AN ANALYSIS OF RISK FACTORS ASSOCIATED WITH WORK-RELATED ACCIDENTS IN THE CONSTRUCTION INDUSTRY. A CASE STUDY OF FOSSIL CONTRACTING COMPANY.

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(B1233286)

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE BACHELOR OF ENVIRONMENTAL SCIENCE HONOURS DEGREE IN SAFETY, HEALTH AND ENVIRONMENTAL MANAGEMENT.

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DEDICATION

This dissertation is dedicated to my family and friends for their unending support.
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My acknowledgement goes to the Lord God Almighty for being my strength throughout the study. My sincere gratitude goes to my academic supervisor Mr. F. Ncube for his guidance and tireless help throughout the research process. Due thanks goes to Fossil Contracting’s Managing Director for allowing me to carry out the study in the organisation. Furthermore I am indebted to the Human Resources Manager and SHEQ Officer for their input in construction legislation. I would also like to thank the Fossil Contracting employees for their co-operation in the study through volunteering as respondents thus making the study a success. Lastly I extend my gratitude to Mr Kureya for making some corrections to the study and my family for the encouragement and financial support.
ABSTRACT

This study’s main thrust was to analyse the risk factors that contribute to work related accidents in the construction industry. It was based on a case study of Fossil Contracting, a small construction firm. The sample frame constituted of 60 workers of which 34 were sampled using the simple random sampling method. Data was collected using self administered questionnaires and key informant interviews and observation checklist guides. Chi-square tests in the study showed that there was a strong association between injuries and period of employment as well as injuries in relation to the departments/area of work. The results of the study revealed a statistically significant relationship (p<0.05) between period of employment and injuries. The study suggests that Occupational Safety and Health trainings on hazard identification would reduce the number of work related accidents. This is of greater benefit to those employed for less than six months or newly employed construction workers. Moreover management commitment is needed in order to build a system of occupational safety and the provision and use of protective equipment should be a priority in all projects. Collected data was analysed using the Statistical Package for Social Sciences (SPSS) version 20 software.
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LIST OF ACRONYMS AND ABBREVIATIONS

C.T  Contracts and Technical

ILO   International Labour Organisation

NSSA  National Social Security Authority

OSH   Occupational Safety and Health

P.P.E/C Personal Protective Equipment/Clothing

OHSAS Occupational Health and Safety Assessment Series

RGN   Rhodesia Government Notice

SHEQ  Safety Health environment and Quality

W.S   Workshop
CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND TO THE STUDY

An estimated 7 to 10% of the global workforce works under the construction industry where 30 to 40% of occupational fatalities are accounted for worldwide (Haslan et al., 2005; Yilmaz, 2014; Zalk et al., 2011). However ILO (2015) states that every day 6 300 people die as a result of occupational accidents whilst 317 million accidents occur on the job annually resulting in several days of absence from work.

The construction industry is considered as one of the most dangerous industries which is filled with risks which contribute to accidents (Amiri et al., 2014; Cheng et al., 2010; Mochtar and Arditi, 2011). Some of the risks include falling from heights, machinery accidents, electrocution and many others and these not only affect the workers but also the global economy in various costs such as compensation costs to social security companies and interruption in production ILO (2007). This is further supported by ILO (2003) which asserts that 2 million global fatalities occur every year. These statistics highlight how risky the construction industry is even to developed countries despite safety systems put in place.

Some African countries do not have National Policies on Occupational Health and Safety whilst those who have adopted the policies have not fully incorporated them in the working sectors of their economy (Augustine and Ajayi, 2013; Ojo, 2010). Nigeria is an example of one of the African countries whose state of occupational health and safety is poor in the construction sector (Idoro, 2008). Hence awareness on some of the occupational hazards, injuries and illnesses may be not anticipated in time until fatalities occur. Keller and Keller (2009) state that no less than 60 000 fatal accidents occur on construction sites around the world whilst most worries go to the construction industries in developing countries (Enhassi et al., 2008).

Zimbabwe has the National Social Security Authority that was established in terms of the NSSA Act of 1989 chapter 17:04. The mandate of NSSA is ensure the establishment and maintenance of safety and health conditions in workplaces through its Occupational, Health
and Safety division. However according to NSSA trends, there has been a constant rise in the number of workplace accidents from 2008 with 3810 injuries and 65 deaths in 2008 whilst in 2013 the number escalated to 5141 injuries and 107 deaths (Hamilton, 2013). Most reported fatalities in the annual occupational safety and health report for NSSA show that most injuries and fatalities come from the construction sector. However not all companies contribute to NSSA such that statistics concerning occupational hazards injuries and illnesses tend to be limited to NSSA registered companies (NSSA, 2012).

Zimbabwean industries have been operating at far below their full capacity as propounded by Dzviti (2010) and Fossil Contracting has not been an exception. Therefore this study seeks to find a way in which the impacts of the risk factors associated with work related accidents can be reduced with the best available technology that the company can use.

1.2 STATEMENT OF THE PROBLEM

Whilst Fossil Contracting Company’s overall safety goal for the period 2014-2015 is to attain no harm to its employees, contractors or third parties, evidence on the ground suggests to the contrary. According to the company’s 2015 midyear report 67% of the recorded injury rates occurred on the category of workers’ termed general hands, whilst the other 33% is for other departments in the organisation. This study thus essentially seeks to unearth the contributory factors in order to suggest sound interventions to the problem.

1.3 JUSTIFICATION

Small to medium enterprises employ about 80% of the world’s construction workers (Zalk et al., 2011), this research aims to increase awareness on occupational safety amongst contractors and employees in the construction industry. Research has been carried out globally on the construction industry risk factors (Mbachu and Taylor, 2014) however there is little research in Zimbabwe concerning the work related accidents for the construction industry. Accidents that occur do not only affect the organisation in lost time injuries but they mainly affect the families of those who would have been engaged in the construction activities. This is usually extreme in cases of permanent disabilities such as amputations where an individual has to stop working in the field which actually supports the rest of the family’s livelihood. Some accidents are usually pointed towards the employee’s lack of discipline carelessness and fatigue hence this study sought to find out the out risks associated with the organisation’s activities so that precautions are taken.
Moreover the study sought to help Fossil Contracting’s management on how to handle risk factors for work related accidents and improve the current control measures. Some managers have the perception that the provision of protective clothing is the best control that can be put in place disregarding the other lines of defence which include eliminating hazard exposure, substituting the hazard and engineering controls as a high priority. Therefore there is need to find out the risk factors so that the appropriate controls may be established.

This study aimed to help increase the student’s research skills. The research can be used as a point of reference by other researchers who may also identify other gaps to continue studying under the topic. Moreover legal institutions can use this research to improve other grey areas of occupational safety in Zimbabwe thus benefiting the construction industry. Hence a healthy workplace with lesser risks can be achieved through controlling hazards associated with certain activities if they cannot be eliminated (Kadiri, 2006).

Moreover with the increase in areas that require infrastructural development the risk factors that result in occupational accidents and injuries need to be addressed. Further assessments may yield better results for the Zimbabwean construction sector so as to distinguish the nation’s construction industry among 3rd world countries as an industry that continues to be built on the dignity of safe work.

1.4 AIM

To assess the risk factors associated with work-related accidents so as to improve the safety system at Fossil Contracting.

1.5 OBJECTIVES

1) To determine the nature and patterns of occupational safety injuries in the construction industry.

2) To examine the sources of the occupational hazards.

3) To determine the challenges towards attaining optimum safety in the organisation.

4) To suggest control measures for accident risk reduction.
1.6 RESEARCH QUESTIONS

1) What is the nature and patterns of occupational safety injuries in the construction industry?
2) What are the sources of hazards?
3) Which organisational challenges are faced in attaining optimum safety?
4) Which control measures can be put in place to reduce accidents?
CHAPTER 2

LITERATURE REVIEW

2.1 THE CONCEPT OF RISK IN CONSTRUCTION

The strategic nature and complexity of the construction industry makes it a very risky business to operate and its risks can affect the performance of projects (Wiguna and Scott, 2005). In the construction industry, a risk is defined as the likelihood of occurrence of a, definite event or a combination of events which can occur during construction activities that usually have a negative outcome (Renuka et al., 2014; Larson and Field, 2007). As compared to other industries the construction industry has had a poor reputation in terms of risk analysis however no project that involves construction is risk free (Laryea and Hughes, 2008). Therefore risks need to be handled so as to be prepared for people’s exposure to the uncertain. Some construction companies resort to identifying risks in each stage of the project life cycle which is said to be plagued with various risks so as to manage those risks (Zhao et al., 2010).

2.2 PROJECT LIFE CYCLE

Renuka et al. (2014) asserts that every construction project is plagued with risks. Therefore risk management should be a priority in organisations despite the size of projects being executed. The diagram below shows the phases in the project life cycle which require risk assessments in order to identify the risks, their consequences and severity.
2.3 RISK FACTORS IN CONSTRUCTION

In projects that are taken in under construction there is the issue of site, weather and unknown geological conditions (Renuka et al., 2014). This may result in certain risks on work to be performed since an area may pose a risk of biological hazards such as snakes, scorpions or natural disasters such that workers are already at risk due to other unknown factors as well (Laryea and Hughes, 2008; Enhassi and Mosa, 2008; Goh et al., 2013). Furthermore Larson and Field (2007) concurs with this line of thought by highlighting that the industry is risky due to the work and the environment exposed to workers.

Poor safety procedures are some of the risk factors that plague the construction industry as supported by Enhassi and Mosa (2008) and Renuka et al. (2014). Since production and meeting deadlines is the main target for construction activities (Larson and Field, 2007), tasks performed may not operate according to the required procedures. Hence when there is a breach in procedures there are higher chances of risks. Examples of procedures include manual handling procedure, shuttering procedures, excavation procedures as well as many other procedures that can be used in construction.
Unavailability of adequate resources such as funds for work to be done may also entail more risks in construction since operating on a tight budget may mean reduced resources to activities that may not affect the client of the project directly except the safety side (Laryea and Hughes, 2007; Sun and Meng, 2009; Goh et al., 2013). Inadequate resources may be due to the need to outbid the other competitors in securing a project thus the organisation may come up with a budget that is very limited in order to meet client needs. Moreover some resources may be very costly to procure for a short term project such as hazardous gas monitoring devices such that contractors may continue to work without them at the risk of those on site.

Inadequate managerial skills, knowledge and insufficient co-ordination are other risk factors in construction as propounded by Renuka et al. (2014) and Goh et al., 2013). Management skills and co-ordination gives an organisation the ability to allocate resources according to the scope, schedule and budget. This is very important in the allocation of human resources as various factors such as level of education, experience, age and marital status among other aspects need to be considered (Alizadeh et al., 2015; Chi et al., 2005; Chi et al., 2009). The factors considered by the authors in the paragraph are vital for example Alizadeh et al. (2015) stated that working experience increases with age whilst risky behaviour is influenced by age.

Construction risk factors also emanate from statutory clearance and approval requirements (Laryea and Hughes, 2007; Renuka et al., 2014). Other projects require procedures in the legislations to be followed such as mandatory PPE/PPC, machine guarding as well as clearance to work on various sites (Factories and works Act R.GN 263; 302 of 1976). Other construction organisations may prefer to start work before completely fulfilling the occupational safety requirements such that those performing the work are at risk of getting injured if adequate protective wear is not provided. However all risks may not be identified at once which is why there is usually room for corrective actions and continual improvement as required by OHSAS 18001:2007 series.

The types of hazards in the construction industry are physical, chemical, biological as well as social hazards. Effects of the above hazards may be acute (Short term) or chronic long term. Each type of hazard may be dominant in one project of construction or another and these hazards are elaborated in detail in the paragraphs below (Kadiri and Niesing, 2012).
2.3.1 PHYSICAL HAZARDS

Physical hazards include falling from heights, welding, vibrations or being run over by moving machinery and they may result in injuries or fatalities in the event of an accident. It is estimated that about 2.3 million construction workers frequently work on heights thus protecting those who work on heights is vital (Siddiqui, 2014). This is because protecting these construction workers helps in preventing about 4 800 injuries and 50 fatalities. Machine operators are also at risk and about 95 000 operators are injured each year whilst approximately 100 are fatally injured. Welders are also at risk of heatburns, radiation (ultra violet, visible and infra-red) and photokeratitis also known as arch eye such that their work environment needs consideration through the provision of a conducive working environment together with adequate protective gear (Kulkarni, 2007).

2.3.2 CHEMICAL HAZARDS

There are also chemical hazards and these appear in various forms such as dust, fumes, and mists, vapours whilst other chemicals can be in a semi-liquid state such as glue or can be powders such as cement (Kadiri and Niesing, 2012; Kulkarni, 2007). Chemical hazards such as cement cause diseases such as dermatitis if the construction worker using them is not adequately protected. Moreover there are others who are exposed to a lot of fumes such as road construction workers who operate bitumen distributors. These people are vulnerable to coughs and other respiratory diseases if they are not well protected during their activities.

2.3.3 BIOLOGICAL HAZARDS

Biological hazards cover exposure to substances such as pathogens (virus and bacteria) as well as venomous or lively aggressive animals such as snakes, hornets and wasps. These hazards are usually common in construction work that is in remote areas where some parts of a forest may need to be cleared for a project. Hence during site clearance most construction workers are exposed to snake bites and bee attacks. In the event that caution is not practised during the work, lives may be lost if some contractors are attacked by dangerous animals. Moreover in remote areas sanitation tends to be low amongst the workers hence they are usually susceptible to pathogenic infections such as stomach aches or Malaria in mosquito prone areas. Therefore baseline risk assessments are important before workers are dispatched to set up at certain remote sites so that they have everything they need (Kadiri and Niesing, 2012)
2.3.4 SOCIAL HAZARDS

Lastly there is the social hazard which stems from the nature of the construction sector which involves constant change due to various projects at a time. Construction workers are not usually stable in terms of their activities. Some are not permanent therefore they have to move constantly from one project to the other. They do not usually get the opportunity to establish working relationships which improve morale during working hours. This becomes a hazard as there is a lack of dependable social support as people get separated from familiar people and surroundings constantly (Kadiri and Niesing, 2012).

2.3.5 ERGONOMIC HAZARDS

Furthermore some of the physical hazards are covered under ergonomic hazards which usually refer to workplace conditions that pose risk of injury to the musculoskeletal system of workers (Kadiri and Niesing, 2012). These ergonomic hazards include repetitive and forceful movements, awkward postures that arise from improperly designed workstations, tools and equipment. Ergonomic hazards are usually hard to spot since a person does not normally notice the strain on the body or the harm that the hazard poses. Some may view these ergonomic hazards as less important but they play a major role in improving employee morale and job satisfaction for example ensuring that work areas are well ventilated in summer and also warm in winter. This reduces cases of heat stress in summer, frost bites in winter and other diseases that may result from poor working conditions.

2.4 CAUSES OF INDUSTRIAL ACCIDENTS

Accidents cost millions of lost man-hours of production each year. Several studies have attempted to examine the causes of industrial accidents in the construction sector related to their countries (Hamid et al., 2008; Zakaria et al., 2010). Some of the main causes of accidents have been attributed to worker negligence, failure to obey procedures, working at higher elevations, operating equipment without safety devices, poor site management skills and knowledge. However causes of accidents differ with each project on construction for example accidents for road construction workers are different from accidents from accidents experienced by builders.

According to Kadiri and Niesing (2012), 34% of the accidents are caused by handling and lifting goods and materials and 29% by trips and falls which is supported by Siddiqui (2014).
study on risks associated with working on heights. The rest of the accident causation percentages are lower such as being struck by objects that is represented with a percentage of 15%.

2.4.1 THE DOMINO THEORY

According to the domino theory of accident causation, 88% of accidents are caused by unsafe acts, 10% by unsafe conditions and 2% by the acts of God (Reason, 1990). In this theory Heinrich propounds that accidents are as a result of sequential events which can be likened to dominoes falling over when we look at them. It states that the falling of one domino may trigger the falling of the rest of the dominos. When a major risk factor is removed such as unsafe acts this may prevent the occurrence of such a chain reaction. Some unsafe acts include horseplay as asserted by Kadiri and Niesing (2012).

2.4.2 BRIEF ACCOUNT OF DOMINOES

The first domino deals with undesirable personal traits that may lead to accidents such as recklessness, stubbornness and some traits passed on from a person’s environment. Some people still uphold the background where production is greater than people’s safety (Reason, 1990). This is followed by the fault of a person where personal traits influenced by background of people contribute to the occurrence of accidents such as untidiness which is a matter of concern in terms of dress code of construction areas. An example is an individual who wears a flowing neck tie and loose clothing whilst operating in areas where there are revolving parts of machinery risking being caught up between those revolving parts.

Unsafe acts as part of the dominoes are regarded as the major domino whereby if they are removed, most accidents are reduced. Forgetfulness and inattentiveness causes some people to overlook the most basic concepts such as forgetting to lock out the main power supply before performing maintenance service on machinery. Moreover other workers tend to multi-task in a risky way for example others may use a drilling machine whilst attempting to keep a conversation going thus drilling into pipes that may contain flammable gases (Kadiri and Niesing, 2012). The falling of the above dominoes then result in accidents which may cause injuries to people if preventative measures are not put in place.
2.4.3 OTHER THEORIES OF ACCIDENT CAUSATION

In as much as the domino theory is mentioned at the beginning of most accident causation theories, there are other accident causation theories to be reckoned with. These theories include the human factors theory, incident or accident theory, the epidemiological theory and several others. The common element about them is their focus on the contribution of human factors to accidents. An example is the human factors theory which elaborates that accidents are caused by overload, inappropriate activities and inappropriate responses. Overload focuses on accidents being caused by people being given a lot of work beyond the capacity of their capabilities. Inappropriate activities cover the undertaking of work which an individual does not have knowledge of such as use of machinery without prior training of its use. Lastly inappropriate responses is characterised by an individual who may identify hazards and risks in the work area but still does not take action such as continuously using a vehicle with loose brakes.

Over-confidence is also another aspect of concern as people feel that they are very competent in a field and proceed to operate machinery without reading the instruction manual. This is usually common amongst people with experience in the field (Alizadeh et al., 2015). Moreover people tend to forget that technology is continuously evolving in such a way that the operating instructions of a welding machine that was manufactured 15 years ago differs with the most recent model.

Furthermore inquisitiveness and thoughtlessness has also been found common in people’s operations as their curiosity get the better of them. This shows another aspect of human factors which contributes to accidents. Certain employees do “silly” things like removing machine guards from machinery and touching the rotating parts to see whether they are smooth or to clean off the oil with a rag or their fingers. This then results in injuries that could have been avoided.

2.4.4 CONSTRUCTION INDUSTRY CHARACTERISTICS

The construction industry is unique and dynamics in nature due to its consistent changes and use of various resources (Amiri et al., 2014; Kulchartchai et al.; 2010). It is full of variable activities such that a greater number of its workers are not permanent. Due to its inconsistent engagement of workers, it makes knowledge and acquisition of regular training difficult thereby militating against safety and health awareness. This is usually common especially in
contracting firms where one could be engaged for a project that lasts for a period of three months such that issues of safety do not receive ample time to be appreciated on an individual basis.

2.4.5 CHALLENGES TO THE CONSTRUCTION SECTOR

Kamoing (1990) states that there is a general lack of comprehensive policies on occupational safety and health, poor access to vital information and inadequate training on man power resources obtained. Hence this gap needs to be filled as some organizations are usually very busy to create time for training sessions so that awareness on safety aspects is transferred to all employees at the organisation. Some employers and employees view occupational health and safety as a waste of resources. This can be further elaborated by the occupational health and safety series that stated that some workers in dusty areas and those exposed to toxic fumes at times do not demand that dust and fume abatement systems be installed but instead one demands danger allowances. In the end occupational respiratory diseases develop causing an increase in statistics of employees who suffer and die from occupational diseases (Hamid et al., 2008).

Moreover some organizations view that obtaining occupational health and safety services is very difficult whilst the main aim of most organizations is to make profit. Furthermore the shortage of competent personnel in the construction sector is the leading cause of accidents and injuries especially in developing countries (Goh et al., 2010). This is due to the reduction of skilled workforces as they migrate to other countries due to the economic situations in search of greener pastures especially in Zimbabwe. Most industries in Zimbabwe were affected by the economic regression such that some were shut down leaving a lot of people unemployed. Hence when new jobs are offered people are compelled to take them up despite the risks to their safety so as to support their families. An example is an accident that may occur when a worker is forced to conduct their activities without proper protective clothing as prescribed by the R.G.N. 263 of 1976 on protective appliances.

Furthermore, accidents are sometimes caused by little or lack of communication and awareness in the workplace (Amiri et al., 2014). If communication is carried out properly, the sharing of lucrative ideas that can impact on occupational health and safety can be achieved. Workers should be made aware of the risks associated with deviating from specified operating
procedures. Accidents continue increasing in frequency because of lack of information among employed personnel which can only be attained through communication. In the construction industry it is usually advised to make use of spotters who use red and green flags especially in operating machines such as excavators which helps to warn the operator of any hazards in the areas of operation. Hence communication can not only be verbal but signs can also be used so as to reduce accidents (Zakaria et al., 2010; Hamid et al., 2008).

Some construction companies experience accidents due to fallible decisions which are made within the organization concerning machinery and equipment. In other small to medium companies top management may be reluctant to conduct frequent maintenance of machinery as required by the R.G.N 302 of 1976 on machinery regulations. This legislation states that the qualified person or person in charge shall be responsible for the maintenance of all safety appliances and safety guards in good condition and not to allow the use of machinery which appears dangerous. However some organizations may overlook these aspects as they aim to meet their target despite the possible risks involved. Furthermore machine maintenance has to be approved by the top management who may disregard the immediate maintenance costs in a bid to make quick profit. This later becomes an expense when an incident such as an accident occurs due to errors such as loose brakes that could have been fixed before authorizing the use of such machines (Reason, 1990).

Workplace accidents are also influenced by ignorance of both employer and employee as some organizations are hardly aware of the requirements of the Factories and Works Act 14:08 of 1976 which governs Zimbabwe’s occupational health and safety. This is because other organisations do not possess a copy of these legal documents or do not understand the terms or contents of the legislation. Hence accidents occur as organisations do not use legislation as a guideline for operational activities. Moreover the lack of transparency in the legislation due to technical jargon leads to the interpretation of the terms in ways that suit the user at the time due to the absence of experts to interpret the terms correctly.

The construction industry absorbs skilled, semi-skilled and skilled labour (Chi et al., 2009; Lin et al., 2008). It is highly recognized in its absorption of unskilled labour. Hence those who are less skilled are abundant and their labour is cheap such that people are more concerned with keeping their jobs instead of their health and safety. Some employees hesitate to demand proper working equipment and conditions as they fear being replaced by people who may actually not
demand for proper working environments and protective clothing due to the scarcity of jobs in the industry. Such scenarios have been common especially in developing countries where jobs are difficult to come by due to the skill set required (ILO, 2001).

2.4.5.1 CHALLENGES TO SMALL TO MEDIUM CONSTRUCTION COMPANIES

In small to medium contracting enterprises, accidents are usually higher than larger enterprises (Lipscomb et al., 2004). This is because construction sites are usually temporary by nature and involve different contractors and subcontractors who are only present for an appointed time of the project (Larson and Field, 2007). Moreover construction sites are highly competitive and work is awarded to the lowest bidder. Therefore these and other factors contribute to the hazards experienced in the sector thus putting pressure on efforts of national safety authorities who then deliver poor occupational safety and health hygiene protection and enforcement to deal with risks associated with construction activities (Zalk et al., 2011).

In the construction sector many pre-conditions of unsafe behaviour originate in poor management decisions or a culture in the organisation in which safety goals maybe considered subordinate to production goals. This then results in violations usually in situations where responsibilities are ambiguous or ill-defined together with time and pressure to meet targets (Reason, 1990).

Some researchers divided the challenges to occupational health and safety into latent and active failures (Reason, 1990). Latent failures were defined as those decisions or actions which have damaging consequences which may lie dormant for a long time and become evident when they combine with local triggering factors. An example is a car accident that may be caused by brake failure of a vehicle that has skipped service time over a long period of time due to top management instructions for certain targets to be met first. On the other hand active failures are those errors and violations that have adverse effects such as hiring an incompetent person to operate high risk equipment such as welding machines which may injure the person as they work without adequate knowledge. Therefore the multiple causation theory that suggests that an accident is a result of various contributing factors comes into play in this scenario (Zakaria et al., 2010).

When occupational accidents occur, they impact people in various ways as shown in table 2.1. It is very important for organisations to know the impacts of their work activities so that they
put in place occupational health systems that cover the risks faced by workers in order to reduce accidents.

**Table 2.1: Consequences of Occupational Accidents**

<table>
<thead>
<tr>
<th></th>
<th><strong>Non tangible effects</strong></th>
<th><strong>Tangible effects</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Victim or individual</strong></td>
<td>• Pain and suffering&lt;br&gt;• Moral and psychological suffering( especially in the case of a permanent disability)&lt;br&gt;• Lowered self-esteem, self confidence&lt;br&gt;• Strain on relationships&lt;br&gt;• Lifestyle changes</td>
<td>• Loss of salary and premiums&lt;br&gt;• Reduction of professional capacity&lt;br&gt;• Medical costs&lt;br&gt;• Loss of time (medical treatment)</td>
</tr>
<tr>
<td><strong>Family and friends</strong></td>
<td>• Moral and psychological suffering&lt;br&gt;• Medical and family burden&lt;br&gt;• Strain on relationship</td>
<td>• Financial costs&lt;br&gt;• Extra costs</td>
</tr>
<tr>
<td><strong>Colleagues</strong></td>
<td>• Psychological and physical distress&lt;br&gt;• Worry or panic (in case of serious or frequent accidents)</td>
<td>• Loss of time and possibly also of premiums&lt;br&gt;• Increase of workload&lt;br&gt;• Training of temporary workers</td>
</tr>
<tr>
<td><strong>Company</strong></td>
<td>• Company image&lt;br&gt;• Working relations and social climate</td>
<td>• Internal audit&lt;br&gt;• Decrease in production&lt;br&gt;• Damage to the equipment material&lt;br&gt;• Quality losses&lt;br&gt;• Training of new staff&lt;br&gt;• Technical disturbances&lt;br&gt;• Organisational difficulties</td>
</tr>
<tr>
<td>Society</td>
<td>Reduction of the human labour potential</td>
<td>Reduction of the quality of life</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Loss of production</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Greef et al. (2004)
CHAPTER 3

METHODOLOGY

3.1 DESCRIPTION OF THE STUDY AREA

Fossil Contracting is a construction firm located 17°50’45.67” S and 31°07’59.50” E of Harare Masasa. Its inception was in 2010 and it specialises on civil works, road construction, contract mining and other activities that involve structural works. It is linked to major roads such as Harare drive and Mutare road which merge at the roundabout as shown by the map below.

![Map of Study Area](image)

Fig 3.1: Study Area

3.2 RESEARCH DESIGN

A case study was used in this research and it made use of both qualitative and quantitative research techniques. Qualitative research was used due to its exploratory nature. Trochim (2000) even stated that qualitative research focuses on various angles that explain human behaviour thus leading to more suitable conclusions. An example is field observations which
were employed since people act in their natural way without altered behaviour when they are not aware that they are being studied thus yielding less biased results.

The researcher used the qualitative research design because it assisted in recording the behaviour and impression of the targeted population on occupational safety issues that it is prone to. Moreover it enabled the researcher to take note of whether contractors and employees work safely when they are under the assumption that they are not being observed.

Quantitative methods of research were used to assess the cause and effect relations of the research and to examine the possible outcomes. Moreover this enabled statistically important conclusions to be drawn about the population by studying a representative sample of a size compatible with the study being carried out as highlighted by Creswell (2003).

Quantitative research has its main variables that are the “cause” and “effect”. The variables assisted the researcher to collect data on the causes of accidents under Fossil Contracting to determine the frequency of one particular accident that may be associated with the activities that may need to be carried under various projects.

3.3 TARGET POPULATION

The researcher’s target population (sampling frame) was the employees under Fossil Contracting which comprised of 60 persons and 30 were sampled and broken down as follows:

<table>
<thead>
<tr>
<th>Occupational category</th>
<th>Sample size</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>General hands</td>
<td>8</td>
<td>26.667</td>
</tr>
<tr>
<td>Diesel plant fitters</td>
<td>5</td>
<td>16.667</td>
</tr>
<tr>
<td>Operators</td>
<td>5</td>
<td>16.667</td>
</tr>
<tr>
<td>Electricians</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>Work shop foreman</td>
<td>1</td>
<td>3.333</td>
</tr>
<tr>
<td>Welders</td>
<td>2</td>
<td>6.667</td>
</tr>
<tr>
<td>Carpenters</td>
<td>2</td>
<td>6.667</td>
</tr>
<tr>
<td>Steel fixer</td>
<td>1</td>
<td>3.333</td>
</tr>
<tr>
<td>Engineer</td>
<td>1</td>
<td>3.333</td>
</tr>
<tr>
<td>Site Clerk</td>
<td>1</td>
<td>3.333</td>
</tr>
<tr>
<td>Brick layer</td>
<td>1</td>
<td>3.333</td>
</tr>
</tbody>
</table>

8 general hands, 5 diesel plant fitters, 5 operators, 3 electricians, 1 work shop foreman, 2 welders, 2 carpenters, 1 steel fixer, 1 engineer, 1 site clerk and 1 brick layer. The sample was derived from the Contracts and Technical department where project based activities are handled. The other samples were obtained from the Workshop department where the personnel which deals with maintenance of machinery is located. These departments were chosen as they were more vulnerable to construction risks due to their exposure to the field where projects are executed.

### 3.3.1 QUESTIONNAIRES

A pilot study was carried out before the distribution of questionnaires. This enabled the researcher to correct some technical jargon that other contractors would not have understood when given the questionnaires to respond. Moreover the pilot study enabled the researcher to receive additional helpful questions in order to get more detailed information from the study.

### 3.3.2 SAMPLING TECHNIQUES

Simple random sampling was used to come up with a sample of 30 people. A list of contractors on site was made available by the engineers in charge. The list of names was put in a hard hat which was used to pick a worker to be included in the research at random. The questionnaires
were then administered to this group. This sampling method gave every contractor onsite a chance to participate (Teddlie and Yu, 2007). Moreover not every contractor was at liberty to leave their work stations hence those who agreed to participate in the study were used. Purposive sampling was used to interview the management which encompassed the SHEQ Officer, 1 Engineer, 1 Foreman and a Site Clerk. This was suitable for obtaining expert information from those who usually lead the people onsite.

Sampling was vital in this research because it is difficult to collect data from all the members of a targeted population for a research project. Instead a selected few members were chosen to ensure that the sample was representing the population that was being studied under the organisation.

3.4 DATA COLLECTION

Primary and secondary data sources were used by the researcher. Primary data provided the researcher with direct feedback from various respondents in the form of interviews, questionnaires and observation surveys. Secondary data was also used as a source of recorded incidents and frequencies at the company from the time they started being recorded. The researcher obtained this data from the Safety, Health, Environment and Quality records database. Secondary data proved to be less time consuming to obtain and it was detailed in terms of the required data and relatively less costly as compared to primary data.

3.4.1 INTERVIEWS

The researcher carried out standardised open ended interviews as these gave room for clarifications in the event of misunderstandings between the interviewer and the interviewee. The interviews were meant for the management at Fossil Contracting. The management constituted of the SHEQ Officer, Engineers, Foremen and Site Clerks. Interviews were used for the management in this research because they have an in depth knowledge of the hazards associated with activities carried out at each project site. Moreover these persons also know how to ensure a safe place of work at their sites so as to reduce accidents.
Table 3.1 Personnel interviewed and the justification.

<table>
<thead>
<tr>
<th>Personnel Interviewed</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHEQ Officers</td>
<td>Oversee safety issues</td>
</tr>
<tr>
<td>Site Clerks</td>
<td>They remind other employees on the correct way to carry out work without injuring themselves as they work the whole day on the project site.</td>
</tr>
<tr>
<td>Engineers</td>
<td>Help in hazard identification by outlining the processes that may result in injuries if control measures are absent</td>
</tr>
<tr>
<td>Foremen</td>
<td>Enforces and approves the carrying out of safe work on site</td>
</tr>
</tbody>
</table>

3.4.2 FIELD OBSERVATIONS

Field observations were used for gathering data through scrutinizing people’s behaviour in their natural settings (Dewalt et al., 1998, Johnson, 1990). Their efficiency was made certain by avoiding a hint of the process to the observed people whilst they were exposed to their day to day activities thus reducing bias (Schensal et al., 1999).

Field observations allowed access to first-hand information and observations were recorded for data analysis since they naturally give away details which people are normally unwilling or unable to provide (Kumar and Ranjit, 2005). Hence the researcher used field observations as a way of procuring information that is usually not given correctly by workers such as the adherence to safe work practices. Examples of some safe work practices include working in areas with adequate signage, wearing and using full protective clothing or equipment and carrying out pre-task risk assessments before work begins. Non-verbal signs were observed which showed the feelings of the various contractors towards the tasks given to them and how they met deadlines to various activities or tasks given whilst working safely (Schmuck, 1997).
Hazards and injuries affecting workers were seen through observing them at work as signs of strain could be seen even when individuals are not aware that they are portraying them.

The researcher also made use of observation checklists which helped in directing focus on the objective of the study. The checklist acted as a guideline for inspections such as adequate signage in areas of work, employee’s use of protective equipment, safe acts as well as general tidiness of work areas. This checklist put in to account the activities being carried out and what was expected to be in the place of work so as to ensure people’s safety for example all tools were not be left lying around in areas of work and all materials were to be at the right place to avoid the risk of tripping or slipping.

3.4.3 SECONDARY DATA

In this study, data was acquired from the Fossil Contracting Integrated Management Information System (IMIS) database. This information was from the period these incidents started being recorded. This was done so as to find out the number of accidents and injuries that have occurred with safe systems in place and those that have occurred before formal systems were in place. Moreover going through the records helped in the identification the major causes of accidents at Fossil Contracting.

Furthermore information on occupational hazards and injuries in the construction industry was obtained from NSSA so that the main causes of accidents may be determined in the industry and to analyse the trends of the accidents in order to determine their increase or decrease. This information was in the form of internet resources and text books on how to create a safe system of work and how the identification of hazards reduced accidents and injuries. The secondary data was not only accessed from NSSA but from other authors of various text books, journals and internet resources on occupational safety and health. The researcher was able to come up with main legislations that govern the construction sector such as the Statutory Instrument 45 of 2013 on Collective bargaining in the construction industry, Statutory Instrument 6 of 2007 on Environmental Management of Effluent and Solid Waste Disposal, Factories and Works Act and the Factories and Works Rhodesian Government Notices (262; 263; 264; 302). These helped the researcher to observe the compliance to these by the organisation under study as a way of proactively reducing accidents and injuries whilst operating efficiently.
3.5 ETHICAL CONSIDERATIONS

A code of conduct needs to be observed and society usually refers to it as behaviour that is regarded as appropriate (Resnik, 2015) Ethics were a vital part of the research as it dealt with human participants. Information obtained from them had possibilities of leading them to isolation in the work group if it was not handled appropriately.

3.5.1 PRINCIPLE 1: INFORMED CONSENT.

The respondents were informed of the purpose of the study as well as the benefits and risks involved by agreeing to participate as highlighted by Smith (2003). This helped them to decide whether to be part of the study or not.

3.5.2 PRINCIPLE 2: PRIVACY AND CONFIDENTIALITY

Sensitive information was requested from the persons in charge so as to avoid cases of using classified information that could have led to law suits. Moreover in the distribution of questionnaires, the respondents were requested not to fill in their names so as to ensure protection from harm that could have resulted from the disclosure of their names thus keeping them anonymous. Private information that could point out the respondents was not shared with external or internal persons.

3.5.3 PRINCIPLE 3: THE PRINCIPLE OF VOLUNTARY PARTICIPATION

The respondents were at liberty to withdraw if they were uncomfortable in answering any questions of the research without being questioned about their actions hence the research was based on voluntary participation of individuals thus yielding less biased results.

3.6 DATA ANALYSIS AND PRESENTATION

Data was analysed using univariate analysis for data over view and classification. There was also the use of cross-tabulation to examine the relationships between the variables and to quantify the odds for independent variables that influenced the increase and decrease of the dependent variable outcome. In addition to this, statistical data analysis was conducted using MS Excel and Statistical Package for Social Sciences (SPSS) version 20 software.
CHAPTER 4

RESULTS

The gender composition of the study area was 96.7% for males and 3.3% for females which show that males were a dominant group in the organisation.

Table 4.1: Age of Respondents

<table>
<thead>
<tr>
<th>Age distribution</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-20</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>21-30</td>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td>31-40</td>
<td>11</td>
<td>36.7</td>
</tr>
<tr>
<td>41-60</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>51-60</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

Age in table 4.1 is to be used as an aid in answering all the objectives as age plays a role in affecting issues of occupational safety positively or negatively. The age that is highest in this study is 21-30 which is usually regarded as the most economically active group. The least age group is 51-60 years.
**Fig 4.1: Level of Education**

The level of education in Fig 4.1 above is crucial in determining accident frequencies amongst those educated to the highest level and those educated up to the lowest level of education which is secondary in this study. Most respondents received ordinary level education. 57% received ordinary level education whilst 40% received tertiary education. The least percentage received Advanced Level education.

**Fig 4.2: Period of employment under Fossil Contracting**
The duration of employment in Fig 4.2 is to aid in ascertaining the nature and patterns of injuries depending on the period of employment of each worker. Period of employment is to be used to assess the vulnerability of workers to risks basing on the period of employment. 60% of the respondents had been employed for the period 0-6 months.

**4.1 FREQUENCY OF ACCIDENTS**

Most accidents recorded in the organisation were on a monthly basis. A week could be completed without experiencing accidents. However accidents were common at the commencement of new projects. This shows that the changeover of projects had higher risks of injuries since general hands were required in each project thus resulting in the employment of new workers who got involved in more accidents whilst adjusting to the job. Moreover some accidents were as a result of inadequate protective wear since some injuries could be avoided if the workers had been provided with safety wear.

![Chart showing types of injuries by age](image)

**Fig 4.3: Types of injuries by age**

In Fig 4.4 above the types of injuries common are cuts amongst all contractors. The highest number of cuts were received by those in the age group 21-30. It also portrays injuries in relation to accidents. The ages that are normally affected by accidents are shown so as to establish whether injuries and age have any relationship at Fossil Contracting.
Fig 4.4: Accidents by department

Fig 4.5 above shows that most accidents are in the contracts and technical department. The highest injuries sustained are cuts followed by bruises.

Table 4.2: Distribution by occupational category

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrician</td>
<td>3</td>
<td>10.0</td>
</tr>
<tr>
<td>Operator</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td>General hand</td>
<td>8</td>
<td>26.7</td>
</tr>
<tr>
<td>Diesel plant fitter</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td>Workshop foreman</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Welder</td>
<td>2</td>
<td>6.7</td>
</tr>
<tr>
<td>Carpenter/joiner</td>
<td>2</td>
<td>6.7</td>
</tr>
<tr>
<td>Steel fixer</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Site engineer</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Site clerk</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Bricklayer</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>100.0</td>
</tr>
</tbody>
</table>
The table above shows the injuries received by each contractor in their respective field of work. General hands show the highest percentage of injuries which is 26.7% followed by machine operators and diesel plant fitters with a percentage of 16.7.

**Table 4.3: Injury risk factors**

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Existent Interventions</th>
<th>Needed interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsafe acts</td>
<td>Safety talks, supervision</td>
<td>• Implementation of fining systems</td>
</tr>
<tr>
<td>Unsafe conditions</td>
<td>Provision of P.P.E/C, make use of the buddy system (watching out for another worker)</td>
<td>• Training on adaptation to work environments (how to work in hot areas, wet areas)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• reduce the use of defective machinery which break down frequently</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• provision of protective gear suitable for the job activity such as chemical respirators for those who are exposed to tar fumes in road construction</td>
</tr>
<tr>
<td>Inadequate knowledge</td>
<td>Constant supervision of workers, safety inductions</td>
<td>• employ competent people</td>
</tr>
<tr>
<td>Inadequate training</td>
<td>Supervision</td>
<td>• hire external trainers for the organisation on fire fighting, first</td>
</tr>
</tbody>
</table>
Inadequate P.P.E

No one should work without adequate PPE

- Constantly hire the same short term contractors for other projects especially general hands. This reduces costs of providing protective wear to every short term contactor who may work for only 5 days.

**Source:** (Survey results, 2015)

**Table 4.4: Injury patterns**

<table>
<thead>
<tr>
<th>Nature of injuries</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>March</th>
<th>June</th>
<th>Jul</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Aid Case</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>3</td>
<td>39</td>
</tr>
<tr>
<td>Minor</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>Major</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 4.5 shows monthly injury fluctuations in construction projects. Injuries vary with the construction works per month due to the nature of activities. There are more first aid cases which are 39 and minor injuries reached 16. Major injuries were only 2.

**Table 4.5: Sources of hazards**

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Percentage by Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>96.77</td>
</tr>
<tr>
<td>Biological</td>
<td>3.22</td>
</tr>
</tbody>
</table>
The table above shows that a great number of respondents identified the sources of hazards as physical with a percentage of 96.77 whilst biological hazards had a percentage of 3.22.

**Fig 4.5: Types of trainings received by each department**

The training statistics in Fig 4.6 helped to establish the degree to which each Contractor is skilled and equipped with trainings to reduce occupational safety accidents. Most training were done in the form of inductions and tool box talks for the contracts and technical department and the least were safety refresher courses. None of the workshop employees were trained in the Train the Trainers’ course.
CHAPTER 5
DISCUSSION

5.1 DEMOGRAPHIC PROFILE

5.1.1 GENDER

The gender composition showed that at Fossil Contracting males constitute a larger percentage especially at project sites where most of the work is strenuous. This was shown by the 96.7% male percentage and 3.3% female percentage in the study. Moreover details from observations support the above statistics as most women under the organisation are concentrated in the offices or recruited for light tasks such as food handling and cleaning of offices. This shows that it is a male dominated organisation as highlighted by the Australian Bureau of Statistics (2008) where an industry is viewed as male dominated if the percentage of men is more than 70%.

5.1.2 AGE DISTRIBUTION

In construction, there are various age groups and usually there is a dominant one amongst the different workers. The age group that had the highest number was 21-30 which constituted 50% of the respondents. This could be attested to the fact that this age group is classified under the very economically active group which is very capable of enduring arduous work activities associated with construction activities. 36.7% comprised of those of ages 31-40 and this age range constituted of mainly those who are in the field due to experience, level of education or both experience and level of education where tertiary is the highest level. Chi et al. (2009) supports that level of education and experience is normally associated with age in construction.

10% of the workers were within the range 18-20 and the legal age for construction works at the organisation was established as 18 years but other studies have younger people in construction from the age of 15 (Alizadeh, 2015; Macedo and Silva, 2005) whilst there were no contractors of ages 41-50. The last age group was 51-60. This senior age group had the lowest percentage of 3.3% since a few people continue with engaging in back breaking activities at such an age unless they are occupying higher positions where they delegate tasks. When older people get injured, the severity is usually greater than younger people in as much as younger
people may be more exposed to accidents (Salminen, 2004; Halvani, 2012). Hence accidents were regarded as less fatal for younger people due to their ability to recover fast.

5.1.3 LEVEL OF EDUCATION

According to figure 4.1, 57% of the workers attained ordinary level education whilst 3% ended at advanced level education. On the other hand 40% of the workers achieved tertiary education which shows that most contractors at Fossil have attained ordinary level education.

Level of education was vital in this study as it helped in determining how various workers handled themselves in terms of occupational safety during their task execution and the injuries received whilst they worked. Moreover this component sought to assess whether level of education guarantees reduced injuries through compliance and adherence to occupational safety procedures.

A test was conducted using SPSS chi-square to show whether level of education had any association with the injuries received but the results showed a p value of 0.96 which proved that there was no significant association between the level of education and the job as shown in appendix 7. Injuries at Fossil Contracting occur generally to everyone despite the level of education. However Amiri et al. (2014) and Halvani (2012) state that the construction industry is dominated by younger workers who are less educated and are more vulnerable to accidents. The same notion is further supported by Alizadeh et al. (2015) in unison with Macedo and Silva (2005) who state that the occurrence of accidents is affected by aspects such as level of education, experience as well as age thus these authors argue that there is a relationship between level of education and injuries from accidents.

5.1.4 PERIOD OF EMPLOYMENT

The period of employment was compared to the injuries received by each contractor using Pearson chi-square. The findings from the empirical evidence were that a significant association was present at Fossil Contracting where the p value was 0.00 against a critical value of 0.05 (see appendix 10). This was further supported by the findings from the study which showed that 60% of the workers on contracts had worked from a period of 0-6 months as shown in figure 4.2. This study is consistent with Alizadeh et al. (2015) who elaborated that accidents were also influenced by the period one is employed. Hence the greater the experience, the lesser the accidents. The results showed a high turnover rate in construction industries thus resulting
in meagre time for safety trainings to contractors as they leave under a short period of time (Kulchartchai and Hadikusumo, 2010). Moreover the 0 to 6 months group was highly exposed at the time of the study due to their limited exposure to various projects since most of the contractors were in the range of 21-30 as highlighted in table 4.2 where experience is usually limited as emphasised by Chi et al. (2009) and Alizadeh et al, (2015).

5.2 NATURE AND PATTERNS OF INJURIES AT FOSSIL CONTRACTING

5.2.1 TYPES OF INJURIES

Injuries at Fossil Contracting were divided into cuts, bruises, slips, trips, falls, burns and working on heights in agreement with Amiri et al. (2014), Halvani et al. (2012) and Rozenfield et al. (2010). These injuries emanated from various accidents which are also divided into first aid cases, minor injuries and major injuries. Injuries were looked at with different associations such as age, marital status and department. Figure 4.4 showed that those of 21-30 received more injuries in the form of cuts and bruises but the p value from chi-square test of association showed a 0.964 figure which states otherwise. This was followed by marital status and injuries associations from figure 4.6 which produced a p value of 0.794 whilst the graph showed that those married had higher injuries.

The above contradictions between the graphs and the associations could be as a result of the sample size which was generally small due to the seasonality of construction workers. Statistically there was no significance in the relationship between injuries and married people but other studies highlight that married people usually suffer more injuries as they expose themselves to hazardous work because of their need to take care of their families (Alizadeh et al., 2015). Single people however maybe selective if they were to be exposed to work that pose a lot risks due to the hazards as they usually do not have dependants looking up to them.

5.2.2 INJURIES ASSOCIATED WITH DEPARTMENTS

There was a significant association of injuries and the departments at Fossil Contracting. These associations were for the Contracts and Technical (C.T) and Workshop (W.S). A p value from SPSS chi-square was recorded as 0.01 (see appendix 8) which serves to show that more injuries were received by those who work in the C.T department as shown by figure 4.5. There is usually high turnover in this department as it usually deals with short term contractual works such that injuries are more common due to less safety awareness (Kulchartchai and
Hadikusumo, 2010). However burns and falling from heights tally showing vulnerability in both departments to the particular risks.

5.2.3 INJURY PATTERNS AT FOSSIL CONTRACTING

The statistics were divided into first aid cases, minor and major injuries as shown in table 4.3. First aid cases were higher with a total figure of 39 ever since they started being recorded in December. This could be attributed to the higher priority of avoiding major injuries that may disrupt production by parties responsible for safety deliverance. When dealing with safety in organisations people tend to disregard near misses and first aid cases as less important but major incidents usually occur from these seemingly insignificant aspects especially if they are not addressed (Reason, 1990).

Moreover other people dread to point out near miss incidents due to fear of being called incompetent as highlighted by some contractors in the study. Moreover those employed for shorter periods as general hands may fear that they may not be rehired for another job if they report a lot of incident and accidents. Minor injuries were 16 and these were treated as minor due to the ability of the people to get treatment at the hospital and being discharged the same day whilst major incidents were lesser. Therefore statistics on reduced injuries may actually mean that other incidents are not reported as suggested by Yilmaz (2014) such that management assumes that the occupational safety is operating as planned.

5.3 SOURCES OF HAZARDS

The main sources of hazards identified at Fossil Contracting were from physical and biological aspects as shown in table 4.6. Some factors under physical hazards showed their ability to harm the body without necessarily touching it such as vibration and noise as supported by the occupational health and safety administration (2007). Vibrations at Fossil Contracting are usually experienced during tipper truck operations, operations of the vibratory roller and other drilling machines. On the other hand noise which emanated from rock blasting, drills and other moving machinery showed that a physical hazard does not necessarily have to be in contact with a person in order to cause harm as supported by (Kadiri and Niesing, 2012; Yilmaz, 2014).

Biological hazards were pointed out by a small percentage of the contractors. The reason could be that they were not really aware that biological hazards were very relevant and not regarded as insignificant but Kadiri (2006) and Kulkarni (2007) pointed them out as major in
construction works. Moreover the small percentage in biological hazards as well as the identification of other hazards could be attributed to the activities that some of the respondents were recruited for. Some activities required recruitment after the risks of some biological hazards had been reduced. These biological hazards are normally common during project activities such as setting out where scorpions are found or during bush clearing where bees and snakes could attack the contractors.

Chemical hazards and psycho-social hazards were not emphasised directly by the contractors. This could be that the contactors were not aware of the classification of the hazards as required by OHSAS 18001:2007 clause 4.3 on hazard identification and risk assessment and also it could be that they did not consider psycho social aspects as hazards at all. However some contractors got to mention pressure at work as a reason for not conducting pre-task risk assessments. Hence this showed some level of awareness of the psychosocial hazards since highlights of pressure from work proved that they knew the hazards but not how they are classified.

5.4 CAUSES OF ACCIDENTS

Accident causation in this study of Fossil Contracting concurred with the domino theory of accident causation where 88% of accidents were attributed to unsafe acts, whilst 10 % were linked to unsafe conditions and the last 2% was regarded as unavoidable causes of accidents (Reason, 1990). This was proven by the chi-square significant difference noted with a p value of 0.01(see appendix 9) which showed an association between causes of accidents and trainings received.

The results portrayed show that there is a gap in the training structure at Fossil Contracting since most trainings recorded were induction trainings and tool box talks as shown by figure 4.6. Moreover the graph showing the trainings received illustrated that most contractors never had special in house trainings or safety refresher courses. This could be attributed to the need to meet targets in order to please clients such that time to train people who may be found leaving after a few months such as general hands is viewed as costly (Larson and Field 2007). Hence these findings show the challenges faced in reducing accidents in construction due to the nature of the industry itself especially to small to medium companies (Wiguna and Scott, 2005).
5.5 ADHERANCE TO OCCUPATIONAL SAFETY REGULATIONS

5.5.2 ADEQUATE SAFETY SIGNAGE AND BARRICADES

The field survey showed that signage requirements were adhered to in work areas. These helped in warning people of the potential hazards associated with the work area and the mandatory protective wear required prior to entering those areas as show by Plate 5.1. Moreover signage helped external stakeholders to identify the organisation in the event of any emergencies that required immediate contact such as environmental pollution and injuries rates on site. Areas of construction work were barricaded especially where there were excavations so as to protect people from accidentally falling into open pits. This is shown by plate 5.1 below. These acts are supported by Kadiri and Niesing (2012), Factories and Works R.G.N 264 and OHSAS 18001:2007.

Plate 5.1 Signage at areas of construction (workers adhering to regulations of putting up signage for construction work and the wearing of adequate protective clothing whilst working).
5.5.3 UNSAFE ACTS BY WORKERS AND USE OF PPE/C

Since each contractor has to be inducted before working, examples of unsafe acts are highlighted by the SHEQ Officer during the induction process. Some workers adhered to safety rules and regulations but others were reluctant to do so due to various reasons. 17.6% of the respondents highlighted that the protective wear was inadequate whilst others elaborated that due to their working conditions, some of the protective clothing was uncomfortable and not relevant to the tasks (see appendix 11). Plate 5.2 shows a worker without appropriate working attire. Every contractor should wear a hard hat, safety shoes, a reflector vest or reflective overalls when they are on site. Other protective equipment such as gloves are worn as per activity.

Moreover protective wear is the last line of defence as it reduces the impacts of hazards instead of protecting totally from the hazards. Since contractors highlighted inadequate protective wear was causing an increase in accidents those who usually work under the organisation requested for protective wear relevant to their related tasks.

Plate 5.2 Unsafe acts by a contractor (worker is not wearing adequate protective clothing during work).

Plate 5.2 shows a contractor carrying out excavation works with inadequate protective wear. The contractor was not wearing a full work suit, steel capped safety shoes as well as a hard hat.
He was exposing himself to the risk of being struck by his spade whilst working. In the event of such an accident the severity of his injuries would be worse due to his inappropriate foot wear.

5.6 MANAGEMENT’S PERCEPTION IN TERMS OF OCCUPATIONAL SAFETY RISKS

Interviews showed that the management had a degree of awareness of the hazards associated with construction activities as well as the risk factors but the challenge was to improve the system to make it a better one for construction works. Some of the employees who worked on site under leadership positions highlighted issues of inadequate protective wear. They were concerned about other contractors who had a habit of operating machines without their permission whilst they were incompetent. A fining system was suggested as a measure to reduce such cases.

Furthermore issues of safety were viewed as the responsibility of the Safety Officer only which actually shows that awareness on safety as a lifestyle and everyone’s responsibility is still low and needs to be done as required by the OHSAS 18001:2007 international standard on occupational safety. Moreover there were issues of lack of empowerment to make independent decisions by those in charge of reducing accidents. Some of them said that if production were to be stopped because of a risky working condition mainly affecting workers without affecting production, complaints about production disruption would be raised. This shows that occupational safety issues need to be taken as a priority if safety in construction is to improve.
CHAPTER 6
CONCLUSION AND RECOMMENDATIONS

6.0 SUMMARY OF FINDINGS

6.1 NATURE AND DISTRIBUTION OF INJURIES

The findings showed that the high turnover rates at Fossil Contracting had an influence on the injuries received. The contractors who were employed for a short period of time sustained more injuries than the contractors who had worked for longer periods.

The trend of accidents ever since they started being recorded was not constant but was dependant on the projects being executed by the organisation during that time of the month. Moreover there was a chance that some incidents were not reported especially for those contractors who worked for very short periods.

Moreover there was no significant relationship between the marital status and injuries received by contractors at Fossil Contracting but some studies contradict this notion.

6.2 SOURCES OF HAZARDS

The main sources of hazards identified which were physical and biological were not the only hazards that affected the workers but it was the issue of not being able to classify hazards.

6.3. CHALLENGES IN ADDRESSING OCCUPATIONAL SAFETY

Since the construction industry is usually project based, some accidents may not be anticipated until a way to manage risks is established. However usually there were cases of unsafe acts due to inadequate knowledge amongst the contractors. Moreover some contractors’ responses highlighted the issue of inadequate protective wear to carry out their work activities.

6.4 CONCLUSION

The study concludes that the construction industry by nature is risky and has to be managed through the use of risk management methods such as risk elimination, risk transfer, risk insurance as well as risk treatment. Moreover human factors also play a role in causing
accidents in the study which shows that there should always be safety inductions and trainings in the industry due to the high turnover rate of contractors.

6.5 RECOMMENDATIONS

Basing on the discussion of findings, the following are the recommendations of the study:

6.5.1 MANAGEMENT COMMITMENT IN MANAGING OCCUPATIONAL SAFETY

There should be commitment from the management in order to establish and implement a risk management system. Proper budgeting should be done for all projects undertaken under the organisation so that all occupational safety requirements are met before project commencement.

External trainers should be hired so that the internal safety personnel can be up to date in terms of trainings required by contractors for various projects e.g. training for fire fighting, training on working in highly flammable zones as well as how to work under various weather conditions without being affected by heat stress, cold stress or other occupational stressors.

6.5.2 PURCHASING CRITERIA

The purchasing criteria of machinery should encompass contactor’s safety therefore the safety department should be informed before machinery is bought. The best available technology should be considered such as machines with vibration insulators so as to reduce cases of hand arm vibration syndromes as occupational stressors. Purchasing machinery with guards reduces the unsafe conditions exposed to workers everyday and buying machines which have the lowest amount of decibels such as 90dB. The 90dB is the exposure limit of noise in Zimbabwe for an 8 hr period (Factories and Works Regulations, R.G.N 263 of 1976).

6.5.3 RECORDING INCIDENTS AND ACCIDENTS

Every accident or incident should be recorded especially near misses and their root cause should be identified. After the reporting process all workers should be informed about the accident or incident. This helps in establishing a learning curve for risk factors associated with work activities that are to be carried out by each worker under the organisation.
6.5.4 PROVISION AND USE OF RELEVANT PROTECTIVE WEAR

The organisation should ensure that there is adequate provision of protective wear especially to general hands who usually work for short periods of time. If the organisation finds it costly to supply a short term person with PPC/E, constant people should be hired continuously so that equipment is utilised until the period for replacing worn out personal protective equipment or clothing is reached. Moreover contractors still need to be taught on the importance of adhering to personal protective equipment or clothing (P.P.E/C) requirements. This helps in reducing the impacts of accidents in as much as P.P.E/C does not totally protect individuals from accidents.
REFERENCES


APPENDICES

APPENDIX 1

QUESTIONNAIRE FOR EMPLOYEES AT FOSSIL CONTRACTING

Dear respondent

This questionnaire is for a student named Michelle Msimbe who is studying towards attaining a Bachelor of Environmental Science degree in Safety, Health and Environmental Management at Bindura University of Science Education. The research is on risk factors in the construction industry that usually lead to work-related accidents especially among small to medium contractors. In order to make this study a success you are kindly asked to respond honestly to the questionnaire. Your response to this study will benefit the organisation as well as the university. All participants’ details will be kept confidential and the results from this study will be used for academic purposes only.

NB. No form of identification is required on this form.

Instructions to the respondent

Tick where applicable and fill in details in spaces provided.

Section A: Personal Details

1. Gender: Male ☐ Female ☐

2. Marital status: Single ☐ Married ☐ Divorced ☐

3. Age: 15-25 ☐ 26-35 ☐ 36-45 ☐ 46-55 ☐ 56+ ☐

4. Level of Education

☐ ☐ ☐
5. Occupation/Job.................................................................

6. **Nature of employment**: Permanent Employee [ ] Temporary employee [ ]

7. How long have you been working for the company.................................................................

Section B: Closed ended and open ended questions section.

8. Have you ever received any type of work-related injuries under the organisation?
   ........................................

9. If yes what sort of injuries were they e.g. (cuts, bruises, slips, trips, falling from heights or other).................................................................................................................................................................

10. Were you wearing adequate Protective equipment when the injuries occurred.................................................................

11. If no what is the reason?........................................................................................................................................................

12. Do you carry out pre-task risk assessments before work? .........................................................

13. If the answer is no, what is the reason for not carrying them out?

........................................................................................................................................................................

14. What do you think are the causes of accidents?

........................................................................................................................................................................
........................................................................................................................................................................
15. What sort of hazards are you exposed to in your day to day activities?
..................................................................................................................................................

16. Which formal safety trainings have you received amongst the following. Tick where applicable.

- Safety inductions
- In-house training
- Tool box talks
- Train the trainers course
- Safety refresher course

17. Which are the common construction hazards that you have seen resulting in injuries in your work experience in the construction industry?
..................................................................................................................................................
..................................................................................................................................................

18. What is the frequency of accidents according to your observation in the organisation?

Weekly ❑  Monthly ❑  Yearly ❑

19. How are you reducing accidents at your work areas in the organisation?
..................................................................................................................................
..................................................................................................................................

20. Any recommendations to improve the Construction working environment?
..................................................................................................................................
..................................................................................................................................
..................................................................................................................................

50
Thank you.

APPENDIX 2

Interview Guide: SHEQ Officer

1. How many accidents have you recorded?
2. What are the main causes of accidents you have recorded at Fossil Contracting?
3. How often do the accidents occur?
4. Are there any safety refresher courses that you have attended so as to improve the organisation’s safety systems?
5. Is there any employee input when coming up with safety procedures for accident prevention?
6. Are there any trainings that have been conducted
7. Do all the employees have the recommended personal protective equipment/clothing?
8. Are any employees taken for medical examinations
9. Is the company certified with any standard which regulates safety and health?
10. Do you carry out safety audits and if so how many times
11. How do you address work related accidents?
12. What do you think can be done to reduce accidents?

APPENDIX 3

Interview Guide: Engineers

1. Which nature of hazards is dominant at your project sites?
2. Which of the hazards mentioned are the main causes of accidents at your sites?
3. How often do you get reports of accidents at your sites?
4. How often do you attend safety talks each week?
5. Are your contractors provided with adequate protection from the hazards?
6. Are these talks useful according to your perception?
7. If they are how useful are they and if not what are the weaknesses?
8. Do the contractors normally work in shift duties?
9. If so what time are most injuries reported? During the day shift or night shift?
10. What can be done to reduce work related accidents at your project sites?
APPENDIX 4

Interview Guide: Foreman

1. What are the hazards associated with the works at your site?
2. Are you able to identify hazards at your work area before an accident occurs?
3. How often do accidents occur at this site?
4. How long does it take for an identified hazard to be addressed?
5. Do you report all accidents no matter their severity?
6. Do all employees have the recommended personal protective equipment to perform their tasks?
7. Who is responsible for carrying out safety talks at your site?
8. What is being done to minimize accidents or injuries?
9. Are there any indications that employees are aware of their safety?
10. Are accidents reducing at your site?

APPENDIX 5

Interview guide: Site Clerks

1. Which are the top hazards that you have identified at your site?
2. What are the risks of the identified hazards?
3. Are the contractors aware of the hazards and their risks?
4. Have you undergone any safety related trainings under the organisation?
5. If yes how are you raising awareness of the particular hazards?
6. Do the contractors have adequate protective wear relevant to their jobs?
7. How often do accidents occur at your site?
8. How do you address such accidents?
9. Who is responsible for carrying out safety talks?
10. According to your observation how do the contractors view issues of safety?
### Observation Checklist

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COMMENTS ON OTHER SAFETY ISSUES OBSERVED

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......................................................................................................................................................
......................................................................................................................................................
......................................................................................................................................................
APPENDIX 7

TYPE OF INJURY AGAINST LEVEL OF EDUCATION

Case Processing Summary

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APPENDIX 8

AREA/DEPARTMENT AGAINST TYPE OF INJURIES

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#### PERIOD OF EMPLOYMENT AGAINST INJURIES RECEIVED

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#### Causes of Increase in Accidents

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