the direct costs, giving greater attention to indirect costs could make more business sense(Jallon, Imbeau and de Marcellis Warin, 2011). A basic list of potential indirect costs as a consequence of construction accidents includes the following, namely:

- Interruption in production immediately following the accident;
- Lower morale effects on co-workers;

- Personnel allocated to investigating and writing up the accident;
- Recruitment and training costs for replacement workers;
- Damage to equipment and materials if not identified an allocated through routine accounting procedures;
- Reduction in product quality following the accident;
- Reduced productivity of injured workers on light duty;
- Product damage;
- Plant and equipment damage;
- Legal costs;
- Production delays;
- Transportation of injured person;
- Loss of efficiency of workers;
- Overtime working and the use of temporary staff;
- Recruitment of replacement staff;
- Investigation costs;
- Clerical efforts; and
- Loss of expertise and experience.

Further, indirect costs are generally those costs attributed to the loss of productivity of the injured worker and the crew, transportation costs to the nearest medical facilities and time expended to complete various forms related to the injury (Pillay, 2014).

2.10. Relationship between direct and indirect cost

Some studies have attempted to determine the ratio between indirect and direct costs of accidents. Researchers, when studying the concepts of direct and indirect cost, express a ratio of indirect costs to direct costs. Heinrich (1979) estimated the ratio of the indirect costs of injuries to the direct costs to be approximately 4:1 using data gathered from various industrial facilities in the United States. A study by Sheriff (1980), found the ratio of indirect and direct costs to be as high as 10:1. Bird and Loftus (1976) estimated the ratio to be even higher at 50:1. Irrespective of the variations in the ratios, in all cases the indirect costs were significant when examining the costs associated with an injury, and typically exceeded the

direct costs substantially. Social services sector in the UK found a ratio of about 3.3 (Monnery, 1998). Hughes and Ferret (2011) suggested that the ratio ranges from 8 to as high as 36. These findings indicate that there is no generally accepted ratio between indirect and direct costs of accidents. Feng (2011) further suggested that company size may also contribute to the ratio difference. As compared to small companies, when an accident happens in large companies, more activities are initiated, more people are involved, more internal administrative processes have to be complied with, and more organizational levels have to be informed (Richardson & Impgaard 2004; Ikpe, 2009; Pillay, 2014;Zou & Sunindijo 2015). This will inevitably increase the indirect costs of the accident and raise the ratio higher. Furthermore, the ratio between indirect and direct costs of accidents tends to increase with the project size (Hinze & Appelgate, 1991). With the ratios analyzed, it clearly shows that indirect costs of an accident could be significantly higher than its direct costs. Direct costs may at first seem to have a low impact on the financial health of any business. Focusing much on them without putting into consideration indirect costs, may fail to reveal the true losses to employers due to an accident (Feng, 2011).

2.11. Other costs of construction accidents

Accidents usually affect employers. However, it is important to identify that accidents affect not only the employer but all the key stakeholders of the construction industry. The ones that are directly affected by accidents whenever they occur are workers. It is always very important to recognize that whenever an accident occurs on any construction site, the workers are the ones mostly affected as they are directly linked to the works. The serious effects of these accidents may either be death, injury and illness which cost workers their present or prolonged health and in future affect the extended families. Fig 2.1 shows the stakeholders affected by accidents.

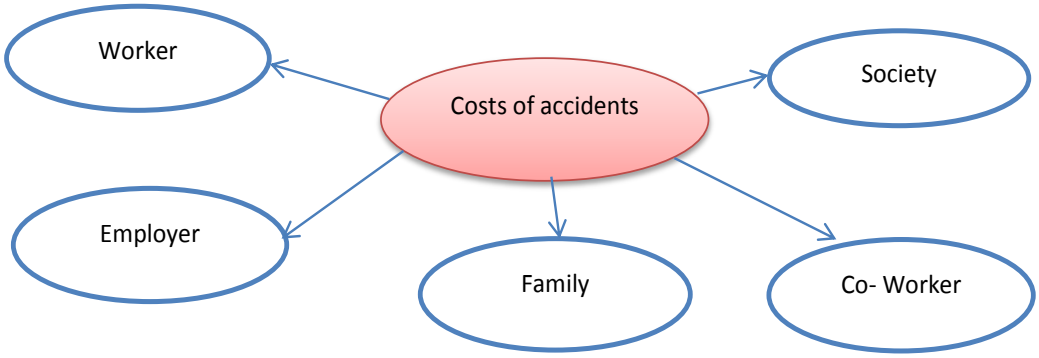

Figure 2.1: Stakeholders affected by cost of accidents (Feng, 2011).

2.12. Cost calculation

Safe Work Australia (2012b) in Zou & Sunindijo, (2015) identified the following seven (7) steps of cost calculations.

1. Identify the major categories of economic costs borne by economic agents (employers, workers and the community).
2. Determine the best source of measurement for each cost item.
3. Define the levels of severity of injury or disease to differentiate between incidents with different cost structures
4. Identify which cost items apply to each severity category.
5. Determine the number of incidents which fall into each severity category, and the average duration of time lost for a typical incident in each category.
6. Calculate the average cost of a typical incident in each severity category by aggregating the typical costs associated with each cost item.
7. Calculate the total cost of all work-related incidents by combining the typical cost of an incident with an estimate of the number of such incidents and aggregating over all classes of incidents.

2.13. Conclusion

Despite efforts being done on the awareness of health and safety, knowledge being gained from various acts and regulations that exist and which arguably should, if complied with, improve health and safety performance on construction sites, a lot of serious accidents

continue to occur. These accidents occur as a result of unsafe acts, unsafe conditions and by management. Construction accidents are more costly than what people think as they carry with them hidden costs. These hidden costs are also known as indirect costs which are usually significantly higher than direct costs. Authors have comprehensively classified costs of construction accidents in different parts of the world and in turn ended up with a huge list of costs of construction accidents. All in all, the costs still fall under direct and indirect costs. Moreover, several numbers of studies concerning costs of construction accidents have been conducted especially in developed countries with the emphasis of trying to curb accidents to avoid costs.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

This chapter presents the methodology used to carry out the research presented in this dissertation in order to address the defined study aim and objectives. The main aim of the study is to determine the costs incurred as a result of accidents on project and the effects of these costs on the overall progress of the project. The chapter highlights the various methodologies that were adopted. It further explains how the problem was investigated and describes the tools used to undertake the investigation. It also describes the characteristics of the research sample and the methods of data analysis used.

3.2.Research methods

There are several research methods that exist and what determines the type of research methods that one will use is what one is researching about. According to Kothari (2004) Data collection techniques can broadly fall under primary and secondary classifications.

3.3.Primary technique

This is the form of data collection by the researcher for the research. Nkhata (1997) describes some of the primary techniques methods as observations, interviews and administration of questionnaires.

3.3.1. Observation

Observation method is one of the commonly used methods especially if one is dealing with behavioral sciences. Under this method, information by researcher is sought by direct observation without getting to ask any questions from the respondent.

Advantages

i. There is enough time for one to reflect on what he is observing
ii. Works well when one is trying to determine the behavioral changes
iii. Bias is eliminated
iv. Its accurate

v. One gets information of what is currently happening.

vi. It is not complicated

vii. It is not influenced by either the past behavior, future intentions or altitudes

Disadvantages

i. It is expensive

ii. Limited information provided by this method

iii. Data isn't effectively collected as some people are rarely accessible to direct observation. (Kothari, 2004)

According to Nkhata (1997), there are various types of observation approaches that a researcher can use which include:

3.2.2 Complete observation

In this case of observation, the researcher hides his identity to such an extent that the group being observed doesn't know that they are being observed. This is so because the researcher behaves in the same way as the group is behaving. This allows the researcher to obtain the exact picture of the group's behavior

Disadvantage

i. Can cause adverse effects if the researcher's behavior arouses suspicion.

3.2.3 Participant observation

In this research, the researcher's identity and role is known. The group is aware of what is happening and the objective of the study is known.

Advantage

i. Minimizes the risk of role pretending.

This research used participant observation. This was achieved through observing the way employees were working, if they were adhering to the health and safety rules & regulations

and their altitude towards work. This helped gather enough information to use in the findings.

3.2.4 Case study

Case studies involve detailed investigation of real life situations. They provide a way of organizing data and looking at the objects to be studied as a whole. The objective of the case study method is to locate the factors that account for the behavior-patterns of the given unit as an integrated totality. Kothari (2004) describes it as an in-depth study rather than breadth.

Advantages

i. Helps us understand the behavior pattern of the concerned unit.
ii. It helps in formulating relevant hypotheses along with the data which may be helpful in testing them.
iii. It allows the use of different research methods depending on the circumstance.

Disadvantage

i. Information gathered under case study scenario is often not comparable.
ii. It mostly creates a danger of false generalization due to the fact that no set rules are followed in collection of the information.
iii. It is expensive and consumes a lot of time as one has to study the natural history cycles of individuals.
iv. Case study method is based on several assumptions which may not be very realistic at times, and as such the usefulness of case data is always subject to doubt (Kothari, 2004)

In this case, detailed questionnaires were given to employees who outlined the work history. Employees gave a scenario on the accidents they were involved in, what their experience was and their costs implications. Each incidence was narrated broadly bringing out the information on accidents and costs aspects

3.2.5 Survey research

This method of research involves the administration of questionnaires to a sample selected from a population. Interviews and questionnaires are the methods employed under this method of research.

a) Interviewing

This method involves collecting data in oral presentation where the researcher requires to get a response from the respondent. This method can be used through personal interviews and, if possible, through telephone interviews

Advantages

Allows clarification of issues.

i. It's flexible as languages can be adjusted in order to suit the educational level of the person being interviewed.
ii. Misinterpretations are avoided concerning questions.
iii. Gives a higher response rate than written questionnaires.
iv. There is greater flexibility under this method as the opportunity to restructure questions is always there, especially in case of unstructured interviews. (Kothari, 2004).

Disadvantages

i. The presence of the interviewer may influence responses.
ii. Personal interviews are costly in terms of time and money.
iii. Certain types of respondents such as important officials or executives or people in high income groups may not be easily approachable under this method and to that extent the data may prove inadequate.(Kothari, 2004).

Interviews in this research were conducted to employees. This was done in order to help gather accurate information as most employees were illiterate. Questions concerning their accident experience and related questions were asked and responded to very diligently.

b) Questionnaires

This type of method involves the use of written questions that are presented to the respondent who is required to respond to the questions in a written form. This method of data collection has proven to be very popular, particularly in the cases of big enquiries (Kothari , 2004). According to Achola and Bless (1988), there are two (2) types of questionnaire survey namely:

- Self-administered questionnaire which is posted to the respondent and returned completed; and
- An administered questionnaire which is delivered by the interviewer.

Advantages

i. It is not very expensive and can widely spread geographically.
ii. There is no bias of the interviewer as answers are in respondents own words.
iii. It creates adequate time for respondent to give well thought out answers.
iv. In cases of circumstances were respondents are not easily approachable, it is a good way of reaching out to them.(Kothari, 2004)

Disadvantages

i. In certain instances, it can create a low rate of return of the duly filled in questionnaires.
ii. It cannot be used by any respondent apart from the educated and cooperating.
iii. Once questionnaires are sent to the respondent, the researcher loses control over it.
iv. There is also the possibility of ambiguous replies or omission of replies to certain questions.
v. It is difficult to know whether willing respondents are truly representative.
vi. It is one of the slowest methods (Kothari, 2004)

There are two (2) types of questions used in questionnaires;

- Open ended
- Closed- ended or structured questions (Achola and Bless, 1988)

Open ended

These are designed in order not to limit the respondent to certain stated alternatives. They permit a free response from the respondent thereby giving him enough room to respond in their own words (Kothari, 2004).These type of questions are very important to a researcher especially when he tries to get information on opinions, suggestions, attitude and reactions to sensitive issues (Achola and Bless, 1988).

Advantages

i. Issues that may not have been asked may be explored, thereby allowing the researcher to gain more information.
ii. They permit self-expression, and abundance of detail.
iii. Due to the fact that information is given spontaneously, information given is more likely to be true.

Disadvantages

i. Analysis of information based on open-ended questions can be time consuming.
ii. It is proves to be tedious especially when analyzing non numeric responses.
iii. Different respondents give different answers which makes coding responses a difficult task.

Closed-ended or structured questions

These type of questions offer a list of options from which the respondent can choose which answer is more appropriate. The options must be exhaustive and stiff (Achola and Bless, 1988).

Advantages

i. It is a quick way of recording answers.
ii. It makes analysis of answers very easy for the researcher.
iii. Answers from different respondents are easier to compare.

Disadvantages

i. Respondents with no or little knowledge can still answer which makes it hard to have correct answers.
ii. Respondents may choose options that they might otherwise not have thought of especially if the options are not exhaustive.
iii. It is not a way of getting accurate answers due to the fact that even marking the wrong response is possible.
iv. Respondents may at times lose interest and suffer from boredom

3.3.Secondary technique

Kothari (2004) defines secondary technique as a method of collecting data which has already been collected and analyzed by someone else. This technique makes the researcher access data that is readily available and thereby making him a secondary user.

Advantages

i. It is inexpensive as the data is already in existence.
ii. It permits the analysis of trends such as traffic or population growth (Bryman, 2001).

Disadvantages

i. Ethical issues of confidentiality might make certain information not to be availed to the researcher especially issues to deal with the government.
ii. Information may be incomplete and imprecise (Bryman, 2001).
iii. Large samples can be made use of and thus the results can be made more dependable and reliable.

Questionnaires were used in the research in order to get in depth information concerning the welfare of the employees. Both open and closed questionnaires were used to collect the information.

3.4.Research design

This study was designed to address the problem statement and achieve the objectives. The study utilized the use of a comprehensive literature review. It was viewed important that a huge amount of literature with regard to the subject be reviewed and be incorporated into the

study. This was seen as being helpful in giving light on the amount of work done on the subject by other researchers as well as the recent trends on the subject. Data collection was done through case studies, interviews as well as through questionnaires and later analyzed and interpreted

3.5. Sampling technique

A random sampling technique was conducted which involved 100 individuals from different construction companies in Zambia. These individuals included 50 employers and 50 employees from construction companies ranging from grade one to grade six. Companies targeted included both civil and building works.

3.6. Literature review

Collection of secondary data on the subject was treated very important in order to understand the subject better as well as to keep tabs on similar works by other researchers. The sources of information used in research should be of high quality, relevant and valid. It is thus essential to obtain the said information from highly trusted sources. Below are some of the sources of information for literature review:

- **Journal articles**

Offer a good source of up-to-date and verifiable information as they are published on a regular basis, usually on monthly or quarterly basis. This is a very credible source of information as an editorial board reviews articles to decide whether they should be accepted or not in the journal.

- **Books**

Tend to be less up-to-date as it takes longer for a book to be published than for a journal article. Text books are unlikely to be useful for literature review as they are intended for teaching, not for research, but they do offer a good starting point from which to find more detailed sources (Kaliba, 2010).

- **Conference proceedings**

Provides latest research and often times research that has yet to be published. The research/papers are also of high quality and reliability as the papers are subjected to a process of review before they are accepted in the proceedings.

- **Newspapers**

Are generally intended for a general and not specialized audience, the information they provide will be of very limited use for literature review (Kaliba, 2010). Often newspapers are more helpful in providing current information about international, national, local and community events.

- **Thesis and dissertations**

Offer a useful source of information though they are hard to access.

- **The Internet**

Is both the fastest-growing and the biggest single source of information in the world with the easiest access The content of the information obtained via internet is of extremely variable quality though one has to be very careful which information to get because anyone can post information on the internet and as a result the quality of some of the contents may not be reliable.

- **Magazines**

Intended for a general audience are unlikely to be useful in providing the sort of information one needs. Specialized magazines may be of use, but usually magazines are not dependable sources for research except as a starting point by providing news or general information about new discoveries, policies, etc. that one can further research on in more specialized sources (Kaliba, 2010).

From the brief highlighted on the sources of information, literature review was carried out through the use of academic journals, internet institution publications, and seminar and conference papers.

3.7.Data collection

i) Interviews

Interviews were conducted with the employees who have once been involved in construction accidents and site managers for the selected construction companies ranging from grade one (1) to six (6). A total of up to hundred (50) participants were targeted. The interviews were used as a tool to obtain further information on causes of construction accidents and the costs that were incurred during the accident.

ii) Questionnaire Survey

The self-administered questionnaire survey was adopted as the main research instrument for the quantitative part of the research. This method proved most suitable as it presented the best option for data collection. A total of fifty (50) questionnaires were distributed. This method also allowed an opportunity even for the top executives and the staff of the contractors that are not easily approachable to take part in the survey. By nature of its structure as well as the assurance of anonymity of the respondents assured, the participants were able to respond freely and without bias to the questionnaires and thus enhancing the reliability of the data obtained.

The final stage involved the approval of the questionnaire by the supervisor. The questionnaire was then subjected to a pre-test in which five potential respondents were asked to fill in the questionnaire in order to examine the level of clarity, and ending with an approval procedure by the research supervisor.

3.8. The survey sample

The population sample of this research was composed of two parties: employers (contractors) and employees (workers) working on construction projects in Zambia. This research used a random sampling method of 50 companies amongst which were building and civil projects. A sample of 50 construction related accidents were selected and analyzed. The case studies were conducted on 50 construction sites in Lusaka that are registered with National Council for construction (NCC). A list of construction companies obtained from National Council of Construction (NCC) and had 175 firms registered and domiciled in

Lusaka and was used to randomly select the 50 companies using systematic random sampling. On each site an employer questionnaire was administered including one employee questionnaires responded by those who had experienced an accident before. In the case of a fatal accident the employee questionnaire was answered by the employer because of the difficulty in tracing the deceased family.

3.9. Methods of data analysis

Data collected from the survey was analyzed using descriptive statistical techniques. An advanced and accurate analysis method was needed to arrange the large body of data in a systematic, fast and reliable way. For this purpose the computer software Statistical Package for Social Science (SPSS) version 11 and Excel were chosen as the best options available. Employee data was captured using Microsoft excel and analyzed using pivot tables. For further review, questions were asked to the contractor in order to find out if they paid for various costs of accidents observed. Analysis of the employer data was done in excel by use of cross tabulations and the related chi-square analysis.

Table 3.1: Sample of excel entries

CS	Employee's job function	Type of accident	Classification of accident	Who paid for the injury	Amount (ZMW)	Type of Expense
1	Electrician	Nailing of hand	Minor	employee	50.00	Medical Cost
1	Electrician	Nailing of hand	Minor	employer	20.00	Medical Cost
1	Electrician	Nailing of hand	Minor	employer	200.00	Salary Paid without Work
3	Stone crusher	Contact with machine	Major	employee	20.00	Transport Costs
3	Stone crusher	Contact with machine	Major	employer	500.00	Medical Cost
3	Stone crusher	Contact with machine	Major	employer	300.00	Transport Costs
3	Stone crusher	Contact with machine	Major	employer	1,700.00	Salary Paid without Work
4	Bricklayer	Fall from scaffold	Major	employee	200.00	Medical Cost
4	Bricklayer	Fall from scaffold	Major	employee	36.00	Transport Costs
4	Bricklayer	Fall from scaffold	Major	employer	608.00	Transport Costs
4	Bricklayer	Fall from scaffold	Major	employer	100.00	Medical Cost
4	Bricklayer	Fall from scaffold	Major	employer	70.00	Transport Costs
4	Bricklayer	Fall from scaffold	Major	employer	608.00	Salary Paid without Work

The employer data was entered using excel and summarized using pivot tables. In order to use pivot tables, each expenses recorded on all the fifty cases were supposed to be described fully in a row. For instance case study number one had three expenditures, a K50 paid by the employer, a K20 paid by the employees, and a K200 salary paid by the employer to a worker on sick leave. These expenses were captured separately in separate rows. For each expenditure, a full description of each in terms of year of accidents, employee function, type of accident and who paid the injury and type expenses was done. This means that case study number one was described in three rows. Table 3.1 shows a sample of how excel entries looked like in the excel database for only case study number one, number three and number four. Case study number three had four expenses. Transport cost borne by the employee, medical cost paid by the employer, and transport cost paid by the employer and a salary without work paid by the employer. Case study number four had six expenses respectively. Table 3.1 gives an example of how the data was entered in excel to come up with the pivot tables. This kind of classification is critical if the data is to be described using Pivot tables.

3.10 Conclusion

This chapter presented the methodology used to carry out the research and address its aims and objectives. Various methodologies that could be employed to achieve research of the nature of this study were highlighted in this chapter. The chapter further detailed an explanation of how the problem was investigated as well as the tools used to achieve the investigation. The nature of the research sample as well as the method of data analysis used in the study was also described.

CHAPTER FOUR: FINDINGS, ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter presents the findings of the analysis of the sample of 50 accident reports and 50 cost reports from employees. Copies of the actual investigation reports, because of their highly confidential nature, could not be included in the dissertation. However, the findings have been aggregated and presented in summary form. Fifty workplace accidents were investigated from various work places and locations in Zambia. The 50 case studies comprised an almost equal mix of private and public works in the construction industry. The injured employees were from a range of occupations and the work based accidents were categorised into falls, cuts, burns, electrical, exertion, poisoning and struck by. The accidents occurred between the years 2008 to 2016. Forty nine (49) of the injured employees were male and one (1) was female.

4.2 Costs of workplace accidents to employers

The case studies show that a wide range of negative costs and effects resulted from the accidents. The employers were affected by a variety of costs as a result of employee accidents. Employer costs from the accidents came from lost salary, compensation, medical, funeral, burial, transport, hospitalization, sick pay and communication.

4.3 Costs and effects of workplace accidents to employees

The amount of money lost by employees varied greatly. Over half (35) employees did not lose any money. 15 employees lost money and the amounts varied between ZMW4.00to ZMW 2,001.00. The average loss of these 15 employees was approximately ZMW 399.00. For an employee on site, this amount (ZMW399.00) is very significant to them due to the fact that an employee gets an approximate of ZMW500.00 as their monthly income. Where employees lost money, the largest proportion, approximately 40%, was due to lost salary. In addition five employees lost their lives as a result of the accident and their compensation was given at an average of ZMW 10,800 for each. Each accident had personal consequences for the employee and they all endured pain and suffering to various degrees. For five employees the negative physical consequences of the accident are permanent.

In order to come up with average cost of accidents, a total of 50 accidents were critically reviewed. The case studies were conducted on 50 construction sites in Lusaka. A list of construction companies obtained from National Council of Construction (NCC) was used to randomly select the 50 companies and on each site an employer questionnaire was administered including one employee questionnaires responded by those who had experienced an accident before. In the case of a fatal accident the employee questionnaire was answered by the employer because of the difficulty in tracing the deceased family.

Table 4.1 shows the raw data collected from employees. It shows the 50 different accidents recorded from different construction sites. It shows the case study number, employee's job function, type of accident and the accident category.

Table 4.1: Case study number, employee job function, year of accident, accident type and accident category

Case study number	Year of Accident	Employee's job function	Accident type	Accident category
1	2009	Electrician	Nailing the hand	Electrical
2	2009	Machine operator	Fall from scaffold	Fall
3	2013	Stone crusher	Contact with machine	Cut
4	2011	Bricklayer	Fall from scaffold	Fall
5	2013	Carpenter	Slip from roof	Fall
6	2011	Carpenter	Contact with circular saw	Cut
7	2013	Steel Fixer	Fall from scaffold	Fall
8	2014	Cook	Burn from water	Burn
9	2015	Carpenter	Cut finger with saw	Cut
10	2016	Scaffolder	Fall from scaffold	Fall
11	2013	Painter	Fall from scaffold	Fall
12	2013	Electrician	Fall from ladder	Fall
13	2014	Bricklayer	Struck by steel	Struck by
14	2014	Bricklayer	Fall from scaffold	Fall
15	2014	Helper	Fall from scaffold	Fall
16	2009	Painter	Fall from scaffold	Fall
17	2009	Electrician	Fall from a ladder	Fall
18	2010	Supervisor	Electrocution	Electrical
19	2009	Foreman	Struck by falling canopy	Struck by

Case study number	Year of Accident	Employee's job function	Accident type	Accident category
20	2014	Helper	Struck by falling timber	Struck by
21	2015	Helper	Fall into a swimming pool trench	Fall
22	2011	Helper	Drunk contaminated water	Poisoning
23	2009	Painter	Stuck in an ATM room	Exertion
24	2015	Electrician	Cut thigh from chiseling the wall	Cut
25	2014	Electrician	Hit his testicles from fall	Fall
26	2013	Carpenter	Fall from scaffold	Fall
27	2013	Helper	Twist ankle on scaffold	Exertion
28	2013	Helper	Cut off his hand with grinder	Cut
29	2013	Helper	Glass squeezed legs	Exertion
30	2013	Helper	leg of tower hit foot	Exertion
31	2013	Helper	Broken cutting disc hit and removed eye	Exertion
32	2013	Site clerk	Steel truss fell on leg	Exertion
33	2013	Site clerk	Fall due to slab collapse	Fall
34	2013	Helper	Specks from grinder entered eye	Exertion
35	2010	Helper	Cut off finger by grinder	Cut
36	2014	Carpenter	Hit finger with two inch nail	Exertion
37	2010	Bricklayer	twist of ankle due to fall from man-made scaffolds	Fall
38	2014	Helper	Hit leg with a pick	Exertion
39	2011	Supervisor	Fall from scaffold as result of an electric shock	Fall
40	2014	Helper	Hit armored cable and got electrocuted	Electrical
41	2015	Helper	Fall from scaffold	Fall
42	2016	Welder	Cut his finger with grinder	Cut
43	2011	Helper	Fall in trench	Fall
44	2009	Helper	Leg hit with steel	Exertion
45	2009	Helper	Twist of ankle	Exertion
46	2009	Plumber	Leg hit with manhole cover	Exertion
47	2015	Bricklayer	Fall from ladder	Fall
48	2010	Plant operative	Fall from storage ranking	Fall
49	2014	Helper	Burn	Burn
50	2014	Helper	Cut wrist with grinder	Cut

The 50 different types of accidents were further summarized in the categories as shown in table 4.2.

From table 4.2, it shows the fifty accidents that were surveyed These accidents were further categorized into falls, exertion, cuts, burns, struck by, poisoning and electrical. Furthermore, the table above shows the accident category and how many accidents happened in each category. It is evident that the accidents involving the highest incidence were falls with 42%, exertion at 24% and cuts at 16%.

Employees were probed on various details about all the individual expenses they incurred during the episode of their accidents. Information sought included the year in which the money was spent; whether the money was spent on a fatal, minor or major accident and the broad category of the expense.

The data was entered using excel and summarized using pivot tables. In order to use pivot tables, each expenses recorded on all the fifty cases are supposed to be described fully in a row. For instance case study number one had three expenditures, a K50, a K20, and a K200. These expenses were described separately in a separate row. For each expenditure, a full description of each in terms of year of accidents, employee function, type of accident and who paid the injury and type expenses was done. This implies that case study number one was described in three rows. The table below shows a sample of how excel entries look like in the excel database for only case study number one, number three and number four. Case study number three had four expenses. Transport cost borne by the employee, medical cost paid by the employer, and transport cost paid by the employer and a salary without work paid by the employer. Case study number four had six expenses respectively

Table 4.2: Number of accidents in different categories

Nature of accidents	Accident
Burn	2
Cuts	8
Electrical	3
Exertion	12
Fall	21
Poisoning	1
Struck by	3
Total	50

Table 4.3 gives an example of how the data was entered in excel to come up with the pivot tables.

Table 4.3: Example of excel entry

Case Study	Employee's job function	Type of accident	Classification of accident	Who paid for the injury	Amount (ZMW)	Type of Expense
1	Electrician	Nailing of hand	Minor	employee	50.00	Medical Cost
1	Electrician	Nailing of hand	Minor	employer	20.00	Medical Cost
1	Electrician	Nailing of hand	Minor	employer	200.00	Salary Paid without Work
3	Stone crusher	Contact with machine	Major	employee	20.00	Transport Costs
3	Stone crusher	Contact with machine	Major	employer	500.00	Medical Cost
3	Stone crusher	Contact with machine	Major	employer	300.00	Transport Costs
3	Stone crusher	Contact with machine	Major	employer	1,700.00	Salary Paid without Work
4	Bricklayer	Fall from scaffold	Major	employee	200.00	Medical Cost
4	Bricklayer	Fall from scaffold	Major	employee	36.00	Transport Costs
4	Bricklayer	Fall from scaffold	Major	employer	608.00	Transport Costs
4	Bricklayer	Fall from scaffold	Major	employer	100.00	Medical Cost
4	Bricklayer	Fall from scaffold	Major	employer	70.00	Transport Costs
4	Bricklayer	Fall from scaffold	Major	employer	608.00	Salary Paid without Work

Table 4.4 shows that for all the 50 cases reviewed 15 reported not to have spent anything while 35 reported at least one form of expense.

Table 4.4: Costs incurred per type of accident

Case study	Year of Accident	Employee's job function	Accident type	Type of accident			Cost of expenditure	Accident category
				F	MJI	MII		
1	2009	Electrician	Nailing the hand	-	-	√	271.00	Electrical
2	2009	Machine operator	Fall from scaffold	-	-	√	No cost incurred	Fall
3	2013	Stone crusher	Contact with machine	-	√	-	2,520.00	Cut
4	2011	Bricklayer	Fall from scaffold	-	√	-	1,622.00	Fall
5	2013	Carpenter	Slip from roof	-	√	-	5,400.00	Fall
6	2011	Carpenter	Contact with circular saw	-	√	-	12,550.00	Cut
7	2013	Steel Fixer	Fall from scaffold	-	-	√	No cost incurred	Fall

8	2014	Cook	Burn from water	-	-	√	295.00	Burn
9	2015	Carpenter	Cut finger with saw			√	10.00	Cut
10	2016	Scaffolder	Fall from scaffold	-	-	√	No cost incurred	Fall
11	2013	Painter	Fall from scaffold		√		3,260.00	Fall
12	2013	Electrician	Fall from ladder	-	-	√	No cost incurred	Fall
13	2014	Bricklayer	Struck by steel	-	-	√	No cost incurred	Struck by
14	2014	Bricklayer	Fall from scaffold	-	-	√	No cost incurred	Fall
15	2014	Helper	Fall from scaffold	-	-	√	570.00	Fall
16	2009	Painter	Fall from scaffold	√	-	-	18,100.00	Fall
17	2009	Electrician	Fall from a ladder	-	√	-	5,050.00	Fall
18	2009	Supervisor	Electrocution	√	-	-	29,400.00	Electrical
19	2010	Foreman	Struck by falling canopy	-	√	-	644.00	Fall
20	2014	Helper	Struck by falling timber	-	√	-	1,390.00	Struck by
21	2015	Helper	Fall into a swimming pool trench	-	-	√	-	Fall
22	2011	Helper	Drunk contaminated water	-	√	-	632.24	Poisoning
23	2009	Painter	Stuck in an ATM room	-	√	-	No cost incurred	Exertion
24	2015	Electrician	Cut thigh from chiseling the wall	-	√	-	No cost incurred	Cut
25	2014	Electrician	Hit his testicles from fall	√	-	-	9,200.00	Fall
26	2013	Carpenter	Fall from scaffold	-	√	-	1,830.00	Fall
27	2013	Helper	Twist ankle on scaffold	-	-	√	-	Exertion
28	2013	Helper	Cut off his hand with grinder	-	√	-	772.00	Cut
29	2013	Helper	Glass squeezed legs	-	√	-	650.00	Exertion
30	2013	Helper	leg of tower hit foot	-	-	√``	650.00	Exertion
31	2013	Helper	Broken cutting disc hit and removed eye	-	√	-	8,300.00	Exertion
32	2013	Site clerk	Steel truss fell on leg	-	-	√	350.00	Exertion
33	2013	Site clerk	Fall due to slab collapse	-	-	√	5.00	Fall
34	2013	Helper	Specks from grinder entered eye	-	√	-	No cost incurred	Exertion
35	2010	Helper	Cut off finger by grinder	-	√	-	1,700.00	Cut
36	2014	Carpenter	Hit finger with two inch nail	-	-	√	No cost incurred	Exertion
37	2010	Bricklayer	twist of ankle due to fall from man-made scaffolds	-	-	√	No cost incurred	Fall
38	2014	Helper	Hit leg with a pick	-	-	√	550.00	Exertion
39	2011	Supervisor	Fall from scaffold as result of an electric	√	-	-	18,000.00-	Fall

			shock					
40	2014	Helper	Hit armored cable and got electrocuted	√	-	-	13,500.00-	Electrical
41	2015	Helper	Fall from scaffold	-	-	√	80.00	Fall
42	2016	Welder	Cut his finger with grinder	-	-	√	4,750.00-	Cut
43	2011	Helper	Fall in trench	-	-	√	10.00	Fall
44	2009	Helper	Leg hit with steel	-	√	-	10.00	Exertion
45	2009	Helper	Twist of ankle		-	√	20.00	Exertion
46	2009	Plumber	Leg hit with manhole cover	-	-	-	No cost incurred	Exertion
47	2015	Bricklayer	Fall from ladder	-	-	√	No cost incurred	Fall
48	2010	Plant operative	Fall from storage ranking	-	√	-	350.00	Fall
49	2014	Helper	Burn	-	√	-	50.00	Burn
50	2014	Helper	Cut wrist with grinder	-	√	-	150.00	Cut
TOTAL				**5**	21	**24**	**142,641.24**	
F: fatal; MJI: Major Injury; MII Minor Injury								

Table 4.4 shows that out of 50 case studies, five had fatal accidents. The total cost of the fatal accidents was ZMW 88, 200.00. The highest amount spent (ZMW29, 400.00) involved case number 18 which is an electrical case and the lowest amount spent (ZMW 9,200) involved case number 25 which is a fall.

Furthermore, the results show that they were 16 major accidents with the total cost of ZMW 46,820.24. The highest amount spent (ZMW 12,550) was on case number 16 which involved a fall. Furthermore, the table shows the lowest amount spent (ZMW 150) on case number 50 which involved a cut.

In addition, the table above shows that they were 14 minor accidents with a total cost of ZMW 7,621.00.We can conclude from table 4.10 that fatal accidents incur very huge costs on most construction sites and for this reason, employers have to make sure that they avoid them by all costs.

Table 4.5: Distribution of costs according to trade

Sum of Amount	Column Labels			
Row Labels	**Fatal**	**Major**	**Minor**	**Grand Total**
Bricklayer		1,622.00		1,622.00
Carpenter		19,780.00	10.00	19,790.00
Cook			295.00	295.00
Electrician	9,200.00	5,050.00	271.00	14,521.00
Foreman		644.00		644.00
Helper	13,500.00	13,594.24	1,940.00	29,034.24
Painter	18,100.00	3,260.00		21,360.00
Plant operative		350.00		350.00
Site clerk			355.00	355.00
Stone crusher		2,520.00		2,520.00
Supervisor	47,400.00			47,400.00
welder			4,750.00	4,750.00

Table 4.5 shows the different trades that were involved in the recorded accidents and the amount of money spent on these trades. The highest amounts spent were on the supervisor (ZMW 47,400), helper (ZMW 29,034.24), painter (ZMW 21,360.00), carpenter (ZMW 19,790.00) and electrician (ZMW 14,521.00). The lowest amounts were spent on the cook (ZMW 295.00), plant operative (ZMW 350.00), site clerk (ZMW 355.00) and foreman (ZMW 644.00). This simply shows that on a typical construction site, the trade that is prone to accidents is mostly the helper and this is all because of the nature of his job as he is found almost everywhere on construction sites. On the other hand, the supervisor seems to incur a larger sum due to the fatal accident that was involved.

Table 4.6: Distribution of costs expenses spent on each accident

From table 4.6 it is very evident that from the 50 accidents recorded, 35 accidents had 102 expenses on the accidents and 15 had none. The highest expense were recorded on medicals (33), transport (23) and lost salary (22). This is so because any injured person has to be transported to the hospital and has to be given medical attention for him to get cured. Furthermore, major accidents had the largest expenses with 55 followed by minor with 25

and fatal with 22. The reason that major accidents had the largest expenses is due to the fact that they are the most occurrence accidents on most construction sites.

Expenses	**Fatal**	**Major**	**Minor**	**Grand Total**
Burial	5	1		6
Communication	1	1		2
Compensation	5	2	1	8
Funeral	5			5
Hospitalization	1			1
Lost salary	1	16	5	22
Medical	1	18	15	34
Sick pay		1		1
Transport	3	16	4	23
Grand Total	22	55	25	102

Table 4.7 shows that out of the 102 expenditures studies 76 were paid by employers while 26 were borne by the employees.

Table 4.7: Expenses paid by employer and employee

Who Paid for Expenses	Fatal	Major	Minor	Grand Total
Employee		13	13	26
Employer	22	42	12	76
Grand Total	22	55	25	102

Out of the 76 expenses by the employers 22 were spent on fatal accidents, 42 were on major accidents while 12 were spent on minor accidents. As for the 26 expenses by the employees 13 were on major accidents while the other 13 were on spent on minor accidents. The distribution of these expenses for the employer is clearly shown in the table below.

Table 4.8: Distribution of accident by various costs components

Type of expense	Fatal	Major	Minor	Grand Total
Compensation	5	2	1	8
Hospitalization	1			1
Sick pay		1		1
Medical Cost	1	14	4	19
Salary Paid without Work	1	14	4	19
Transport Costs	3	10	3	16
Cost of Communication	1	1		2
Cost Burial Procession	5			5
Funeral Expenses	5			5
Grand Total	22	42	12	76

Table 4.9 shows the total expenditure on accidents for each categories of expenditure

Table 4.9: Total expenditure by category paid by Employers

Costs incurred from	Fatal	Major	Minor	Grand Total
Compensation	54,000.00	11,000.00	3,000.00	68,000.00
Hospitalization	300.00			300.00
Sick pay		300.00		300.00
Medical Cost	200.00	3,775.00	970.00	4,945.00
Salary Paid without Work	4,500.00	25,595.12	2,071.00	32,166.12
Transport Costs	1,200.00	1,745.00	650.00	3,595.00
Cost of Communication	100.00	50.00		150.00
Cost Burial Procession	17,800.00			17,800.00
Funeral Expenses	10,100.00			10,100.00
Grand Total	**88,200.00**	**42,465.12**	**6,691.00**	**137,356.12**

Table 4.9 shows for instances that there were five payments for compensations for fatal accidents amounting to ZMW 54,000.00. this implies that the average payments for a typical

company on compensation is ZMW 54,000 divide by 5 giving us K10,800.00 for fatal accidents, K5,500.00 for major accidents and about K3,000.00 for minor accidents

Table 4.10 summarizes the average expenses for a typical firm that pays the categories in the first column in the table below

Table 4.10: Average expenditure by category paid by employers

Type of expense	Fatal	Major	Minor
Compensation	10,800.00	5,500.00	3,000.00
Hospitalization	300.00	-	-
Sick pay	-	300.00	-
Medical Cost	200.00	269.64	242.50
Salary Paid without Work	4,500.00	1,828.22	517.75
Transport Costs	400.00	174.50	216.67
Cost of Communication	100.00	50.00	-
Cost Burial Procession	3,560.00	-	-
Funeral Expenses	2,020.00	-	-

Source: Research Survey Data

The graph shows that during a typical episode of an accident and if it's a policy of the company to pay for compensation, hospitalization, medical Cost, paid the salary without Work, transport costs cost of communication, cost burial procession, funeral expenses, a typical company would spend on average ZMW21, 880.00 on a fatal accident and ZMW 8,122.36 on a major accidents. For a minor accident it would cost about ZMW3, 976.92 on average. The distribution of average amount spent is shown in figure 4.1.

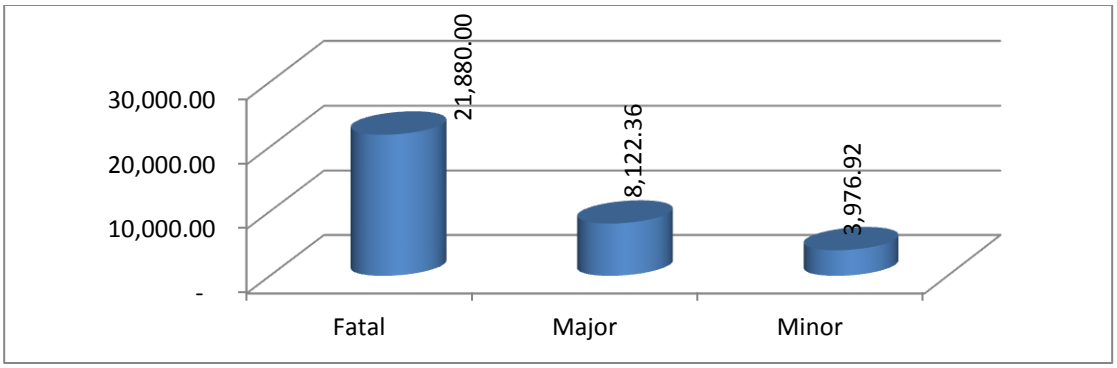

Figure 4.1: Average amounts spent on accident

From figure 4.1, there is a significant difference in amounts between fatal and major, major and minor. This is all because the major and minor accidents did not have compensation expense.

Out of the ZMW21,800.00 that could be spent on fatal accident about 49.4% goes to compensation, 20.6% goes to paying a salary without work while the cost of burial procession and funeral expenses would take up roughly 16.3 and 9.2%. Other cost like transport, hospitalization and communication make up less than 3%.This is illustrated in table 4.2.

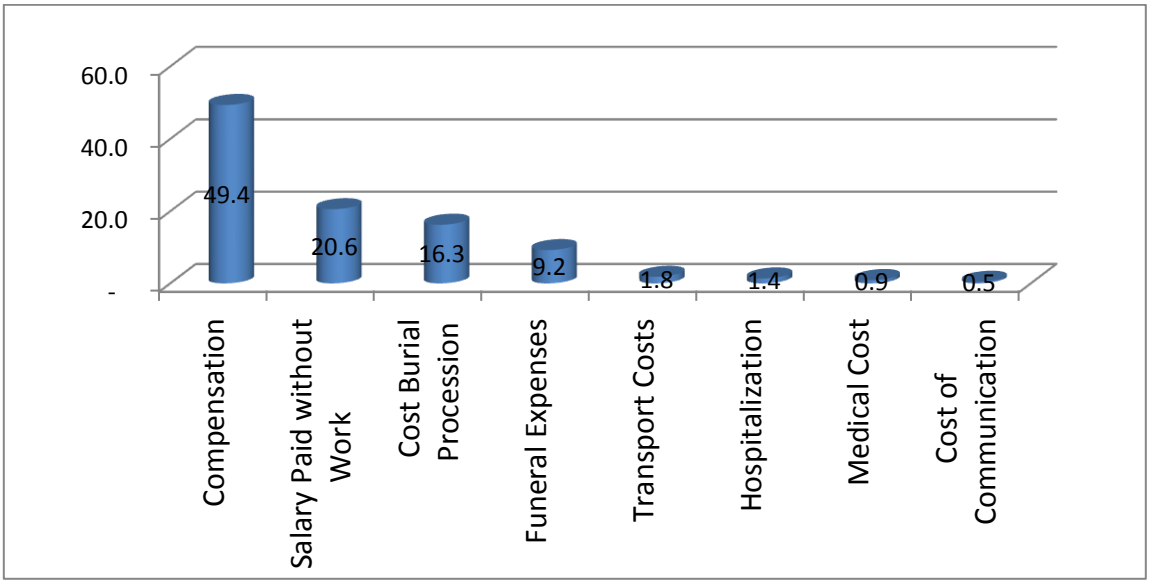

Figure 4.2: Distribution of costs on fatal accidents

Figure 4.3 shows the likely distribution of the ZMW 8,122.36 that was spent on major accidents. The graph shows that the major cost drivers in the case of a major accident is compensation and the lost salary due to paying an individual who is not working during the episode of injury due to an accident

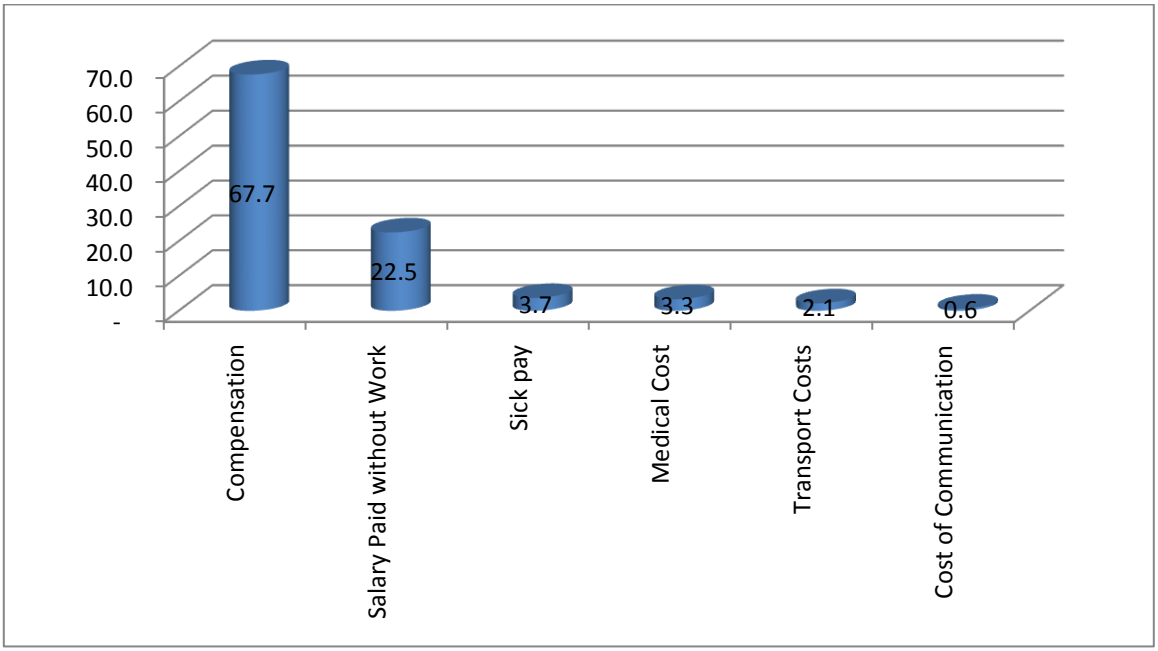

Figure 4.3: Percentage distribution of costs on major accidents

The graph in figure 4.4 shows the likely distribution of the ZMW 3,976.92 that was spent on a typical case of a minor accident. The graph shows that the major cost drivers in the case of a minor accident is also compensation and the lost salary due to paying an individual who is not working during the episode of injury due to an accident.

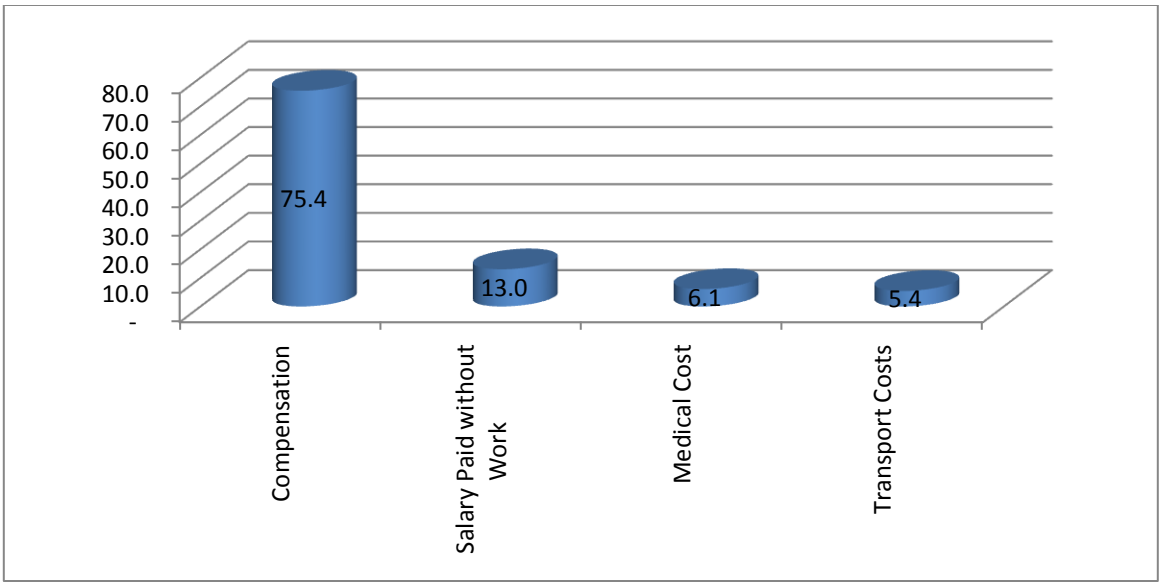

Figure 4.4: Percentage distribution of costs on minor accidents

Using similar analysis the cost incurred by a typical employee on a major accident is medical cost and transport cost while that of minor accident is also medical and transport cost which by comparison with that of the employee is negligible

Table 4.11: Average cost of accidents by employees

Expense	Major	Minor
Medical Cost	162.00	61.36
Transport Costs	233.00	127.50

Table 4.11 shows the average costs of accidents borne by the employee. It is evident that major accidents incur a larger cost for the employee in terms of medical and transport.

A further investigation using chi-square analysis was done to investigate if at all the size of the company is significantly related the size of the company. The Results are presented in Table 4.12. The results show the distribution of cost incurred to compensate injured employees by the size of the company. Shown below the table is the associated Chi Square value and the related P-value

Table 4.12: Compensation to injured party by Size of the Company

	Compensation to injured party		
How many employees on average does your company employ per annum	Disagree	Agree	Total
Below 50	23.8%	76.2%	100.0%
Between 50 – 60	41.4%	58.6%	100.0%
Above 60	34.0%	66.0%	100.0%

Chi-Square Value 1.676, p-value 0.196

Table 4.13 shows that the majority firms (66%) agree to the practice of paying for compensation to injured employees. 76.2% of the smaller firms agreed that they do pay compensation while 58.6% of the big firms said they do pay compensation. However, based on the P-Value for the Chi Square which is 0.196 we can conclude that this difference is insignificant meaning that small and big firms are equally likely pay compensation to injured employees than not. Since compensation is a big cost component for both fatal, major and minor accidents all the firms need to control this cost by ensuring that accidents are avoided.

Sick pay is also one of the most important costs that small firms pay to injured persons. 85.7% of the smaller firms incur this cost while only 14.3% of the firms do not incur this cost. The difference is also however not statically significant either at 5 or 10% on account of the P-value being 0.108

Table 4.13: Sick Pay by Size of the Company

	Sick pay		
How many employees on average does your company employ per annum	Disagree	Agree	Total
Below 50	14.3%	85.7%	100.0%
Between 50 -60	34.5%	65.5%	100.0%
Above 60	26.0%	74.0%	100.0%

Chi-Square Value 2.582. P value 0.108

On medical bills paid to the injured person, table4.14 shows that the majority firms i.e 72% agree that they have a policy to pay medical bills to the person who has been injured and the P-value shows that there is no statically significant relationship to payment of medical bill and the size of the company implying that big firms and small firms alike are more likely to incur this cost

Table 4.14: Medical bills paid to injured person by Size of the Company

	Medical bills paid to injured person		
How many employees on average does your company employ per annum	Disagree	Agree	Total
Below 50	23.8%	76.2%	100.0%
Between 50 -60	31.0%	69.0%	100.0%
Above 50	28.0%	72.0%	100.0%

Chi-Square Value 0.315, P-Value 0.574

On cost of communication the majority firms i.e. 78% disagree that they incur significant cost related to this category of cost related to accidents. In fact this is a small cost driver even when analyzed from the employee's point of view.

Table 4.15: Costs of communication charges by Size of the Company

	Costs of communication charges		
How many employees on average does your company employ per annum	Disagree	Agree	Total
Below 50	66.7%	33.3%	100.0%
Between 50 – 60	86.2%	13.8%	100.0%
Above 60	78.0%	22.0%	100.0%

Chi-Square Value 2.710 P value 0.10

On cost of funeral 54% of the firms don't have a policy that pays funeral cost for fatalities occurring to injured persons. 62.1% of the big firms do not pay for the cost of funerals resulting from fatal accidents while 42.9% of the firms disagree to paying for funeral cost

Table 4.16: Funeral costs by Size of the Company

	Funeral costs		
How many employees on average does your company employ per annum	Disagree	Agree	Total
Below 50	42.9%	57.1%	100.0%
Between 50 -60	62.1%	37.9%	100.0%
Above 60	54.0%	46.0%	100.0%

Chi Square value 1.810, P-value 0.179

Whilst smaller firms do pay significantly (66.7%) for burial cost they bigger firms do not as only 31% do make such payments. The significant value of the P-value show that there is a significant relationship between size and burial cost which implies those smaller firms are supposed to be worried about burial cost more than bigger firms.

Table 4.17: Burial Cost by Size of the Company

	Burial costs		
How many employees on average does your company employ per annum	Disagree	Agree	Total
Below 50	33.3%	66.7%	100.0%
50 and Above	69.0%	31.0%	100.0%
Total	54.0%	46.0%	100.0%

Chi Square value 4.160, P-value 0.041

4.4. Conclusion

Having surveyed employees on the various costs associated with injuries due to accidents, it's clear that while the workers suffer the trauma of accidents the bulk of the expenses fall on the employers. These accidents were categorized into falls, cuts, electrical, poisoning, exertion and struck by with the highest number of incidences occurring in falls. The analysis has shown that costs associated with fatal accidents are quite high compared to major and minor accidents. The analysis has shown that if the firm pays all the cost components associated with a fatal accident it will incur about ZMW 21,880.00 while if pays all the cost components associated with a major and minor accident it will incur ZMW 8,122.36 and ZMW 3,976.92, respectively. Employee and employer costs of accidents are spent from lost salary, sick pay, compensation, medical, transport, hospitalization, funeral procession, burial procession, insurance and communication respectively with the highest spent on compensation. The extent to which a firm foots this bill depends on how widespread the practice of paying various cost components is amongst the firm.

CHAPTER FIVE: DISCUSSION

5.1 Introduction

This chapter discuss the findings in collaboration with the existing body of knowledge on the costs of accidents in the construction industry. Discussion of findings with literature was very important in determining how the research fits in the existing body of knowledge on the subject.

Therefore picking up from chapter four where the findings were presented and analysed, this chapter strives to provide an explanation and implication of the results.

5.2 Implications of accident costs.

Most authors from developed countries who conducted research on costs of construction accidents base their findings on reports on taken from compensation institutes while findings were based on the actual costs taken from taken from the affected individuals. This simply shows that the Zambian construction industry has no proper rules and regulations that enforce on having records of reports on previous accidents. Basing on these facts, records of reports on any accidents have to be kept as these will help plan for proper health and safety. Other than this, records of reports of accidents help a country to see as to whether they are improving on the costs incurred whenever an accident happens or not. In short records of reports of accidents will always act as a mirror for future use and a proper instrument of calculating the effect on gross domestic product (GDP).

In the US the workers compensation claims was $38.7 billion (Safety index of Liberty Mutual 2007) while the findings in Zambia state that the compensation claims came to ZMW68,000.00 for the period of 2008 to 2014 .Further, from the findings, the highest cost of expense by the employers was from compensation. We can simply conclude from both the findings and the literature that compensation claims are one of the most contributing factor in costs of construction accidents. For this reason, it's very important that these compensation claims to be transferred to a third party. In the literature review, it clearly states that compensation claims are sorted out by a third party which is an insurance

company but on the contrary, most Zambian contractors pay for compensation claims rather than transfer the expense to a third party. Whenever expenses are high, it is very important for any construction company to transfer the costs to a third party in order to avoid huge loses.

According to Zou and Sunindijo (2015), they have proved that costs of construction accidents are expensive. These construction accidents become costly both in terms of human suffering and financial loss. This was seen in the findings as well were stakeholders, employees, employers and society at large experienced human suffering and financial loss due to these accidents. From the 50 accidents recorded in the findings, the costs were incurred by both the employer and employee. It is very certain that employees (workers) are the ones that face great loss as they are the ones who are directly affected by the accident. It is always very important to recognize that whenever an accident occurs on any construction site, the workers are the ones mostly affected as they are directly linked to the works. The serious effects of these accidents may either be death, injury and illness which cost workers their present or prolonged health and in future affect the extended families.

A recent study on cost of construction accidents by Pillay (2014) in South Africa showed that from a sample of 100 construction accidents, it costs a total of R32, 981,200.00 (ZMW 263,849.60) while findings show that from a total of 50 construction accidents, it costs an estimate of ZMW 142,841.24.This simply shows that findings support literature by showing that no matter the number of construction accidents, the costs is always high especially that in Zambia the cost of living is very high.

According to literature, 4% of GDP for developed countries was lost due to construction accidents. On the contrary, findings have no evidence of how much the construction accidents affect the GDP meaning more research has to be conducted in order to find out the percentage of effect on the gross domestic product (GDP). It is very important to know the percentage of effect the cost of construction have on the GDP so as to see its effects on the country's economy.

According to the literature, emphasis was made stating that costs are either direct or indirect. Therefore, from the research carried out in developed countries, estimates of costs are given for both the direct and indirect while the findings only have quantified and estimated the costs of direct costs. Indirect costs have been very difficult to quantify as they are hidden and most people in Zambia are not fond of these costs as they tend to render them insignificant not knowing that they are actually the costs that contribute a larger portion to the costs.

Literature have recorded that accidents are usually caused by unsafe acts of employees, unsafe conditions and management. Such conditions highly contribute to workers being unsafe and as a result highly contribute to their injuries. In agreement to this statement, findings have also discovered that accidents are mostly as a result of unsafe conditions usually caused by both the employee and employers negligence. Other than that, findings have also discovered that poor attitude by workers towards health and safety has also contributed to the high rates of these construction accidents. Workers simply fail to adhere to the rules and regulations of proper health and safety. Moreover, findings have also discovered that not only workers are to blame but their employers also contribute to these accidents as they at times do not buy their workers proper gear to use when carrying out construction activities.

Conclusion

In conclusion, literature and findings are usually similar. The gap between the two is usually minimal due to the fact that findings will always discover new facts as the idea behind the research is to contribute to the body of knowledge.

CHAPTER SIX: CONCLUSION AND RECOMMENDATION

6.1. Introduction

This chapter provides conclusions and recommendations. All conclusions were drawn after a thorough analysis based on the findings and the literature.

6.2. Evaluation of research conclusion

The research objectives were provided in chapter one. The chapter indicated that the literature would be reviewed followed by data collection, analysis, findings and discussions. The research synopsis was repeated in this section.

Chapter two which is the literature review discussed a number of factors. It looked at the general overall safety performance in the construction industry. Despite efforts being done on the awareness of health and safety, knowledge being gained from various acts and regulations that exist and which arguably should, if complied with, improve health and safety performance on construction sites, a lot of serious accidents continue to occur and in turn yield a huge cost burden on the stakeholders, employees and society as a whole. The major costs identified were direct and indirect costs. This chapter further looked at the accident classifications which were identified as fatal, major and minor. Records show that these accidents are caused due to unsafe acts, unsafe conditions and management related issues. Although several studies are being done to evaluate the cost of construction accidents, it is very clear that these studies are only done for developed countries and very little on developing countries. This is why this study has been done for Zambia to stand in the gap.

In chapter three, the research design was outlined. The methods and procedures for administering the questionnaires, data collection and analysis were discussed.

Chapter four provided the results and data analysis for this study and discusses the results.

Conclusion for the whole study was done in chapter five. It showed the costs of construction accidents by categorizing them into minor, major and fatal. It was recorded that fatal accidents are very expensive with the highest expense being compensation.

6.3. Evaluation of research objectives

RO1 To identify and classify the accidents that occurs on construction sites

The following results were established from the study and identified the accidents which occur on construction sites as follows.

1. nailing the hand,
2. fall from scaffold,
3. contact with machine,
4. slip from roof,
5. contact with circular saw,
6. burn from water,
7. cut finger with saw,
8. fall from ladder,
9. struck by steel,
10. electrocution,
11. struck by falling canopy,
12. Cut thigh from chiseling the wall
13. hit testicles from fall
14. twist ankle on scaffold
15. cut hand with grinder,
16. glass squeezed legs,
17. leg of tower hit foot,
18. broken cutting disc hit and removed eye,
19. steel truss fell on leg,
20. fall due to collapse of slab,
21. specks from grinder entered eye,
22. cut off finger by grinder,
23. hit finger with 2” nail,
24. hit leg with pick,
25. fall from scaffold as result from electric shock
26. struck by timber,
27. fall into swimming pool trench,

28. drunk contaminated water,
29. Stuck in ATM room
30. Hit armored cable and got electrocuted,
31. leg hit with steel,
32. leg hit with manhole cover,
33. Cut wrist with grinder.

Results further categorized the accidents into falls, cuts, burns, exertion, electrical, struck by, poisoning and classified them into minor, major and fatal.

RO2 To determine the costs associated with identified accidents.

It was established from the research that construction accident costs arose from

1) funerals,
2) Burial procession,
3) compensation,
4) hospitalization,
5) medicals,
6) transport,
7) sick pay
8) lost salary and
9) Salary paid without work.

6.4. Contribution to the body of knowledge

This study assessed the costs of construction accidents on construction sites in developing nations particularly in African countries with a specific focus on Zambia**.** It was established that in Zambia, no research has been done to investigate into costs of construction accidents. This study therefore contributes to the growing body of knowledge established through empirical research by addressing the following main points.

1. It was established that the most worrying fact about the Zambian construction industry is that it is undocumented. The industry has no history as there are few information sources in the country about the construction industry. Details of cost issues and implication of the industry is not comprehensively documented not even

with CSO (Central statistics offices) and other construction mother bodies. As a result, official data on the knowledge of costs, costs implications to the project and it effects are imprecise and underestimated. The under- reporting explains the difficulties of analysis of costs of construction accidents and its effects on the employer, employees, stakeholders and society as a whole. This study therefore has through research findings provided information of the level of awareness of costs of construction accidents. It has further provided information on the current status of costs of construction accidents based on the contribution made by key stakeholders.

2. It was further argued in the study that most construction accidents are as a result of management ignorance and poor supervision which translates into a negative health and safety performance that in future contributes to the costs whenever an accident occurs. This study therefore contributed to identifying the role key of construction industry employers, employees and stakeholders

6.5. Key findings

The case studies revealed the following major key conclusions. Firstly, the unpredictable outcome of accidents in terms of costs and effects became evident. The severity of the accidents, the subsequent costs and effects to employers and employees was determined from the initial accident.

Over half (35) employees did not lose any money. 15 employees lost money and the amounts varied between ZMW4.00 to ZMW 2,001.00. The average loss of these 15 employees was approximately ZMW 399.00. Where employees lost money, the largest proportion, approximately 40%, was due to lost salary or rather salary paid minus working. In addition five employees lost their lives as a result of the accident and their compensation was given at an average of ZMW 10,800 for each.

Employer costs of accident also varied greatly between ZMW4.00 to ZMW 143,000.00. These included salary costs for giving the employee despite not working, medical, compensation, funeral, burial, transport, sick pay, hospitalization and communication The

largest cost employers encountered as a result of workplace accidents was compensation which came to nearly half (49%) of total losses.

Fourthly, the accidents affected the employees far more than their employers. Employees reported greater harmful effects to themselves, when compared to the effects on their employers.

Finally, the accident costs affected the employer far more than the employee as the employer got to bear most of the expenses found after the accident.

6.6. Conclusion

Fatal accidents are more costly compared to major and minor accidents and the whole chunk is borne by the employer. For this reason, it is very important for employers to make sure that fatal accidents are avoided by putting in place proper health and safety measures and ensuring that all employees adhere to these measures. Furthermore, it has been noticed that for most accidents the risk falls directly on the employer. For other accidents, though costs are smaller, still employers bear the larger burden of the costs. It is for this reason that employers should put in place a policy of transferring the risks (costs) to a third party by making sure that certain accidents are insured. This will eventually help reduce on certain costs and still remain productive.

It has been noticed that at no point is the cost borne by a third party such as insurance companies or workers compensation fund. It has been documented in many literature that when the cost of an adverse effect is borne by the person affected the outcomes are sub-optimal compared to when the costs are borne by a risk manager such as insurance companies or workers compensation fund.

The results have also shown that for most of the costs size of the company does not matter based on most insignificant p-values of the chi-square, they suggest that small and big companies, measured by employment size, bear the same risk of incurring these costs implying they should equally pay attention to reducing or avoiding accidents from the cost

point of view. Burial cost come so significant which can be explained that for smaller companies the family ties are stronger and are more likely to pay for burial and funeral costs.

The study confirmed that a comprehensive analysis of the cost of every construction-related accident was necessary for any organization to completely understand the broad implications of these accidents on their overall performance. Such an analysis would enhance the prospects of an improved allocation of resources to proactive strategic health and safety interventions that would prevent accidents from occurring. However, to achieve this objective all associated costs would need to be captured and recorded.

Employees in particular need to be aware of the potentially serious financial effects an accident can have on them. This will hopefully motivate them into improving their own safety behavior.

Employee must still engage in an adversarial process with their employer to be recompensed for financial losses due to the workplace accidents. It therefore seems advantageous, where the medical evidence is uncontested, that employees should have their immediate expenses reimbursed in order to lessen any financial hardship for them.

6.7. Recommendation for further studies

1. Further research has to be done in Zambia to find out on the indirect costs of construction accidents.
2. There is need to create a model that will help find the costs of construction accidents.
3. There need to broader the same research and diverse in mining sector in Zambia.
4. Awareness has to be done to sensitize people on costs implications that come along with accidents and come up with ways of avoiding them.
5. Contractors should provide appropriate health and safety information to their employees on construction job site,
6. Relevant law enforcing agencies should be proactive conducting regular site inspections to check on contractors' compliance with the existing legislations governing H&S.

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APPENDICES

APPENDIX 1

QUESTIONNAIRE

AN INVESTIGATION INTO COSTS OF CONSTRUCTION ACCIDENTS

SECTION A

EMPLOYER'S DETAILS

INSTRUCTIONS

Kindly tick or indicate your appropriate response(s) in the spaces provided.

1. Position of respondent in the company
   (i) Projects manager [ ] (ii) Quantity surveyor [ ] (iii) Engineer [ ] (iv) Foreman [ ]
   (v) Other state……..……

2. Sex of respondent
   (i) Male [ ] (ii) Female [ ]

3. Age of respondent
   (i) Below 20 years [ ] (ii) Between 20-30 years [ ] (iii) Between 30-40 years [ ]
   (iv) Between 40-50 years [ ] (v) Above 50 years [ ]

4. Professional Experience of respondent
   (ii) Below 5 years [ ] (ii) Between 6-10 years [ ] (iii) Between 11-15 years [ ]
   (iv) Between 16-20 years [ ] (v) Above 21 years [ ]

5. Highest level of education
   Certificate [ ] (ii) Diploma [ ] (iii) Degree [ ] (iv) Masters [ ] (v) PhD [ ]

6. How many employees on average do you employ on one of your **current project site**?
   (i) Below 20 [ ] (ii) Between 21-40 [ ] (iii) Between 41-60 [ ] (iv) Above 61 [ ]

7. How many employees on average does your company employ per annum?
   (ii) Below 50 [ ] (ii) Between 51-70 [ ] (iii) Between 710-90 [ ] (iv) Above 91 [ ]

8. What is the contract sum of the project you are currently mostly engaged in?
   (i) Below ZMW 500,000 [ ]
   (ii) Between ZMW 500,001-2,000,000 [ ]
   (iii) Between ZMW 2,000,001-5,000,000 [ ]
   (iv) Between ZMW 5,000, 001-10,000,000 [ ]
   (v) Above ZMW 10,000,001 [ ]

SECTION B: OCCUPATIONAL HEALTH AND SAFETY ON CONSTRUCTION SITES

This section assesses your involvement in health and safety. To answer the questions that follow below, kindly read the statement provided in the table and circle or tick one appropriate number in the table that suits your opinion using the following five point scale.

1=Strongly Disagree (SD), 2=Disagree (D), 3=Not Sure (NS), 4=Agree (A), 5=Strongly Agree (SA)

	Employee's safety	SD	D	NS	A	SA
1	Have relevant risk assessments been completed for all sites?	1	2	3	4	5
2	Are these available for staff on site	1	2	3	4	5
3	Is PPE supplied to all site staff & replaced when necessary	1	2	3	4	5
4	Are site indications carried out at all locations	1	2	3	4	5
5	Are employees adequately supervised while on site	1	2	3	4	5
6	Do you ensure that adequate H&S measures are in place while employees are working?	1	2	3	4	5
7	Is health & safety training given to employee	1	2	3	4	5

SECTION C: ORGANISATIONAL COSTS AND EFFECTS OF THE ACCIDENT

To answer the questions that follow below, kindly read the statement provided in the table and circle or tick one appropriate number in the table that suits your opinion using the following five point scale.

1=Strongly Disagree (SD), 2=Disagree (D), 3=Not Sure (NS), 4=Agree (A), 5=Strongly Agree (SA)

	Employee's safety	SD	D	NS	A	SA
1	Have any employees been injured ever since the inception of the project	1	2	3	4	5
2	Loss of customers' orders or other opportunities	1	2	3	4	5
3	Damage to plant or equipment and repair costs	1	2	3	4	5
4	Cost of any productivity loss resulting from injury	1	2	3	4	5
5	Replacement of persons by way of extra salary costs	1	2	3	4	5
6	New equipment costs	1	2	3	4	5
7	Overtime wages	1	2	3	4	5
8	Compensation to injured party	1	2	3	4	5
9	Loss of production time in hours	1	2	3	4	5
10	Sick pay	1	2	3	4	5
11	Costs of external consultations to advise on work practice changes	1	2	3	4	5

SECTION D: DIRECT AND INDIRECT COSTS EFFECTS

This section assesses the effect to the company caused by injuries. From the table of direct and indirect costs given below, which of these does the company pay for? Kindly read the statements provided in the table and circle or tick your best option that the company pays for.

1=Strongly Disagree (SD), 2=Disagree (D), 3=Not Sure (NS), 4=Agree (A), 5=Strongly Agree (SA)

	Costs effects on the company	SD	D	NS	A	SA
1	Legal costs or court expenses	1	2	3	4	5
2	Any fines or penalties	1	2	3	4	5
3	Any pending personal injury claims	1	2	3	4	5
4	Any increase in insurance premium after the accident	1	2	3	4	5
5	Medical bills paid to injured person	1	2	3	4	5
6	Travel expenses paid to injured person	1	2	3	4	5
7	Any costs in new recruitment practices	1	2	3	4	5
8	Any expenses in new staff recruitment	1	2	3	4	5
9	Costs of retraining new staff	1	2	3	4	5
10	Costs of communication changes	1	2	3	4	5
11	Loss of customer orders or other opportunities	1	2	3	4	5
12	Damage to plant	1	2	3	4	5
13	Cost of any production loss resulting from Injury	1	2	3	4	5
14	Replacement of persons by way of extra salary costs	1	2	3	4	5
15	New equipment costs	1	2	3	4	5
16	Overtime wages worked to make up for the resultant delays	1	2	3	4	5
17	Compensation to injured person	1	2	3	4	5
18	Loss of production time in hours	1	2	3	4	5
19	Sick pay	1	2	3	4	5
20	Telephone charges (communication)	1	2	3	4	5
21	Repair costs	1	2	3	4	5
22	Damage to equipment	1	2	3	4	5
23	Loss of production time	1	2	3	4	5
24	Administrative costs in terms of paperwork related to reports.	1	2	3	4	5
25	Funeral costs	1	2	3	4	5
26	Supervision and management loss time	1	2	3	4	5
27	Idle plant and equipment	1	2	3	4	5
28	Time lost by injured employees and co-workers;	1	2	3	4	5
29	Injured employees productivity loss costs	1	2	3	4	5
30	Medical costs	1	2	3	4	5
31	Burial costs	1	2	3	4	5
32	Costs of clean up after accident	1	2	3	4	5
33	Costs of replacing material, plant and equipment	1	2	3	4	5
34	Orientation of the replacement worker(s)	1	2	3	4	5
35	Costs resulting from delays	1	2	3	4	5
36	Additional supervision costs	1	2	3	4	5
37	Costs related to rescheduling of work to ensure timely	1	2	3	4	5

	completion					
38	Transportation of injured worker(s)	1	2	3	4	5
39	Wages paid while injured person was idle	1	2	3	4	5
40	Disruption of schedules	1	2	3	4	5
41	Use of temporary staff	1	2	3	4	5
42	Other costs (state below)	1	2	3	4	5
	1)					
	2)					
	3)					

APPENDIX 2
PART TWO (Structured interview)

EMPLOYEE'S DETAILS

Accident circumstances to elicit a narrative account of the incident

THE PERSON

1. Gender of employee…….
2. Age of Employee ……
3. Job title …… ……
4. Length of time in sector……
5. Length of time with employer …….
6. Family status Single/ Engaged / Married / Devorced / widowed

THE ACCIDENT

1. Day and year of accident…….
2. Time of accident ……
3. Circumstance leading up to accident……..…
   ……...
   ……..
4. Detail of accident and injury……..…….
5. Immediate effect of injury on the employee (consciousness, cognition, pain etc),
6. Detail of first aid ……..
   …….…….
7. Actions of co – workers ……..
   ……..……..
8. Actions of management …….
   ……..
9. Removal to hospital and time …….
10. Action of hospital on arrival …….
    ……
    ……
11. Details of treatment …….
    ……..
    ……
    …….

12. Details of diagnosis……..

    ……

    ……

13. Initial contact with relatives ……..
14. Effect on relatives……
15. Time spent in hospital ……
16. How many visitors on average per day visited the hospital……..
17. How many used public transport…….
18. How many used private transport……
19. How many walked to the hospital……
20. What is the average costs spent by person using public transport……
21. What is the average costs spent on fuel by the person using private transport……
22. How many visitors work…….
23. How many visitors do business……
24. How many left their work to visit the hospital
25. How many of these visitors depend on the patient……..
26. How many co-workers came to visit at the hospital…….
27. How many co-workers left work unfinished in order to visit at the hospital……
28. Details of release from hospital……..

    ……..

    ……..

    ……

29. Any contact with co workers……..

    …….

30. Any contact with employer ……...
31. Details of time spent at home after release from hospital

    ……

    ……

    ……

    ……

32. How many co-worker visited him at home…….……..

    ……

33. Immediate costs faced by injured person on return from hospital

……...…….

……..…..……

……

……

…….

34. Subsequent non predicted costs faced by injured person on return from hospital

……..…….

35. Effect on family and relatives of injury……..…….

……

……

……

36. Any permanent changes to family activities…….

……

37. Any permanent changes to injured person activities…….

……

38. Any message to co workers management state bodies and government…….....

……

……

……..

INDIVIDUAL COSTS AND EFFECTS

Direct costs to the individual

1. Number of working days absent ……..……
2. Monthly salary……..…..
3. Period of time for which salary was not received from company……..……
4. Any medical costs YES/ NO. If YES how much……..…….
5. Any travel costs YES/ NO. If YES how much ……..…….
6. Value and date of compensation received……..……..
7. .Retraining costs for any new career YES / NO.
    - if Yes any details……..…….
8. New clothing or new equipment purchased. YES/ NO
    - If Yes any details……..…….
9. Days spent in hospital A&E and No of visits as outpatient
10. Any long term medical consequences or effects from the accident YES NO if Yes any details…….
11. Any lost savings YES NO if Yes any detail
12. Costs spent by relatives

Relative		Approximate Cost

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