



**ST. MARY'S UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

**IDENTIFYING THE MAJOR CAUSES OF WORK-
RELATED INJURIES IN CONSTRUCTION PROJECTS**

THE CASE OF RAMA CONSTRUCTION P.L.C

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DECEMBER 2020

ADDIS ABABA, ETHIOPIA

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ID NO. SGS/0422/2009A

**A THESIS SUBMITTED TO ST. MARY'S UNIVERSITY, SCHOOL
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DECLARATION

I, the undersigned, declare that this thesis is my original work; prepared under the guidance of Temesgen Belayneh (Ph.D.). All sources of materials used for the thesis have been duly acknowledged. I further confirm that the thesis has not been submitted either in part or in full to any other higher learning institution for the purpose of earning any degree.

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December, 2020

ENDORSEMENT

This thesis has been submitted to St. Mary's University, School of Graduate Studies for examination with my approval as a university advisor.

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December, 2020

DEDICATION

I dedicated this piece of work to my beloved father (Girma Abebe) and mother (Birhane Abebe).

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LIST OF ACRONYMS

BCDS DB – Bishoftu Chefe Donsa Sendafa Design Bid Road Project

BS -British Standard

CBE – Commercial Bank of Ethiopia

G.C -General Contractor

GDP – Gross Domestic Product

HSE -Health Safety and Environment

ILO - International Labor Organization

ISO -International Organization for Standards

OSHA -Occupational Safety and Health Administration

OHSAS -Occupational Health and Safety Assessment Series

PPE - Personal Protective Equipment

RII - Relativity Importance Index

SPSS -Statistical Package for Social Science

USDOL -United States Department of Labor

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ABSTRACT

Construction industry in Ethiopia is growing rapidly while safety in the construction projects is very poor. For a construction project to be successful, safety is utmost importance. The objective of this research is to identify the major causes of work-related injuries in construction projects in Ethiopia particularly for the case of projects Rama Construction Plc. Accordingly, survey research design was used to accomplish the objective of the study. Mainly a five point Likert scale questionnaire was distributed to construction and safety departments in the company to identify the major causes of work-related injuries. The data was analyzed using quantitatively descriptive statistics Microsoft Excel and SPSS. Consequently, the study results show that “workers’ negligence”, “inappropriate use of personal protective equipment’s”, and “insufficient and unsuitable scaffoldings” were the three major factors of work-related injuries among the 37 identified factors. In addition to this, the study finds that the major causes of work-related injuries in the construction company were causes related to human element and unsafe working methods. Moreover, in the construction company, the major work-related injuries were associated with employees rather than employer. Finally, the study recommended that training needed to be provided frequently to all level of workers on construction safety which is going to be helpful towards reducing its occurrence.

Key words: *Construction industry, Work-related injury*

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The construction industry is one of the significant industries that contribute to the growth of a country. In Ethiopia, construction industry has an important role towards the development of the economy. Particularly in many developing countries, major construction activities account for about 80% of the total capital assets and 10% of the total gross domestic product GDP (Meti, 2019). Although the construction industry is not the main sector that contributes to economy growth, it actually acts like a catalyst to other sector of economy such as education, finance, manufacturing and others. Besides, it has an important role in producing job creation for many citizens. The industry, employing the largest labor force that are both skilled and unskilled laborers. The industry provides high employment opportunities, probably only second to agriculture (Wubshet, 2004). Moreover, the construction industry in Ethiopia has accomplished extensive growth particularly in the past few decades. It accounted for 7.6% of the total GDP of the country in the year 2014 (Meti, 2019).

Despite the highlighted gains of the sector, there are negative attributes associated with construction work. The construction industry is exposed to very dangerous circumstances. The performance of the industry in safety is very poor as well as the standard of safety is worse in developing countries. Currently, Ethiopia is one of the developing countries where the strong growth of construction industries is observed. As the number of construction projects increase, the safety of the construction projects becomes very poor. Every minute around the globe, accidents occur in construction projects and thousands of lives are lost. Recent studies show that millions of people experience work-related injuries in their life time. According to Lucy et al., (2016) annually, throughout the world, an estimated number of 271 million people suffer with work-related injuries, and 2 million die as a consequence of these injuries.

The safety of workers is utmost importance in order to accomplish a successful construction project. Failure of safety against work-related injuries in construction project have various affected the project negatively. These work-related injuries impact projects in cost overrun, time overrun, poor performance and ineffective productivity (Abdul-Rahman, et al., 2013). Another

study which was carried out by Shakil et. al (2018), strengthens this by pointing out work-related injuries as the mother of other many problems that contributes for complexities in construction projects like project delay, affecting the quality of construction work, decreasing the labor productivity, cost overrun of the project, arising dispute between stakeholders, affecting the psychology of worker negatively. The consequences of this accidents go far beyond the particular construction project. The estimated economic loss caused by work-related injuries and disease was equivalent to 4 % of the world's gross national product.

Therefore, in order to minimize the impacts of work-related injuries in construction project, identifying the major causes is crucial. So this study aimed at identifying the major causes of work-related injuries in construction projects.

This study conducted the case of Rama construction company construction projects. Rama construction company is grade one general contractor engaged in building, industry, road construction project works, and real estate development. Currently, 17 ongoing projects are under construction.

1.2 Background of the Company

Rama Construction Private Limited Company is established in 1995 in Addis Ababa, Ethiopia. The Company is registered under Ethiopian law. Ever since its establishment the Company has successfully accomplished different construction works estimated at hundreds of millions of Birr for the Federal Government, Regional Governments and the Private sectors of Ethiopia. Currently the Company is a category -1 General Contractor, undertaking a number of construction activities in different parts of the country. It engaged in building, industry, electric power substation, road construction project works and Real Estate development. It has a vision to be the first choice for all constructions in Ethiopia and competitive actor undertaking all types of construction works. Likewise, it has mission to participate on the country's socio-economic development with highest level of ethical, reliable and professional manner and carry out quality construction services to all stakeholders in a timely and cost effective manner (Company profile).

The Company is certified in Integrated System of Quality and Environmental Management System (ISO 9001:2015 and 14001:2015). Also, it is certified in OHSAS, Occupational Health

and Safety (BS 18001:2007), which was awarded in December 2017. It established and implemented quality, environmental, health and safety policy by increasing customer satisfaction, preventing pollution, injury and ill health to employees. In addition, it ensures the safety and security of employees and project neighborhoods by creating a working environment which is free from danger and professional hazards. It adopted a pro-active risk management approach to health, safety and environment through the identification of hazards, assessment and elimination or control of those hazards. The provision of such information, instruction, training and supervision as may be necessary to ensure employees health and safety at work. Besides, it aimed at elimination of work-related injury and illness by reviewing measurable objectives and targets with continuous improvement (Company profile).

1.3 Statement of the Problem

Work-related injuries are a major public health problem resulting in serious social and economic consequences that could be prevented if appropriate measures are taken. Annually, throughout the world, an estimated number of 271 million people suffer work-related injuries, and 2 million dies as a consequence of these injuries. The estimated economic loss caused by work-related injuries and disease was equivalent to 4 % of the world 's gross national product. The impact is 10 to 20 times higher in developing countries, where the greatest concentration of the world 's workforce is located. Moreover, the majority of the world 's workforce does not have access to occupational health services. Only 5 to 10 percent of the workforce in developing countries and 20 to 50 percent of the workforce in developed countries have access to some kind of occupational health services.

Prior studies conducted in the area of work-related injuries in the construction industry in Ethiopia are very few. The existing few labor safety studies were focused on the manufacturing industries rather than the construction sector. Since health and safety features in different industries are likely to be different, it is worth studying the labor safety status of the construction industry in Ethiopia. Furthermore, the findings of studies conducted in developed countries may not apply to a developing country like Ethiopia due to various factors associated with the level of economic development of the countries as well as the prevailing work culture. Besides, almost all the existing limited studies in Ethiopia focus on identifying factors causing accidents in industries.

Few studies in the construction area were on assessing the safety and health management practices. Hence; they did not identify work-related injuries in the Ethiopian construction industry. Therefore, unlike prior researches, this study mainly focuses on studying major causes of work-related injuries in the construction industry in Ethiopia. It is intended to be carried out to fill the gap by identifying the major causes, the study went one step ahead solving this problem.

1.4 Research Objective

1.4.1 General Objective

The main objective of this study is to identify the major causes of work-related injuries in construction projects in Ethiopia particularly for the case of projects in Rama construction Plc.

1.5 Research Questions

The research questions this study answers are:

- What are the major causes for the occurrence of work-related injuries with regards to falling from height, collapse, human element, management, electric hazards, fire hazards; and unsafe working methods.

1.6 Scope of the Study

This research identifies the major work-related injuries in the construction industry in Ethiopia particularly for the projects of Rama construction company. The study focuses to identify the major causes in the projects of Rama construction company. This was done from the perspective of employees of Rama construction company. It is based on the opinion of project managers, technical managers, engineers, architects, foremen, and safety officers working in the company.

1.7 Limitation of the Study

Due to different constraints, it is not possible to study this topic from different perspectives like the company's construction project consultants and clients. The other limitation is that; the study was not cover previously completed company's projects.

1.8 Significance of the Study

The results of the study were focusing on identifying the major causes of injuries in Rama construction company construction projects and analysis on the identified major injuries will pave a way for construction professionals to come up with minimizing injuries solutions. Also, the identified impacts will have the potential of creating awareness of its consequences. As a result of this, different construction participants like project managers, engineers, safety officers will be conscious enough to think about minimizing injuries incurring activities in the construction projects. Furthermore, there are very few works of literature relating directly to work-related injuries on construction projects in Ethiopia. This study contributes to the literature on work-related injuries in construction projects. The findings of this study may be utilized by the company to review policies on safety and health issues.

1.9 Organization of the Study

This study paper is organized into five chapters. Chapter one provides the introductory aspect of the study which encompasses the background of the study, brief history of the company, statement of the research problem, objective of the study, the research question, significance of the study, scope of the study, limitation of the research and organization of the research. Chapter two presents literature review with general descriptions by different researchers on causes of work-related injuries in construction projects. Chapter three will be about research methodology. Chapter Four will present results and discussion. And the last chapter will present summary, conclusion and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This part focuses on theoretical literature review, empirical literature review, and conceptual framework of the study. Past theoretical research studies that have been written on the field are briefly discussed. The main aim is to gather information on the research topic. Empirical studies and conceptual framework of the study which is about what the overall concept of the study also presented in this part.

2.2 Theoretical Literature Review

2.2.1 Definitions

“Accident” and “Injury” are much related terms, but it does not mean that they are the same. It is important to understand their similarities and differences.

Accident: -An accident refers to any unforeseen event that injures people or damages their health. It also refers to any damage or loss to property, materials, business prospect or the environment (HSE, 2014).

Injury: -An injury or illness is an abnormal condition or disorder. Injuries include cases such as, but not limited to, a cut, fracture, sprain, or amputation. Illnesses include both acute and chronic illnesses, such as, but not limited to, a skin disease, respiratory disorder, or poisoning (OSHA 2004).

2.2.2 Overview of Work-Related Injuries

A work-related injury is an injury or illness caused, contributed, or significantly aggravated by events or exposures in the work environment. Work-related injuries occur on the job and as a direct result of the tasks allotted to the specific job. According to OSHA (2004), An injury or illness is an abnormal condition or disorder. Injuries include cases such as, but not limited to, a cut, fracture, sprain, or amputation. Illnesses include both acute and chronic illnesses, such as, but not limited to, skin disease, respiratory disorder, or poisoning. OSHA (2004) defined work-relatedness is presumed for injuries and illnesses resulting from events or exposures occurring in

the work environment unless an exception specifically applies. A case is presumed work-related if, and only if, an event or exposure in the work environment is a discernable cause of the injury or illness or a significant aggravation to a pre-existing condition.

USDoL (2019) considers an injury or illness to be work-related if an event or exposure in the work environment either caused or contributed to the resulting condition or significantly aggravated a pre-existing injury or illness. Work-relatedness is presumed for injuries and illnesses resulting from events or exposures occurring in the work environment.

In contrast, USDoL (2019) not consider the situation as work-related injury if the injury or illness occurring in the work environment that falls under one of the following exceptions. First, if the injury or illness results solely from voluntary participation in a wellness program or a medical, fitness, or recreational activity such as blood donation, physical examination, flu shot, exercise class, racquetball, or baseball. Second, if the illness is the common cold or flu. However, contagious diseases such as tuberculosis, brucellosis, hepatitis A, or plague are considered work-related if the employee is infected at work). Third, if the illness is, a mental illness. Mental illness is not considered work-related unless the employee voluntarily provides the employer with an opinion from a physician or other licensed health-care professional with appropriate training and experience (psychiatrist, psychologist, psychiatric nurse practitioner, etc.) stating that the employee has a work-related mental illness.

2.2.3 Causes of Work-Related Injuries in the Construction Industry

The construction industry is exposed to very dangerous circumstances. The performance of the industry in safety is very poor as well as the standard of safety is worse in developing countries. Currently, Ethiopia is one of the developing countries where the strong growth of construction industries is observed. A review of the literature indicates that identifying the factors and causes of work-related injuries in construction projects has been the passion of many researchers. Leykun (2019) identified construction workers are exposed to a wide difference in health injuries in the workplace. Injury and exposure are not the same it differs from place to place, from job to job, by the day of occurrence, even by the hours and seconds of a lifetime. The main causes of accidents or injuries on construction sites in Nigeria include the following in order of superiority:

lack of safety training, poor understanding of the risks associated with the work, the influence of unsafe behavior by workmates, overconfidence, shortage of equipment Zaynab (2012).

W.A.Asanka and M. Ranasinghe(2015) introduced three main root causes of accidents in the construction sector. First, failure to identify the unsafe condition before the work. Second, proceed with work even after identifying the unsafe condition; and finally neglecting the initial unsafe condition and proceeding with work.

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

Kartam et al., (1998) did a study in Kuwaiti construction and noted that the causes of accidents were due to worker turnover and false acts; inadequate safety performance; improper cleaning and unusable materials; destiny; low tool maintenance; supervisory fault; and misplacing objects.

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

Various types and causes of work-related injury are distinguished by different researchers. Work-related injuries do mostly occur on construction project, ranging from falling from height (Smitaet al., 2016), collapse (Hughes and Ferrett, 2007), human element (Abdelhamid and Everett, 2000),management (Abdelhamid Hamid et al.,2008), electric hazard (Hughes and Ferrett, 2007), fire hazard (HSE, 2006), unsafe working methods (Abdul Hamid et al.,2008).However, HSE (2006) identified the most frequent work-related injuries as falls, collapses, fire hazard, mobile plant, falling material and collapses, electrical accidents as well as trips. Apart from the occurrence of work-related injuries, HSE also identified the various ill-health conditions that the

workers are exposed to, which include asbestos, manual handling, noise and vibration, and finally chemical exposures. Furthermore, going through literature extensively, seven types(categories) of work-related injuries were differently identified. These are: Falling from height; Collapse; Human element; Management; Electric hazard; Fire hazard; Unsafe working methods.

A. Falling from Height

Falls from height are one of the most common types of accidents that occur at construction sites. Smita and Bhole (2016) on their study pointed out construction workers are often required to work at very high heights, on scaffolding and ladders, in windows and on roofs. A fall is categorized when a person is injured after falling or jumping from a ladder, scaffold, building, roof, or other elevated place or working area landing, with impact, on the ground or surface below.

According to the USDOL (2019), these accidents account for 34percent of all on the job deaths of construction workers. In addition, the Occupational Safety and Health Administration (OSHA) reports that 20% of the 4,674 total worker fatalities in 2017 were in the construction industry, from those fatalities, nearly 40% were from falling from height.

Lucy et al., (2016) in a study to evaluation of health and safety practice in building construction which was conducted in Addis Ababa pointed out that the causes of injuries in construction projects. According to their study, it was found that falling from height is the first cause of injury. In addition, they stated that falling from height is the major cause of injury due to the reason that no horizontal protection made to high rise building.

B. Collapse

Collapse is one of the most dangerous types of construction accidents. Many are injured by excavation collapse. According to P. Hughes and E. Ferrett (2007) showed that there are on average seven fatalities each year in excavation collapse work. Also, it showed that injuries to workers, who were working in excavations were caused by excavation collapse accounts 14%.

According to HSE (2006) all materials, spoil and plant stored away from the edge of the excavation to reduce the chance of a collapse. Most accidents related to collapse caused by unprotected sides and leading edges, unprotected excavations with barricade and fence,

movement too close edges of excavations, improperly displayed warning notices, and working excavations in restricted areas.

In the case of collapse, Lucy et al., (2016) opined that the collapse is the major cause of injury in Ethiopian construction. So as the researchers stated, collapse is the fourth cause and this is due to poor work methodology during trench excavation and fails to brace edges.

C. Human Element

Abdelhamid and Everett (2000) conducted a comprehensive study in the USA and found one of the major cause of work-related injury is human elements. Human elements were due failed to secure and warn; failed to wear personal protective equipment(PPE); horseplay; operating equipment without authority; operating at unsafe speed; personal factor; remove safety device; serviced moving and energized equipment; took unsafe position or posture; used defective tool or equipment; and other unsafe action.

The human element or factor such as the negligence of the workers in doing their works will also lead to the work-related injuries. The unsatisfactory body condition of the workers such as tiredness, illness, alcohol and drug consumption will also affect the efficiency of works. The experience of the workers such as the total number of man hours and training that they have undertaken may also be one of the factors that determine the occurrence of the work-related injuries at sites (Abdul Hamidet al.,2008).

According to the reported work-related injury cases from year 2000 to 2004 obtained from department of occupational safety and health documents in Malaysia shows human element come in third position (12.5%) as lack personal protective equipment usage and workers' negligence contribute to the major cause of work-related injuries (Abdul Hamidet al., 2008).

D. Management

Work-related injuries may occur if the workers do not use the personal protective equipment (PPE) that has been provided by the management such as safety boots, safety belts, safety helmets, goggles and so on. In addition, the management is responsible in making company safety programs and policies. If these programs and policies are poor, the likelihood of happening work-

related injuries is high. Besides, managements must give an attention in engaging safety personnel. Incompetent safety personnel might be the reason in causing work-related injury rather than preventing. Further, managements must give clear employee accountability and responsibility for workplace health and safety and provide safety education training for workers.

The data gained from department of occupational safety and health documents in Malaysia shows that the causes of construction work-related injuries on average are mainly attributed to the management (29.2%) such as poor inspection programs, poor safety policies and lack of safety education programs (Abdelhamid Hamidet al.,2008).

E. Electric Hazards

When electricity brought into contact with conducting material, such as people, animals or metals, it permits releases of energy which may result in serious damage or loss of life. Constant awareness is necessary to avoid and prevent danger from accidental releases of electrical energy (Hughes and Ferrett, 2007). According to the study, most injuries and deaths from electricity are due to, using poorly maintained electrical equipment, working near overhead high tension lines or domestic electricity supplies, contact with underground power cables during excavation work and working without appropriate safety gear. The principal hazards associated with electricity are: electric shock, electric burns, electrical fires and explosions, arcing, portable electrical equipment, secondary hazards.

F. Fire Hazards

Fire hazards are not as common but do occur in construction sites creating damages and resulting in complete dislocation of building project schedules and delays. Common causes of fires in construction sites are poor storage of highly flammable gases and other materials, damaged cables and improper fuses or failure of safety devices, overload or poorly maintained temporary electrical equipment, accumulation of rubbish against electrical equipment and discarding of smoking materials. Fire consequences include personal injuries, death and damage to materials and the buildings. (ILO code of practice, 1992). In addition, according to Hughes and Ferrett (2007), each year at UK, fire brigades attend over 41,000 fires at work in which about 40 people are killed and over 2500 are injured. According to the study, the major injuries for fires on site

are caused by braising work carried out by plumbers, gas lines for underground work, power lines, power leads and tools, machinery requiring petrol and diesel, and hazardous chemicals.

G. Unsafe Working Methods

Unsafe working method can be defined as incorrect procedures and work styles that have been practiced by the workers. This may be due to the insufficient information from the management resulting in workers disobeying the works procedures. In addition, the level of knowledge and skills of the workers towards the procedures that have been taught to them will contribute to the proper execution of works (Abdul Hamidet al.,2008).

Unsafe working conditions are conditions in which the physical layout of the workplace or work location violates safety working standards (Jha 2011). Unsafe conditions on a construction site includes uncovered holes, inadequate personal protective equipment etc. (Jha 2011). Work-related injuries can be caused by failure to identify an unsafe condition, ignorance of unsafe conditions being reported by the worker or being reckless on health and safety issues.

According to Ridley 99 per cent of the accident are caused by either unsafe acts or unsafe conditions or both (Ridley, 1986). The unsafe working methods area violation of an accepted safe procedure which could permit the occurrence of an injury.

2.3 Empirical Literature Review

A study with the title of *Prevalence of occupational injuries and associated factors among construction workers* was carried out by Hanna et al. (2017) to determine the prevalence of occupational injuries located in Addis Ababa, Ethiopia. The main objective of the research was to determine the prevalence of occupational injuries and associated factors among building construction workers. To do that, the researchers used a cross sectional study approach. So, fifteen licensed grade one building construction companies in Addis Ababa selected and a multi stage sampling was used to recruit 809 study participants. The data was collected from February 01, 2015 to March 20, 2015 in five sub-cities. The research revealed that three leading causes of injuries were hurt by sharp instrument followed by fall accidents and injuries caused by falling, splinting or splashing objects. Also, the study assesses the severity of occupational injuries. It

found out that 86.7% were absent from work for seven days or less and 10.8% were hospitalized from which 41.9% were hospitalized for more than one day.

The other study was carried out by Selam Kassahun (2017) in her study titled *Analysis of facts and figures in construction site accidents in Ethiopia*. To develop baseline data on accident rate of Ethiopian construction industry was the main objective of the study. In addition, with the aim of showing the trends that has the highest accident rate by analyzing the ratio of accidents to employees. The study used a mixed method of research that combines both qualitative and quantitative forms. The primary data was collected by site surveying and interviewing and filling questionnaires. The secondary data was obtained from government office of Addis Ababa city of labor and social affairs bureau. According to the results, the study revealed that there had 1191 non-fatal injuries happened in the year 2005 which is the first. The second in the frequency of non-fatal injury was in 2007 with 1001 injuries and third was in 2006 with 545 injuries. In addition, the study revealed that the first ranked fatal accident was 23 fatalities, out of these 21 fatality was happened in one site in a day in this year 2009. The second in fatal injury was happened in 2007 with 20 fatalities and third was in 2005 with 12 fatalities.

A study titled *Work-related diseases and occupational injuries among workers in the construction industry* was carried out on selected construction workers employed by big construction companies which are located in Egypt. The study was carried out by Alazab R (2004) to assess the distribution of occupational injuries and common risk factors of these injuries among workers in the construction industry. The researcher used a cross-sectional study as the main research strategy and covered construction workers employed by a big construction company in Egypt starting from January 2003 and finished in August 2003. After collecting the necessary data, the study revealed that struck by an object, falling at ground level, and being hit by falling objects were the top three common accidents leading to injuries. Besides this, the results of the study showed that the incidence rate for disabling injuries per 100 employees is 18.1, which means 18.1 days away from work or restricted activity and the incidence rate for fatal injuries is 0.3%, which is the number of fatal injuries divided by employee's worked hour.

The other study conducted by Stephen Kazomba (2017) titled as *Causes and impact of work-related accidents for small manufacturing and services sector in Zimbabwe*. The study is

descriptive in nature. The objective of the research was to identify the causes of work-related accidents for small micro enterprise in the manufacturing and services sectors. The researcher used questionnaires, interviews and observations approaches to meet the stated objectives. The result of the study revealed that the untrained workers or unskilled workers, none use or improper use of personal protective equipment, and no machine safety guards were found out to be the three topped list of causes of work-related accidents on the Zimbabwe small micro enterprises. Based on

the severity level of the identified causal factors, improper use of personal protective equipment was ranked first next to use of no machine safety guards. The result further indicated that there is insufficient awareness about the causal factors of work-related accidents in the small micro enterprise of Zimbabwe.

The other study was a research conducted by Marie Dalton (2002) in Ireland titled *Fatal accidents in the Irish construction industry*. A study of contributory factors survey for fatal accidents in the Irish construction industry from 1991 to 2001. The major objective of the study was to investigate the construction fatalities by the health and safety authorities of Ireland during the period from 1991 to 2001. In addition, the aim of this research is to do a causal analysis to identify contributory factors. The researcher collected fatality files for the stated period from the health and safety authority of Ireland which were stored in hard copy. A total of 169 construction and construction related fatalities occurred during the 10-year period were analyzed in the study. The study identified that, consistent with other studies, almost half of the fatalities in the construction sector 44% were attributable to falls from height. Other incident types that accounts over 10% each are struck by something collapsing or overturning and contact with electricity.

2.4 Conceptual Framework

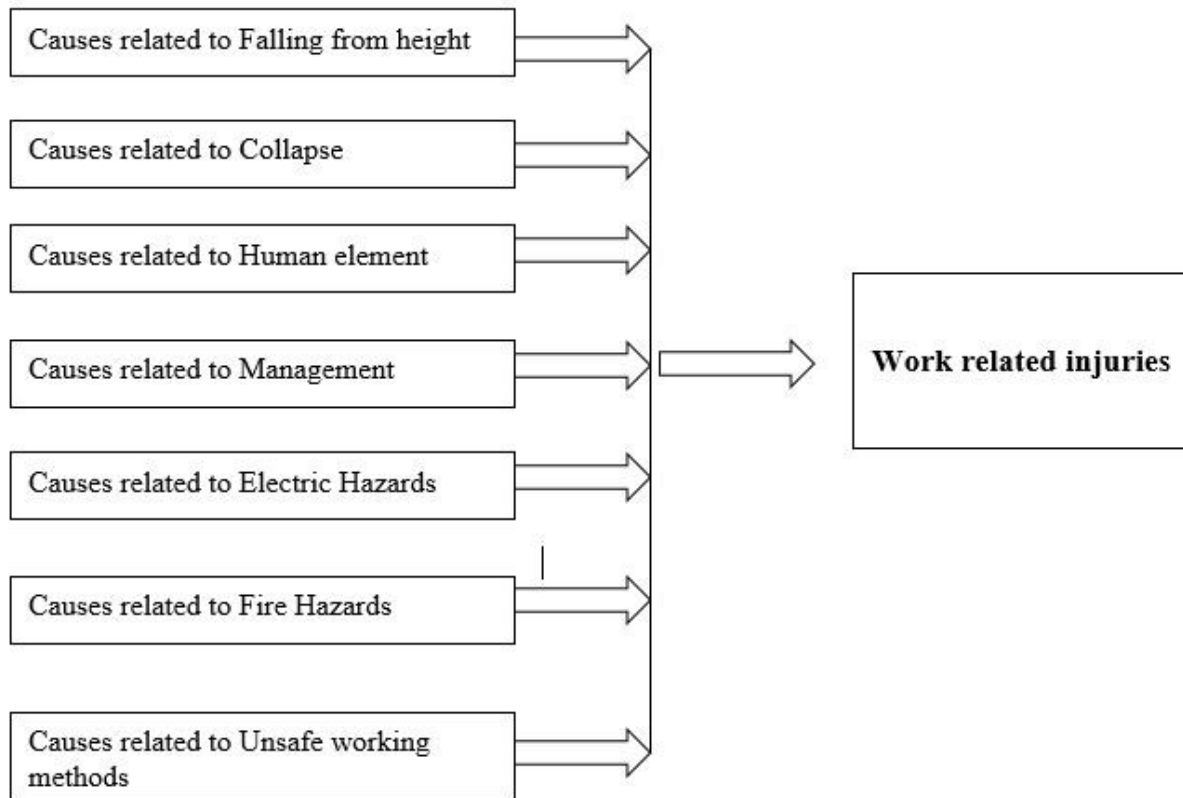


Figure 2. 1: Conceptual framework

Source: Own development from different sources (2020)

The conceptual framework states that causes related to falling from height, causes related to collapse, causes related to human element, causes related to management, causes related to electrical hazards, causes related to fire hazards and causes related to unsafe working methods leads to work-related injuries.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter includes the methodology used in order to meet the objective of the study. This section specifically explains in detail about the research approach and design, population and samples, data collection tools used, data analysis and ethical considerations.

3.2 Research Approach and Design

According to Robson (2002), based on the purposes they serve, researches can be categorized into three types: explorative, descriptive, and explanative. Exploratory research is characterized as the seeking of new insights, the “looking around”, and the asking of questions or the bringing of some phenomenon into new light. Descriptive research is characterized as the depicting of accurate profile of people, events, or situations. Finally, explanatory research aims at gaining an explanation of a specific problem, generally in the form of causal relationships (Robson, 2002).

To successfully achieve the research objectives and answer the stated research questions, the study selected descriptive design. Descriptive research used because the study seeks to identify major factors that causes work-related injuries in construction projects. As it is stated earlier, the objectives of this study are mainly to identify the major causes of work-related injuries. So the reason behind using the descriptive design is because the research question is towards answering the “what” and is explaining or describing the work-related phenomenon.

A research can be either of qualitative or quantitative or mixed in nature. Quantitative research approach is an approach which generate numerical data and use statistics to improve numerical data. It is helpful to assess the magnitude of something. Qualitative research approach is an approach that involve human events such as human interactions, social organizations, and the like. It is suitable to describe, interpret, verify and evaluate a given phenomenon. Mixed methods research is an approach to inquiry that combines both qualitative and quantitative forms of

research. It involves philosophical assumptions, the use of qualitative and quantitative approaches, and the mixing or integrating of both approaches in a study (Creswell, 2003).

To meet the objectives of the study, the study adopted both quantitative and qualitative or a mixed research approach. The reason behind selecting the approach for the study is to cover the weakness of each approach with the strength of the other approach.

3.3 Population and Sampling Method

3.3.1 Target Population

This study targeted construction projects which are at the construction stage in Rama Construction Company. The studied population was based on the data acquired from human resource department of Rama Construction. Hence, the total population consists of 17 construction projects out of the total population three samples were taken by decomposing the projects into three strata. These are building projects, industrial projects and road projects. The building projects were 10, industrial projects are 2 and road projects are 5.

The researcher narrows down the scope to the three categories and one project selected from each category because of the following reasons of justification; the project being currently under construction stage, the data availability factor and the time constraint to complete the project work limited the researcher to focus only on these three projects.

3.3.2 Sampling Size

Convenience sampling technique was used to select the respondents under the representative projects. The questionnaire was distributed to each project sites of all construction and safety department employees. Therefore, the questionnaire was distributed for a total of 66 respondents', 22 of the respondents are from building project, 22 of the respondents are from an industry project and 22 of the respondents are from road project. The response rate of the questionnaire was so far so good. 93.9% of each representative group returned the questionnaire by disclosing their view about the major causes of work-related injuries of the constructions projects understudied.

3.4 Data Sources and Data Collection Tools

Data sources

Mainly primary data used for this study. More specifically, the researcher used a questionnaire survey. Also, a semi-structured interview was used to substantiate results obtained from different data sources and types.

Data collection tools

I. Questionnaire

Questionnaire design

A questionnaire was undertaken to gather the required information from professionals who have been involved in the construction and safety sector; towards answering the basic research question. Based on the objective of the study the questions were classified into three sections. All of the questions are closed-ended. The questionnaire is divided into the following three major parts.

Section A: Respondents identification

This part covers inquiries on general background information of the respondents. It includes six important questions which are: category of the project, name of the project, gender, position, year of experience and year of experience in the specific project.

Section B: Causes of work-related injuries in construction projects

This section is of the questionnaire was added to answer the first question of the research. About 37 causes with seven groups were identified from different literature reviews and then the respondents were asked to identify the level of agreement on the identified factors to be the cause of work-related injuries on their project. A five-level Likert scale was used to rate the causes of work-related injuries with a range from strongly agree to strongly disagree.

Full set of the questionnaire is attached as Appendix.

II. Semi structured interview

As stated by Stuart MacDonald & Nicola Headlam (2009), semi-structured interview is a more commonly used interview technique that follows a framework in order to address key themes rather than specific questions. At the same time, it allows a certain degree of flexibility for the researcher to respond to the answers of the interviewee and therefore develop the themes and issues as they arise. In this study, a semi-structured interview was carried out to collect data from the four projects selected. Semi-structured interview was used to collect data from three project managers and one department manager. The data obtained through this tool was about a general description of the project, major factors causing of work-related injuries. Identifying the causes was used for triangulating the responses obtained from the questionnaire survey (Samrawit, 2019). Using this data gathering instrument is imperative to get substantial data about the issue under the study (attached on appendix B).

3.5 Procedures of Data Collection

According to Muller (2011), validity and reliability are measures used in quantitative research to assess the accuracy of the measurement tool and its consistency. Validity refers to the extent we are measuring what we hope to measure (and what we think we are measuring) while Reliability is concerned with questions of stability and consistency - does the same measurement tool yield stable and consistent results when repeated over time. Both types of measures are important tools to reach at a valid research result. Therefore, to achieve this, the researcher has used the following mechanisms.

A. Validity

Validity refers to the ability of the instrument to measure what it is designed to measure. It is the accuracy and meaningfulness of inferences which are based on research results. Validity therefore is whether an instrument is on target in measuring what is expected to measure. To determine the validity of the instruments the researcher presented the questionnaire and the interview guide to the advisor for critique. Then to ensure the validity, the data collecting instruments was tested in pilot study. The pilot study was carried out before distributing the questionnaire and the process involves giving the questionnaire to some number of respondents who have knowledge of that area to give comments on it.

B. Reliability

Reliability is the extent to which the same finding will be obtained if the research was repeated at another time by another researcher. If the same finding can be obtained again, the instrument is consistent or reliable. The Cronbach's alpha instrument is one of the most commonly used for accepted measures of reliability. Cronbach's alpha is a coefficient represented as a number between 0 and 1. The internal consistency reliability is higher if the Cronbach's alpha is closer to 1. The minimum level for reliability when using Cronbach's alpha coefficient is 0.7 and any value below this indicates that the variables are inconsistent and unreliable (Fellows & Liu, 2007).

Table 3. 1: Results of reliability analysis

Variable	Cronbach's alpha coefficient
Causes of work-related injuries	
Causes related to Falling from height	0.829
Causes related to Collapse	0.738
Causes related to Human element	0.750
Causes related to Management	0.831
Causes related to Electric Hazards	0.749
Causes related to Fire Hazards	0.780
Causes related to Unsafe working methods	0.801
All Questions	0.940

Source: Own survey (2020)

In this study, this coefficient was used to measure the reliability of the questionnaire. As shown in the table above, the reliability of the questionnaire used for the study has been tested by SPSS version 20. The alpha coefficient was calculated for each scaled group factors and the entire questionnaire. As the result indicated the result of each group were greater than 0.70, which is the minimum level for reliability. Therefore, it can be concluded that the questionnaire survey is reliable and consistent. After obtaining these values, the researcher proceeded to the data analysis step.

3.6 Methods of Data Analysis

This research used two types of data analysis methods, to analyze the sample data. The descriptive statistical analysis was used to analyze the means of the data collected through the close-ended questions of the questionnaire. The data collected using semi-structured interviews were analyzed using qualitative data analysis techniques together with the results of the descriptive statistics to supplement one by the other. Descriptive statistics that involve both measures of central tendency (mean, median, and mode) and measures of dispersion (standard deviation) were used to analyze the ordinal data using SPSS software. Since the research objective is to identify the major once from the identified lists, to meet the objective the relativity importance index (RII) method was implemented to determine the ranks of all factors listed in the questionnaire. Finally, the data obtained from the questionnaires were presented in tables.

I. Relativity importance index (RII)

Relative importance index is used to show the importance of each factor that cause of work-related injuries by weighting them with the means of summing up the scores that each person gave to the issues. After calculating the RII value, the factors were ranked based on their respective values.

The following formula was used to calculate the RII according to L. Muhwezi et.al, (2014).

$$RII = \frac{\sum W}{A * N}$$

$$(0 \leq RII \leq 1)$$

Where:

W = is the weight given to each factor by the respondents and ranges from 1 to 5,

(where “1” is “strongly disagree” and “5” is “strongly agree”);

A = is the highest weight (i.e. 5 in this case) and;

N = is the total number of respondents.

3.7 Ethical Considerations

According to Rajesh Kumar and C. Kandasamy (2012) ethical consideration in research work are the following:

- **Right to choose;** Everyone has the right to determine whether or not to participate in a research project.
- **Right to be informed:** Research participants have the right to be informed of all aspects of a research task. Knowing what is involved, how long it will take, and what will be done with the data, etc.
- **Right to Privacy:** All consumers have right to Privacy.

An utmost effort was exerted to comply with all ethical standards throughout data collection and report writing process. In the questionnaire and interview, the participants of the respondents were voluntary. The name of respondents is not stated in any of the study parts and their responses were confidential.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter deals with the results and discussion of the data gathered. The chapter has four sections, section 4.1 presents introduction to the chapter, section 4.2 presents response rate of the respondents and section 4.3 presents the demographic information of the respondents related to gender, project category and work experience. Finally, results and discussion regarding the factors causing work-related injuries presented in section 4.4.

4.2 Response Rate

Sixty-six employees were engaged in the sample that was selected but 63 questionnaires were responded and returned. After screening was conducted, one questionnaire was rejected and thus, the analysis was carried out using the remaining 62 questionnaires making the response rate to be 93.9%.

4.3 Demographic Information

The demographic information considered in the study was the respondents gender, category of the project, name of the project, project location, position in the project, total work experience and specific work experience in the project.

4.3.1 Respondents Gender, Work experience in the Construction Industry & in the Specified Project

Respondents were to indicate their gender. The data was analyzed and the results are shown in Table 4.1. It was found that 69.4% were male and 30.6% were female. The difference of the respondent's gender could be attributed to male dominance.

Work experience of respondent shown in Table 4.1 depicted 53.2% of the respondents had 1-5 years' experience, 29.0% had between 6-10 years' experience, 12.9% had 11 up to 15 years' of work experience, and 4.8% of them had greater than fifteen years' work experience. This shows

that majority of the respondents have a work experience less than ten years indicating the respondents were young.

Respondents work experience in the specific project as seen in Table 4.1 showed 22.6% of the respondents less than one year, 67.7% were between 1 - 4 years, and respondents greater than were mark 9.7%. This work experience in the specific projects indicates that most of the respondents which accounts 90.3% were stayed in the specific project.

Table 4. 1: Respondent’s gender, Work experience in the construction industry & in the specified project

Gender	Frequency	Percentage (%)	Cumulative (%)
Female	19	30.6	30.6
Male	43	69.4	100.0
Total	62	100.0	
Work experience in the construction industry	Frequency	Percent (%)	Cumulative (%)
1-5	33	53.2	53.2
6-10	18	29.0	82.2
11-15	8	12.9	95.1
>15	3	4.8	100.0
Total	62	100.0	
Work experience in the specified project	Frequency	Percent (%)	Cumulative (%)
<1	14	22.6	22.6
1-4	42	67.7	90.3
>4	6	9.7	100.0
Total	62	100.0	

Source: Own survey (2020)

4.3.2 Respondents Category of Project

Regarding the respondents' category of project, the below Table 4.2 shows that from the total respondents', 21 (33.9%) of the respondents were from building projects, 20 (32.2%) of the respondents were from industrial projects, 21 (33.9%) of the respondents were from road projects. The results imply that there is a fair distribution of respondents from all category of Rama construction projects.

Table 4. 2: Respondent's category of project

Category of project	Frequency	Percent (%)	Cumulative (%)
Building	21	33.9	33.9
Industry	20	32.2	66.1
Road	21	33.9	100.0
Total	62	100.0	

Source: Own survey (2020)

4.3.3 Respondent's Project

Respondent's project shown in Table 4.3 depicted 33.9% of the respondents were from Gondar Azezo Upgrading Road Project and Nile Insurance Head Quarter Building Project. The rest 32.2% were from Komolcha Manufacturing Plant Project. So, it can be said that there is unbiased distribution of respondents from all projects.

Table 4. 3: Respondent's project

Name of the project	Frequency	Percent (%)	Cumulative (%)
Gondar Azezo Upgrading Road Project	21	33.9	33.9
Komolcha Manufacturing Plant Project	20	32.2	66.1
Nile Insurance Head Quarter Building Project	21	33.9	100.0
Total	62	100.0	

Source: Own survey (2020)

4.3.4 Respondent's Project Location

From Table 4.4, it is possible to see that 33.9% of the respondent's project location were at Addis Ababa and Gondar. While, 32.2% of the respondent's project location were situated at Kombolcha.

Table 4. 4: Respondent's project location

Project location	Frequency	Percent (%)	Cumulative (%)
Addis Ababa	21	33.9	33.9
Gondar	21	33.9	67.8
Kombolcha	20	32.2	100.0
Total	62	100.0	

Source: Own survey (2020)

4.3.5 Respondents Position in the Company / Project

The questionnaires were received from 62 professionals who are working in different position within the construction sites of the company. As shown in Table 4.5, the respondents position illustrated that 16.1% of the respondents were engineers, 12.9% of the respondents were construction managers, quality inspectors and surveyors. 11.3% of the respondents were safety officers, 9.7% of the respondents were foremen, 6.5% of the respondents were project managers, 3.2% of the respondents were quantity surveyors and mechanical supervisors. The rest 1.6% of the respondents were coordination technician, electrical and mechanical supervisor, formwork coordinator and planning expert. From this we can observe that the majority of the respondents were engineers since, most of the company activities focuses on the construction.

Table 4. 5: Position in the company / project

Position in the company / project	Frequency	Percent (%)	Cumulative (%)
Construction Manager	8	12.9	12.9
Coordination Technician	1	1.6	14.5
Electrical Supervisor	1	1.6	16.1
Forman	6	9.7	25.8
Formwork Coordinator	1	1.6	27.4

Material Inspector	1	1.6	29.0
Mechanical Supervisor	2	3.2	32.3
Engineers	12	19.3	51.6
Quality Inspector	8	12.9	64.5
Planning Expert	1	1.6	66.1
Project Manager	4	6.5	72.6
Quantity Surveyor	2	3.2	75.8
Safety Officer	7	11.3	87.1
Surveyor	8	12.9	100.0
Total	62	100.0	

Source: Own survey (2020)

4.4 Factors Causing Work-related Injuries

This section of the questionnaire was designed to obtain data about the top major work-related injury causing factors. In order to obtain that, a list of frequent work-related injury causing factors were identified from literature review and modified based on the feedbacks collected from the pilot study. After that, a list of 37 work-related injury causing factors were selected and grouped in to seven groups as causing factors related to falling from height, collapse, human element, management, electric hazards, fire hazards and unsafe working methods.

The rank of the seven categories and each causing factors were analyzed using descriptive statistics and ranked using Relative Importance Index (RII) value. According to the obtained results the categories were ranked as follows.

Table 4. 6: Category of causes of work-related injuries

	Causes of work-related injuries	N	Mean	SD	RII	Rank
C	Causes related to Human element	62	3.810	1.171	0.762	1
G	Causes related to Unsafe working methods	62	3.719	1.610	0.744	2
B	Causes related to Collapse	62	3.655	1.168	0.731	3
A	Causes related to Falling from height	62	3.634	1.216	0.727	4
D	Causes related to Management	62	3.552	1.234	0.710	5
E	Causes related to Electric hazards	62	3.545	1.141	0.709	6
F	Causes related to Fire hazards	62	3.409	1.210	0.682	7

Source: Own survey (2020)

As shown on Table 4.8, mean, standard deviation, relativity importance index (RII) is calculated for each category of major causes of work-related injuries. As the statistical results depicts that, most factors had a mean value greater than 3.4. It indicates each of the selected causing factors were agreed by the respondents. The highest mean score as attained by causes related to human element with (mean =3.81, standard deviation = 1.171& RII = 0.762) and the least mean was scored by causes related to fire hazards (mean = 3.409, standard deviation =1.210& RII = 0.682). Each of these seven groups are discussed in detail according to their rank; after that the top three work-related injury causing factors from each category are discussed below.

4.4.1 Factors Causing Work-related Injuries that are Related to Human Element

As stated above causes related to human element is the leading cause of work-related injury category with mean value of 3.81 and RII value of 0.762. Some of the studies reviewed indicated that the human elements or factor such as the negligence of the workers in doing their works will also lead to the work-related injuries. The results of Abdul Hamid et al. (2008) ranked human element as the third major cause for work-related injury. Whereas, Shakil et al. (2018) determined human elements as the fourth highest contributor to the cause of work-related injury among other fourteen group of causes.

Five work-related injuries were selected under the human element category. Respondents were asked to indicate their level of agreement on the listed work-related injury causing factors. The

respondents identified that “*workers’ negligence*” is the ruling cause of work-related injury from the category of human element. Based on the received responses the factors were ranked as indicated in the table below.

Table 4. 7: Causes related to human element

Causes of work-related injuries that are related to Human element	Mean	SD	RII	Rank	Overall Rank
Inappropriate use of personal protective equipment’s	4.000	1.159	0.800	2	2
Lack of concentration to work	3.806	1.304	0.761	3	5
Workers’ negligence	4.081	1.076	0.816	1	1
Miss use of tools	3.726	1.176	0.745	4	10
Horseplay in workplace	3.435	1.140	0.687	5	30

Source: Own survey (2020)

Based on the results obtained from survey, respondents ranked “*Workers’ negligence*” as the first work-related injury causing factor with the mean value of 4.081 and RII value of 0.816. This work-related injury causing factor is ranked 1st from the total 37 factors. The work-related injury causing factor ranked second in this category was “*Inappropriate use of personal protective equipment’s*” with mean value of 4.0 and RII value of 0.80. This work-related injury causing factor is ranked 2nd from the total identified 37 factors. The work-related injury causing factor ranked 3rd by the respondents in the human element category was “*Lack of concentration to work*” with a mean value of 3.806 and RII value of 0.761. This factor is ranked 5th from the overall factors.

4.4.2 Factors Causing Work-related Injuries that are Related to Unsafe Working Methods

From the selected seven work-related injury causing categories, unsafe working methods was ranked second with mean value of 3.719 and RII value of 0.744. Five work-related injury causes were selected under the category of unsafe working methods. Respondents were asked to indicate their level of agreement on the listed work-related injury causing factors. Based on the received responses the factors were ranked as indicated in the table below.

On the study, Abdul Hamid et al. (2008) ranked causes related to unsafe working methods by 26.4% as second major cause of work-related injury mostly related to incorrect work procedures. The ranking given is exactly the same with this study. In addition to this, Shakil et al. (2018) stated this factor as equipment and tools related and ranked this factor as 9th from overall fourteen categories.

Table 4. 8: Causes related to unsafe working methods

Causes of work-related injuries that are related to Unsafe working methods	Mean	SD	RII	Rank	Overall Rank
Incorrect usage of working procedures	3.710	1.206	0.742	3	13
Low knowledge of using tools	3.677	1.128	0.735	4	15
Fail to obey work procedures	3.823	1.079	0.765	1	4
Leaving working tools exposed to accidents	3.726	1.190	0.745	2	10
Fail to report unsafe methods	3.661	1.200	0.732	5	16

Source: Own survey (2020)

Respondents ranked “*Fail to obey work procedures*” as the first cause of work-related causing factor with the mean value of 3.823 and RII value of 0.765. This work-related causing factor is further ranked 4th from the total 37 factors. According to the responses collected, “*Leaving working tools exposed to accidents*” was ranked 2nd from the category with mean value of 3.726 and RII value of 0.745. This causing factor ranked 10th from the total identified causing factors. The work-related injury causing factor ranked 3rd by the respondents in unsafe working methods category was “*Incorrect usage of working procedures*” with a mean value of 3.710 and RII value of 0.742. This factor is ranked 13th from the overall factors.

4.4.3 Factors Causing Work-related Injuries that are Related to Collapse

The third ranked work-related injury causing category is collapse. This category ranked third with mean value of 3.655 and RII value of 0.731. Yoseph (2015), illustrated this category fourth cause of work-related injury. In addition, Lucy et al. (2016) ranked classified this category as the second cause. And this is due to the reason that eucalyptus trees used as protections which can delay after some times.

Five work-related injury causes were selected under the category of collapse. Respondents were asked to indicate their level of agreement on the listed work-related injury causing factors. Based on the received responses the factors were ranked as indicated in the table below.

Table 4. 9: Causes related to collapse

Causes of work-related injuries that are related to Collapse	Mean	SD	RII	Rank	Overall Rank
Unprotected sides and leading edges	3.613	1.150	0.723	4	21
Unprotected excavations with barricade and fence	3.726	1.190	0.745	2	10
Movement too close edges of excavations	3.806	1.143	0.761	1	5
Improperly displayed warning notices	3.645	1.61	0.729	3	17
Working excavations in restricted areas	3.484	1.198	0.697	5	27

Source: Own survey (2020)

Respondents ranked “*Movement too close edges of excavations*” as the first cause of work-related causing factor with the mean value of 3.806 and RII value of 0.761. This work-related causing factor is further ranked 5th from the total 37 factors. According to the responses collected, “*Unprotected excavations with barricade and fence*” was ranked 2nd from the category with mean value of 3.726 and RII value of 0.745. This causing factor ranked 10th from the total identified causing factors. The work-related injury causing factor ranked 3rd by the respondents in collapse category was “*Improperly displayed warning notices*” with a mean value of 3.645 and RII value of 0.729. This factor is ranked 17th from the overall factors.

4.4.4 Factors Causing Work-related Injuries that are Related to Falling from Height

Respondents ranked the work-related injury cause category falling from height as fourth with mean value of 3.634 and RII value of 0.727.

As stated by Yoseph (2015), falling from height is the leading cause of occupational accidents in construction site workers. According to the study, the responses from construction professionals and construction site workers revealed that falling from height is the leading cause of fatal injuries. Most literature studies confirm this factor as a leading cause of work-related injuries. For instance,

Lucy et al. (2016) ranked this factor 1st cause of work-related injury. The reason behind this problem is that there is no horizontal protection made to high rise building. Similarly, Mohd Nasrun et al. (2016) ranked falling from height at construction sites as first by 22%. The study was based on statistics of the number of fatality and disability due to falling from height in Malaysia construction sites.

Six work-related injury causes were selected under the category of falling from height. Respondents were asked to indicate their level of agreement on the listed work-related injury causing factors. Based on the received responses the factors were ranked as indicated in the table below.

Table 4. 10: Causes related to falling from height

Causes of work-related injuries that are related to Falling from height	Mean	SD	RII	Rank	Overall Rank
Unprotected openings and fragile roofs	3.774	1.047	0.755	2	7
Insufficient and unsuitable scaffoldings	3.871	1.312	0.774	1	3
Overbalanced ladder	3.452	1.263	0.690	6	29
Missing or broken rungs of ladder	3.548	1.210	0.710	4	24
Overload scaffoldings	3.516	1.170	0.703	5	25
Erection and dismantle of scaffoldings by unskilled or unexperienced labor	3.645	1.294	0.729	3	17

Source: Own survey (2020)

Based on the results obtained from survey, respondents ranked “*Insufficient and unsuitable scaffoldings*” as the first work-related injury causing factor with the mean value of 3.871 and RII value of 0.774. This work-related injury causing factor is ranked 3rd from the total 37 factors. The work-related injury causing factor ranked second in this category was “*Unprotected openings and fragile roofs*” with mean value of 3.774 and RII value of 0.755. This work-related injury causing factor is ranked 7th from the total identified 37 factors. The work-related injury causing factor

ranked 3rd by the respondents in the falling from height category was “*Erection and dismantle of scaffoldings by unskilled or unexperienced labor*” with a mean value of 3.645 and RII value of 0.729. This factor is ranked 17th from the overall factors.

4.4.5 Factors Causing Work-related Injuries that are Related to Management

Respondents ranked the work-related injury cause category management as fifth with mean value of 3.552 and RII value of 0.710. Five work-related injury causes were selected under the category of management. Respondents were asked to indicate their level of agreement on the listed work-related injury causing factors. Based on the received responses the factors were ranked as indicated in the table below.

Studies which are carried out in this area indicated the causes of construction accidents on average are mainly attributed to the management by 29.2% such as poor programs, poor safety policies and lack of safety education programs (Abdul Hamid et al.2008). Abdul Hamid et al. (2008) ranked causes related to management as the 1stmajor cause for work-related injury. Whereas, Shakil et al. (2018) determined management related causes as the 12thhighest contributor to the cause of work-related injury among other fourteen group of causes.

Table 4. 11: Causes related to management

Causes of work-related injuries that are related to Management	Mean	SD	RII	Rank	Overall Rank
Poor safety programs and policies	3.468	1.388	0.694	4	28
Unclear employee accountability and responsibility for workplace health and safety	3.629	1.090	0.726	2	19
Failed to provide safety resources	3.774	1.286	0.755	1	7
Lack of providing safety education training for workers	3.565	1.182	0.716	3	23
Engaging incompetent safety personnel	3.323	1.225	0.665	5	33

Source: Own survey (2020)

Based on the results obtained from survey, respondents ranked “*Failed to provide safety resources*” as the first work-related injury causing factor with the mean value of 3.774 and RII value of 0.755.

This work-related injury causing factor is ranked 7th from the total 37 factors. The work-related injury causing factor ranked second in this category was “*Unclear employee accountability and responsibility for workplace health and safety*” with mean value of 3.629 and RII value of 0.726. This work-related injury causing factor is ranked 7th from the total identified 37 factors. The work-related injury causing factor ranked 3rd by the respondents in the falling from management category was “*Lack of providing safety education training for workers*” with a mean value of 3.565 and RII value of 0.716. This factor is ranked 23th from the overall factors.

4.4.6 Factors Causing Work-related Injuries that are Related to Electric Hazard

The sixth ranked work-related injury causing category is electric hazard. This category ranked sixth with mean value of 3.545 and RII value of 0.709. Five work-related injury causes were selected under the category of electric hazard. Respondents were asked to indicate their level of agreement on the listed work-related injury causing factors. Based on the received responses the factors were ranked as indicated in the table below.

Yoseph (2015), identified electricity as one of the major cause of work-related injury in construction projects. Accordingly, electricity ranked 6th cause of work-related injury which is the same as this study. The same way, Mohd Nasrun et al. (2016) ranked falling from height at construction sites as 4th by 13%. In contrast, Lucy et al. (2016) ranked this factor 7th cause of work-related injury.

Table 4. 12: Causes related to electrical hazard

Causes of work-related injuries that are related to Electric hazard	Mean	SD	RII	Rank	Overall Rank
Using poorly maintained electrical equipment's	3.774	1.047	0.755	1	7
Working near overhead high tension lines	3.323	1.238	0.665	4	33
Inappropriate cable protection systems	3.629	1.244	0.726	3	19
Contact with underground power cables during excavation work	3.306	1.223	0.661	5	36
Using wires that have not been grounded properly	3.694	0.951	0.739	2	14

Source: Own survey (2020)

Respondents ranked “*Using poorly maintained electrical equipment’s*” as the first cause of work-related causing factor with the mean value of 3.774 and RII value of 0.755. This work-related causing factor is further ranked 7th from the total 37 factors. According to the responses collected, “*Using wires that have not been grounded properly*” was ranked 2nd from the category with mean value of 3.694 and RII value of 0.739. This causing factor ranked 14th from the total identified causing factors. The work-related injury causing factor ranked 3rd by the respondents in electrical hazard category was “*Inappropriate cable protection systems*” with a mean value of 3.629 and RII value of 0.726. This factor is ranked 19th from the overall factors.

4.4.7 Factors Causing Work-related Injuries that are Related to Fire Hazard

From the selected seven work-related injury causing categories, fire hazard was ranked last with mean value of 3.409 and RII value of 0.682.

Six work-related injury causes were selected under the category of fire hazard. Respondents were asked to indicate their level of agreement on the listed work-related injury causing factors. Based on the received responses the factors were ranked as indicated in the table below.

Yoseph (2015), illustrated fire hazards category 3rd under the category of others cause classification. In addition, Lucy et al. (2016) classified this category of fire hazards as other cause of work-related injuries. According to Lucy et al. (2016) fire hazards ranked 8th from overall eight categories by 30.25%.

Table 4. 13: Causes related to fire hazard

Causes of work-related injuries that are related to Fire hazard	Mean	SD	RII	Rank	Overall Rank
Inadequate fire warning systems	3.516	1.264	0.703	2	25
Unrestricted smoking areas in site	3.387	1.092	0.677	3	31
Lack of firefighting equipment’s	3.581	1.262	0.716	1	22
Inadequate means of escaping and access for emergency fire vehicles	3.339	1.130	0.668	4	32
Inadequately notify flammable materials	3.306	1.275	0.661	6	36

Uncontrolled of hot work and naked flame appliances	3.323	1.238	0.665	5	33
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Source: Own survey (2020)

Respondents ranked “*Lack of firefighting equipment’s*” as the first cause of work-related causing factor with the mean value of 3.581 and RII value of 0.716. This work-related causing factor is further ranked 22th from the total 37 factors. According to the responses collected, “*Inadequate fire warning systems*” was ranked 2nd from the category with mean value of 3.516 and RII value of 0.703. This causing factor ranked 25th from the total identified causing factors. The work-related injury causing factor ranked 3rd by the respondents in fire hazard category was “*Unrestricted smoking areas in site*” with a mean value of 3.387 and RII value of 0.677. This factor is ranked 31th from the overall factors.

The following are the top five major causes of work-related injuries from the overall 37 factors. All of them are discussed above in detail in their own category.

Table 4. 14: Top five major causes of work-related injuries

Causes of work-related injuries	Causes of work-related injuries category	Mean	SD	RII	Rank
Workers’ negligence	Causes related to Human element	4.081	1.076	0.816	1
Inappropriate use of personal protective equipment’s	Causes related to Human element	4.000	1.159	0.800	2
Insufficient and unsuitable scaffoldings	Causes related to Falling from height	3.871	1.312	0.774	3
Fail to obey work procedures	Causes related to Unsafe working methods	3.823	1.079	0.765	4
Lack of concentration to work	Causes related to Human element	3.806	1.304	0.761	5
Movement too close edges of excavations	Causes related to Collapse	3.806	1.143	0.761	5

Source: Own survey (2020)

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The purpose of this study was to identify the major causes of work-related injuries in Rama construction projects. The results of the study were presented in the previous chapter. In this chapter, summary of the main findings, conclusion and recommendations will be made. This chapter is consisted of three sections.

5.2 Summary of major findings

According to the collected data through questionnaires and semi-structured interviews the study revealed the following results.

- Among the identified work-related injuries causing factors, the top major factor was cause related to human element. Those causes related to human element happened due to workers' negligence and inappropriate use of personal protective equipment's.
- The findings show that the causes of work-related injuries are more related to the employees rather than the employers as indicated by the results to the factor of human elements (1st) and unsafe working method (2nd) as compared to the management (5th).
- The causes of work-related injuries were not adequately recorded and documented to be used as a lesson learned for the next project or to come up with injury reduction strategies.

5.3 Conclusion

Construction projects plays a vital role for economic development of countries. Safety is utmost important for construction projects due to the nature of the construction industry. But, it is usually considered as a secondary concern where the main concern is completing projects with the required quality, cost and time. Safety issues considered when an accident occur on the construction projects.

The main objective of the research is to identify the major causes of work related injuries in construction projects particularly for the case of Rama construction projects. When looking at the results of the analysis the following conclusions are drawn: -The literatures show that work-related injuries are caused by a wide range of factors, some of which are falling from height, collapse, human element, management, electric hazard, fire hazard and unsafe working methods. From the survey results, it is found that all the respondents are aware of the main causes of work-related injuries. The cause of work-related injuries in the Rama construction projects are a multi-faceted phenomenon mainly attributed to workers' negligence, inappropriate use of personal protective equipment's, insufficient and unsuitable scaffoldings, failure of workers to obey work procedures, lack of concentration to work, and movement too close edges of excavations.

Finally, to prevent construction work-related injuries, various measures such as proper use of PPE, safety trainings, proper supervision and toolbox meetings should introduce. The occurrence of work-related injuries should be recorded and reported. Safety personnel should be appointed in the sites to supervise the workers.

5.4 Recommendations

Based on the findings of the research, the following recommendations are forwarded.

- Training needed to be provided regularly to all level of workers on construction safety using qualified professionals.
- The management should provide effective supervision during the execution of works and more efforts need to be done by the management of the construction company to improve the awareness of employees.
- The construction company should make sure that all employees appropriately wear personal protective equipment and punish the employees who make safety violation.

5.5 Recommendations for further study areas

- This study was carried out for the case of projects in Rama construction Plc; so further studies should be made on other construction companies to identify additional causes of work-related injuries.
- Research can be conducted to identify the causes of work-related injuries including the perspective of consultants and clients which not covered in the present study.
- The findings of this study are limited to source population of employees from construction and safety department. Hence, recommendation of other studies can increase the population to skilled and unskilled labors to compare the findings to that of this study in order to make more informed recommendations.
- Research can be conducted focusing on the effect of work-related injuries on successful completion of construction projects.

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APPENDIX A
QUESTIONNAIRE

Project Management Department
M.A thesis on Project Management

Dear Respondent,

I am kindly requesting your willingness to participate in this research “**Identifying the Major Causes of Work-Related Injuries in Construction Projects: The Case of Rama Construction Plc.**” by filling this questionnaire. Any information you are willing to provide will be greatly appreciated.

The objective of this research is to identify the major causes of work-related injuries in construction projects in Ethiopia particularly for the case of projects in Rama construction Plc.

All the data collected will only be used for academic purpose. If you have any inquiry, please feel free to contact me through the provided addresses.

Thank you for giving 15 minutes of your time and your kind cooperation for the research.

Contact Address

Abiy Girma

E-mail: gooabt@gmail.com

Phone No: 0913-469561

SECTION A: RESPONDENT'S IDENTIFICATION

1. Category of your project

- [1] Road
- [2] Industry
- [3] Building
- [4] Other, please specify _____

2. Name of the Project _____

3. Gender

- [1] Male
- [2] Female

4. What is your position in the company / project?

- [1] Project Manager
- [2] Engineer (Office Engineer / Site Engineer / Construction Engineer / Project Engineer)
- [3] Forman
- [4] Safety Officer
- [5] Other, please specify _____

5. How many years have you worked in the construction industry?

- [1] 1-5 years
- [2] 6-10 years
- [3] 11-15 years
- [4] >15 years

6. How many years have you worked in the specified project?

- [1] <1 year
- [2] 1-4 years
- [3] >4 years

SECTION B: CAUSES OF WORK-RELATED INJURIES IN CONSTRUCTION PROJECTS

7. The following are selected factors that might be causes for the occurrence of work-related injuries in construction projects. Please indicate your level of agreement on the following statements regarding to your project.

A. Causes related to Falling from height		Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
1	Unprotected openings and fragile roofs					
2	Insufficient and unsuitable scaffoldings					
3	Overbalanced ladder					
4	Missing or broken rungs of ladder					
5	Overload scaffoldings					
5	Erection and dismantle of scaffoldings by unskilled or unexperienced labor					
B. Causes related to Collapse		Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
6	Unprotected sides and leading edges					
7	Unprotected excavations with barricade and fence					
8	Movement too close edges of excavations					
9	Improperly displayed warning notices					
10	Working excavations in restricted areas					
C. Causes related to Human element						

		Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
11	Inappropriate use of personal protective equipment's					
12	Lack of concentration to work					
13	Workers' negligence					
14	Miss use of tools					
15	Horseplay in workplace					
D. Causes related to Management		Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
16	Poor safety programs and policies					
17	Unclear employee accountability and responsibility for workplace health and safety					
18	Failed to provide safety resources					
19	Lack of providing safety education training for workers					
20	Engaging incompetent safety personnel					
E. Causes related to Electric Hazards		Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
21	Using poorly maintained electrical equipment's					
22	Working near overhead high tension lines					
23	Inappropriate cable protection systems					
24	Contact with underground power cables during excavation work					

25	Using wires that have not been grounded properly					
F. Causes related to Fire Hazards		Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
26	Inadequate fire warning systems					
27	Unrestricted smoking areas in site					
28	Lack of firefighting equipment's					
29	Inadequate means of escaping and access for emergency fire vehicles					
30	Inadequately notify flammable materials					
30	Uncontrolled of hot work and naked flame appliances					
G. Causes related to Unsafe working methods		Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
31	Incorrect usage of working procedures					
32	Low knowledge of using tools					
33	Fail to obey work procedures					
34	Leaving working tools exposed to accidents					
35	Fail to report unsafe methods					

Thank You Very Much!

APPENDIX B

SEMI STRUCTURED INTERVIEW QUESTIONS

**Project Management Department
M.A thesis on Project Management**

Dear Respondent,

You are invited to take part in this study entitled “**Identifying the Major Causes of Work-Related Injuries in Construction Projects: The Case of Rama Construction Plc.**”. Before you agree to participate in this study, it is important that you understand the objective of the study. The objective of this research is to identify the major causes of work-related injuries in construction projects in Ethiopia particularly for the case of projects in Rama construction Plc.

The study is being conducted in partial fulfillment of the Masters of Project Management (M.A). Participation in this survey is voluntary. Your name will not appear on any of the documents. Your responses will be treated as confidential, and I will ensure that any statements or comments you make cannot be linked to you as an individual.

Thank you for giving your time and your cooperation for the research.

Contact Address

Abiy Girma

E-mail: gooabt@gmail.com

Phone No: 0913-469561

QUESTIONS

1. Can you give me a general explanation about your project?
2. Can you explain how the work-related injuries occurred in your project site?
3. What are the major causes of work-related injuries?
4. Who should be responsible for work-related injuries in construction projects?
5. Are the types and causes of accidents and injuries occurring in the site recorded?
6. How often do work-related injuries occur to your project?
7. Do you consciously record work-related injuries and their frequency? If yes, how?

APPENDIX C

ANALYSIS OF CAUSES OF WORK-RELATED INJURIES IN CONSTRUCTION PROJECTS

No .	Causes of work-related injuries	Total number (N)	Mean	Standard Deviation	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	RII	Over all Rank	Rank in the group
					1	2	3	4	5			
A.	Causes related to Falling from height		3.634	1.216						0.727	4	
1	Unprotected openings and fragile roofs	62	3.774	1.047	2	7	9	29	15	0.755	7	2
2	Insufficient and unsuitable scaffoldings	62	3.871	1.312	5	7	6	17	27	0.774	3	1
3	Overbalanced ladder	62	3.452	1.263	6	8	15	18	15	0.690	29	6
4	Missing or broken rungs of ladder	62	3.548	1.210	4	10	11	22	15	0.710	24	4
5	Overload scaffoldings	62	3.516	1.170	4	7	19	17	15	0.703	25	5
6	Erection and dismantle of scaffoldings by unskilled or	62	3.645	1.294	6	7	9	21	19	0.729	17	3

	unexperienced labor											
B.	Causes related to Collapse		3.655	1.168						0.731	3	
7	Unprotected sides and leading edges	62	3.613	1.150	4	8	9	28	13	0.723	21	4
8	Unprotected excavations with barricade and fence	62	3.726	1.190	4	7	9	24	18	0.745	10	2
9	Movement too close edges of excavations	62	3.806	1.143	2	7	14	17	22	0.761	5	1
10	Improperly displayed warning notices	62	3.645	1.161	2	10	14	18	18	0.729	17	3
11	Working excavations in restricted areas	62	3.484	1.198	5	7	17	19	14	0.697	27	5
C.	Causes related to Human element		3.810	1.171						0.762	1	
12	Inappropriate use of personal protective equipment's	62	4.000	1.159	2	9	2	23	26	0.800	2	2
13	Lack of concentration to work	62	3.806	1.304	6	6	5	22	23	0.761	5	3

14	Workers' negligence	62	4.081	1.076	2	4	9	19	28	0.816	1	1
15	Miss use of tools	62	3.726	1.176	3	9	8	24	18	0.745	10	4
16	Horseplay in workplace	62	3.435	1.140	4	9	16	22	11	0.687	30	5
D.	Causes related to Management		3.552	1.234						0.710	5	
17	Poor safety programs and policies	62	3.468	1.388	8	9	9	18	18	0.694	28	4
18	Unclear employee accountability and responsibility for workplace health and safety	62	3.629	1.090	2	10	10	27	13	0.726	19	2
19	Failed to provide safety resources	62	3.774	1.286	6	6	5	24	21	0.755	7	1
20	Lack of providing safety education training for workers	62	3.565	1.182	2	12	14	17	17	0.713	23	3
21	Engaging incompetent safety personnel	62	3.323	1.225	6	9	18	17	12	0.665	33	5
E.	Causes related to Electric Hazards		3.545	1.141						0.709	6	

22	Using poorly maintained electrical equipment's	62	3.774	1.047	2	5	15	23	17	0.755	7	1
23	Working near overhead high tension lines	62	3.323	1.238	6	10	16	18	12	0.665	33	4
24	Inappropriate cable protection systems	62	3.629	1.244	6	5	12	22	17	0.726	19	3
25	Contact with underground power cables during excavation work	62	3.306	1.223	7	7	19	18	11	0.661	36	5
26	Using wires that have not been grounded properly	62	3.694	0.951		8	16	25	13	0.739	14	2
F.	Causes related to Fire Hazards		3.409	1.210						0.682	7	
27	Inadequate fire warning systems	62	3.516	1.264	8	2	17	20	15	0.703	25	2
28	Unrestricted smoking areas in site	62	3.387	1.092	5	6	19	24	8	0.677	31	3
29	Lack of firefighting equipment's	62	3.581	1.262	6	5	16	17	18	0.716	22	1
30	Inadequate means of escaping and access for	62	3.339	1.130	5	7	22	18	10	0.668	32	4

	emergency fire vehicles											
31	Inadequately notify flammable materials	62	3.306	1.275	9	6	14	23	10	0.661	36	6
32	Uncontrolled of hot work and naked flame appliances	62	3.323	1.238	9	3	19	21	10	0.665	33	5
G.	Causes related to Unsafe working methods		3.719	1.161						0.744	2	
33	Incorrect usage of working procedures	62	3.710	1.206	3	10	8	22	19	0.742	13	3
34	Low knowledge of using tools	62	3.677	1.128	4	6	10	28	14	0.735	15	4
35	Fail to obey work procedures	62	3.823	1.079	2	6	12	23	19	0.765	4	1
36	Leaving working tools exposed to accidents	62	3.726	1.190	4	7	9	24	18	0.745	10	2
37	Fail to report unsafe methods	62	3.661	1.200	3	8	16	15	20	0.732	16	5

APPENDIX D

COMPANY HEALTH SAFETY AND ENVIRONMENTAL ORGANIZATIONAL STRUCTURE AT HEAD OFFICE AND PROJECT

