

**HEALTH AND SAFETY PERFORMANCE ON  
CONSTRUCTION SITES IN RWANDA**

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# **Health and Safety Performance on Construction Sites in Rwanda**

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**DECLARATION**

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

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## **DEDICATION**

This research thesis is dedicated to you my lovely family – ‘THE KUBAHIKAS’. And to you all who tirelessly stood by me throughout this journey, this thesis is dedicated to you as well.

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First of all, I acknowledge my Lord and Saviour Jesus Christ who died for my sins and who has enabled me to reach this far. He has lifted me out of the miry clay and set my feet upon the rock in the most troubling times (Ps 40:2)

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## ABBREVIATIONS AND ACRONYMS

<b>OSH:</b>	Occupational Safety and Health
<b>OHS:</b>	Occupational Health and Safety
<b>OSHA:</b>	Occupational Safety and Health Authority
<b>GDP:</b>	Gross Domestic Product
<b>GoR</b>	Government of Rwanda
<b>SME</b>	Small and Medium Sized Enterprises
<b>H&amp;S</b>	Health and Safety
<b>HSE</b>	Health and Safety Executive
<b>ILO</b>	International Labour Organisation
<b>SWMS</b>	Safe Work Method Statement
<b>PPE</b>	Personal Protective Equipment
<b>HSW</b>	Health and Safety at Work
<b>CSA</b>	Canadian Standards Association
<b>CDM</b>	Construction Design and Management
<b>COSHH</b>	Control of Substances Hazardous to Health
<b>NCI</b>	National Construction Industry
<b>NCCR</b>	National Construction Council of Rwanda

**EDPRS** Economic Development and Poverty Reduction Strategy

**MDGs** Millennium Development Goals Millennium Development Goals

**MIDIMAR** Ministry of Disaster Management and Refugees

**MIFOTRA** Ministry of Public Service and Labour

**MININFRA** Ministry of Infrastructure Ministry of Infrastructure

**MINIRENA** Ministry of Natural Resources and Environment

**MINISANTE** Ministry of Health

**MINIJUST** Ministry of Justice

## ABSTRACT

In Rwanda, the system of occupational health and safety (OSH) practice in the construction industry is ineffective, rendering the OSH performance of the industry poor. However, this issue is not limited to Rwanda. Construction works are considered risky, with regular and high accident rates and ill-health problems for workers, practitioners, and end users. Health and safety issues have always been a significant problem and concern in the construction industry. Workers are exposed to occupational diseases and injuries hazards and the adverse effects of excessively long work hours. Machines, plants and other sophisticated construction equipment pose a danger to the operators, who in most cases do not have prior skills for operating such machines or plants. The number of occupational injuries in the construction industry in Rwanda is high and has kept increasing despite the existing structures there; for safety and health management on construction sites. From this perspective, this study aimed to investigate the health and safety performance of construction projects in Rwanda. An overview of published research and legislation was undertaken. In order to meet the objectives of the study, questionnaires were designed and distributed to potential construction industry players. Structured interviews were carried out with selected government officials in charge of occupational health and safety and construction experts from a selection of large to medium construction sites. After analysis of the results, the study recommends the provision and use of PPE for all workers and, at all times, the launch of education campaigns to arouse awareness among all management and construction workers and more diligent OSH precautions by site staff and provisions at the corporate level. Additionally, adequate staffing of the OSH department and formulation of a more effective OSH framework (of policies, laws, and institutions) at the national level should create a more enabling environment for high OSH performance in the construction industry of Rwanda. This study aimed to bring about awareness of the risks faced by construction workers in Rwanda. The study also provided practical information which will facilitate all the construction stakeholders in enhancing safety on the construction sites.

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of the research

Construction is broadly perceived as being both economically and socially significant. However, the business is likewise viewed to be among the most hazardous. Global approximations by the International Labour Organization (ILO) demonstrate that world occupational health and safety problems in the construction industry are broader than previously recorded. Globally, poor performance in the industry represents more than 1.1 100,000 fatalities yearly, compared to roughly 30-40% of the world's work-related fatal injuries (Alkilani, Jupp, & Sawhney, 2013).

Typically, the construction industry adds to 11% of the Gross Domestic Product in most developing nations (Giang & Pheng, 2010). Nevertheless, many construction activities are intrinsically health and safety risks, for example: working at heights, working underground, working in restricted spaces and closeness to falling materials, handling loads manually, handling hazardous substances, noises, dust, using plants and equipment, fire, exposure to live cables, poor housekeeping and ergonomics (Anchu, 2016).

In an urban setting, health and safety accidents are generally more severe because elevated structures stay overwhelming with the quickly developing complexities of domain-wide construction projects to adapt to modernizing cities arena and intense demand for housing, offices, services, and different infrastructures because of the high urbanization. Despite its significance, the construction industry is considered risky, with continuous and high accidents and ill-health problems for workers, practitioners, and end users (Grace & Cornelius, 2014).

The construction sectors of developing countries are commonly dominated by contractors who can be classified as Small and Medium Sized Enterprises (SMEs),

which work basically within domestic markets. Previous studies demonstrate that these contractors give little attention to health and safety issues, resulting in many accidents and health problems (Alkilani, Jupp, & Sawhney, 2013).

Various factors could impact the health and safety management of construction sites in developing countries. They include poor infrastructure framework, lack of appropriate health and safety regulation, legislation and laws, low education levels among labourers, absence of proper recording and notification systems, competitive tendering, extreme weather conditions, and corruption (Alkilani, Jupp, & Sawhney, 2013).

Amongst the most common myths that have tormented this industry is that health and safety come at a cost. Construction managers tend to believe that introducing and executing measures that ensure health and safety in the construction sector will lead to more significant expenses and, consequently, lower profitability. Studies have demonstrated an investment in construction health, safety, and profitability by increasing productivity rates, boosting employee morale, and decreasing attrition (Grace & Cornelius, 2014).

Many nations in sub-Saharan Africa do not record occupational accident statistics. This is true in the case of Rwanda, where 'The National Institute of statistics Rwanda' does not collect data on occupational accidents and injuries within the construction industry (Cokeham & Tutesigensi, 2013). This absence of information was corroborated when Sion McGeever, a growth and infrastructure advisor working in Rwanda for the United Kingdom's Department for International Development, concluded that no official accident statistics were available for Rwanda. Besides, a detailed search of the World Health Organization's Global Health Observatory revealed no occupational injury statistics for Rwanda (Cokeham & Tutesigensi, 2013). However, it is vital that such information is available, as accidents' statistics, but obtusely, are the best method of communicating the importance of H&S. Accident statistics will allow for informed H&S management practices to be developed, preventing accident frequencies from escalating

as the country makes significant advancements towards industrialization (Cokeham & Tutesigensi, 2013).

Most construction companies also do not recognize health and safety as a strategic enabler of sustained economic growth; henceforth, performance is not measured with respect to occupational health and safety. Subsequently, there is no motivator for stakeholders to improve OSH performance since they view investing in OSH as a luxury, coming at a cost and one of the things for compliance. The result is not giving sufficient education and training to their employees as far as health and safety are concerned amidst operations' execution (Althaqafi & Salah, 2017).

## **1.2 Statement of the problem**

In Rwanda, construction sites have been ranked as the second most dangerous place at which to work after mines and quarries. The OSH Profile conducted in 2012 revealed workers' exposure to occupational hazards by economic sectors as follows: Mining and Quarrying with 34%; Construction with 18%; Agriculture, Hunting and Fishing with 13.8% and Transport, Warehousing and Communication with 13%. Also, deaths, permanent disabilities, and injuries have increased for construction workers through major accidents and poor working conditions. ( Ministry of Public Service and Labour, 2012)

The number of occupational injuries increased numerically in the previous years as follows: 35 (2007), 82 (2008), 93 (2009), 112 (2010), 118 (2011), and 138 (2012). The number of occupational fatalities likewise continued increasing: 41 (2007), 84 (2008), 114 (2009), 194 (2010), 264 (2011) and 263 (2012). OSH Country Profile likewise revealed that the amount of money (Rwf) spent on occupational hazards in the last seven years was 175,581,001 (2003), 182,985,999 (2004), 182,932,862 (2005), 162,567,520 (2006), 215,999,138 (2007), 232,185,746 (2008) and 247,938,542 (2009-2010). ( Ministry of Public Service and Labour, 2012).

From the above statistics, 'The National Institute of Statistics Rwanda last collected data on occupational accidents and injuries within the construction industry in 2012, and a detailed search of the World Health Organization's Global Health Observatory revealed no occupational injury statistics for Rwanda (Cokeham & Tutesigensi, 2013).

The existing regulatory and compliance mechanisms are not efficient or stringent. There is no comprehensive or timely dissemination of OSH information to the construction industry to address the OSH requirements specific to the industry. The OSH regulations in the construction industry are not detailed enough and not well complied with through monitoring systems and audits.

The Occupational Safety and Health division under the Ministry of Labor and Public Service, which is responsible for employees' well-being at workplaces, cannot inspect every building/road under construction in the whole country. As such, employers tend to compromise on most construction projects' safety and health standards.

The practices of competitive tendering and award of most public contracts to the lowest bidder in Rwanda compel contractors to drive low prices while cutting costs, which influences health and safety.

### **1.3 Objectives of the study**

#### **1.3.1 General objective**

The main objective of this research was to investigate the health and safety performance of construction projects in Rwanda.

#### **1.3.2 Specific objectives**

The specific objectives of the study are to:

1. Assess the knowledge level among construction workers on health and safety practices and skills in construction projects in Rwanda.

2. Analyze the sources and types of hazards and accidents encountered in construction projects in Rwanda.
3. Evaluate the implementation of health and safety management structures in construction projects in Rwanda.
4. Highlight expert views to develop and adopt a practical framework for the improvement of health and safety performance in construction projects in Rwanda.

#### **1.4 Research questions**

In order to successfully address the situation in the study, the following questions were developed;

1. How knowledgeable are the construction workers on health and safety practices and skills in construction projects in Rwanda?
2. What are the sources and types of hazards and accidents encountered in construction projects in Rwanda?
3. What is the level of implementation of health and safety management systems in construction projects in Rwanda?
4. What steps should be taken for a practical framework to be developed and adopted for the improvement of health and safety performance in construction projects in Rwanda?

#### **1.5 Justification for the study**

Currently, quality and safety are two primary issues in the construction industry. Apart from the quality of work, a safe working environment is essential to erase the high-risk image closely associated with the construction industry. Construction safety is a quality standard indicated in the agreement and required by the clients. As projects become more complex, safety has become a primary focus in ensuring the safety of construction personnel and properties.

## **1.6 Significance of the study**

The significance of the study stems from the necessity to develop a framework for improving health and safety performance in construction projects in Rwanda and contribute to knowledge in this area where very little information exists. Improvement on health and safety during the organization's operations reduces costs incurred due to accident compensations, increases productivity, boosts employee morale, reduces hazards and risk in workplaces. Therefore, this should not be seen as a regulatory burden in an organization. The study hence offers a best practice guide on the improvement of health and safety performance in construction projects.

Very little has been done to address the construction industry crisis where the workers' lives have been lost. This study aims at bringing about awareness of the risks faced by construction workers in Rwanda. The study also provides practical information which will facilitate all the construction stakeholders in enhancing safety on the construction sites.

## **1.7 Limitations and assumptions of the study**

In consideration of the explanation of the research design, the researcher chose the cross-sectional design for this study. However, for practical reasons – available time and cost of field work, the researcher adopted the case study design within which the survey was. Eight (8) cases of construction sites at different stages were identified and used. Therefore, findings from these cases should give a sneak preview of the situation and provide a basis for a more extensive and later study of the industry.

## **1.7 Scope of the study**

The study was carried out on construction projects (road construction and building works) spread in different parts of the country. The study covered both private and public developments. Finally, the study also involved interviews with the government

authority in charge of health and safety in Rwanda, which is under the Ministry of Public Service and Labour.

## **1.8 Definition of key terms**

**An accident** is defined as any unplanned event that results in injury or ill health of people, or damage or loss to property, plant, materials or the environment or a loss of a business opportunity' (Hughes & Ferrett, 2007). Ping (2007) defined an accident as an unplanned, undesirable, and non-controlled event. An accident does not necessarily result in an injury; it can also damage equipment and material.

**A dangerous occurrence** – is a 'near miss' which could have led to severe injury or loss of life (Hughes & Ferrett, 2007). Examples include the collapse of a scaffold, a crane, or any passenger-carrying equipment failure.

**Environmental protection** – refers to the arrangements to counter those activities in the workplace which affect the environment (in the form of flora, fauna, water, air, and soil) and, perhaps, the health and safety of workers. They include waste, effluent disposal, and pollution (Hughes & Ferrett, 2007).

**Health** is the protection of the bodies and minds of people from illness resulting from the materials and procedures used in the workplace (Hughes & Ferrett, 2007).

**Near miss** – is an incident that could have resulted in an accident. Knowledge of near misses is essential since research has shown that for every ten 'near miss' events at a particular

location in the workplace, a minor accident will occur (Hughes & Ferrett, 2007).

**Occupational or work-related ill-health** – is concerned with those illnesses or physical and mental conditions that are either caused or triggered by workplace activities (Hughes & Ferrett, 2007). Such disorders may be induced by the particular work activity of the individual or by activities of others in the work place. The time interval between exposure and the start of the illness may be short or long (Hughes & Ferrett, 2007).

**Risk and Hazard** ‘Risk’ is the exposure to loss/gain or the likelihood of occurrence of loss/gain multiplied by its respective magnitude. Events are inevitable if the likelihood of occurrence is 100% or uncertain if the probability is 0% (Mousa, 2005). (Zayed & Jr, 2007) defined risk as the manifestation of potential or actual constraints that could stand in the way of project performance, causing partial or complete failure either during construction or at the time of use. Risk = Hazard × Exposure, where a hazard is *how an event can cause harm and exposure as the extent to which the hazard can influence the likely recipient of harm.*

**Risk Assessment** Risk assessment is a procedure that identifies the hazards associated with particular activities/tasks, evaluates the effects of exposure to the hazards, and implements the measure wanted to control the risk of injury/ill health to as low a level as possible (Phoya, 2012). The assessment of risks updates risk control decisions, the implementation of which is monitored and reviewed to ensure that the risk is

controlled and remains within the tolerable limit (Phoya, 2012).

**Risk management** Risk management is integral to sound management and decision-making at all levels. In construction, perceiving risk management is integral to construction management (Phoya, 2012). Risk management may also be defined as the identification and evaluation of actual and potential risk areas as they pertain to the company as a total entity, followed by either termination, transfer, acceptance (tolerance), or mitigation of each risk (Barnard, 2005).

**Safety** is the condition of being protected from harm or other non-desirable consequences. Safety can also refer to the control of recognized hazards in order to attain an acceptable level of risk. Safety is the form of a ‘steady state’ of an organization or place doing what it is supposed to do (Hughes & Ferrett, 2007).

**Welfare –** the provision of facilities to maintain the health and safety of individuals at the workplace. They include washing and sanitation arrangements, the provision of drinking water, heating, lighting, and accommodation for clothing, seating (when required by the work activity), eating, rest rooms and first aid arrangements (Hughes & Ferrett, 2007).

## **1.9 Outline of the study**

The study report comprises of five chapters organized as below:

Chapter one gives the background of the research and addresses statement of the research problem. The general objective, specific objectives, research questions are also

stated. The chapter also explains the significance, justification, limitations, scope of the study and also the definition of key terms under the study.

Chapter two discusses the literature review which includes the accidents and safety in the construction industry worldwide and in Rwanda, several health and safety hazards normally encountered in the construction industry, theories related to occupational safety and health performance, legislation governing health and safety in the construction industry, national policy on OSH in Rwanda, literature gap, theoretical and conceptual frameworks.

Chapter three addresses the research methodology adopted for the study, including the research design and methods for collecting the relevant data. The research instruments, data processing and analysis procedures, and sample selection criteria are discussed.

Chapter four addresses the data analysis and presentation of the results. The response rate is discussed, including a descriptive analysis of collected data, and their implications are highlighted. Appropriate statistical methods for data presentation are used.

Chapter five gives a summary of the study findings, conclusions drawn from the study are presented, and recommendations are made. Areas suggested for further research are discussed.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter provides the theories used for this research. The purpose of this literature review was to gain an understanding of the existing research and debates relevant to the area of study.

The chapter comprises three main sections: accidents and safety in the construction industry worldwide; accidents and safety in the construction industry in Rwanda; and theories related to occupational safety and health performance. The theoretical and conceptual frameworks for the study are presented, and the literature gap is highlighted.

#### **2.2 Accidents and safety in construction industry worldwide**

Accident is defined as occurrence which is unexpected, not intentional and which upsets a planned sequence of work resulting to loss of production, injury to personnel, damage to plant and equipment and eventually interrupting production flow (Kadiri, et al., 2014). ILO estimates that at least 60,000 fatal accidents occur in a year on construction sites around the world, which is one in six of all fatal work-related accidents (ILO, 2005). In the same manner, occupational health and safety statistics presented by different researchers for example Phoya (2012) revealed that the injury and fatality rate in construction projects is very high in association with other sectors of industry in the majority of countries. The fatal injury rate for the construction industry is higher than the national average among industries worldwide (Kadiri, et al., 2014).

The construction industry alone produces 30 % of all fatal industrial accidents across the European Union (EU), yet it employs only 10 % of the working population. In the United States (US), it is responsible for 20 % of all fatal accidents and only 5 % of the employed. In Japan, construction accidents are responsible for 30 % to 40 % of the

overall total industrial accidents, with the totalities being 50 % in Ireland and 25 % in the United Kingdom (Phoya, 2012). The numbers of fatalities within the industry are only the tip of the iceberg, with thousands of major injuries, and even more minor ones resulting in lost time.

While the governments and industries in developed countries recognize that the construction industry's undesirable accident record must be improved, with many supporting for the adoption of a zero accident policy, poor safety records keep on hindering performance improvement. This is especially clear in developing countries where a shortage of reliable information on occupational accidents exists because of the absence of proper recording and notification systems, combined with low development of H&S awareness (Alkilani, Jupp, & Sawhney, 2013).

Despite the fact that the mechanization of the construction industry is not uniform all through the world particularly in the developing countries, which use labour intensive construction techniques, high accidents and fatalities rates are massively different from developed regions (Alhajeri, 2011). This is due, in part to the minimum use of equipment, skilled workers, and difficulty in acquiring required materials, and absence of adequate infrastructure and other facilities. Furthermore, there are many different impediments to the achievement of good standards, for example, pressure of production or performance targets, and the intricacy of the organization are common examples of such obstacles including the most crucial factor of cultural and behavioral aspects (Alhajeri, 2011).

Innovation in social sciences has been identified as having promoted a greater awareness of the sanctity of life and the unacceptability of early death due to work-related accidents. The injury data discussed above highlights that the high number of construction site accidents is a universal problem of much concern (Alhajeri, 2011).

The construction industry has therefore earned the notoriety of being a risky or highly hazardous industry as a result of the disproportionately high occurrence of accidents and

fatalities that happen on construction sites around the globe (Yemul & Darade, 2014). Internationally, construction workers are a few times bound to die on the work than workers in different industries while the risk of serious injury is almost three times higher (Grace & Cornelius, 2014).

Construction health and safety risks are always a serious concern for both practitioners and researchers all over the world. Thus, construction has been considered as the most hazardous place in which to work with a high level of health and safety risks (Alhajeri, 2011). There is a considerable lack of awareness or importance for safety at most levels of the construction industry. In addition, various safety measures have been assessed. Avoidance of accidents has thus become a paramount factor which could be a major cause of concern in the construction industry. Therefore any effort to identify and explore possible ways of stopping and controlling accidents should be sought after (Kadiri, et al., 2014).

Quality and safety remain important issues in the current construction industry.

Further, a safe work environment is very essential to erase the high risk image that is closely associated with the construction industry. Safe work environment may also be referred to as construction safety which is a customary of quality that is indicated in the contract and required by the client. Often as projects are becoming more complex, safety has become the main focus in ensuring the safety of the construction personnel and properties. Developed countries such as the UK and Australia have enforced safety rules in contractors' works on site. (Misnan, Mohammed, Mahmood, Mahmud, & Abdullah, 2008)

The construction industry requires a large work force based on wet trades. This factor contributes to the low quality of work due to the workers' lack of expertise and training, while at the same time disclosures them to accidents easily (Saidin, 2013).

Accident theory on human factors shows that there is a chain of occasions which are

caused by human faults. These factors are:

- 1) Overload;
- 2) Irrelevant response; and
- 3) Irrelevant activities.

Referring to the Heinrich Theory, accidents are caused by main factors that can be foreseen such as human faults, unsafe environment, or unsafe use of machineries.

Accidents and injuries can be circumvented by eliminating these factors. Changes need to be undertaken by the construction industry through establishing a model of safety and health culture, which may improve the safety and health level in line with the requirements of safety and health in the construction industry (Saidin, 2013).

A study highlighting statistics gathered from Namibian workplaces on common causes of workplace incidents revealed that the most widely recognized incidents at the workplace happen more frequently because of ordinary negligent human activity than the use of dangerous machinery and substances (Norine, Zenon, & Mbabazize, 2016). This likewise demonstrates the significance of the role played by individual workers in guaranteeing safety and health in the workplace. With regard to compliance with the regulations, it has been noticed that regulatory bodies simply function on a state mandate, and base their work on law and policies. Basically this should be in help of human welfare; yet practically speaking it is deficient. In a country like Rwanda where industrial development has been built on serious environmental injustice, regulation is practically ineffective (Norine, Zenon, & Mbabazize, 2016).

Many studies for instance have demonstrated that health and safety improvements will only be accomplished if workers change their behaviors and incentive schemes are implemented to motivate them. It is evident that these endeavors are not genuinely adequate to curb the occurrence of risky acts on construction sites. Accordingly, preventing occupational injuries and illness ought to be a primary concern for all employers and employees in any countries (Alhajeri, 2011).

## **2.3 Health and safety hazards in construction sites**

In order to understand the sources of accidents and subsequent injuries, several researchers have tried to develop theories as to why accidents occur. Accidents are viewed as originating from a technical or human error. The multiple accidents causation theory postulates that there are many influential causes leading to an accident. The causes are classified into behavioral and environmental factors (Afosah, 2014).

Various researchers have divided health and safety hazards into two groups: namely: the physical injury hazards and the ill-health hazards. Hazards of physical injury include death consequences. Hazards of ill-health can only be reported after a long period and cause sickness or death after a certain period of time (Afosah, 2014). The following are common hazards in construction sites regardless of the physical injury or ill-health problems.

### **2.3.1 Manual Handling**

Manual handling is where by human attributes are exerted on a load unaided. It may involve any occupation whereby the employment of force is applied by an individual to elevate, push, pull, carry or otherwise move or confine any object either in motion or static (Kibe, 2016).

### **2.3.2 Noise**

Occupation loss hearing may occur where there is unregulated exposure of workers to high levels of noise such as noise from machines, welding or carpentry works. Thus, constant exposure to such hazard poses risks to site employees if effective control management like earplugs is not worn to protect workers' hearing. Therefore, noise on sites should be maintained at a bearable level or a noise protection gear provided (Oladiran & Sotunbo, 2005)

### **2.3.3 Electricity**

Important as it is, electricity is extremely hazardous and may lead to death if not well handled. Any contact to a live wire may lead to injury or death. In the UK, for example, 2% of all mortalities at work are caused by electrical shocks (Benjamin, 2008).

### **2.3.4 Equipment, Machinery, Tools and Transport**

Lives of construction workers have been lost on site from accidents caused by equipment, machinery or vehicles. This is particularly owed to reversing machinery, falling of machines on steep slope and within the excavation space, and from haul trucks. Injuries could lead to amputations, back or brain damages and fractures (Hughes & Ferrett, 2007).

### **2.3.5 Height**

Falls from height have been identified among the foremost frequent killers of workers in construction sites. They include falls of people and objects which could harm anything below. Statistically, over 100 deaths result from construction site falls (Hughes & Ferrett, 2007). Window cleaners, painters or decorators face the highest risk wherever there are no proper safety management remedies in place. Site falls include falls from cranes, scaffoldings, roofs or from elevator shafts. (Kibe, 2016)

### **2.3.6 Slips and Trips**

Viewed as the commonest workplace hazards, slips and trips contribute to over a third of all major accidents (Benjamin, 2008). 95% of major trips cause fractures. Slips and trips are the one commonest reason behind injuries at work (Statistics on fatal injuries in the workplace in Great Britain, 2016)

### **2.3.7 Chemicals Substances**

Several construction chemicals are used during constructions which pose danger to all those in close proximity or in touch with them. Faintness, headaches, eye irritations are some of the results of continued exposure to the chemicals. Some of these chemicals cause injury to the central system and may damage the skin, liver, kidneys and increase the chances of cancer (Kibe, 2016).

### **2.3.8 Dust**

Exposure of workers to dust on site uninterruptedly could lead to eye problem, cough and respiratory disorder and allergies. Construction materials such as sand and cements, demolition works of existing structures and wood or carpentry works are the major producers of dust on site. Their inhalation could result in bodily and medical disorder to the workers. Therefore, proper protection against dust on site must be provided for all site personnel (Philip & Clive, 2002).

### **2.3.9 Human Error**

Human error is an undesirable human judgment or decision that is capable of affecting the performance of a system (Kadiri, et al., 2014). This error may well be a result of failure on the part of construction workers themselves whereas on site, as a result of unsafe perspective of the workers, error in judgments, lack of attention at work, lack of awareness on the danger encompassing the activities and safety needs. Thus, there should be appropriate safety training for all construction workers, guaranteeing a safe perspective on site and reciprocally, reducing the potential of incidence of accidents on sites (Benjamin, 2008).

### **2.3.10 Aggression, Violence and Bullying**

Aggression, violence and bullying contribute to different risks like stress. Often workers are singled out from the rest and this has an effect on them mentally. Some view this as

bullying. At construction sites, aggression and violence are incontestable through foul language and physical attacks (Hughes & Ferrett, 2007).

## **2.4 Health and safety management in construction**

Health and safety management is defined as planned efforts and procedures for identifying work place hazards and decreasing accidents and exposure to harmful situations and substances. Use of protective clothing and equipment, accident response, prevention and trainings are all apart of health and safety management in construction.

### **2.4.1 Health and safety training**

Health and safety training is a vital a part of the health and safety culture and it is a legal demand, under the Management of Health and Safety at Work Regulations 1999 and different regulations, for employers to produce adequate trainings for their subordinates. Trainings are important whenever new technology is being employed, new equipment or systems of works are being introduced, where there have been transfers of personnel into new positions, and where vulnerable employees have been hired. (Executive, Health and Safety Training; Brief Guide, 1999). These trainings include:

#### **Induction training**

It is important that trainings be conducted to new workers about items such as conditions, quality, health and safety required within the organisation and records be kept for all employees who have received it and what kind of training was provided. This record could also be needed as proof in any future subsequent legal claims against the organization (Hughes & Ferrett, 2007).

New employees should be trained on accident reporting, health and safety management systems being employed, safety and health policy of the organisation, shown any emergency points and any other facilities (Aidah, 2013).

### **Job-specific training**

Job-specific training ensures that workers undertake their jobs in an exceedingly safe manner. This provides a variety of talent training and is commonly best done 'on the job' - generally referred to as 'toolbox training' (Governace, 2014). Details of the safe system of tasks allow all personnel to figure out how systems ought to be aligned. Additionally to traditional safety procedures, emergency procedures and the usage of personal protective equipment have to be covered here (Hughes & Ferrett, 2007).

### **Supervisory and management training**

This covers all management levels including the board of directors, from top to bottom since these are the decision makers and occasionally take tours on the sites. This training ensures and guarantees them to look out for each other as far as health and safety standards are concerned. It also covers the health and safety law (Executive, Health and Safety Training; Brief Guide, 1999).

### **Specialist training**

These training courses are usually conducted by specialist organizations and flourishing participants are rewarded with gifts or certificates (Governace, 2014).

They include fireproof prevention, fork lift truck driving, overhead crane operation, scaffold investigation and statutory health and safety inspections. Further training courses should also be offered where need be in scenarios such as process changes and accidents. The strategies to convey these trainings should however be frequently reviewed and checked to confirm their continued effectiveness (Executive, Health and Safety Training; Brief Guide, 1999).

## **2.4.2 Internal influences on health and safety standards**

There are many influences on health and safety standards, some positive and others

negative. No business, particularly small businesses, is totally divorced from their suppliers, customers and neighbors.

The internal influences include management commitment, production demands, and communication, competence and employee relations.

### **Management commitment**

It is important for senior or top managers to serve as role models to their sub-ordinates. Employees will give little care to health and safety if their leaders choose to break the rules instilled or if they do works without considering an element of health and safety and what implication arise if health and safety are not given a paramount consideration (Executive, Health and Safety in Engineering Workshops, 1999). Top managers therefore must endeavor to always conduct meetings about health and safety, audits and investigation of accidents and incidents in the construction sites.

### **Communication**

Good communication among several hierarchies in the construction industry is important and serves a powerful message as far as health and safety are concerned. Poor communication may lead to misunderstandings, mishaps and loss of interest amongst several construction workers. It is therefore important that health and safety issues are discussed and properly well captured during these meetings and solutions found for problems encountered (Benjamin, 2008).

### **Competence**

Competency is a paramount factor for the effectiveness and operations of any organisation. Getting people with the right skills ensures that the tasks and responsibilities are executed in manner that is safer. It establishes commitment to health and safety and a way of security for the hands. The loyalty that it develops within the personnel will be a big profit to safety (Hughes & Ferrett, 2007).

## **Employee representation**

Passionate, competent employee safety representatives given the resources and freedom to fulfill their function effectively can make a major contribution to good health and safety standards. They can provide the vital bridge between managers and employees (Hughes & Ferrett, 2007).

### **2.4.3 External influences on health and safety standards**

These include societal expectations, legislation and enforcement, insurance companies, trade unions, economics, commercial stakeholders.

#### **Societal expectations**

The construction industry should make it a point and ensure that the best standards for health and safety are provided to all players (Hughes & Ferrett, 2007). All employees should strive to work for only good employers, purchasing commodities from responsible organizations, use of desirable safety gear like fashion helmets, and the media educating the masses about good and poor work.

#### **Legislation and enforcement**

Good laws ought to have a positive result on health and safety standards. Legislation has an effect on standards by stating the minimum standards of operation, regulations through which to take in case of any accidents or incidents or court proceedings (Hughes & Ferrett, 2007).

#### **Insurance companies**

Insurance companies influence health and safety standards mostly through money incentives. They may influence standards by offering the best premiums to the safest industries; demand on risk reduction enhancements to stay insured (Executive, Health and Safety in Engineering Workshops, 1999).

## **Trade unions**

Trade unions can influence standards by (Hughes & Ferrett, 2007):

1. Providing training and education for members.
2. Influencing governments to regulate, enhance enforcement activities and provide guidance.
3. Influencing employers to provide high standards for their members and encouraging members to work for safer employers.
4. Helping members to get proper compensation for injury and ill-health if it is caused through their work.

## **Economics**

Economic science plays a significant role in influencing health and safety standards (Hughes & Ferrett, 2007). The most common ways are:

1. Low cash flows will force employers tend to ignore health and safety needs.
2. If employers are extremely tuned in to the particular and potential value of accidents and fires, they will be more involved in finding remedies and prevention. (Terry, Carolyn, & Brotherton, 2007)

## **Commercial stakeholders**

A lot will be done by commercial stakeholders to influence safety and health standards. This includes:

1. Demanding correct arrangements for health and safety management at provider companies before they tender for work or contracts.
2. Checking on suppliers to determine if the workplace standards are satisfactory.

3. Supporting moral investments.
4. Seeking prime useful data for purchasers.
5. Insisting on high standards to obtain detailed planning permission (Terry, Carolyn, & Brotherton, 2007).

#### **2.4.4 Elimination or substitution of risky activities**

This is the most effective approach of identifying and providing remedies for any hazard (Hughes & Ferrett, 2007). Elimination involves dropping a certain method if its associated risk is too extreme to handle. For example, the use of burnt clay roof tiles, instead of asbestos roofing tiles. Substitution describes the employment of a less hazardous variety of the substance (Hughes & Ferrett, 2007).

#### **2.4.5 Changing work methods/patterns**

In some cases, it is doable to vary the strategy of operating so that exposures are reduced. For example use rods to clear drains rather than sturdy chemicals; use the roof scaffold to repair the gutters instead of ladders (Hughes & Ferrett, 2007).

Generally, the pattern of labor will be modified so that people do things in an exceedingly a lot of natural approach. An example is when laying bricks and mortar for masonry, consider whether or not the construction workers are right or left handed. It also includes encouraging movement of people around the work premises (Kale, 2013).

#### **2.4.6 Reduced time exposure**

This involves reducing the worker's time exposure to certain hazards. Workers could be given different tasks or allowed to take several breaks. It is solely appropriate for the management of health related hazards to show screens and dangerous substances (Hughes & Ferrett, 2007). However, it is important to note that for many hazards, there are short-term exposure limits as well as normal working occupational exposure limits

over an 8-hour period. Short-term limits must not be exceeded during the reduced time exposure intervals (Charles, 2018).

#### **2.4.7 Systems of safe work**

This highlights the safest method of executing a task (Hughes & Ferrett, 2007). If the risks involved are high or medium, the details of the system should be in writing, often called a 'Safe Work Method Statement (SWMS)', and should be well communicated to the employees, formally in a training session. Records should be kept for all the trainings undergone by employees and should ensure they understand and abide by them. It is important that a safe work method statement (SWMS) is prepared prior to any task and all high risk work commencements. A safe work method statement (SWMS);

1. Clearly highlights all high risk construction work under execution.
2. Identifies health and safety hazards and risks likely to be met.
3. Describes how the risks will be controlled, and
4. Describes how the risk control measures will be put in place and maintained.

The table on the following page highlights an example of a safe work method statement. It describes different construction activities, identifies the hazards for each activity, and provides several control mechanisms to eliminate the identified hazards.

**Table 2.1: Template for a Safe Work Method Statement (Hughes & Ferrett, 2007)**

<b>WORK SAFETY ANALYSIS</b>		<b>Reference No:</b>
<b>Task:</b>	<b>Team: Permit Receiver:</b>	<b>Date: Reviewed by (Reviewing Manager):</b>
Simultaneous Operations: Demolition of the existing maternity ward.		
Predictable accidents: Slips, trips and falls; cuts, bruises and bodily injuries; falling from height, fire sparks, pinch points, flying objects, heavy loads		
STEPS (Break task into steps in order of sequence)	HAZARDS (Identify hazards for each step)	CONTROLS (List actions to eliminate or control all identified hazards)
TOOLS AND EQUIPMENT TO BE USED:		
REQUIRED PPE:		

Source: (Hughes & Ferrett, 2007)

#### **2.4.8 Monitoring and supervision**

Well trained and competent workers should be employed in management and monitoring positions. All risky tasks should be well supervised and checked to ensure all the necessary steps have been taken and no stone has been left unturned. Checklists should be used to confirm that no important issues have been left out. All the necessary organization reports ought to be checked to determine whether or not any areas of significance have been identified and corrections or suggestions were enforced (Executive, Health and Safety in Engineering Workshops, 1999).

#### **2.4.9 Personal protective equipment (PPE)**

Personal protective equipment (PPE) solely ought to be used as a final resort (Hughes & Ferrett, 2007). There are several reasons for this. The foremost vital limitations are that PPE:

1. Ensure safety to the person sporting it and not others near.
2. Must be worn always.

3. Should be worn properly and immediately replaced once it gets old and no longer serving its purpose.

The advantages of PPE are:

1. Used in confined spaces where no other safety measure can be taken.
2. In emergencies for rescues.
3. Ensures safety while permitting continued task execution.

Examples of personal protective equipment include the following:

**a) High-visibility clothing**

It is important that any worker who may be endangered by vehicular traffic on a project must wear a garment that provides a high level of visibility. There are two distinct features to high-visibility clothing.

1. Background material; this must be fluorescent orange or bright orange in colour to provide a higher level of daytime visibility and is recommended.
2. Retro reflective Stripes or bands to afford the worker both lowlight and night-time visibility.

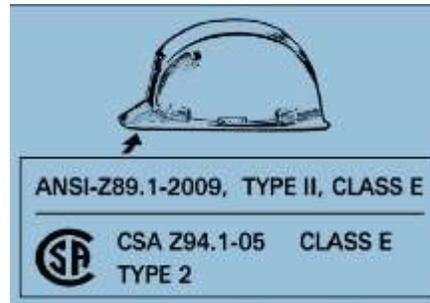


**Figure 2.1: High Visibility Clothing**

(Hughes & Ferrett, 2007)

### b) Head protection

Hard hats should be mandatory for all construction workers on the job. The hat must withstand an electrical contact equal to 20,000 volts phase to ground and must guard the head against any falling objects.



**Figure 2.2: Standards for head protection in CSA**

(Hughes & Ferrett, 2007)

### c) Hand/skin protection

Hands and skin are prone to physical, chemical, and radiation hazards. Personal hand/skin protection prevents injury from physical hazards such as sharp edges, splinters, burns. Corrosive or toxic chemicals and ultraviolet radiations which may cause cancer are also guarded against. Leather gloves are the most preferred protection.

### d) Respiratory protection

In the course of their work, construction personnel are exposed to respiratory hazards in the form of dangerous dusts, gases, fumes, mists, and vapours. Respirators however are uncomfortable to wear, do not deal with the hazard at the source and may be unreliable if not properly used and maintained (Hughes & Ferrett, 2007).

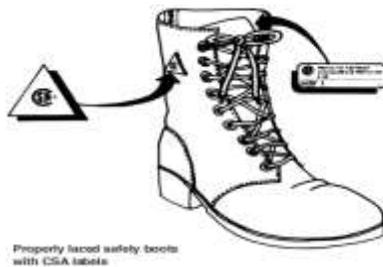


**Figure 2.3: Respiratory Protection**

(Hughes & Ferrett, 2007)

**e) Foot protection**

Foot protection helps protect against ankle and other injuries caused by nails and other hazards in construction sites.



**Figure 2.4: Standards for safety boots in the CSA**

(Hughes & Ferrett, 2007)

**f) Hearing protection**

Most construction activities produce noise. Typical construction work may involve equipment driven by large and small engines, metal fabrication, power drilling and sawing, air hammering, and blasting all of which can produce noise at harmful levels.

Depending on the noise level, duration of exposure, and other factors, a temporary or permanent hearing loss may result. Temporary hearing losses will usually be restored by the body within a few hours after the exposure has ceased.



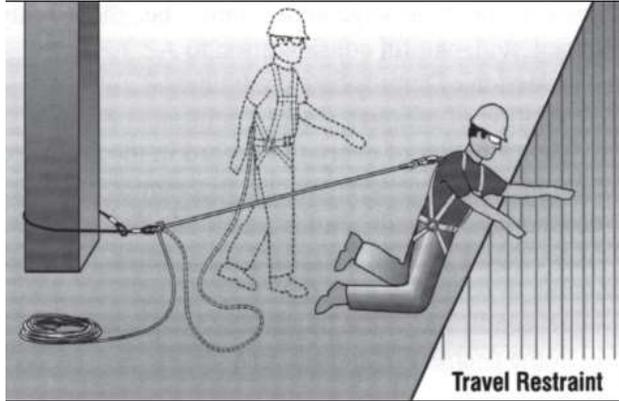
Figure 2.5: Hearing Protection (Hughes & Ferrett, 2007)

**g) Personal fall protection**

A worker at risk of falling certain distances must be protected by guardrails or, if guardrails are not practical, by a travel restraint system, fall-restricting system, fall-arrest system, or safety net.

**i. A fall-restricting system**

This should limit a worker's free-fall distance to 0.6 meters (2 feet). Temporary fixed supports used for anchorage with a fall restricting system must support at least six kilonewtons (1,350 pounds) without exceeding the allowable unit stress for each material used. A fall-restricting system generally fasten to a sternal connection on your harness, then to a wire rope grab or fixed ridged rail system used for climbing ladders.



**Figure 2.6: Travel restraint to prevent falls from height (Hughes & Ferrett, 2007)**

**ii. A fall-arrest system**

A fall-arrest system must include a CSA-approved full-body harness with a lanyard equipped with an energy absorber and must prevent a falling worker from hitting the ground or any object or level below the work. The system must not subject a falling worker to a peak fall-arrest force greater than 8 kilonewtons.



**Figure 2.7: Personal fall protection with full body harness and snap hooks (Hughes & Ferrett, 2007)**

**iii. Safety nets**

The system is installed below a work surface where a fall hazard exists. Safety nets must be inspected and tested by a professional engineer or supervised by the engineer. A copy of the inspection and test must be kept at the project until the net is no longer needed.



**Figure 2.8: Roofing safety net**

(Hughes & Ferrett, 2007)

## **2.5 Legislative governing health and safety in construction**

This sub-section presents the legal framework of health and safety in the UK, as one of the cases of international best practices in this field.

### **2.5.1 Health and Safety at Work etc Act 1974 (HSW Act)**

Commonly referred to as the foundation of British Health and Safety Law, the Health and Safety at Work etc Act 1974 stipulates responsibilities of employers to the general public and sub-ordinates (Hughes & Ferrett, 2007). Employers are required to apply common sense and reasonable judgment, identify any hazards and put in place all the necessary remedies to counter-attack these hazards. Every manager must hold a risk assessment. Under this Act, designers, suppliers, employers, employees are imposed

upon a duty of care in association their roles and responsibilities (Executive, Health and Safety in Engineering Workshops, 1999).

### **2.5.2 Environmental Protection Act 1990**

This is the basis of environmental protection legislation. This is split into 9 components. Part 1 is Integrated Pollution management (IPC) which introduces technological or polluting sophisticated processes while part B covers the less polluting processes Local Air Pollution Control (LAPC) (Hughes & Ferrett, 2007).

### **2.5.3 The New Roads and Street Works Act 1991**

Under this Act, organizations are obliged and given a right to dig up roads or repair existing pipes or cables in order to install new ones. The prevailing legislation encompassing street works is primarily enshrined within the New Roads and Street Works Act 1991 (New Roads and Street Works Act; Code of practice, 2012).

### **2.5.4 Confined Spaces Regulations 1997**

These Regulations concern any work that is carried out in a place which is considerably (but not perpetually entirely) boxed, wherever there is a fairly predictable risk of great injury from conditions and/or venturesome substances within the work premises or nearby. Victims are normally workers without the right equipment and trainings (Executive, Confined Spaces Regulations; Approved code of Practice, 2009).

### **2.5.5 Construction Design and Management (CDM) Regulations 1994 and Amendment Regulations 2000**

This was introduced to cover chemicals and substance deemed hazardous to the health of construction players. These include paints, cement, solvents, dust, and fumes. The regulation imposes a duty of care on employers to put in place the necessary control measures to curb these hazardous materials and reduce the risk they pose to all who are

in contact or in close proximity to them (Executive, The Construction (Design and Management) Regulations, 2007).

#### **2.5.6 Construction (Head Protection) Regulations 1989**

This imposes a duty a care on employers to ensure that all employees are provided with the right head protection and there are guidelines in place for every employee to adhere to and ensure their head protection is worn at all times. Any loss of any employees' head protection must be immediately reported to the relevant authorities and immediately a new one provided (Hughes & Ferrett, 2007).

#### **2.5.7 Control of Substances Hazardous to Health Regulations (COSHH) 2002 and 2005 Amendment**

This covers most substances hazardous to health found in workplaces of all types. The substances covered by COSHH include: substances used directly in work activities (solvents, paints, adhesives, cleaners), during processes or work activities (dust from sanding, fumes from welding) and naturally occurring substances (for example grain dust).

#### **2.5.8 Health and Safety (First Aid) Regulations 1981**

These regulations state that every workplace must have an appointed well trained individual to give first aid to workers where need be. Several workplaces require different first aid requirements and a duty of care is imposed on employers to provide such based on the workplace (Executive, First Aid at Work ; Acode of Practice and Guidance, 2009).

## **2.6 Accidents and safety in construction industry in Rwanda**

The problem of Occupational Safety and Health has consistently been on a rise regardless of several efforts by the Government of Rwanda in providing safe workplaces for workers through laws and several programs.

Occupational accidents and diseases impose an infinite value to Rwanda and are among the hindrances of construction progress. With this regard, Rwanda has taken totally different measures to counter these challenges ( Ministry of Public Service and Labour, 2012).

ILO C187 - Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187) highlights the key parts that ought to represent a national occupational safety and health system.

For Occupational hazards, OSH Country Profile disclosed that ergonomic lighting, technology ventilation, physical thermal and chemical petrochemicals were terribly low and technology length of labor hours was moderate within the Organizations. OSH Country Profile also disclosed that the highest level of awareness on OSH was in government establishments with 18.9% and the lowest level was in the transport sector with 0%; the highest level of existence of fireplace extinguishers was in government establishments with 18.9% and the lowest level was in mining and production sector with 0%; the highest level of training on fire was in the manufacturing sector with 9.77% and the lowest level was in mining, construction, transport and agriculture sectors with 9% ( Ministry of Public Service and Labour, 2012).

### **2.6.1 Occupational safety and health in Rwanda**

Rwanda is a Member of ILO since 1962 and has ratified a number of conventions in relation with OSH. Rwanda has also conducted a survey on OSH National Profile in 2012 to come up with an image of OSH in the Country.

There have been considerable efforts to promote OSH in Rwanda. Such efforts include putting in place laws regulating OSH in Rwanda, labour inspectors at district level doing inspections on OSH; annual trainings on awareness of OSH in different enterprises; putting in place the different national policies and strategic plans on social security and health to address OSH issues.

**a) Benefits of OSH policy**

A well versed OSH Policy is crucial for developing a stable and productive work atmosphere. Since 2009, the laws that control labour in Rwanda have been revised to market healthier labour relations, acceptable operating conditions, equity within the workplace and improve skills. Improved operating conditions are necessary to confirm higher labour productivity, higher quality work, healthier labour relations and compliance with quality standards ( Ministry of Public Service and Labour, 2012).

The economic gains related to OSH enhancements include:

- a) Accrued productivity and employee motivation;
- b) Reduction of operating time lost owed to injury and disease;
- c) Reduced time lost on machinery break down;
- d) Saving on incomes from cut of costs like insurance costs and legal fees.

**b) Rationale for occupational safety and health**

Occupational safety and health (OSH) is an international concern that seeks to improve the welfare of laborers through the transformation of work place atmosphere. OSH seeks to set up workplace processes and procedures so that workers' interaction with the work atmosphere and equipment bring home the bacon standards that guarantee optimum safety and health ( Ministry of Public Service and Labour, 2012).

The National Policy for occupational safety and health ought to be a key tool, complimenting poverty reduction and different national development programs.

Rwanda's human population is a source of national capital and development that need to be protected from occupational hazards in order to be useful in future, make better employee motivation, attract investors, and increase productivity and organizational profitability. Efficient hygiene and industrial safety measures geared towards reducing industrial accidents and other risks are paramount ( Ministry of Public Service and Labour, 2012).

Rwanda's occupational safety and issues mirror international trends that get to improve safety and health within the work atmosphere as defined by ILO. Rwanda has so aligned its OSH in response to ILO Convention 187 (2006) on the Promotional Framework for Occupational Safety and Health and Convention 155 on occupational safety and health and also the operating atmosphere (1981).

Adequate OSH Policy and standards are required for Rwanda's continued integration into the world's economy. International investors who subscribe to world-class OSH standards are reluctant to invest in markets in which local firms are able to compete unfairly through reduced OSH standards. Increasingly, Rwanda's exporters - particularly those who export to developed economies will be required to comply with international quality management standards. These standards require world-class performance in areas such as OSH, environmental protection and product safety ( Ministry of Public Service and Labour, 2012).

### **2.6.2 National policy framework**

The key ones are the Vision 2020, the Economic construction and poorness Reduction Strategy (EDPRS), and different sector policies associated with Employment, social insurance and Health.

#### **a) Vision 2020**

The main aim of Vision 2020 is to transform Rwanda into a middle income country with healthy and skilled citizens. Rwanda considers its population as its basic resource and

banks thereon for its future construction. Rwanda targets to ceaselessly increase lifespan of its people (Infrastructure, 2009). For Rwanda's construction industry, the emergence of a viable personal sector that may take over because the principle growth engine of the economy, is totally key. To attain these enhancements, envisaged and current population policies ought to go hand in hand with ways to overcome issues within the health private sectors ( Ministry of Public Service and Labour, 2012).

**b) Economic Development and Poverty Reduction Strategy (EDPRS)**

The Rwanda Economic Development and Poverty Reduction Strategy (EDPRS) provides a medium term framework for achieving the country's future construction aspirations as embodied in Rwanda Vision 2020, the Seven Year Government of Rwanda (GOR) programmed, and also the Millennium Development Goals. With respect to social-economic sector, EDPRS has four priorities: increase economic process, bog down growth, tackle extreme poorness and guarantee larger potency in poverty" reduction. To attain this, Rwanda is exploring different ways like promoting development of skills, modernization of agriculture, private sector development, improved health sector and many others. (Infrastructure, 2009). All these policies have contributed to the promotion of health at large and the occupational safety and health in general.

**c) Government Program for 2010-2017**

Rwanda adopted a Seven (7) year development programme that outlines the broad GOR priorities organized in four pillars: Sensible governance, justice, economy and social well-being. The goal is to have skilled, healthy and wealthy citizens through better healthcare, better education, job creation and sports facilities. These will all promote better occupational safety and health in Rwanda. (Infrastructure, 2009).

**d) Other sectoral policies**

These include: Health Sector Policy (2005), the Policy governing the Standards of Health Services in Rwanda (2009), the National Policy for Community Health (2008), the National Policy to Fight against HIV/ AIDS (2005), the National Policy on Condoms (2005), the National Nutrition Policy (2005), the Policy on Community-based insurance (2004), the National Policy on generative Health (2003), Health Policy deciding conditions for varsity hygiene (2008), the Policy on Water and Sanitation(2004), the National Mining Policy (2004), the National Urban Construction Policy (2008), the National Human Settlement Policy (2009), Rwanda National construction industry Policy (2009), the employment Policy (2007), the National social security Policy (2009), the National Social Protection Policy (2004), and many others. It is evident that these numerous policies have greatly contributed to the promotion of health at massive and occupational safety and health in general ( Ministry of Public Service and Labour, 2012).

### **2.6.3 National legal framework**

Government of Rwanda has also put in place the national legislation promoting occupational safety and health at workplace. These include:

- Rwandan Constitution of 2003 as amended up to now that in its article 49 determines that each national is entitled to a healthy and satisfying OSH;
- Law no 13/2009 of 27/05/2009 control labour in Rwanda, in its articles 90, 91, 92, 93, 94, 95, and 96, on health and safety at workplace;
- Law 86/2013 Of 11/09/2013 establishing the overall statutes for public service in its articles 64, 65, 66, 67, 69,70 and particularly article 68, provides for health and safety at workplace;
- Law n°24/2012 of 15/06/2012 relating to planning of land use and construction in Rwanda;
- Ministerial Order no. 07 of 13/07/2010 determining the modalities of the functioning of the labour inspector particularly in its articles 3 and 7;

- Ministerial Order no. 02 of 17/05/2012 determining conditions for occupational safety and health;
- Ministerial Order no. 01 of 17/05/2012 determining the modalities of building and functioning of occupational safety and health Committees particularly in its articles 3, 10, 11, 12 and 13;
- Rwanda Building Control Regulations, May 2012;

Finally, the Government of Rwanda has expressed its commitment to attaining the Millennium Development Goals. To eradicate poverty and hunger, Rwanda has introduced totally different policies together which integrate and extend social protection, raise the contribution of manufacturing and services to economic development for property growth and improve health standing, among others. The promotion of Occupational Safety and Health will play a great role to support all of these initiatives ( Ministry of Public Service and Labour, 2012).

## **2.7 Theoretical frame work**

This study was anchored on both system safety theory and accident energy transfer theory.

### **2.7.1 System safety theory**

A systems theory approach treats safety as an emergent property. Such property can be controlled by a set of constraints related to the behavior of the components of the system. According to the systems approach, accidents occur when the components interact and those interactions violate the constraints (Leveson, 2002).

According to (Zhang Yuebing., 2011), system safety theory holds that, in any system's life cycle, system safety engineering and system safety management method should be applied to identify the hazards in that system, and effectively adopt controlling measures to minimize their danger to the minimum, thus making the system reach the optimal safety degree in the stipulated performance, time and cost scope, and effectively prevent

and control further accidents. This is relevant to the study because of the high industrialization processes taking place in the Rwanda, whereby taking safety precautionary measures would minimize hazards and improve workers' safety. (Zhao & Xiang, 2011) divided the hazards in the production system into basic and controllable hazards. Basic hazard is also known as an inherent hazard (of work system), which means material hazard such as energy (or specific energy source or energy carrier) or dangerous substance. Therefore, the theory assumes that all factors that affect the controlling system to exercise constraints on the controlled objective are all known as controllable hazards.

However, the description of the hazard here by the scholars looks an ambiguous definition which makes extension of safety unclear to the workers. System safety theory also missed out on how and what precautionary measures can be taken against the basic and controllable hazards.

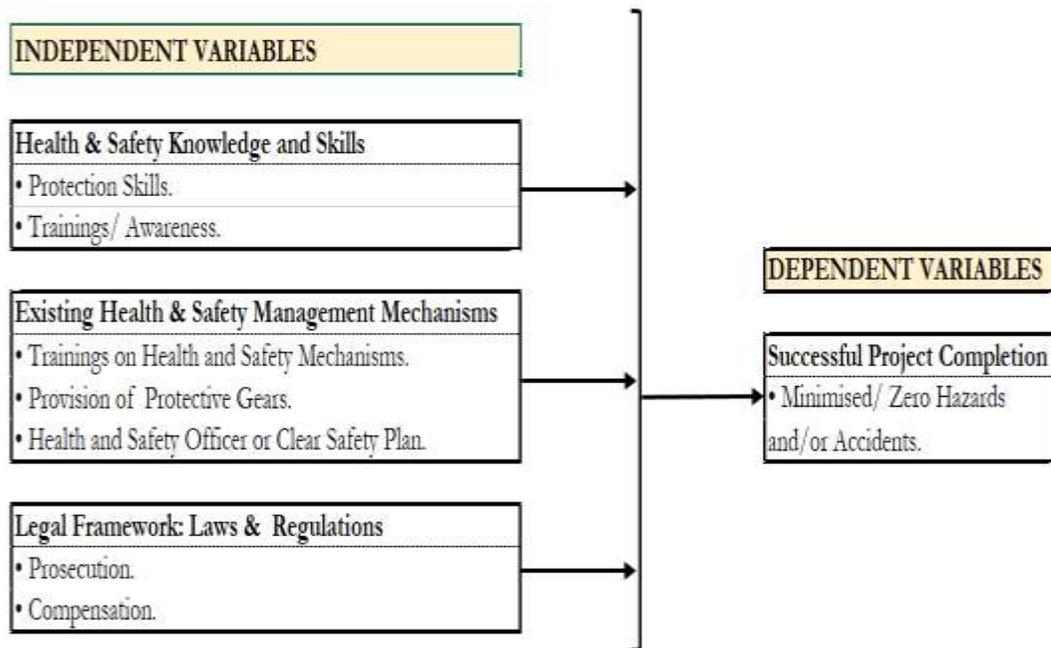
### **2.7.2 Energy release theory of accident**

According to (Karmis, 2001), all injury accidents (or damage accidents) are because of getting in contact with excessive energy in a form that exceeds the resistance of tissue or structure. The energy release theory of accident assumes that the energy or dangerous substance that exists in the system may cause an accidental release. The theory deems that; no accident will occur if there contains no hazard in the system. In fact, no accident will happen if the system contains no energy or dangerous substance leading to accidents, yet unpredictable accidents occur without human existence at work place. This means hazards can still occur without exertion of energy by the workers. To prevent accidents, it is important to eliminate various hazards and control various kinds of energy or dangerous substance. However, the theory was shortsighted on the contribution of human performance to accidents. Secondly, the theory adopts purely linear and mechanical model of causality, which is inappropriate in complex systems where accidents are generally caused by many interacting, partially competing and unpredictable factors.

## 2.8 Conceptual framework

This section explains the relationship between variables of the study, namely: independent variables and dependent variables. Conceptual frameworks is structured from a set of broad ideas and theories that assist the study in the identification of the research problem, research questions and the most appropriate literature to review (Norine, Zenon, & Mbabazize, 2016). The research was to investigate the health and safety performance in the construction sites.

In relation to OHS, the law exists to identify the responsibility of the parties involved in industrial or commercial activities. It imposes responsibilities on employers to protect the health and safety of their employees when they are at work and protects the right of people to participate in the paid workforce without suffering injury or ill health as a result. (Norine, Zenon, & Mbabazize, 2016)



**Figure 2.9: Conceptual framework**

Source: Author, 2022

## **2.8.1 Review of Variables**

### **a) OHS Regulations**

There are two main aspects of legislation for construction safety;

- Prosecution, in order to deter breach of safety legislation.
- Employee compensation as a remedial measure on the key safety-related legislation administered by the Labor Department.

The OHS Act contain minimum requirement which employers must comply with in order to guarantee the safety of personnel.

### **b) Existing OHS Risk Management Mechanism**

- Training and awareness

The Occupational Health and Safety Awareness and Training Regulation (O. Reg. 297/13) under the Occupational Health and Safety Act (OHSA) is the new regulation that requires employers to make sure workers and supervisors complete a basic occupational health and safety awareness training program.

The training program for workers should include instruction on: the duties and rights of workers under OHSA, the duties of employers and supervisors under OHSA common workplace hazards and occupational illnesses; the role of joint health and safety committees (JHSCs).

### **c) OHS Knowledge and skill**

The Workplace Health and Safety Handbook have been developed as a guiding tool for all who have a role to play in workplace health, safety and welfare. Health and safety representatives assume the important role of representing fellow workers on issues affecting their health, safety and welfare. A safe working environment delivers a full

range of workplace safety, public safety and industrial relations services to all employees at workplaces independently of other organizations on behalf of the state government including:

- Increasing awareness about workplace safety through active engagement with employers and workers.
- Growing knowledge, understanding and skills with improved education and training.
- Ensuring compliance and helping industry understand and meet its obligations
- Monitoring and assessing safety procedures to encourage and assist with a cycle of continuous improvement.

The study assumes that the dimensions under the independent variable (health & safety knowledge and skills, existing health & safety management mechanisms, legal framework: laws & regulations) have a direct relationship on how to successfully complete the project with minimized and zero hazards and/ or accidents.

## **2.9 Research gap**

The review of the related research on health and safety hazards have not argued out explicitly issues to do with knowledge base of the workers and how it would ensure health at work and their performance. Most scholars have discussed the question of employee knowledge in broad sense but not in particular reference to the construction industry. Similarly, the common types of hazards and risks the construction workers are exposed to have remained equally a knowledge gap in the construction industry in Rwanda.

As far as safety and health performance systems are concerned, most of the strategies in the construction industry have not been well complied with which reduces work performance among workers, owed to high exposure to risks and hazards. This study

therefore intends to engage various participants to identify and fill these gaps. The study therefore seeks to fill by evaluating the implementation of health and safety management systems and how to develop a framework for the improvement of health and safety performance in construction sites in Rwanda.

## **2.10 Critique of Literature**

Whereas health and safety is one of the most important key areas in most organizations, it is given the minimal coverage or none at all. Typically, OHS is often treated in research as one of a number of human resource management variables in studies concerned primarily with other phenomena. (Norine, Zenon, & Mbabazize, 2016).

A major trend in HRM research has been the growing interest in the relationship between strategy and human resource management, based on the assumption that human resources and their management contribute significantly to sustainable competitive advantage for organizations. Without exception, OHS and OHS management are excluded from the operationalization of this relationship in terms of policy or practice (Boxall & Purcell, 2008).

Much of the OHS management literature is prescriptive (Wallace & Ross, 2006). It is populated largely by textbooks directed at students and practitioners in OHS. Consequently, they are not empirically grounded representations of what constitutes OHS management, nor are they conceptualizations that are verified or validated through systematic field study; rather they are their respective authors' attempts at ordering concepts, tools, techniques, and technologies and in sights (Norine, Zenon, & Mbabazize, 2016).

## **2.11 Chapter Summary**

The implementation of health and safety management systems has been analyzed and discussed under the literature review. Local and global literature has also been reviewed. A number of legislations; both local and international were reviewed in this section.

Findings showed similarities between these legislations, although some countries, such as the UK, have a far more established culture and history of legislating and enforcing health and safety measures in the workplace than Rwanda.

A conceptual framework explaining the relationship between the independent and dependent variables was finally developed to help find answers to the research questions.

In this chapter also, theories relating to accidents in construction sites have been presented. Systems safety theory, energy release theory of accidents and Heinrich theory are discussed. The chapter also discussed the process and methods of risk identification, assessment and risk control on construction sites. It advocates that risk should be assessed at every stage in the life of a construction project, and that it should involve the input of all stakeholders and the project participants.

This chapter discussed the situation of health and safety risks globally, revealing that health and safety is a global issue needing efforts to address it. The chapter discussed the sources of accidents and ill-health problems on construction sites, revealing that they are caused by factors such as job site conditions, equipment and materials, humans, management factors and job factors. The chapter outlines different types of hazards existing on construction sites.

## CHAPTER THREE

### RESEARCH METHODOLOGY

#### 3.1 Introduction

This chapter presents the methodology that was adopted during the study. It describes and discusses the research design, sample size and selection, the data collection methods that were used and their corresponding data collection instruments, data processing and analysis procedures, as well as steps that were taken to ensure validity and reliability during the study, measurement of variables and ethical considerations undertaken.

#### 3.2 Research design

The study adopted a cross sectional research design within a case study. The cross sectional design was used in order to gather data from a cross section of the respondents in order to answer the research question as stipulated by Amin (2005).

The study was descriptive since it was undertaken in order to ascertain and be able to describe the characteristics of the variables (Sekaran, 2003). Consequently, a systematic description that is as factual and accurate as possible was obtained (Amin, 2005). This kind of design enabled the researcher to meet the research purpose and objectives and to answer the questions of the study. The research design was determined by considering how to link the research questions with data collection and analysis of the results as applied in Phoya, (2012). In consideration of the explanation of research design, the researcher chose the cross-sectional design for this study.

The study objectives guided by the literature review provided a basis for the planning and design of the research strategy. Questionnaires and interviews were .1 respondents.

Questions must be able to meet the study objectives. Aspects of the study that were not necessarily covered by the questionnaires, were captured through the well planned and

effectively designed interviews. Therefore, in order to obtain all the required valuable information on the performance of health and safety in the construction sites in Rwanda, both questionnaires and interviews had to compliment each other.

### **3.3 Target population**

In Rwanda, categorization of companies operating in the field of building and engineering works is done by Rwanda Public Procurement Authority (RPPA). This categorization is based on the value of the project for which a specific firm/company can tender for. From this list, eight (8) construction companies were selected for the study.

The following was there considered to determine and establish the target population:

- Construction companies with at least 250 employees at any time frame/ stage.
- Both road and building works in order to get representation of all the construction works in the industry.
- Large and medium sized enterprises to avoid bias of the research findings.

In consideration to this, eight (8) construction companies at their respective sites were identified and selected as the target population. [four (4) road projects and four (4) building projects]. Each construction site had at least 250 employees and therefore the target population was 2000 employees [250 (employees) x 8 (sites) = 2000].

The study also targeted the government authority in charge of health and safety in Rwanda which is under Ministry of Public Service and Labour. Structured interviews were carried out with selected health and safety inspectors under the Ministry of Public Service and Labour to get their views on health and safety in the construction industry in Rwanda. Data got from these interviews was used in the development of a framework for the improvement of health and safety implementation in the construction sites in Rwanda.

### 3.4 Sampling and sampling technique

Simple random and stratified sampling techniques were combined. Simple random sampling was carried out on the site construction workers for the different construction sites. This was based on the availability of the staff at the time of interviews because not everyone could be interviewed due to time constraints. This also allowed fairly equal chances of being selected in the sample.

Because the study population was finite, Krejcie – Morgan formula was employed to calculate the necessary sample size, as explained in Mugenda & Mugenda (2003) to get the sample size, n.

$$n = \frac{\chi^2 N p(1-p)}{e^2(N-1) + \chi^2 p(1-p)}$$

Where:

$\chi^2 = 3.841$ ; Chi-square value at 95% confidence level.

‘p’ (population proportion) = 0.5; and the study set this at 0.5 (50%), which would be the worst-case scenario to guarantee that the calculated sample size is larger enough to accurately represent the overall population within the set margin of error and confidence level.

‘e’ (margin of error) = 0.05; this percentage indicated how close the sample results was to be the true value of the overall population discussed in the study. The study used 5% as a margin of error.

‘N’ is the population size in the study.

Therefore,

using  $x^2 = 3.841$ ;  $p = 0.5$ ;  $e = 0.05$ ;  $N = 2000$ ,

$$\frac{3.841 \times 2000 \times 0.5 (1-0.5)}{0.05^2 (2000-1) + 3.841 \times 0.5 (1-0.5)}$$

$$n, = 322$$

Therefore, n, (sample size) was 322 respondents.

Distribution of the sample size was done as shown on the table below:

**Table 3.1: Sample Size Determination**

<b>Category of respondents</b>	<b>Population</b>	<b>Sample size</b>	<b>Percentage of total sample taken</b>	<b>Sampling Technique</b>
Construction managers	32	10	3.11%	Simple
Supervisors	160	54	16.77%	Simple
Frontline staff	1808	258	80.12%	Simple
Total	2000	322	100%	

Source: Author, 2022

- Construction Managers are people in the organization at any level above supervisor.
- Supervisors are people at the first level in the organization who have responsibility over the work of others.
- Front line staff are people who have no subordinates in the construction industry.

Stratified sampling technique was used to select the health and safety inspectors under the Ministry of Public Service and Labour for the interview. The sample target size was 5 respondents in this category.

### **3.5 Data collection**

This section explains the procedures, methods and instruments used for data collection.

#### **3.5.1 Procedure for data collection**

The researcher obtained an introductory letter from the university and presented it to the different construction sites for permission to conduct the study. Once permission was granted, the researcher proceeded and approached the respondents with the request to interview and administer the questionnaires.

Officials from Ministry of Public Service and Labour were also selected to participate in face to face interviews which were guided by a structured interview guide. Finally, various documents were reviewed for qualitative data insights and relevant themes taken note of by the researcher to complement the questionnaire and interview data.

#### **3.5.2 Data collection methods and instruments**

This research relied on both primary and secondary data collection methods to collect first and second hand information. In this case, questionnaire survey and interviews were used for primary data and documentary review for secondary data.

##### **a) Questionnaire Survey Methods**

A questionnaire is a pre-formulated written set of questions to which respondents will answer, usually within rather closely defined alternatives Uma (2003). The questionnaire method was used because of its efficiency and convenience in data collection. A questionnaire is quite easy to administer since each item has alternative answers and is economical too in terms of resources (Mugenda & Mugenda, 2003). Questions were set pertaining to compliance to health and safety at construction sites and were administered to construction managers, construction supervisors and frontline workers on the sites.

##### **b) Interviews method**

On interviewis(Attabra-Yartey, 2012) argues that is one of the very effective methods of gathering a large volume of data. As a method, interviewing can be used for both positivist and phenomenological research. When used in positivist research it is normally used with closed questions. When used in phenomenological research interviews are normally unstructured or semi-structured, with open-ended questions. Because this research was phenomenological in nature, various forms of interviewing were adopted, such as formal and less formal, semi-structured and open-ended interviews.

Face to face interviews were undertaken on appointment with the Occupational Safety and Health Authority (OSHA) in a bid to generate detailed in-depth information around the topic. The main information required from this group was concerned with how they facilitate and enforce health and safety performance at construction sites. This qualitative approach supplemented findings from the questionnaire (quantitative data). Interviews in this study helped the researcher obtain more information on the relationship between internal control systems and financial performance. This method was used because it offered the researcher an opportunity to adapt questions, clarify the questions by using the appropriate language, clear doubts and establish rapport and probe for more information (Sekaran, 2003).

**c) Documentary Review method**

Documentary review formed part of the data collection instruments. Information on the legal and institutional aspects of health and safety performance was retrieved from documents such as by-laws, Acts, correspondence and reports from the institutional and construction sites. Documents such as organizational policy, site meeting proceedings, risk analysis reports and site plans were reviewed. Information was gathered through reviewing documents, published reports (quarterly, midyear, and annual reports) and minutes of project meetings.

**d) Observation method**

Observation was another method used during the study. The qualitative case study researcher spends the majority of the time personally in contact with the activities and operations of the case. Observational techniques are therefore very relevant for those doing case study (Phoya, 2012). The present study adopted the non-participant observation technique. The researcher was introduced to staff on project sites on the first visit, which gave him the opportunity to develop rapport with both site management staff and operatives.

Observation focused on job site organization, work practices, the equipment and tools being used, the nature of activities performed on the construction sites, workers' risk behavior, such as adhering to rules and wearing PPE and how communication takes place on the sites. Recording of observations involved writing field notes and taking photographs. Observations were made on a total of 14 (fourteen) sites.

A rating scale from 1-5 was assigned to each element in the checklist where each measurement was carried out as an overall assessment of the participants in the a team.

1 - Must be improved

2 - Should be improved

3- Should be evaluated

4 - Small deviation

5 -100% safe

**Table 3.2: Check-list for Behavioural Observations**

Observation Element	Evaluation
Dry areas are wet	
Ladders are in a horizontal position hanging on brackets	
Cables and pipeline are hanging on brackets	
Barriers are used to protect falls from heights	
Danger zone is indicated by signs	
Vehicles are speeding in the tunnels	
There is sufficient light in the working areas	
Ways/paths are free from obstacles	
Personal Protective Equipment	
Gloves	
Ear protection	
Respiratory protection	
Helmets	
Safety boots	
Safety goggles	

### **3.6 Measurement of variables**

The study variables were measured using a five point Likert scale. This was used as a rating scale to assess the opinions, behaviors and attitudes of the targeted respondents and also allowed the researcher to easily operationalize personality traits or perceptions.

During the study, participants were presented with Likert-type questions/statements with 5 responses to capture their degree of agreement. The respondents were exposed to a wide range of opened ended questions with check boxes to tick approximately. The questions asked were considered ordinal data with a clear rank order but without an even distribution.

This eased coding and analyzing of the results. The five point Likert scales used were;

- Agreement (5= Strongly Agree, 4 = Agree, 3= Undecided 2 = Disagree and 1 = strongly disagree).

- Relevance (5 = Very Important, 4 = Important, 3 = Fairly Important, 2 = Slightly Important, 1 = Not Important).
- Frequency (5 = Always, 4 = Very Often, 3 = Sometimes, 2 = Rarely, 1 = Never).
- Satisfaction (5= Extremely Satisfied, 4 = Very Satisfied, 3 = Moderately Satisfied, 2 = Slightly Satisfied, 1 = Not at all Satisfied)

The Likert scale was used and not the more comprehensive ones due to the following reasons:

- It takes the minimum participant's time to answer.
- Quantitative: Likert scales easily operationalize complex phenomena by breaking down abstract topics into recordable observations. This enables statistical testing of hypotheses.
- Fine-grained: Because Likert-type questions aren't binary (yes/no, true/false, etc.) you can get detailed insights into perceptions, opinions and behaviors.
- User-friendly: Unlike open-ended questions, Likert scales are closed-ended and don't ask respondents to generate ideas or justify their opinions. This makes them quick for respondents to fill out and can easily yield data from large samples.
- Easily used as a comparative and ordinal scale for measuring and evaluating perceptions.
- Allows for micro-discriminations to be employed between the measured factors.

### **3.7 Validity and reliability**

Validity and reliability describes how collection of the data or how the conduct of the analysis brings reliable findings. The study ensured validity by reducing subject or participant error, subject or participant bias, observation error and observation bias.

#### **3.7.1 Validity**

Validity is the appropriateness of the research instrument. Content validity is used since it focuses on the extent to which the content of the instrument corresponds to the content of the theoretical concept it is designed to measure (Amin, 2005). The findings of the data were triangulated from the multiple data sources collected. Rich and thick descriptions of the themes were provided through the presentation of detailed contexts for quotations used to support the emergent themes. The study was documented by providing a thick description of the context. A thick description allowed readers to judge whether the findings had the potential to be transferable to their own situations.

#### **3.7.2 Reliability**

Reliability refers to the ability of an instrument to produce the same result whenever it is repeatedly used to measure a variable from the same respondents even by the internal consistency and logical flow of questions before data collection. To achieve the necessary objectivity/conformability of the study, a detailed explanation of the methods and procedures were provided. Respondents were given the questionnaire and information was entered into Statistical Package for Social Sciences (SPSS) and run a test (internal consistency) whose results were used to determine the questionnaire reliability. To further ensure reliability, dependability, audit ability and coding checks were done.

### **3.8 Data analysis**

Data collected was analyzed both qualitatively and quantitatively.

### 3.8.1 Quantitative analysis

The mass of raw data collected was systematically organized in a manner that facilitates analysis. Data collected through questionnaires (quantitative) were coded with each code representing a response category for each item in the questionnaire. The data were analyzed using descriptive statistics, frequencies, percentages and means.

All the data collected from the overall 5 point Likert scale was treated as interval level. The scales had a clear order and the difference between each point from the others was evenly spaced. For example:

**a) Agreement**

- = Strongly Agree, (4.20-5.00)
- = Agree, (3.40- 4.19)
- = Undecided, (2.60-3.39)
- = Disagree, (1.80-2.59)
- 1 = Strongly disagree, (1-1.79)

**b) Frequency**

- 5 = Always, (4.20-5.00)
- 4 = Very Often, (3.40- 4.19)
- 3 = Sometimes, (2.60-3.39)
- 2 = Rarely, (1.80-2.59)
- 1 = Never, (1-1.79).

The questions from the Likert scale were individually analyzed for deeper insights into specific attributes. Since the questions all measured a single trait or attitude when combined, they were also grouped together and analyzed as a Likert scale. The researcher coded the answers to each question into numbers and then added up the numbers to get an overall attitude score for each participant.

Descriptive statistics were used to summarize all the data collected in simple numerical form. Since the data was interval, scores from each question were added to get the total score for each participant. Mean, or average scores, standard deviation or spread of the scores of the sample were then calculated and analyzed.

### **3.8.2 Qualitative analysis**

Qualitatively the data were analyzed using thematic analysis. This is because the approach complements the quantitative data. Emerging themes were used as summaries from the respondents.

### **3.9 Ethical consideration**

A number of ethical issues were addressed before the study started. The study first sought and obtained informed consent from the top management of all the entities that were to be covered before data collection. All respondents were assured of strict adherence to ethical standards throughout the research. Strict confidentiality of all respondents was also assured and any information obtained from them was used solely for the purpose of the present study and no any other use whatsoever.

The respondents were provided with adequate information about the study. They were informed about the purpose and benefits of the study to the construction industry as a whole. All data collected and analyzed was used for the purpose for which the current study was undertaken and was not divulged to any unauthorized persons. For anonymity, the study refrained from collecting data that pertains to the identity of the participants. Where cases were discussed, the real names of the participants were not used.

### **3.10 Chapter summary**

The research design and strategy employed in the study has been discussed under this chapter. The research methods adopted have also been discussed. The measurement of

variable and the use of 5 point Likert scales was discussed and why it was employed over the other comprehensive ones including its' advantages.

The chapter has argued for a multi-methodology approach which the study adopted based on the context of the study and information required to shed light on the phenomenon under consideration. The research design discussed in the chapter describes the links between all elements of the methodology adopted for the study; the underlying philosophical assumptions of the research, the research methods and the methods of data collection employed by the study. Analytical techniques adopted in the study have also been explained. The processes followed from the conception of the research idea up to the writing up of the thesis have been described. The next chapter that follows present the results of the study (analysis, presentation and interpretation of the findings).

## CHAPTER FOUR

### DATA ANALYSIS, RESULTS AND DISCUSSIONS OF THE FINDINGS

#### 4.1 Introduction

This chapter presents analysis of the data obtained from the various construction sites to explain health and safety performance in a typical construction company in Rwanda. The chapter comprises of five main sections: response rate and background information on the respondents; knowledge on safety and health practices; accidents in construction sites; implementation of safety and health systems; and suggestions for a strategy to improve OSH performance in construction projects.

#### 4.2 Response rate and background information

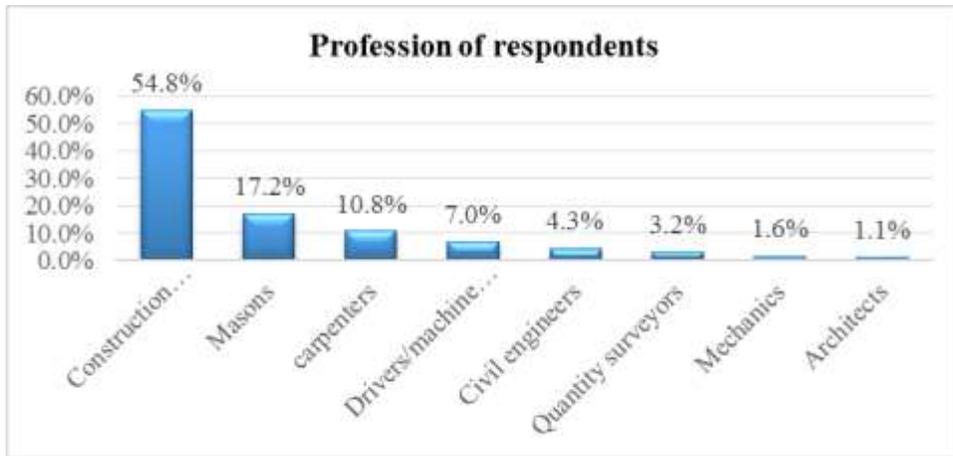
Out of a sample of 322 questionnaires issued, 186 were returned constituting a response rate of 57.7% of the target responses. These included; construction managers, supervisors and frontline staff. According to Mugenda & Mugenda (2003), 50% is regarded as an acceptable response rate in social research surveys such as this one.

The sites were fully active at various stages of construction activity. The characteristics of the respondents have a bearing on the credibility and quality of responses, which in turn determine the internal and external validity of the study. They include: profession, education qualifications, familiarity to the construction work, period spent in the construction industry and stage of participation as follows:

##### 4.2.1 Profession of respondents

Figure 4.1 shows that majority of the workers 102 (54.8%) were construction helpers, 32 (17.2%) were masons, 20 (10.8%) were carpenters, 13 (7.0%) were driver's / machine operators, 8 (4.3%) were civil engineers, 6 (3.2%) were quantity surveyors, architects, 3 (1.6%) were mechanics and 2 (1.1%) were architects. The views of this cross-section of

respondents brought forth the influence of health and safety performance in the construction industry in Rwanda. Secondly, the strategic nature of the respondents lends credence to the findings as a valid representation of the lived experience of the respondents.

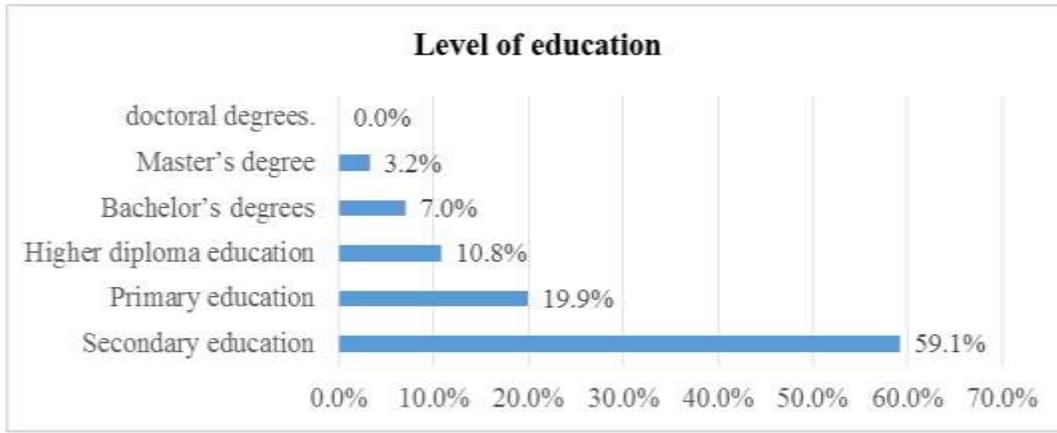


**Figure 4.1: Profession of Respondents**

: Author, 2022

#### **4.2.2 Education level of the respondents**

Majority of the respondents 110 (59.1%) had secondary education, 37 (19.9%) had a primary education, followed by 20 (10.8%) who had higher diploma education, 13 (7.0%) had bachelor's degrees, 6 (3.2%) had a master's degree and 0 (0%) had doctoral degrees.

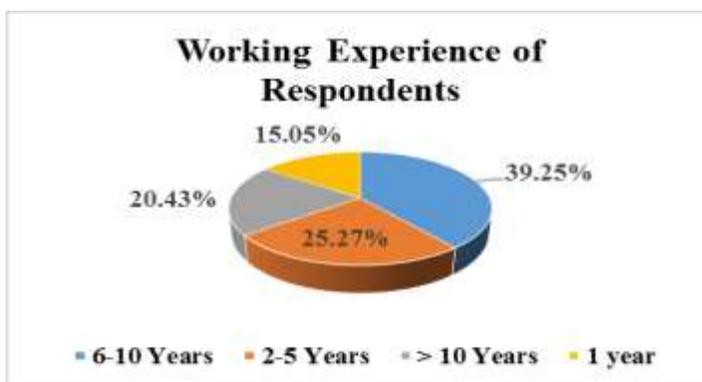


**Figure 4.2: Education Level of Respondents**

Source: Author, 2022

#### 4.2.3 Working experience of respondents

Majority of the respondents had been in the construction industry for 6-10 years 73 (39.25%), followed by 2-5 years 47 (25.27%), followed by 38 (20.43%) had more than 10 years of experience and lastly 28 (15.05%) who had a 1-year experience in the construction industry (Figure 4.4).



### **Figure 4.3: Working Experience of Respondents**

Source: Author, 2022

#### **4.3 Knowledge on health and safety skills in construction projects**

The first objective of this study focused on the knowledge levels amongst construction workers on the health and safety practices and skills on the construction projects in Rwanda.

The respondents' knowledge levels on the health and safety practices and skills on the construction projects in Rwanda were examined, and from the findings 28(15.05%) were extremely aware, 63 (33.87%) were very aware, 32(17.20%) were moderately aware, 47 (25.27%) were slightly aware and only 16 (8.60%) were not at all aware as shown on Table 4.1 below;

**Table 4.1: Knowledge levels about health and safety in construction site**

	<b>Extremely aware (4.20-5.00)</b>	<b>Very aware (3.40- 4.19)</b>	<b>Moderately aware (2.60-3.39)</b>	<b>Slightly aware (1.80- 2.59)</b>	<b>Not at all aware (1-1.79)</b>	<b>Mean</b>	<b>Std. Dev.</b>
<b>Knowledge levels about health and safety</b>	28 (15.05%)	63 (33.87%)	32 (17.20%)	47 (25.27%)	16 (8.60%)	3.17	0.98

Source: Author, 2022

Table 4.1 shows the levels of health and safety knowledge of construction workers in Rwanda. The assessment was done on the common health and safety issues in the construction sites. The mean score (3.17) indicated that there was a moderate level of health and safety knowledge and awareness amongst the construction workers. However, statistics still show there is a lot to do as far as safety and health awareness is concerned as it was clear that there are still construction workers not at all aware about health and safety (16). This means without this awareness, these workers are still exposed to hazards and accidents.

Table 4.2 shows how the information about Health and Safety was obtain mostly by respondents. Majority of the respondents 67 (36.1%) got information about occupational health and safety from personal experience, followed by 54 (29.0%) from the organization trainings, 37 (19.9%) from co-workers and 28 (15.0%) from supervisors.

**Table 4.2: How information about health and safety was obtained**

<b>Source of Information</b>	<b>Frequency n = 186 (%)</b>
Personal Experience	67 (36.1%)
Organization trainings	54 (29.0%)
Co- Workers	37 (19.9%)
My supervisor	28 (15.0%)

Source: Author, 2022

Safety training and orientations are necessary elements of an effective safety program. The supervisors and the construction workers must understand the occupational health and safety procedures, regulations and policies and the construction company’s safety policy and procedures associated with the work.

One of the respondents from the construction sites visited had to say this about knowledge levels amongst construction workers at the construction sites:

“When construction workers first arrive on the site, a safety orientation training program should be provided and the training session can cover the company and project safety policies, safe regulations, site orientation, personal protective equipment and OSHA required training.”

#### **4.4 Accidents in construction sites**

The second objective of the study sought to establish the types and sources of accidents and or hazards encountered on the construction sites. The results from the table below indicated that slips and fall injuries, nail Injuries, falling debris and Trench cave ins or excavation accidents crushing or amputation injuries are the most common types of injuries associated with construction projects in Rwanda. These cause wounds, cuts and fractures to the construction workers. The responses are presented on Table 4.3.

Table 4.3 shows that slips and fall are the commonest type of accidents encountered in construction sites in Rwanda (mean 3.55). 50 respondents (26.88%) always encounter this type of accident. None has never encountered this. The second commonest type of accident is nail injuries with 18.28% agreeing to always encountering this type of accident. Falling debris and trench or excavation accidents always follow with 3.12 and 2.69 means respectively as respondents agree that these accidents sometimes occur. The least ranked accidents were ladder failures and chemical or heat burns with 2.56 and 2.50 means respectively. 46.77% agree that ladder failures rarely happen and 11.29% agree to have never encountered chemical or heat burns.

**Table 4.3: Types of Accidents**

Type of accidents	Always		Often		Sometimes (2.60-3.39)		Rarely (1.80-2.59)		Never (1-1.79)		Mean	Std. Dev.
	(4.20-5.00)	(3.40-4.19)										
<b>Slip and fall injuries</b>	50	26.88%	61	32.80%	42	22.58%	33	17.74%	0	0.00%	3.55	0.85
Nail injuries	34	18.28%	72	38.71%	43	23.12%	29	15.59%	8	4.30%	3.40	0.87
Falling debris	25	13.44%	37	19.89%	72	38.71%	46	24.73%	6	3.23%	3.12	0.84
Trench cave ins or excavation accidents	8	4.30%	18	9.68%	70	37.63%	76	40.86%	14	7.53%	2.69	0.73
Scaffold or ladder failures	6	3.23%	25	13.44%	42	22.58%	87	46.77%	26	13.98%	2.56	0.80
Chemical, Fire, heat or electrical burns	7	3.76%	14	7.53%	44	23.66%	100	53.76%	21	11.29%	2.50	0.74

Source: Author, 2022

One of the workers observed that,

*“The likelihood of a construction worker having wounds, bruises, fractures and broken bones as a result of fall injuries and nail injuries is high and the likelihood of occurrence is more than 50% in a week”*

Table 4.4 presents the most common hazards usually encountered in construction sites in Rwanda. Respondents were asked to rank the most common hazards to the least common hazards and the results are shown in the table below:

**Table 4.4: Sources of Hazards**

Types of Hazards	Strongly agree (4.20-5.00)	Agree (3.40-4.19)	Undecided (2.60-3.39)	Disagree (1.80-2.59)	Strongly disagree (1-1.79)	Mean	Std. Dev.
	105 (56.45%)	81 (43.55%)	0 (0%)	0 (0%)	0.00%	4.25	0.40
	68 (36.56%)	97 (52.15%)	8 (4.3%)	13 (6.99%)	0 (0%)	3.94	0.65
	79 (42.47%)	60 (32.26%)	25 (13.44%)	16 (8.60%)	6 (3.23%)	3.81	0.88
Demolition	Working with live electricity	86 (46.24%)	23 (12.37%)	21 (11.29%)	13 (6.99%)	3.53	0.93
Working in confined spaces.	Working at height	65 (34.95%)	38 (20.43%)	29 (15.59%)	21 (11.29%)	3.25	1.00
Exposure to chemicals	Working with heavy plant and machinery	48 (25.81%)	30 (16.13%)	46 (24.73%)	25 (13.44%)	3.11	1.08

Source: Author, 2022

From the above take, 105 (56.45%) strongly agreed that working with live electricity is the most common hazards usually encountered in construction sites and none disagreed with this. It is therefore important that throughout the works, this hazard is well planned for through insulation mechanisms as consequences could be fatal. The second ranked hazard was working at heights with 97 (52.15%) of the respondents agreeing with this. Followed by working with heavy plant and machinery which also poses danger to all around the sites with only 6 (3.23%) of respondents strongly disagreeing to this. The least ranked hazards were demolition, working in confined spaces, exposure to chemicals with means of 3.53, 3.25 and 3.11 respectively. Table 4.5 presents the most common causes of accidents on construction sites.

**Table 4.5: Common causes of accidents**

Common Causes of accidents	Strongly agree (4.20-5.00)	Agree (3.40-4.19)	Undecided (2.60-3.39)	Disagree (1.80-2.59)	Strongly disagree (1-1.79)	Mean	Std. Dev.
<b>Long hours of work</b>	121	41	16	6 (3.23%)	2	4.17	<b>0.77</b>
<b>Lack of safety gear</b>	135 (65.05%)	21 (22.04%)	13 (8.60%)	12	5 (1.08%)		
<b>Extreme weather conditions</b>	74 (72.58%)	91 (11.22%)	8 (6.99%)	9 (6.45%)	4 (2.69%)	4.16	<b>0.90</b>
<b>Sophisticated machines and plant</b>	74 (39.78%)	88 (48.92%)	4 (4.30%)	12 (4.84%)	8 (2.15%)	3.95	<b>0.73</b>
<b>Working at heights, confined spaces and underground</b>	55 (29.57%)	108 (58.06%)	9 (4.84%)	4 (2.15%)	10 (5.38%)	3.83	<b>0.77</b>
<b>Weak regulatory body</b>	35 (18.82%)	133 (71.51%)	5 (2.69%)	6 (2.32%)	7 (3.76%)	3.78	<b>0.67</b>

Source: Author, 2022

From the findings, the most common causes of injuries from the highest ranked to the lowest are long hours of work, lack of safety gear, extreme weather conditions, sophisticated machines and plant, working at heights, confined spaces and underground and weak regulatory body. Crush injuries can have side effects, including fractures, internal injuries, head and brain injuries and back injuries. One of the staff stated that;

*“In some cases, a crush injury may result into amputation and total permanent disability of the affected workers; many people are injured due to being cuts by equipment and hand held working tools such as chisels, screwdrivers, knives, saws, hammers, nails and drilling machines”.*

The feedback from one of the supervisors strongly agrees on the fact that there are irresponsible attitudes of workers during working or handling machines and discipline issues. Many accidents occur because of irresponsible attitudes of the workers, negligence and carelessness of workers evidently in risky situations such as leaving pieces of wood with nails in the walk ways, working on scaffolding sustained with concrete blocks instead of assembling the scaffolding available on construction site.

In relation to unregulated practices on construction sites, some workers also exhibit discipline issues for example use of alcoholic beverages, where some workers go for alcoholic drinks after work. This condition will affect the worker’s safety performance on the following day. Such unregulated practices on construction sites are potentially dangerous behaviors which have consequences of causing harm to other people. The constructors do not have the right to randomly test construction workers for alcohol or drug use although there are policies in place to take action against the workers.

One of the site managers said that,

*“There is a high probability of falling from height due to the fact that most workers are exposed to the height on high rise works and these usually occur as a result of lack enough edge protection”*

#### **4.5 Implementation of health and safety management structures in construction projects**

The third objective of the study sought to know the level of implementation of health and safety management systems in construction projects in Rwanda. The results from the table 4.6 give the results from the respondents on the level of implementation of health and safety management systems in construction projects in Rwanda.

**Table 4.6: Implementation of Health and Safety Management Systems**

<b>Implementation factors</b>	<b>Strongly agree (4.20-5.00)</b>	<b>Agree (3.40-4.19)</b>	<b>Undecided (2.60-3.39)</b>	<b>Disagree (1.80-2.59)</b>	<b>Strongly disagree(1-1.79)</b>	<b>Mean</b>	<b>Std. Dev.</b>
The site has a safety officer and a written safety plan.	156 (83.87%)	17 (9.14%)	6 (3.23%)	5 (2.69%)	2 (1.08%)	4.38	<b>1.10</b>
The company has a formal health and safety training programme.	82 (44.09%)	90 (48.39%)	10 (5.38%)	4 (2.15%)	0 (0%)	4.07	<b>0.83</b>
The company has a written environmental, health and safety policy.	72 (38.71%)	101 (54.30%)	6 (3.76%)	4 (2.15%)	2 (1.08%)	4.02	<b>0.82</b>
The company keep records of all the accidents to the employees.	68 (36.56%)	107 (57.53%)	6 (3.23%)	5 (2.69%)	0 (0%)	4.02	<b>0.78</b>
The organization provides compensation when accidents occur.	45 (24.19%)	67 (36.02%)	35 (18.82%)	27 (14.52%)	12 (6.45%)	3.45	<b>0.95</b>
The organization periodically update it's the health and safety policy.	<b>20</b> <b>(10.75%)</b>	<b>33</b> <b>(17.74%)</b>	<b>84</b> <b>(45.16%)</b>	<b>15</b> <b>(8.06%)</b>	<b>34</b> <b>(18.28%)</b>	<b>2.95</b>	<b>1.08</b>

Source: Author, 2022

From Table 4.6, 156 (83.87%) of the respondents strongly agreed that the company has a formal and safety training program while only 2 respondents strongly disagreed with this implementation factor. 44.09% of the respondents strongly agreed that the company has a formal health and safety training programme and none strongly disagreed. However, 10 respondents were not sure about this. 72% of the respondents also strongly agreed that the company has a written environmental, health and safety policy with 7 (3.76%) undecided about this factor. 68 (36.56 %) of the respondents strongly agreed that the company keeps records of all the accidents to the employees while 3.23% (6) were undecided or not sure about this. 45.16% (84) of the respondents were not sure and undecided on whether the organization periodically updates its health and safety policy and only 20 (10.75%) strongly agreed with this implementation factor. 45 (24.19 %) strongly agreed that the organization provides compensation when accidents occur while 27 (14.52 %) disagreed on this.

Training provides workers with ways to obtain additional information about potential hazards and their controls; they could gain skills to assume a more active role in implementing health and safety control programs or to effect organizational changes that would enhance worksite protection.

Therefore, construction workers must be given health and safety induction training when they start work which should cover basics such as first aid and fire safety. There should also be job specific health and safety training. Training should be provided if risks change, and refresher training when skills are not frequently used.

Personal protective equipment (PPE) are the protective clothing, helmets and other garment or equipment designed to protect the body from the injury by electrical hazards, heat and infection, for job related health and safety purposes. Use of personal protective equipment should be employed to reduce employee exposure to hazards where engineering and administrative controls are not feasible or effective in reducing these exposures to acceptable levels. PPE program should be implemented. This program should also address the hazards present, the selection, maintenance, and use of PPE, the

training of construction workers, monitoring of the program to ensure its ongoing effectiveness. The PPE required in the construction sites include; helmets, hand gloves, safety boots, respiratory protection, hearing protection, welding face shield and eye protection glasses, overall protection suites, safety belts, safety nettings and high-visibility clothing.

Respondents were asked about the use of PPE on site and the results are shown on Table 4.7;

**Table 4.7: Use of Personal Protective Equipment**

<b>Safety Gear</b>	<b>Always (4.20-5.00)</b>	<b>Often (3.40-4.19)</b>	<b>Sometimes (2.60-3.39)</b>	<b>Rarely (1.80-2.59)</b>	<b>Never (1-1.79)</b>	<b>Mean</b>	<b>Std. Dev</b>
High visibility clothing	116 (62.37%)	53 (28.5%)	12 (6.45%)	5	0 (0%)	4.20	0.59
Helmets	77 (41.4%)	63 (33.87%)	20 (10.75%)	14 (7.53%)	12 (6.45%)	3.77	0.95
Safety Boots	61 (32.8%)	68 (36.56%)	45 (24.19%)	8 (4.3%)	4 (2.15%)	3.75	0.78
Overall protection suites	45 (24.19%)	51 (27.42%)	47 (25.27%)	35 (18.82%)	8 (4.3%)	3.38	0.94
Welding face shield and eye protection goggles.	40 (21.51%)	39 (20.97%)	65 (34.95%)	34 (18.28%)	8 (4.3%)	3.29	0.91
Respiratory protection	37 (19.89%)	42 (22.58%)	51 (27.42%)	29 (15.59%)	27 (14.52%)	3.14	1.06
Hearing protection	17 (9.14%)	23 (12.37%)	28 (15.05%)	78 (41.94%)	40 (21.51%)	2.56	0.97
Safety belts	13 (6.99%)	18 (9.68%)	22 (11.83%)	98 (52.69%)	35 (18.82%)	2.46	0.88

Source: Author, 2020

Table.4.7 shows the most used up to the least used personal protective equipment.

Results show that high visibility clothing is the most used with 116 (62.37%) respondents saying this PPE is always used and none said it is never used. 77 (41.4%) also always use helmets and only 12 respondents never use helmets. 61 (32.8%) always use safety boots and 45 sometimes use the boots. 35 (18.82%) rarely uses overall protection suites and only 8 never use this. 40 (21.51%) always use welding face shield and eye protection goggles. The three least used PPE are respiratory protection, hearing protection and safety belts with respective means of 3.14, 2.56 and 2.46.

The management's commitment to safety or lack of commitment will set the tone for the rest of the members of the company. The management usually takes every opportunity to become involved in it company's safety effort.

Safety training and orientations are necessary elements of implementation of health and safety management on the construction sites for effective safety program. The supervisors and construction workers must understand the companies' health and safety policy and procedures and the hazards associated with the work at the sites. When the construction workers arrive on site, a health and safety orientation training program should be availed to them. The training and orientation session can include the company's and project safety policies, safety regulations, site orientations, personal protective equipment and health and safety required training.

Safety audits are very important in the implementation of health and safety management systems. Before any construction work is executed, it is a good practice by the construction companies to checklist the various areas in order to monitor the work properly and take serious actions if necessary. Checklist for safety audit is required in order to know the compliance or non-compliance to the Health and Safety Act and machineries active perceived to be important from the health and safety point of view. The outcomes of the audit are revealed on how the construction company is maintaining a healthy and safe incident reporting and investigation.

Frequent keeping of records of the accidents on the construction projects helps in the implementation of the health and safety at the construction sites. Weekly or monthly reviews of the project safety records including accident statistics, reports of the injuries incurred and results from the safety inspections by the health and safety team is a very important safety tool. Such reviews focus attention on the safety effort and can identify the problematic areas that need further safety attention. It is also important to know the cause of accidents so that attention can be directed at controlling them. Providing incentives on site to the good health and safety performers motivates workers to work hard because the employers provide incentives in various forms.

#### **4.6 Expert views for devising a strategy to improve health and safety performance in construction projects**

The fourth objective of the study was to highlight expert views to develop and adopt an effective framework for the improvement of health and safety performance in construction projects in Rwanda. These views were from interviews held with experts (environmental, health and safety, and top managers) for the several construction sites surveyed for the study. Interviews were conducted with 16 experts from the selected construction sites and their results are tabled in the table 4.8. Additionally, views were sought from interviews of the officials at the Ministry of Public Service and Labour. This section presents those expert views.

##### **4.6.1 Expert views from the construction sites selected for the study**

Table 4.8 shows the mean scores, standard deviations and the percentage frequencies of the 6 suggested factors necessary to improve health and safety performance.

**Table 4.8: Factors necessary to improve Health and Safety performance**

Factors necessary to improve Health and Safety p	Extremely important (4.20-5.00)	Very important (3.40-4.19)	Moderately important (2.60-3.39)	Slightly important (1.80-2.59)	Not at all important (1-1.79)	Mean	Std. Dev.
Provision of safety gear	12	3	1	0	0	4.35	<b>0.14</b>
	(75%)	(18.75%)	(6.25%)	(0%)	(0%)		
Health and safety trainings to all workers	10	4	2	0	0	4.20	<b>0.17</b>
	(62.5%)	(25%)	(12.5%)	(0%)	(0%)		
Job safety analysis and daily toolbox talks	11	3	1	1	0	4.20	<b>0.17</b>
	(68.75%)	(18.75%)	(6.25%)	(6.25%)	(0%)		
Improved monitoring and supervision	9	3	3	1	0	4.00	<b>0.20</b>
	(56.25%)	(18.75%)	(18.75%)	(6.25%)	(0%)		
Management commitment	7	6	1	2	0	3.90	<b>0.18</b>
	(43.75%)	(37.5%)	(6.25%)	(12.5%)	(0%)		
Strict inspection mechanisms and heavy Fines	6	5	2	2	0	3.56	<b>0.21</b>
	(37.5%)	(1%)	(12.5%)	(12.5%)	(0%)		

Source: Author, 2022

The results also show the most significant factors to improve health and safety performance on the various construction sites in a decreasing order of priority, the strategic factors may be listed as follows: Provision of safety gear, health and safety trainings to all workers, job safety analysis and daily toolbox talks, Improved monitoring and supervision, management commitment, and lastly strict inspection mechanisms and heavy Fines.

For health and safety to be improved in the construction projects in Rwanda, there is need for worker's emolument, safety presentation and control, safety arrangement and management commitment and the Rwanda Regulations. The institutional and legal governance framework on health and safety in Rwanda has little impact. The majority of the construction workers are small and medium enterprises operating within the domestic market where enforcement of the health and safety standards and labour standards is very lax. Enforcement of the health and safety regulations remains a problem due to lack of adequate resources available to government institutions responsible for health and safety administration. There remains an acute need for contact provisions to support the enforcement of labour laws in developing countries.

Placing the right person on the right job is critical for the improvement of the health and safety at the construction sites. The health and safety manager is responsible for producing the necessary documentation for the safety management system, such as health and safety procedures, method statements and risk assessment. One of the supervisors at one of the sites said that;

*“I have 16 years’ experience in working with the Health and Safety Environment internationally and have acquired several internally recognized certifications and also qualifications in my professional career”*

The Health and Safety team is a tremendous resource for the project and has a big impact on the contractors’ upper management.

Safety arrangements bring unsafe working practices and hazardous situations to management's attention, the communication line between the management and workforce has to be open. From the interview, one of the supervisors explained;

*“There is an open communication line between the workers and the health and safety team and other site supervisors”*

The health and safety team encourages the construction workers to report hazards on a daily basis. For the health and safety in the construction sites, safety related responsibilities must be transferred to the employees but with lower level of authority. From the interviews with the health and safety team, it was told that workers and foremen are made aware of their safety related responsibilities through toolbox talks and safety meetings.

Management plays an important role in improving the health and safety in the construction sites in Rwanda. The management of enterprises is responsible for translating the safety management program into action. In the health and safety team, different perceptions exist on management commitment towards safety. According to one of the team members, management commitment towards the health and safety does exist either at site or at the main headquarter office.

However, one of the foremen observed that when they are behind schedule, safety does not matter as much as production and they are will to do shortcuts at the expense of safety. For example, there were cases on site where the workers had to perform the work more effectively by overloading the vehicles. If they did not oblige, they would be fired from work.

One of the management staff's concerns were that the construction workers on site had no experience with working with safety, and therefore “did not know any better”. Because of such concerns, there is need for an effective training program and all the staff and visitors must receive health and safety induction training from the health and

safety team. The operators, foreman and managers should also receive specific job training according to the health and safety training program.

Management is obliged to follow the same safety rules as everyone else and they are covered by the disciplinary system for safety violations. Observations from the construction sites support this statement; most construction managers follow the same safety rules as anyone else while being on the construction sites.

Work in the construction projects in Rwanda is tough and involves much manual or physical activity. It is also hazardous and dirty and therefore good welfare facilities not only improve worker's welfare but also enhance efficiency. Welfare facilities such as the provision of drinking water, washing, sanitary and changing accommodation, rest rooms and shelter, facilities for preparing and eating meals, temporary housing, assistance in transport from place of residence to the work site and back, all help to reduce fatigue and improve worker's health.

However, health and safety measures employed in construction projects sometimes are scanty and fail to meet the required standards. The culture and attitude of construction workers and the project supervisors about health and safety often condone risk taking and unsafe work practices. Therefore, lack of proper information and ignorance are also to blame for poor safety measures in construction sites.

One of the interviewed construction workers observed:

*“Some workers felt that the safety equipment such as helmets and safety boots are too cumbersome and uncomfortable”.*

The respondents were also asked about the barriers to the operation of occupational health and safety performance and management. The major barriers to the operation of the occupational health and safety performance according to the respondents are: the type of health and safety management system, internal organizational factors, contractor relations and nature of the organization.

Respondents were asked to indicate which factors were considered to be occupational health and safe management barriers. The management systems imposed by senior management without discussion with construction workers and off the- shelf system enforced without amendments are the occupational health and safety management system barriers that hinder the performance of the health and safety in Rwanda.

Respondents were also asked to indicate which factors were considered to be internal organizational barriers that hinder the performance of the health and safety management. From the interviews, these factors include: words unsupported by practice, health and safety activities restricted to technical experts, extensive casual and part time workforce, and high labour turnover, in adequate resources, inadequate training of employees in health and safety and limited accountability mechanisms.

The respondents were also asked to indicate which contractor's relationship barriers hinder the implementation of occupational health and safety managements in the construction industry in Rwanda. The interviews indicated that principal contractor simply requiring sub-contractor to have health and safety management system, principal contractor simply imposing their health and safety management system on sub-contractor and subcontractor's health and safety management system inconsistent with principal contractors are the contractor relation barriers that hinder the operation of occupational health and safety management.

#### **4.6.2 Expert views from the staff of the Ministry of Public Service and Labour**

Interviews were conducted with the government Staff (experts) in the Occupational Safety and Health Department of the Ministry of Public Service and Labour. According to those officers, the department of occupational safety and health has been in existence in Rwanda since 2010 under the Ministry of Public Service and Labour.

Additionally, that the vision of the national policy on OSH is to have a safe and healthy workplace for everyone and a country where the best practices on OSH are part of the

daily activities. Accordingly, from the interview, it was understood that the objectives of the OSH Department are as follows:

- The primary objective is to reduce the number of work-related accidents and diseases in Rwanda.
- The secondary objective is to provide equitable compensation benefits to those who may get injured in work-related accidents or contract occupational diseases, which include medical aid, financial compensation and access to rehabilitation services.

Regarding the recent construction accidents which have also claimed the lives of the construction workers, the interviewees pointed out that the OSH department has gone ahead to inspect workplaces and investigate the accidents to their prevent re-occurrences. From their experiences, falls from heights, electrocutions, cuts, slips and 'caught-in' during demolition works or excavations are the most common types of construction accidents encountered.

As for the safety levels in the construction industry in Rwanda, the government staff were fairly satisfied, but pointed out that the department is unable to inspect every building/road under construction in Rwanda. This is due to inadequate number of labour inspectors to cover every project in the country. Today, there is one inspector per district in rural areas and two labour inspectors per district in Kigali City. The inspection work is too much for the existing staffing level. From the view point of the government officers, the low levels of construction worker safety in Rwanda have been brought about by:

- Lack of top management commitment in most of the construction companies;
- Too much sub-contracting of works which denies the main contractors the ability and power to supervise the works;
- Lack of worker orientation and on-site training;

- Lack of safety officers on site;
- Inadequate PPE;
- Lack of warning signs and boards on sites;

The above factors responsible for the low levels of construction worker safety in Rwanda pointed out by the government officials were generally similar to the same factors noted from the observations from the questionnaire data of the construction managers, supervisors and front line staff when asked about the major causes of accidents in construction sites in Rwanda.

Accordingly, achievements of OSH department are the training of construction workers and professionals generally and on-invitation by construction companies. Other achievements include;

- Competent authority in charge of occupational Safety and Health.
- Decentralization structures up to village level to facilitate the mobilization, sensitization, monitoring and law enforcement.
- National Country Profile on Occupational Safety and Health of 2012.
- Reduction in transaction costs such as insurance costs and legal fees.

Despite those achievements, there remain serious challenges to the occupational safety and health conditions in construction industry in Rwanda. According to the specialist safety inspectors interviewed, the challenges can be summarized as follows:

- Very limited OSH skills and human resources in the public and private sectors;
- Lack of enough funding mechanisms for prevention agencies;
- Low level of culture of prevention among employers and workers;
- Lack of a comprehensive reporting system and database for work-related accidents and diseases;

- Rate of work-related accidents, diseases and fatalities is high imposing a huge cost on Rwanda;
- Lack of adequate occupational safety and health services;
- Those who are trained in occupational safety and health seek greener pastures abroad where they are paid higher.

Finally, expert views of the government officials on the measures to improve construction worker safety in Rwanda were given as follows:

- Instituting better enforcement mechanisms;
- Inspection should be carried-out on machine operations;
- Sensitizing people (workers and employers) regarding safety and health at construction sites;
- Stricter enforcement of penalties for non- compliance; and
- Individual responsibility for safety should be fostered in the various stakeholders in the construction industry.

All the expert views (construction sites and Occupational Safety and Health Department of the Ministry of Public Service and Labour) pointed out are a major input to the devising or formulation of the construction occupation safety and health (OSH) transformation strategy.

#### **4.7 Chapter Summary**

The study findings and analysis have been discussed under this chapter. The characteristics describing the respondents such as their profession, education qualifications, and working experience in the construction industry have been captured. Information on the research questions of the study has been discussed to meet all the objectives of the research. These were:

- Assessing the Knowledge level among construction workers on health and safety practices and skills.
- Analyzing the sources and types of hazards and accidents encountered in construction projects
- Evaluating the level of implementation of health and safety management structures.
- Analyzing and highlighting the expert views for the development and adoption of an effective framework for the improvement of health and safety performance in construction projects in Rwanda

## CHAPTER FIVE

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 Introduction

This chapter presents summary of the study findings, discussions, conclusions and recommendations on how to improve health and safety in the construction industry in Rwanda. It also suggests areas for further research for more knowledge and a better understanding about this field of study.

#### 5.2 Summary of the study findings

The aim of the study was to investigate the health and safety performance in the construction projects in Rwanda. Accordingly, four (4) objectives were set as follows: assess the knowledge level among construction workers on health and safety practices and skills in construction projects in Rwanda; to analyze the sources and types of hazards and accidents encountered in construction projects in Rwanda; to evaluate the level of implementation of health and safety management systems in construction projects in Rwanda; and finally, to highlight expert views develop and adopt an effective framework for the improvement of health and safety performance in construction projects in Rwanda.

##### 5.2.1 Demographic characteristics of the respondents

The findings of the study showed that majority of the workers 102 (54.8%) were construction helpers, 32 (17.2%) were masons, 20 (10.8%) were carpenters, 13 (7.0%) were driver's / machine operators, 8 (4.3%) were civil engineers, 6 (3.2%) were quantity surveyors, architects, 3 (1.6%) were mechanics and 2 (1.1%) were architects.

In terms of the educational level of the respondents, 110 (59.1%) had secondary education, 37 (19.9%) had a primary education, followed by 20 (10.8%) who had higher

diploma education, 13 (7.0%) had bachelor's degrees, 6 (3.2%) had a master's degree and 0 (0%) had doctoral degrees.

Different researchers have pointed out the impact of education level on health and safety performance. (Oladiran & Sotunbo, 2005) observed that employees with a low level of education find it difficult to interpret contract documents and health and safety laws. This leads to a poor understanding of many issues concerning the health and safety of workers.

Majority of the respondents had been in the construction industry for 6-10 years 73 (39.25%), followed by 2-5 years 47 (25.27%), followed by 38 (20.43%) had more than 10 years of experience and lastly 28 (15.05%) who had a 1-year experience in the construction industry

### **5.2.2 Knowledge levels amongst construction workers on the health and safety practices and skills**

The first objective of this study focused on the knowledge levels amongst construction workers on the health and safety practices and skills on the construction projects in Rwanda.

The respondents' knowledge levels on the health and safety practices and skills on the construction projects in Rwanda were examined, and from the findings 28(15.05%) were extremely aware, 63 (33.87%) were very aware, 32(17.20%) were moderately aware, 47 (25.27%) were slightly aware and only 16 (8.60%) were not at all aware.

Statistics still show there is a lot to do as far as safety and health awareness is concerned as it was clear that there are still construction workers not at all aware about health and safety (16). This means without this awareness, these workers are still exposed to hazards and accidents

Majority of the respondents 67 (36.1%) got information about occupational health and safety from personal experience, followed by 54 (29.0%) from the organization trainings, 37 (19.9%) from co-workers and 28 (15.0%) from supervisors.

Knowledge and awareness of health hazards have been established in studies done among construction workers. The results show how essential the knowledge about health and safety is important in improving the health and safety performance in the construction industry in Rwanda.

Developing and grow knowledge on health and safety successfully propels businesses on top. Health and safety knowledge can raise awareness about health issues. Once all the construction workers learn about the value of their health, they are encouraged to execute and perform their duties in a healthier behavior. They are always encouraged to support and promote activities and practices that reduce and manage health risk factors. Any individual who gives importance to the health and safety system is able to come up with great management ideas that can help in creating a safe, healthy, and productive workplace environment.

### **5.2.3 Types and sources of accidents and or hazards encountered on the construction sites**

The second objective of the study sought to establish the types and sources of accidents and or hazards encountered on the construction sites in Rwanda. From the study it was indicated that slips and fall injuries, nail Injuries, falling debris and Trench cave ins or excavation accidents crushing or amputation injuries are the most common types of injuries associated with construction projects in Rwanda. Slips and fall are the commonest type of accidents encountered in construction sites in Rwanda (mean 3.55). 50 respondents (26.88%) always encounter this type of accident. None has never encountered this. The second commonest type of accident is nail injuries with 18.28% agreeing to always encountering this type of accident. Falling debris and trench or excavation accidents always follow with 3.12 and 2.69 means respectively as

respondents agree that these accidents sometimes occur. The least ranked accidents were ladder failures and chemical or heat burns with 2.56 and 2.50 means respectively. 46.77% agree that ladder failures rarely happen and 11.29% agree to have never encountered chemical or heat burns.

Respondents were asked to rank the most common hazards to the least common hazards. Accordingly, 105 (56.45%) strongly agreed that working with live electricity is the most common hazards usually encountered in construction sites and none disagreed with this. It is therefore important that throughout the works, this hazard is well planned for through insulation mechanisms as consequences could be fatal. The second ranked hazard was working at heights with 97 (52.15%) of the respondents agreeing with this. Followed by working with heavy plant and machinery which also poses danger to all around the sites with only 6 (3.23%) of respondents strongly disagreeing to this. The least ranked hazards were demolition, working in confined spaces, exposure to chemicals with means of 3.53, 3.25 and 3.11 respectively.

Statistics indicate that over 1,000 construction workers are injured and killed each year at their work sites. Over 300 deaths are a result of construction site falls (ILO, 2005). Studies from different countries for example, New Zealand, indicate that, falls from heights are the leading cause of injuries on construction sites (Angel, 2013). In China's construction industry, falls account for approximately 51% of injuries (Cheng, Leu, Lin, & Fan, 2010). In Hong Kong, work-related falls from heights represented more than 47% of all fatal incidents (Ping, 2007) .

Alhajeri (2011) reported that more than 30% of fatalities in Taiwan can be attributed to falls. As a result, falls are the costliest occupational hazards in many countries. Common construction site falls include roof-related falls, crane falls, scaffolding falls, elevator shaft falls, falls resulting from holes in flooring, and falling objects. These usually occur as a result of inadequate edge protection, or from objects in storage being poorly secured. Workers at risk of falling from a height include painters, masons, decorators

and window cleaners and those who undertake one-off jobs without proper training or equipment.

#### **5.2.4 Common causes of accidents**

From the findings, the most common causes of accidents from the highest ranked to the lowest are long hours of work, lack of safety gear, extreme weather conditions, sophisticated machines and plant, working at heights, confined spaces and underground and weak regulatory body. This is in line with the different reports that workers in the construction industry have a high risk of work injuries and work related illness resulting from exposure to different levels of hazards.

In relation to unregulated practices on construction sites, some workers also exhibit discipline issues for example use of alcoholic beverages, where some workers go for alcoholic drinks after work. This condition will affect the worker's safety performance on the following day. Such unregulated practices on construction sites are potentially dangerous behaviors which have consequences of causing harm to other people.

Lubega, Kiggundu and Tindiwensi (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 the people involved in the construction projects, engaging incompetent personnel; non- vibrant professionalism, mechanical failure of construction machinery/ equipment, physical and emotional stress and chemical impairment.

#### **5.2.5 Implementation of health and safety management structures in construction projects**

The third objective of the study sought to know the level of implementation of health and safety management systems in construction projects in Rwanda. 156 (83.87%) of the respondents strongly agreed that the company has a formal and safety training program while only 2 respondents strongly disagreed with this implementation factor. 44.09% of

the respondents strongly agreed that the company has a formal health and safety training programme and none strongly disagreed. However, 10 respondents were not sure about this. 72% of the respondents also strongly agreed that the company has a written environmental, health and safety policy with 7 (3.76%) undecided about this factor. 68 (36.56 %) of the respondents strongly agreed that the company keeps records of all the accidents to the employees while 3.23% (6) were undecided or not sure about this. 45.16% (84) of the respondents were not sure and undecided on whether the organization periodically updates its health and safety policy and only 20 (10.75%) strongly agreed with this implementation factor. 45 (24.19 %) strongly agreed that the organization provides compensation when accidents occur while 27 (14.52 %) disagreed on this. Improving the health and safety of the construction works has been proven to save lives, money and time and also improving goodwill and reputation. The right to safe and healthy working conditions in construction industry has been a central issue in the global campaign where health and safety laws and regulations have separate subdivisions particularly for the construction industry (Badenhorst, 2004). Safer and healthier working environment make a significant contribution to poverty alleviation and sustainable development as construction is labour intensive, particularly in developing countries like Rwanda (Cokeham & Tutesigensi, 2013).

The government through putting up strict regulations, improved communication, strict inspection mechanisms improved monitoring and supervision, and good implementation framework can make a good impact on the occupational health and safety implementation in the construction industry. However, going by the construction worker's feedback, the construction industry in Rwanda needs more of the government backing in the implementation of strict regulations and inspection mechanisms.

#### **5.2.6 Use of Personal Protective Equipment (PPE)**

Personal protective equipment (PPE) was in use on most of the construction projects: Results showed that high visibility clothing is the most used with 116 (62.37%) respondents saying this PPE is always used and none said it is never used. 77 (41.4%)

also always use helmets and only 12 respondents never use helmets. 61 (32.8%) always use safety boots and 45 sometimes use the boots. 35 (18.82%) rarely uses overall protection suites and only 8 never use this. 40 (21.51%) always use welding face shield and eye protection goggles. The three least used PPE are respiratory protection, hearing protection and safety belts with respective means of 3.14, 2.56 and 2.46.

Use of personal protective equipment should be employed to reduce employee exposure to hazards where engineering and administrative controls are not feasible or effective in reducing these exposures to acceptable levels. PPE program should be implemented. This program should also address the hazards present, the selection, maintenance, and use of PPE, the training of construction workers, monitoring of the program to ensure its ongoing effectiveness.

### **5.2.7 Expert views for devising a strategy to improve health and safety performance in construction projects**

The fourth objective of the study was to highlight expert views to develop and adopt an effective framework for the improvement of health and safety performance in construction projects in Rwanda. These views were from interviews held with experts (environmental, health and safety, and top managers) for the several construction sites surveyed for the study. Additionally, views were sought from interviews of the officials at the Ministry of Public Service and Labour.

The most significant factors to improve health and safety performance on the various construction sites in a decreasing order of priority, the strategic factors may be listed as follows: Provision of safety gear, health and safety trainings to all workers, job safety analysis and daily toolbox talks, Improved monitoring and supervision, management commitment, and lastly strict inspection mechanisms and heavy Fines. For health and safety to be improved in the construction projects in Rwanda, there is need for worker's emolument, safety presentation and control, safety arrangement and management commitment and the Rwanda Regulations. The institutional and legal governance

framework on health and safety in Rwanda has little impact. The majority of the construction workers are small and medium enterprises operating within the domestic market where enforcement of the health and safety standards and labour standards is very lax. Enforcement of the health and safety regulations remains a problem due to lack of adequate resources available to government institutions responsible for health and safety administration. There remains an acute need for contact provisions to support the enforcement of labour laws in developing countries.

According to the interviews with expert officers under the department of occupational safety and health under Ministry of Public Service and Labour, falls from heights, electrocutions, cuts, slips and 'caught-in' during demolition works or excavations are the most common types of construction accidents encountered. Much as the department is unable to inspect every building/road under construction Rwanda due to inadequate of labour inspectors to cover every project, these experts are fairly satisfied with the safety levels in the construction industry in Rwanda.

From the view point of the government officers, the low levels of construction worker safety in Rwanda have been brought about by: lack of top management commitment in most of the construction companies, low literacy levels among several construction employees, too much sub-contracting of works which denies the main contractors the ability and power to supervise the works, lack of worker orientation and on-site training, lack of safety officers on site, inadequate PPE and the lack of warning signs and boards on sites;

Finally, expert views of the government officials on the measures to improve construction worker safety in Rwanda were given as follows, instituting better enforcement mechanisms, regular inspection on machine operations, sensitizing people (workers and employers) regarding safety and health at construction sites, and stricter enforcement of penalties for non-compliance.

### **5.3 Conclusions**

The importance of health and safety in companies, especially construction ones, not just in the Rwanda but worldwide is well established. Incentives can always be provided that are economic, moral or legal for organizations to achieve and attain the highest standards as far as health and safety are concerned. In reality since the early sixties of the last century, the construction industry passed through a tremendous growth and development and now it is essential for employers and employees to be aware of the health and safety issues that concern them and demand for qualifications in this area is increasing especially in the emergent or developing countries.

This research through the literature review that was carried out has shown that not much effort has been undertaken as concerns health and safety in the Rwanda, and no data to support the research was available, hence, the importance of the questionnaires and the interviews in shedding some light, however limited, on this new topic as far as the case of Rwanda is concerned.

From the study it was discovered that larger contractors tend to perform better compared to smaller companies generally because they have greater resources to do so. Large firms are associated with larger projects containing more risks and so are typically required to implement better health and safety procedures. On the other hand, small contractors generally perform poorly for similar reasons, their projects are generally smaller and have lesser health and safety risks. Many occupational health and safety professionals believe that the application of effective occupational health and safety management systems will lead to a better health and safety performance. Management commitment plays a major role in health and safety performance. However, small companies seem to lack both the financial resources and management commitment to improve their own health and safety performance.

Strict policies and standard regulation and monitoring are thus recommended so as to ensure and improve health and safety management at organizational level and among local building contractors. There is also need for health promotion and campaign so as to sensitize and enlighten workers on health risks (work-related injuries and diseases)

attributed to poor utilization of personal protective equipment. The enforcement mechanism for health and safety can be said to be weak and wanting. The absence of pressure which can be brought to bear on construction workers of construction means some construction managers usually take advantage of the lack of punitive deterrent measures to place economic gain above other business objectives including health and safety. It was therefore not uncommon to find some contractors managing the sites without bothering about health and safety issues. Proper health and safety mechanisms not only contribute to the wellbeing of the worker but the effectiveness of the entire project

With regard to the safety and health, trainings consist of instruction in hazard recognition and control measures, learning safe working practices and proper use of personal protective equipment, and acquiring the knowledge of procedures and preventive actions. Training provides construction workers with ways to obtain information about hazards and their controls.

Construction projects are very dangerous places, and rescue equipment and first aid kits should always be available. What is needed depends on the size of the site or project and the size of construction workers employed. On larger sites with more than 300 workers, there should be a properly equipped first aid room and at least one person on every shift should have been trained in first aid to a nationally recognized standard. On day -to-day works procedures, an accident register book should be kept at the site, in which all types of minor injury such as bruises, to major accidents like imputing disability and fatalities should be recorded.

#### **5.4 Recommendations**

Health and safety performance and management in the construction industry in Rwanda is important to ensure that accidents and risks are minimized. To help improve the operations of health and safety performance and management in the construction

industry in Rwanda, five recommendations can be made based on findings from this study, as follows:

All workers must at all times wear their personal protective equipment properly and as directed by their employer or comply by the person in control of the site. Contractors should make provision for safety and health when preparing bids. The provision for safety and health must be made competitive with the aim to compete with other bidders and to avoid a monetary loss. Costs for personal protective equipment's measures should be explored and explicitly be part of tendering and costing for the project implementation.

Contractors should provide appropriate programs that are consistent with national laws and regulations to ensure the health and safety of workers. This includes maintaining a workplace that has minimal risks and accidents that can result in injury or loss of life. They should also ensure that a competent person inspects the construction project sites at suitable intervals to ensure that safety guidelines are adhered to.

More education campaigns need to be launched to arouse awareness among all management and construction workers. The Directorate of occupational health and safety services should incorporate an information and education wing in which a data bank of educative materials on health and safety measures can be kept and practical methods of disseminating them to relevant parties developed. This directorate must also ensure that the construction sites are inspected regularly for health and safety as provided in Occupational Safety and Health Act.

Contractors must make an assessment of the health and safety risks to which construction workers and others are exposed in construction projects. The significant findings must be noted where five or more workers are employed. Since managing health and safety is different from managing any other aspect in construction, there is need to do a risk assessment to find out about the risks, and to put sensible actions in place to control them, and make sure they stay controlled.

## **5.5 Framework for health and safety management.**

The fourth objective of the study were to highlight expert views to develop and adopt an effective framework for the improvement of health and safety performance in construction projects in Rwanda. The principles of good and effective management provide a sound basis for the improvement of health and safety performance.

Based on the results from the interviews and questionnaires, the framework shown in Figure 5.1 is suggested consisting of five key elements, these are:

### **5.5.1 A clear health and safety policy.**

Evidence shows that a sound, well thought out policy contributes to business efficiency and continuous improvement throughout the operation. The demonstration of senior management involvement is evidence to all stakeholders that responsibilities to people and the environment are taken seriously

### **5.5.2 A well-defined health and safety organization.**

The shared understanding of the organization's values and beliefs, at all levels of the company or concern is an essential component of a positive health and safety culture. An effective 'organization will be noted for good staff involvement and participation; high quality communications; the promotion of competency; and the empowerment of all employees to make informed contributions.

### **5.5.3 A clear health and safety plan.**

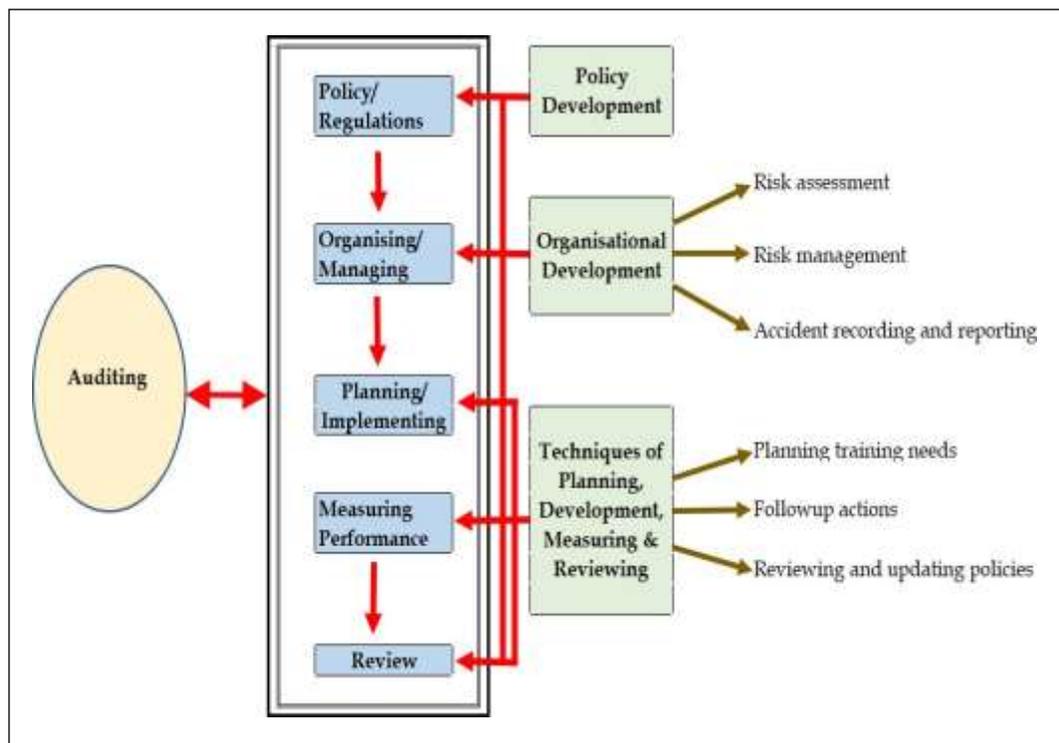
This involves the setting and implementation of performance standards and procedures through an effective health and safety management system. The plan is based on risk assessment methods to decide on priorities and set objectives for controlling or eliminating hazards and reducing risks. Measuring success requires the establishing of performance standards against which achievements can be identified.

#### **5.5.4 The measurement of health and safety performance**

This includes both active and reactive monitoring to see how effectively the health and safety management system is working. Active monitoring involves looking at the premises, plant and substances, the people, procedures and systems. Reactive monitoring discovers through investigation of accidents and incidents why control has failed. It is also important to measure the organization against its own long term goals and objectives.5.5.1

### 5.5.5 The audit and review of health and safety performance.

The results of monitoring and independent audits should be systematically reviewed to see if the management system is achieving the right results. This must be part of any company's commitment to continuous improvement. Comparisons should be made with internal performance indicators and the external performance of organizations with exemplary practices and high standards. Including health and safety performance in meaningful annual reports is considered best practice.



**Figure 5.1: Framework for health and safety management**

Source: Author, 2022

## **5.6 Areas for further research**

The following areas are recommended for further research;

- Conduct more studies on site accidents, reporting and records so as to advise the government on policy formulation and implementation of health and safety in the construction industry.
- Organize and conduct more and detailed interviews with the health and safety officers up to the district level to get more information about the execution of their duties as far as health and safety are concerned.
- A study for formulation of a more effective OSH framework to enhance performance of the construction industry of Rwanda, with respect to health and safety on sites since enforcement of the existing one has remained fruitless.
- Explore the transportability of knowledge and advanced awareness of health and safety from developed countries to less developed ones like Rwanda and how this may be achieved

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## APPENDICES

### Appendix I: Introduction Letter

  
**JOMO KENYATTA UNIVERSITY  
OF AGRICULTURE AND TECHNOLOGY**  
Office of the Director  
**KIGALI CAMPUS**  
P.O Box 3373, Kigali-Rwanda Email: [director\\_kigalicampus@jkuat.ac.ke](mailto:director_kigalicampus@jkuat.ac.ke)

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**FROM:** DIRECTOR **DATE:** 2<sup>ND</sup> FEBRUARY 2019  
**TO:** TO WHOM IT MAY CONCERN. **REF:** JKU/13/05/749

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**SUBJECT:** TUKESIGA PIUS- AB343-C010-7726/2015.

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The above named is a bona fide student of Jomo Kenyatta University of Agriculture and Technology (JKUAT) pursuing a Masters Degree course in Construction Project Management.

On behalf of JKUAT, I am writing to request your institution to allow him to access data and information that shall assist him in his research. We assure you that any data and information collected shall only be used for research purposes.

Any assistance accorded to him shall be highly appreciated.

Yours Faithfully,  
  
  
**PROF. CHERUIYOT WILSON (PhD),**  
**DIRECTOR.**

 JKUAT is ISO 9001:2008 Certified   
*Setting trends in higher education, research and innovation*

## Appendix II: Questionnaires

THIS QUESTIONNAIRE IS DESIGNED FOR THE RESEARCH THESIS TITLED  
'HEALTH AND SAFETY PERFORMANCE IN THE CONSTRUCTION INDUSTRY  
IN RWANDA'

### QUESTIONNAIRE; CONSTRUCTION WORKERS

Note: Your contribution will be treated with utmost confidentiality.

Please fill in/tick as appropriate.

#### SECTION A – DEMOGRAPHY AND CONSTRUCTION INFORMATION BACKGROUND

Profession.

- Engineer    Land Surveyor    Architect    Quantity Surveyor     
Environmentalism    Land Valuer    Geo-technicians    Other  
(Specify).....

Age Category.

- 18-35    36- 45    45-55    Above 55

Education Level.

- Primary Level    Secondary Level    Higher Diploma    Bachelors    Masters  
 PhD    Other (Specify).....

How familiar are you with kind of work?

- Not at all familiar       Slightly family       Somewhat familiar  
 Moderately familiar  Extremely familiar

How long have you been doing this kind of work?

- 1 year       2-5 years       6-10 years       More than 10 years.

At what stage of the project did you come into participation?

- Inception    Substructure    Superstructure    Finishes       Other  
 (Specify) .....

**SECTION B – HEALTH AND SAFETY POLICY, MANAGEMENT, MONITORING AND REVIEW**

How much do you know about occupational safety and health?

- Very much    Fair Amount    Little    Very little    Nothing

How did you get to know this information about occupational safety and health?

- Organisation       Short Training       Co-Workers        
 My supervisor    Other (Specify).....

Are you familiar with what Occupational Health and Safety Procedures, Regulations and Policies exist in Rwanda’s construction industry?

- Not at all familiar       Slightly family       Somewhat familiar

Moderately familiar  Extremely familiar

Please use Strongly Disagree =1, Disagree =2, Undecided =3, Agree =4, Strongly Agree = 5 to rank the following statements.

	Question	1	2	3	4	5
iv.	The company has a formal health and safety training programme.					
v.	The company has a written health and safety policy.					
vi.	The company has a written environmental policy.					
vii.	There are site supervision personnel with basic knowledge on occupational safety requirements.					
viii	The site has a safety officer or a written safety plan.					

Please use Never =1, Rarely =2, Sometimes =3, Very Often =4, Always= 5 to answer the following questions.

	Question	1	2	3	4	5
ix.	How frequent does your organisation update it's the health and safety policy?					

x.	How often do you notice unsafe practices on the site which could affect you and other construction workers?					
xi	How often do accidents occur on the site?					
xii.	How often does the company keep records of all the accidents to the employees?					
xiii.	How often does the company utilize the accident records to prevent similar accidents?					
xiv.	How often do you receive compensation when accidents occur?					
xv.	How often has the company been issued with a prohibition notice or been prosecuted by any Environmental Agency?					

xvi. Please use Never use =1, Almost never =2, Occasionally/Sometimes =3, Almost every time =4, Every time = 5 to rank the following about the use of Safety gear (personal protective equipment) on site.

	Safety Gear	1	2	3	4	5
a.	Helmets					
b.	Hand gloves					
c.	Safety Boots					
d..	Respiratory protection					
e.	Hearing protection					
f.	Welding face shield and eye protection glasses					

g.	Overall protection suites					
h.	Safety belts					
i.	Safety Nettings					
j.	High-visibility clothing					
k.	Overall protection suites					
l.	Dusty surfaces sprinkled with water					
m.	Hoarding					
n.	Others (Specify) .....					

xvii. Please use Never =1, Rarely =2, Sometimes =3, Very Often =4, Always = 5 to rank the occurrence of the following suggested accidents you notice on the site.

	Type of accident	1	2	3	4	5
a.	Slip and fall injuries					
b.	Chemical, Fire, heat or electrical burns					
c.	Scaffold or ladder failures					
c.	Crushing or amputation injuries					
d.	Nail injuries					
e.	Trench cave ins or excavation accidents					
f.	Crane accidents					
g.	Eye injuries					
h.	Electrocution					
i.	Poisoning due to toxic inhalation					

j.	Falling debris					
k.	Anchor bolt failures					
l.	Ceiling, wall or roof failures					
m.	Others (Specify) .....					

xviii. Please use Strongly Disagree =1, Disagree =2, Undecided =3, Agree = 4, Strongly Agree = 5 to rank the following suggested major causes of accidents in the construction industry.

	Causes of accidents	1	2	3	4	5
a.	Long hours of work					
b.	Sophisticated machines and plant					
c.	Adherence to traditional methods of working					
c.	Unregulated practices on construction sites					
d.	Practices of competitive tendering					
e.	Weak regulatory body					
f.	Working at heights, confined spaces and underground					
g.	Handling loads manually					
h.	Extreme weather conditions					
i.	Lack of safety gear					
j.	Low literacy levels					
k.	Corruption					

l.	Others (Specify) .....					
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xix. Please use Not important =1, Slightly Important =2, Fairly important =3, Important = 4, Very Important = 5 to rank the following suggested factors of improving health and safety management in the construction industry.

	Health and safety Management	1	2	3	4	5
a.	Strict regulations					
b.	Strict inspection mechanisms					
c.	Heavy Fines					
c.	Management commitment					
d.	Use of experienced workers					
e.	Health and safety trainings to all workers					
f.	Provision of safety gear					
g.	Job safety analysis and daily toolbox talks					
h.	Improved communication					
i.	Reduced time exposure					
j.	Improved monitoring and supervision					
k.	Others (Specify) .....					

Please use Not at all satisfied =1, slightly satisfied =2, Moderately Satisfied =3, Very Satisfied =4, Extremely Satisfied = 5 to answer the following questions.

	Question	1	2	3	4	5
xx.	How do you rank the safety of the construction workers on this site?					
xxi.	How would you classify the safety levels in the construction industry in Kigali City?					

SECTION C – OPEN QUESTION

In your opinion, what are the major causes of construction accidents and what measures would you propose to improve construction worker safety in Kigali City?

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THANK YOU SO MUCH FOR YOUR PARTICIPATION



### Appendix III: Research Interview

THESE INTERVIEW QUESTIONS ARE DESIGNED FOR THE RESEARCH THESIS TITLED 'HEALTH AND SAFETY PERFORMANCE IN THE CONSTRUCTION INDUSTRY IN RWANDA'

#### INTERVIEW QUESTIONS - OCCUPATIONAL HEALTH AND SAFETY INSPECTOR (MINISTRY OF PUBLIC SERVICE AND LABOUR)

**Note:** Your contribution will be treated with utmost confidentiality.

Please fill in/tick as appropriate.

Name (Optional).....

Profession.

Engineer     Land Surveyor     Architect     Quantity Surveyor      
Environmentalist     Land Valuer     Geo-technicians

Other (Specify).....

Education Background.

Higher Diploma     Bachelors     Masters     PhD     Other  
(Specify).....

How long have you been doing this kind of work?

- 1 year       2-5 years       6-10 years       More than 10 years.

Professional affiliation

Body.....

Date joined.....

How long has this department existed in Rwanda?

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What are the main objectives of the department?

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Is the safety of construction workers at the required standards? What action has the Occupational Health and Safety department taken to ensure the health and safety of the worker?

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What do you think is the main cause of the low levels of construction work safety?

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What steps has the OHS department taken in making sure that contactors comply with the safety regulations concerning the construction workers?

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What are some of the achievements of the OHS department as far as construction of workers is concerned?

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What barriers or challenges does the OHS department face in implementing its programme to improve construction work safety?

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From your experience, what are the most types of construction accidents?

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How would you classify the safety levels in the construction industry in Kigali?

- Excellent    Very good    Good    Fair    Poor

What are your duties as far as safety of construction workers is concerned?

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Are you able to inspect every building/road under construction in Kigali City?

- Always    Often    Sometimes    Rarely    Never

What problems and challenges are you faced with while performing your duties?

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Use any construction Building/site you inspected to answer questions xvii-xx.

At what stage of construction did you inspect the building?

- Commencement     Excavation for the foundations    (c) Concrete in foundations  
 Damp proof course     Installation of sanitary fittings     Completion of works      
Occupation    of    building     Other    (Specify)  
.....

Were you satisfied with the building regulations adhered to in this project?

- Not at all satisfied     Slightly Satisfied     Moderately Satisfied      
Very satisfied     Extremely satisfied

Did the project meet your expectations as far as safety of workers is concerned?

- Strongly Disagree     Disagree     Undecided     Agree  
 Strongly Agree

Explain your answer in (xix.) above

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What measures would you propose to improve construction worker safety in Rwanda?

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THANK YOU SO MUCH FOR YOUR PARTICIPATION