# INVESTIGATING THE EFFECT OF OCCUPATIONAL SAFETY AND HEALTH MEASURES ON THE COST OF CONSTRUCTION WORKS IN UGANDA- A CASE NAKAWA DIVISION, UGANDA

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A DISSERTATION SUBMITTED TO THE DIRECTORATE OF RESEARCH AND GRADUATE TRAINING IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE IN CONSTRUCTION TECHNOLOGY AND MANAGEMENT OF KYAMBOGO UNIVERSITY

**OCTOBER, 2025**

## DECLARATION

I, **Eluru John,** hereby declare that this submission is my original work and that, to the best of my knowledge and belief, it does not contain any previously published or written works by other authors, nor does it contain any works that have been approved for the award of any other degree by the university or other institution of higher learning, with the exception of those that have been properly acknowledged in the text and reference list.

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## APPROVAL

The undersigned approve that they have read this dissertation and hereby recommend for submission to the Graduate School of Kyambogo University, a dissertation entitled Assessing the Effects of Occupational Safety and Health Measures on the Cost of Construction Works in fulfilment of the requirements for the award of Masters of Science in Construction Technology and Management Degree of Kyambogo University

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## ACKNOWLEDGEMENT

I would like to first start by thanking God for guiding me in this journey of success. I believe with him by my side; I will complete this course successfully.

I want to sincerely thank and appreciate my supervisors for their significant role in the completion of this project through guidance and assistance. Dr. Vicent Ssenyondo and Dr. John Muhumuza Kakitahi for motivating and guiding me throughout this study.

Finally, I would want to give my father, Mr. Ongorok Charles, my deepest gratitude for all the financial assistance he has given me.

## DEDICATION

I would like to dedicate this dissertation to my father Ongorok Charles, Grand Mother Amenyu Mary Ekellot, elder brother Ekellot Emmanuel, Sisters; Asio Grace Ongorok, Akello Esther Amenyu and Amuge Mirriam. Aunties; Ritah Ekellot, Hellen Apolot and Annet Icumar, Children which include; Ongorok Timothy, Akwii Blessing Abigel, Aber Jamaimah Ruth, Okello Jodan, Okebe Joshua and others

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| | |
|---|---|
| ALR | Accident Loss Ratio |
| BOQ | Bill of Quantity |
| CDM | Construction Design and Management Regulations |
| CV | Coefficient of Variation |
| CVI | Content Validity Index |
| CSR | Corporate Social Responsibility |
| EA-SH | European Agency for Safety and Health |
| EBF | European Builders Federation, |
| EPP | Emergency Preparedness Planning |
| EU | European Union |
| GDP | Gross Domestic product |
| HIRA | Hazard Identification, and Risk Assessment |
| HSE | Health and Safety Executive |
| ICAO | International Civil Aviation Organization |
| ILO | International Labor Organization |
| JHA | Job Hazard Analysis |
| KCCA | Kampala City Council Authority |
| MSHPTS | Mine Safety and Health Programme Technical Staff |
| NSC | National Safety Council |
| OAG | Office of the Auditor General |
| OHSMS | Occupational Health and Safety Management System |

| | |
|---|---|
| OSH | Occupational Safety and Health |
| OSHA | Occupational Safety and Health Act |
| PPP | Personal Protection Programmes |
| PPE | Personal Protective Equipment |
| SAQ | Self-Administered Questionnaire |
| SD | Standard Deviation |
| S&H | Safety and Health |
| SIR | Safety Investment Ratio |
| ROI | Return on Investment |
| TQM | Total Quality Management |
| UBOS | Uganda Bureau of Statistics |
| UNABCEC | Uganda National Association of Building and Civil Engineering Contractors |
| WHSC | World Health Safety Committee |

## ABSTRACT

The Occupational Safety and Health Act of 2006 was enacted by the Government of Uganda as one of the strategies taken to enhance the welfare and health of workers on construction sites. It was important to investigate if the occupational safety and health (OSH) measures had a good effect. Design, progressive and incident reports were reviewed before considering over 500 respondents from 24 bungalow construction sites across Nakawa Division. Questionnaires and interview guides were distributed to site workers. Among those considered, only 216 valid questionnaires and interview guides from 10 construction sites were returned from respondents that were randomly considered from class category A-3, A-4 and A-5 of indigenous construction companies. Frequency and percentage tables were used to analyse the data. The findings show that the cost associated with OSH measures recorded the Safety Investment Ratio (SIR) of 0.71%. The cost incurred due to construction accidents recorded the Accident Loss Ratio (ALR) of 0.47%. The overall effect of OSH measures was 1.18%, which was considerably low. This result indicates that, despite the fact that 77% of construction workers experience accidents, indigenous construction companies do not make significant investments in occupational safety and health. Adherence to OSH was difficult with negligence, manual lifting and shortage of personal protective equipment (PPE) as the major causes. There is need to invest more on OSH measures in order to minimize the costs implications of sickness and death associated with accidents. It was recommended that the effect of OSH measures needs to be investigated on sites with fatal injuries. Fire protection and chemical storage too need to be investigated in Uganda. The study was limited to only Nakawa Division. Research on the effect of occupational safety and health measures on cost needs to also be conducted in other Divisions in Kampala and cities within Uganda. More studies should be conducted on innovative technology on safety and health measures at construction sites in Uganda. These findings are significant in the formulation of safety and health regulations and in the application of occupational safety and health measures.



Keywords: *OSH measures, Cost implication, Indigenous companies, Bungalow construction site, Accident loss ratio, Safety investment ratio*.

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of the Study

An estimated 1,000 individuals per day worldwide die in work-related accidents, and another 6,500 per day die from work-related illness (ILO, 2019). There were 2.78 million work-related deaths overall in 2017 as opposed to 2.33 million in 2014 (Hamalainen, 2017; ILO, 2019). Estimates indicate that almost 65% of all workplace fatalities occur in Asia, 11.8% in Africa. 11.7% in Europe, 10.9% in America and 0.6% in Oceania.

Furthermore, ILO, (2021) figures show that 317 million non-fatal occupational accidents occur worldwide on the job yearly resulting to more than 4 days of absence from work. Accidents on construction site are a result of unsafe behavior and circumstances (Smith et al., 2017), but they can be prevented if laborers recognize and appreciate how important safety practices are (Okorie et al., 2016). Injury facts, a website with information from the National Safety Council of USA (ROI, 2019), estimates that deaths and injuries cost the US economy $151.1 billion in 2016 both directly in terms of medical treatment and indirectly.

In East Africa, the construction industry is characterized with the human handling and lifting of loads, the dragging and pushing of loads, the continuous durations of repeated tasks, and the use of vibrating equipment. Due to non-compliance to safety, these has led to musculoskeletal conditions such as back injuries, upper limb problems, ear damage, and poor eye sight. Costs incurred due to accidents are high. In Tanzania, 5% or less of the labor force can access services of OSH (Mrema et al., 2015), whilst in Kenya, most

construction sites do not use OSH measures effectively, leaving employees exposed to hazardous conditions and accidents (Nyaruai et al, 2016).

Uganda is not exceptional from other East African countries. The industry is experiencing many serious accidents from falls to accidents with power tools, heavy lifting accidents and being buried by collapsing buildings (Okwel et al., 2019). Abdulgafoor et al. (2018) cited WHO, (2014), which stated that more than 36,000 people died and 2460 per 1000 disability adjusted life-years were lost in Uganda due to all injuries. This number alone accounts for 12% of the total disease burden (20619 per 1000 disability adjusted life-years) in the nation. Buildings under construction in Kampala collapse, trap, kill and injure people (Okwel et al, 2019). Some firms have been criticized for shoddy building because of inefficient or no practice of S&H as well as quality management procedures (Muhwezi et al., 2021). Due to the construction sector's failure to conduct inspections, enforce the Occupational Health and Safety Act, 2006, and failure to collect occupational data for accidents, safety and health statistics for Uganda alone cannot be easily established. Agbede et al. (2015) links Uganda's poor health and safety conditions to the country's inadequate implementation of health and safety laws.

Safety and health is certainly the most important investment for all, and the question is not how much it will cost us but rather how much it will save us (Lopez et al., 2013). Construction site safety and health is important in ensuring safe working environment including its vicinity but this will depend on preparation, training, cooperation, and vigilance

A number of regulations have been put in place to govern OSH in work places both internationally and locally. Construction Design and Management Regulations (CDM, 2015) enable employers design projects wisely so that hazards associated with construction are controlled from the beginning to the end, with the goal of increasing worker S&H. Uganda uses the Occupation Safety and Health Act 2006. Section 13 of this Act, states that it is the responsibility of the employer to safeguard employee welfare, health, and safety. The Act's primary goal is to safeguard employees from workplace health and safety risks. It outlines the responsibilities of all parties involved in the workplace as well as the rights of the employees. These regulations aim at minimizing the cost of construction works

However, the OSH gap seems to be due to inadequate work place preventive measures of accidents (Mrema et al, 2015; Kadiri et al, 2014). This has caused a rise in the number of sick workers who are concerned about work-related stress, psychological risks, and non-communicable diseases (ILO, 2019). It has also resulted in property loss, the death of skilled workers, early retirement, and lost production time. The complexity of the project, competing expectations, and interpersonal conflicts between employees and their employers may all be contributing factors to the hurdles to S&H in the workplace (Taiwiah and Mensah 2016). Inability to bridge the OSH hazard gap has prompted the need to look into whether or not OSH practices utilized in Uganda's construction industry affect the cost of construction projects.

## 1.2 Statement of the Problem

Construction accidents have created a public concern in Uganda despite the current use of occupational safety and health measures. Previous interventions like the implementation of the OSH Act of 2006 and the initiatives like the 1998 Uganda National Association of Building and Civil Engineering Contractors (UNABCEC) occupational safety and health program, have been used to promote safety and health awareness in construction.

The use of these OSH measures seem to be insufficient. Accidents in the construction industry have persisted despite government efforts to improve safety and health for all employees across the nation, including the repeal of the Factories Act of 1964 and statutory instrument No. 87 (2014)

In Uganda, Majority of construction workers do not comply with S&H standards. Failure to prevent accidents has resulted into death and sickness. .

Therefore, a study of the effect of OSH measures on the cost of construction works needs to be investigated in order to improve on safety and health in Uganda.

## 1.3 Objectives of the study

### *1.3.1 Main Objective*

The main objective of the study was to develop a framework that can be used to improve on occupational safety and health measures in minimizing cost of construction works in Nakawa Division

### *1.3.2 Specific Objectives*

The specific objectives were:

i. To investigate the cost associated with occupational safety and health measures during construction works in Nakawa Division
ii. To investigate the cost incurred due to construction accidents during construction works in Nakawa Division.
iii. To identify the challenges faced while implementing occupational safety and health measures in minimizing the cost of construction works in Nakawa Division.
iv. To generate solutions necessary for developing a framework for improving the occupational safety and health measures in minimizing the cost of construction works in Nakawa Division.

### 1.4 Research Questions

These research questions served as a guide for the investigation.

i. What is the cost of occupational safety and health measures from construction works in Nakawa Division?
ii. What is the cost of construction accidents from construction works in Nakawa Division?
iii. What are the challenges faced while implementing occupational safety and health measures in minimizing the cost of construction works in Nakawa Division?
iv. What can be done to improve occupational safety and health measures in minimizing the cost of construction works in Nakawa Division?

### 1.5 Research Justifications

Employees are desperate of employment in the hazardous building industry (Alkkaissy et al., 2020) because they want to earn a living. This puts their lives at stake due to ignorance

of their rights to a safety and health (Biswas et al. 2017). Workers need to be trained, sensitized or motivated about compliance to the safety and health measures so that they can operate safely. The second hierarchal level of Maslow's theory of motivation states that all workers are entitled to safety as a basic need with a sense of security and wellbeing. This includes good health and protection from accidents, harm and their adverse effects. There is thus need to review the OSH measures to check its adequacy in protecting employees and property in Nakawa Division otherwise workers and people around the construction sites will continue to die or suffer from accidents and illness such as musculoskeletal disorders, hand arm vibration syndrome, hearing damage, dermatitis, respiratory illness or stress. Researchers have investigated on effects of occupational safety and health at construction sites in Uganda but majority have investigated in terms of management systems while others have investigated in terms of construction accidents, leaving no clear information when it comes to the cost aspect.

### 1.6 Significance

Three categories of beneficiaries in this study include; academicians, government and construction workers. The study will be beneficial to academicians because it will add new knowledge to existing literature and form a basis of further research study. The study will be beneficial to government because it will guide government on the formulation of safety and health regulations as well as construction workers. The study further will be beneficial to managers, supervisors and workers because it will guide them in applying safety and health measures in their construction works.

## 1.7 Scope of study

The study concentrated on bungalow buildings so as to access the safety and health performance of indigenous companies. This is because workers employed by indigenous firms are more exposed to occupational safety and health hazards compared to large construction firms (Olutuase, 2014). The research was conducted from Nakawa Division in Kampala, Uganda's capital city. Nakawa Division was chosen because 26.06% of construction accidents in Kampala City occur from Nakawa Division (Irumba, 2014).

The study covered the period of 6 months from December 2021 to May 2022. The research study reviewed only the ongoing projects under construction

## 1.8 Conceptual frame work

The independent variables, intervening variables, and dependent variables were outlined in the conceptual framework.

The independent variables comprise of OSH measures and Contractors. OSH Measures considered include training and induction, first aid facility, warning signs and signals, personal protective equipment, appropriate lifting equipment and safe work methods (ILO, 2017; Lui et al, 2020; OSH Act 2006). The contractors considered include those from indigenous companies of class A-3, A-4 and A-5 (UNEBCEC, 2023).

The intervening variables comprised of OSH policy, construction project phases and environmental factors while the dependent variables comprised of cost of construction works which include cost of OSH investment and cost of construction accidents (MSHPTS, 2011; Faith & Uur, 2015)

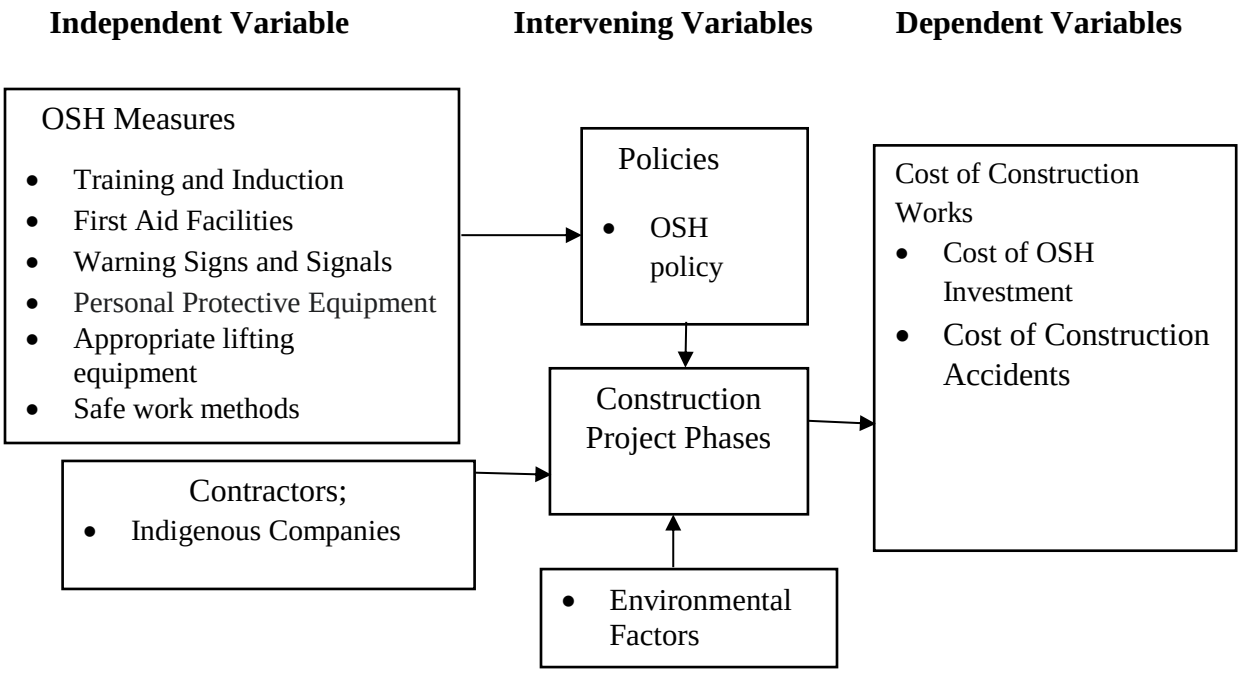


***Figure 1. 1: Conceptual framework***

# CHAPTER TWO

# LITERATURE REVIEW

## 2.0 Introduction

This Literature review highlights the value of OSH and provides an explanation of studies pertaining to various OSH measures. Highlighting safety and health during various building phases. It concisely describes the cost of construction projects in respect to OSH before it elaborates on the viewpoints of the academics regarding the effects of cost.

## 2.1 Occupational Safety and Health (OSH)

Occupational safety and health (OSH) is a field with multiple disciplines that focuses on the welfare, health, and safety of people while they are at work. Sometimes it is referred to as workplace health and safety (WHS), occupational health, or occupational safety (OS).

Health is the protection of people's bodies and minds against illness caused by work-related products, processes, or procedures (Hughes and Ferret, 2008) whereas Safety is the prevention of individuals from suffering physical harm, danger, or injury (ICAO, 2013; Mitchell & Shmidt, 2014). The attainment of material and economic goals is facilitated by a high degree of OSH, which also results in good quality and performance in the workplace.

## 2.2 Occupational Safety and Health (OSH) Measures

Safety and health measures are described by the International Labor Organization (ILO, 2001) as ensuring the greatest level of prevention and maintenance of physical, mental,

and social well-being, the avoidance of workplace-related illnesses, and the defense of employees against workplace hazards that could harm their health.

These measures include:

### *2.2.1 Appropriate lifting equipment*

Construction site workers move large amounts of items or materials physically or with the aid of powered equipment. These personnel will perish or have significant accidents as long as these tasks are not carried out safely. For instance, material falling from hoists, the overturning of cranes, or slinging failures can all result in accidents. Workers who must lift heavy objects like stones and paving blocks, stones, and packaged products like cement and aggregates could sustain long-term injuries (ILO, 2017).

### *2.2.2 Safe work methods*

A significant portion of accidents in the building industry include falls, and due to the nature of falls, a significant portion of these incidents end in serious or even fatal injuries. Thus, information and instruction regarding work at heights, safe working practices and risk perception must be provided to all employees and supervisors. Scaffolding is used on many construction sites to create secure work platforms. Scaffolds must be built on a solid, level foundation that can withstand their weight and any loads that may be imposed on them (Liu et al, 2020). Workers must make sure that ladders and stepladders are in good condition before using them by inspecting the stiles to make sure they are not cracked, buckled, or warped, making sure there are no missing or broken rungs, and making sure the feet are secure (Erika et al, 2020). There are various procedures that lessen the effects

of a fall in addition to those previously mentioned that stop workers from falling. They include personal fall arrest systems, soft landing systems, and safety nets (Brodskiy, 2019)

### *2.2.3 Occupational Safety and Health Training*

OSH training entails learning how to identify and control hazards, and learning safe work practices, understanding how to utilize personal protective equipment properly, and learning about emergency protocols and preventive measures.

Certain tasks on the building site such as fire prevention, forklift truck operation, overhead crane operation, first aid, scaffolding inspection, and necessary health and safety inspections all require specialist training.

Workers have access to more knowledge about potential risks and how to avoid them through training. The ability to undertake hazard control programs more actively or to adjust organizational structures to improve worksite safety is acquired by the workforce

### *2.2.4 Site Induction*

Immediately after beginning work at a new location, all new hires should undergo thorough inductions that are appropriate for their level of experience so they may learn about potential risks and hazards and how to mitigate them (Gilmour et al, 2017). The induction should be site-specific and emphasize any unique hazards, such as those detailed in Schedule 3 of the CDM 2015 Regulations, as well as any necessary control measures for employees involved in the project. The induction program needs to be thoughtfully created (Zulu & Haupt, 2016). Those who periodically visit the site, like architects or students, should also receive site inductions in addition to those who work there regularly.

### *2.2.5 First Aid*

According to Section 55 of the OSH Act 2006, every workplace must have at least one first aid box or closet with first aid supplies. These must be under the control of responsible individuals, at least one of whom must always be accessible during working hours. First aid procedures are meant to keep the injured or ill person alive, stop the injury from getting worse, aid in recovery, and sustain life. Nonetheless, according to), first aid knowledge and perception are still lacking to a satisfactory degree (Kerim, 2016).

### *2.2.6 Warning signs and signals*

One of the main ways to spread information regarding S&H is using signs and signals. Construction workers are warned by safety signs of any potential risks and hazards they may encounter (Xu & Saric, 2018). Use of illuminated indicators, hand signaling, auditory signals like fire alarms, verbal communication and the labelling of pipes carrying hazardous materials all fall under this category. Safety signs also include conventional signboards for warnings, fire exits, notices of fire action plans (fire drills), and firefighting apparatus. There is a risk of confusion or missing essential information if there are too many signs together (HSE. 2015).

### *2.2.7 Personal Protective Equipment*

When engineering and administrative measures are ineffective in bringing employee exposure to dangers down to tolerable levels, the OSH Act (2006) mandates the use of PPE. PPE's program should be put into action if it is to be employed. This program should cover existing risks, choosing, maintaining, and using personal protective equipment

(PPE), training staff, and monitoring the program to assure its continuous efficacy (Radwa, 2020).

PPE is essential on construction sites, and its functions include body and fall protection devices; protection for the eyes, face, and ears; protection for the lungs; protection for the hands and arms. PPE has drawbacks, some of which include the need for additional monitoring to ensure that it is worn, the cost of the PPE, and the possibility that some PPE may make the user feel uncomfortable and drag out the process. (Muema, 2016). Jonathan (2017) conducted research and discovered that Kampala has a minimal PPE usage rate. He advised building construction firms to adopt the provisions of the Uganda OSH Act 2006 as quickly as is practical.

**2.3 Safety and Health throughout the Different Project Phases**

Engineering for construction is a phased process. The four project phases of larger construction projects are typically: conception, design, implementation (construction), and operation (Spangenberg, 2009). The entire project team must own and include safety, from the designers and engineers to the subcontractors and their staff.

The steps were further separated by EC (1992) into the preliminary stage and the building stage, which are the two main stages. Conception, design, and preparation are all parts of the stage before work on the site actually starts. Construction work on the project site is essentially what happens during the execution or construction stage.

### *2.3.1 Safety and Health in the Preparation Stage*

Traditionally, a design professional's main responsibility was to create a structure, leaving construction workers to handle safety. Yet throughout the project's design and planning phases, design experts can make wiser decisions. Making more informed choices during the design phase might save a substantial portion of casualties. It is crucial that management participate in the project's processes for safety planning and control (Isaac & Edrei, 2016). The capacity to impact safety in relation to time (the project schedule) is depicted in figure 2.1. (EBF, 2013).

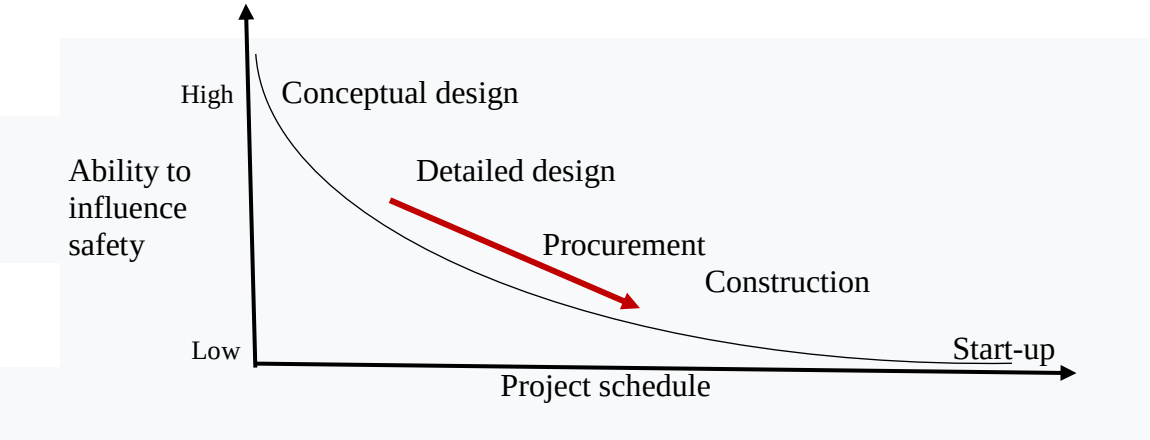


***Figure 2. 1: Influence of construction safety versus project schedule (EBF 2013)***

The figure 2.1 above shows that the ability to influence safety is inversely proportional to the project schedule. It is high at the conceptual stage, followed by design, procurement, construction and very low at the start-up stage.

In this regard, designing for safety is a crucial strategy. It is the procedure by which engineers and architects specifically take construction workers' safety into account while designing a structure. Prefabrication, the use of less hazardous materials and systems, use

of construction engineering techniques, as well as enhanced spatial research and attention are all likely to increase as we design for safety (Toole and Gambatese, 2006).

### *2.3.2 Safety and health in the Execution Phase*

S&H during the execution phase lies entirely as the client and contractor's responsibility. The client is required to designate project supervisors to help them, designate coordinators for S&H issues, ensure that S&H plans are created, and take into account general preventative concepts during project planning and preparation, including how long the work will take.

The contractor is in charge of guaranteeing the structures' quality, safety, and health. The process must be closely monitored for stability, accuracy, and the lack of flaws. At each stage of construction, structures' spatial stability should be given special consideration because serious human errors account for about 80% of accidents (Baiburin, 2017). Also, because there are so many materials supplied to a construction site during the erection stage, trash is frequently generated. The contractor should make sure that a designated storage space be near where the products are required to reduce needless double handling and material transfer (ILO, 2017).

### *2.3.3 Relationship between safety and health measures and accident prevention benefits*

When there is a higher culture of safety, basic safety efforts possess a bigger beneficial impact in preventing accidents (Feng 2013). It is generally accepted that preventing an issue can lower the cost of production.

A technique for safety cost optimization offered in 2004 (Tang et al., 2004), relies on two notions.

1. That safety performance and investment are positively correlated, meaning that the greater the investment in safety, the more effective the safety performance
2. That there is a negative correlation between accident costs and safety performance, meaning that low accident costs result from strong safety performance.

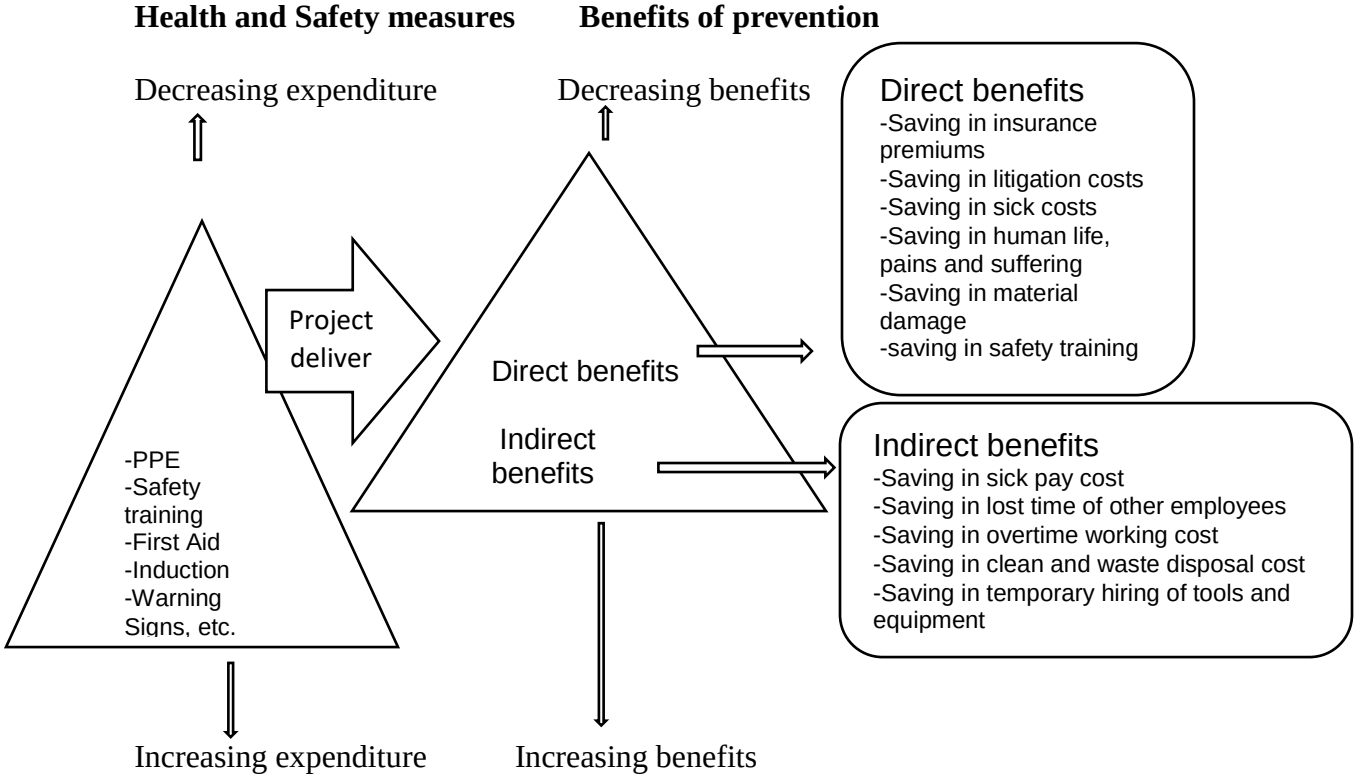


***Figure 2.2: The components of OSH and associated benefits (Tang et al. 2004; HSE, 2005)***

Contractors can lower the risk of diseases and injuries in the workplace by implementing safer technologies, coordinating and managing health and safety procedures, supplying workers with PPE, and training of employees. The vast expenses connected with

workplace accidents and illnesses are paid by both workers and society (Leigh, 2011). Both the contractor and the client/employer frequently see H&S as a cost rather than a benefit (Okwel et al, 2019). Therefore, it is crucial to calculate the expenses associated with such preventative actions because doing so will encourage businesses to increase their S&H spending. S&H must be enforced as a legal necessity in order for some clients to invest in OSH, even though it is difficult to determine its financial benefits (Charawee, 2016).

## 2.4 Cost of Construction Work

Cost is defined by CIMA (2021) as the total amount spent on a specific item. Cost is a measure of previous labor, material, or both sacrifices. Safety and health can only be attained by spending more money (Olajide et al, 2016).

### *2.4.1 Costs associated with accident prevention*

Although not necessary for production, S&H are required for accident prevention. The supply of first-aid services, PPE, safety promotion, staff in charge of safety, regulatory compliance operations, and legal advice are some of the expenses related to accident prevention (MSHPTS, 2011).

### *2.4.2 Costs associated with accidents*

Accident costs fall into two categories as direct and indirect. Costs that can be estimated using the direct accounting approach are referred to as direct costs. These comprise first aid costs, hospital costs, disability benefits, compensations, court fees, and the costs of the criminal penalties for accidents involving fatalities, property damage and workplace

treatment. Indirect costs include, but are not limited to, lost workdays, lost working time at the place of employment, lost time for accident investigations and legal proceedings, lost production time after accidents, lost employee productivity, damage to operational machines or the inability to use them, tarnished company reputation, and fine payments for late deliveries. According to research, overall indirect costs are significantly greater than total direct costs (Fatih & Uur, 2015).

### 2.5 Previous Works and Gaps of the Cost of Construction Work

Construction companies place a priority on costs because they serve as the starting point of calculating company's profits and losses. Most clients prefer using cheaper prices to build their structures (Hardie and Saha, 2012). The lack of enough funds results in indigenous companies opting for cheaper alternatives with a view of fulfilling the stated budgetary targets, thus leading to OSH measures being neglected (Hardie and Saha, 2012). Awareness of occupational health and safety measures has increased because of the growing number of construction accidents, resulting in their inclusion as part of project performance criteria (Awodele and Ayoola 2015).

The cost of investing in occupational health and safety measures is beneficial for both accident prevention and legal compliance (Okoye and Okolie, 2014). Based on ELM Training Magazine 2020, Industry Report, companies spent approximately $1,111 on training per staff in 2020, notwithstanding the fact that there were considerable variations across businesses. Although larger enterprises only spent $924, smaller organizations spent an average of $1678. There is no formula for evaluating a return on investment in

safety, many experts concur that the effort is worthwhile because it produces beneficial outcomes. Case studies of safety programs found that cost advantage is 44% (Maudgalya et al., 2008). Lower costs constitute 28% among the top advantages of effective workplace safety programs (White Paper, 2012).

The safety and health costs of construction companies was found to lie between 0.5% and 3% of the overall project cost (Smallwood, 2004). Another research discovered that safety and health costs lie between 1 % and 10 % of the contract value (Adekunle et al., 2020). Safety and health was also estimated as 5% of the overall project cost (Pellicer et al, 2014). In Turkey, the median safety cost was 1.92% of the total cost (Gurcanli et al., 2015).
For the case of accidents, the cost of accidents to the total cost was 0.251 (Feng et al., 2015). The overall cost of construction projects is rising because of accident by 1% of total construction costs (Sanni et al. 2018). The estimated cost of accidents in South Africa amounts to about 5% of the final construction value (Windapo, 2013). For OSH measures and treatment of injuries, companies need about 20 million dollars (Otti et al, 2016). In 2016, workplace fatalities and injuries cost the US economy $151.1 billion according to injury statistics from the National Safety Council of USA, an online statistical data resource (ROI, 2019).

Although awareness about OSH measures has increased due to the national occupation safety Act of 2006, there is still a gap in the effectiveness of OSH measures in preventing accidents. There are many accidents at the construction sites.

## 2.6 Challenges Affecting Safety and Health on the Cost of Construction Work

Negligence among workers during construction affects safety and health by causing loss of lives and sicknesses (Kadril et al. 2014). Challenges such as policy gap, limited funds for purchasing PPE'S, lack of accountability, lack of transparency, lack of awareness and planning, all contribute to the failure of OSH implementation (Atusingwize et al, 2018). Other challenges affecting OSH include; inadequate training of workers, poor service and maintenance of equipment, site congestion (Irumba, 2014), inappropriate handling and lifting of loads (ILO, 2017)

Management of OSH hazards is not adequate because of ineffective use of preventive measures (Mrema et al, 2015, Kadiri et al, 2014). It has also led to project complexity, interpersonal conflicts between employers and employees (Taiwah & Mensah 2016)

## 2.7 Occupational Safety and Health in Uganda's Construction Industry

Being a low-income nation, Uganda struggles to meet its population needs (Okwel et al, 2019). Accidents occur often in Uganda's construction sector. Insufficient oversight, supply of poor quality, psychological problems, and insufficient illumination for employees working at night are risk factors in the business (Irumba, 2014). Other risk factors include workers' poor training and overcrowding on construction sites (Lubega et al, 2000). S&H don't just apply to the construction crew working on the site, they also apply to guests and anybody else who could be participating in site activities. Section 13 of the OSH Act 2006, Part III-General Duties, Obligations, and Responsibilities of Employers details the responsibility of the employer as safeguarding his workers.

Nonetheless, even when OSH Act, 2006 is available, Ugandans tend to be careless about health precautions like donning helmets or wearing the proper footwear. PPE use among building construction workers is low (15.6%), according to research studies conducted in Kampala (Jonathan et al, 2017).

It can be attributed to the reality that certain protective gear is inconvenient to wear for an entire day and potentially hinders down work, such as helmets which get uncomfortable with heat and gloves that make it difficult when using certain tools. Also, most contractors that are working on multiple projects at once require excessive labor from their staff. The extent of focus to the risks of not adhering to S&H is diminished by the fatigue they experience. Employees at construction sites not only disregard the health and safety problems at the sites, but they also fail to consider their own safety, increasing the accident prevalence in Uganda. These situations have culminated in fatalities, injuries, property and equipment destruction, lost output, a nd financial losses (Okwel et al, 2019). Atusingwize et al. (2018) ascribed policy gaps, lack of awareness, inadequate planning, scarce resources, insufficient human capacity, lack of openness and accountability as causes of OSH measure implementation failures in Uganda.

## 2.8 Summary of Chapter

According to the literature analysis, there is a need for reform in the various aspects of managing health and safety in the construction business due to vast expenses connected to high death rate, accidents and illnesses. The literature review demonstrates the necessity for a thorough analysis of how the sector presents itself in terms of managing occupational

safety and health costs. The literature review demonstrates how the construction project will be hampered if OSH precautions are not used. The emphasis should be on strengthening the capacity of Uganda's construction sector to notice and adapt to any of the OSH measures mentioned, including a deeper comprehension of OSH Act of 2006, other laws and legislations and strategic decision-making in order to provide safe works to any construction project.

The literature review shows that most of the contractors have invested less than 10% in safety and health as shown in the table below.

**Table 2. 1: References where the gaps are stemming from**

| **Reference** | **Where gap is stemming from** |
|---|---|
| Smallwood, 2004 | The safety and health costs of construction companies was found to lie between 0.5% and 3% of the overall project cost |
| Adekunle et al., 2020 | Safety and health costs lie between 1 % and 10 % of the contract value |
| Pellicer et al, 2014. | Safety and health was estimated as 5% of the overall project cost |
| Gurcanli et al., 2015 | The median safety cost was 1.92% of the total cost |
| Feng et al., 2015 | The cost of accidents to the total cost was 0.251 |
| Sanni et al. 2018 | The overall cost of construction projects is rising because of accident by 1% of total construction costs |
| Windapo, 2013 | The estimated cost of accidents amounts to about 5% of the final construction value |

# CHAPTER THREE

# METHODOLOGY

## 3.0 Introduction

The study's methodology, including the research design, study population, sample size, sampling strategies, data collection tools and methodologies, validity and reliability, data gathering process, data analysis techniques and framework are presented in this chapter.

The methodology was designed to answer specific objectives as follows;

i. Objective one was to investigate the cost associated with occupational S&H measures during construction works in Nakawa Division. The objective was achieved by asking the procurement officers the prices of each OSH item currently being used on their construction sites as well as asking prices from market places like construction hardware
ii. Objective two was to investigate the cost incurred due to construction accidents during construction works in Nakawa Division. The objective was achieved by asking the OSH officers at site the nature of site accidents construction workers have ever suffered from while at the current site, cost of site accident and the work category they belonged as causalities.
iii. Objective three was to identify the challenges faced while implementing occupational safety and health measures in minimizing the cost of construction works in Nakawa Division. The objective was achieved by having the respondents respond to the degree of hindrance to the implementation of OSH measures, and the challenges hindering the implementation of OSH measures on their construction sites.

iv. Objective four was to generate solutions necessary for developing a framework for improving the occupational safety and health measures in minimizing the cost of construction works in Nakawa Division. The objective was achieved by asking the respondents on ways of improving OSH measures in their construction sites.

## 3.1 Research Approach

The study used a mixed-methods strategy that combined quantitative and qualitative techniques. All of the specific objectives were evaluated and measured using both qualitative and quantitative techniques in order to develop a framework that can be used to improve on occupational safety and health measures in minimizing cost of construction works in Uganda.

Quantitative technique enabled the researcher to gather data that was expressed numerically (Almalki, 2016) as well as relationships about the effects of occupational safety and health measures on the cost of construction works. When compared to the qualitative approach, which focused on describing rather than measuring (Kumar, 2011).

Whereas the qualitative methods used interview guides, the quantitative method was administered via a questionnaire.

## 3.2 Population and Sample

### *3.2.1 Population*

Population is a broad group that the researcher is interested in (Fraenkel & Wallen, 2008). About 1066 building plans were approved for construction in Kampala in 2016

(KCCA, 2017). Statistics of building plans approved in 2019 show that 58% of all buildings under construction are residential buildings (UBOS, 2020). The number of workers employed per building sites in Uganda is averagely 24, a drop from 30 per site in 2001/2002 (UBOS, 2011). Therefore, for this research study, A case study of Nakawa Division was considered because of its high construction activities as well as high accident rates in Kampala (Irumba, 2014)

The targeted population comprised of managers, engineers, supervisors, safety officers, procurement officers, craftsmen and unskilled workers of indigenous firms from category A-3, A-4 and A-5 (UNABCEC, 2023) within Nakawa Division in Kampala City. The research only considered workers actively engaged in the construction process that were 18 years of age or older.

### *3.2.2 Sampling and Sampling Strategies*

The fundamental goal of a sample was to allow researchers to study members from the general public so that they could use the findings to draw generalizations about the population as a whole. For statistical analysis to be valid, the sample size needs to be a good representation of the population from which it will be derived. A sample of 10 bungalow sites spread across Nakawa division was considered with an average of 21 workers per site. This sample population of workers is valid (Krejcie & Morgan, 1970), Stratified and observation sampling was used. A total of 216 workers was randomly considered from the indigenous construction firms, this included the: site managers, site engineers, supervisors, safety officers, procurement officers, general site foremen,

foremen masonry, plumbers, electricians, masons and casual workers. According to the researcher, more casual workers were sampled because they are the most affected followed by the technicians as shown from the table 3.1 below.

**Table 3. 1: Sample size determination**

| SN | Category of Contractors | Sample Population | |
|---|---|---|---|
| | **A-3, A-4 or A-5** | **Number** | **Description/ category** |
| 1 | Site Managers | 10 | Each site had one site manager out of the 10 sites |
| 2 | Site Engineers | 10 | Each site had one site engineer out of the 10 sites |
| 3 | Site Supervisors | 10 | Each site had one site supervisor out of the 10 sites |
| 4 | Safety Officers | 4 | Four sites had one safety officer out of the 10 sites |
| 5 | Procurement Officers | 10 | Each site had one procurement officer out of the 10 sites |
| 6 | Foremen Masonry | 10 | Each site had one foreman masonry out of the 10 sites |
| 7 | Plumbers | 10 | Each site had one plumber out of the 10 sites |
| 8 | Electricians | 10 | Each site had One electrician out of the 10 sites |
| 9 | Masons | 43 | All the 10 sites had a total number of 43 masons |
| 10 | Un skilled laborers | 99 | All the 10 sites had a total number of 99 Casual Worker. |
| | **Total** | **216** | |
| | Annual contracts of class A-3 contractors (> 5 billion – 10 billion),<br>Annual contracts of class A-4 contractors (> 1 billion - 5billion),<br>Annual contracts of class A-5 contractors (< 1billion), | | |

### 3.3 Description of the Study

The research took place in Nakawa Division, Kampala, the capital city of Uganda, which is the country's biggest economic and building hub.

### 3.4 Data Collection

#### *3.4.1 Questionnaire Tools*

The main data collection tool was Self-Administered Questionnaire (SAQ) with five items on it. The items include: worker identification; safety investment of occupational safety

and health (OSH) measures, cost of accidents; challenges affecting OSH measures and suggested solutions to improve OSH measures. The Likert scale was used to evaluate the challenges and recommended solutions.

Questionnaires were useful tool for gathering information that is descriptive of the circumstances, characteristics, or events that are currently occurring in a group (Burns, 2000). The primary goal of a questionnaire is to gather information from a big and diverse group of persons and to produce accurate and reliable statistics from a significant section of a community in a timely manner and for the least amount of money (Dane, 1990), The benefits of employing a questionnaire are founded on the assumptions that participants will be truthful, resulting in trustworthy information, and that subjects' interpretations of the questions presented will likely match those of the researcher. In addition to the benefits, it is less expensive and quicker than other designed methods.

### *3.4.2 Interview guide*

The second main tool for gathering data was the interview guide. This method was utilized to establish high levels of uniformity in the approach used and decrease interviewer bias as compared to questionnaires. In addition, the technique allowed the researcher to gather information from persons who were in the good position to give it.

The site managers, engineers and the supervisors were provided with semi-structured interview guides

### *3.4.3 Secondary data Collection*

To supplement the main data gathered, the researcher analyzed data from the design reports, progress reports, and incident reports from the selected sites.

## 3.5 Sources of Data

### *3.5.1 Primary Data Source*

This study's primary data was then gathered using self-administered questionnaires and a key informant interviewing guide. According to the study's goals, the questionnaire and interview guide were created.

### *3.5.2 Secondary Data Collection*

For this research purpose, the researcher relied on secondary data that includes design reports, progress reports and data from incident reports from the selected sites.

## 3.6 Validity and Reliability of Research Instruments

Validity and reliability are designed to control quality of the data. Pretests were carried out after the researcher designed the questionnaires and the interview guide

### *3.6.1 Validity of research instruments*

Content validity was used to measure the degree to which data collected using a particular instrument represents a specific content of a particular concept, (Mugenda & Mugenda, 1999). Content validity index (C.V.I) was used to establish the validity of the questionnaire. C.V.I was measured as items rated 3 or 4 by both judges divided by the

total number of items in the questionnaire (Oso & Onen, 2005). C.V.I was 0.85 which was above the acceptable 0.7 hence data valid.

**Table 3. 2: Showing Content Validity Index**

| **Item** | **Judge 1** | **Judge 2** | **Judge 3** |
|---|---|---|---|
| Worker identification | 4 | 4 | 4 |
| Safety investment of OSH Measures | 4 | 3 | 3 |
| Cost of Accident | 4 | 3 | 3 |
| Challenges affecting OSH Measures | 3 | 3 | 4 |
| Ways of Improving OSH Measures | 3 | 3 | 3 |
| Total | 18 | 16 | 17 |
| Average | 3.6 | 3.2 | 3.4 |
| Percentage (%) | 90% | 80% | 85% |
| CVI = $(\frac{90}{100} + \frac{80}{100} + \frac{85}{100}) \div 3$ = **0.85** | | | |

### *3.6.2 Reliability of research instruments*

Test re-test reliability was used to find the degree to which scores on the same test yielded consistent results after repeated trials, (Mugenda and Mugenda 1999). Reliability was done by administering the test to one of the construction sites and it provided evidence that scores obtained on a test at one time (test) were the same or close to the same when the test was re administered some other time (retest).

## 3.7 Data Analysis

Frequency and percentage tables were used to analyze the data. The information was further analyzed and interpreted using additional statistical software called Statistical Package for Service Solution (SPSS) version 21.0. Before entering the computer, the

questions were encoded using the Likert scale. Qualitative data analysis was done using content analysis method. Text summaries were used to easily describe and analyze the qualitative features of the data. Hence, to present, describe, and analyze data gathering and to adequately draw conclusions from the findings, qualitative and quantitative methodologies were used.

### 3.8 Framework

The developed framework was composed of the following; -

a) The safety levels
b) Conditions for achieving the safety levels
c) The check to prove that minimum acceptable safety level for the framework has been achieved

### 3.9 Chapter Summary

Both stratified sample and observation techniques were applied in this research. Qualitative and quantitative data was gathered. Both primary and secondary data sources were used to collect the data, which was then analyzed using means, frequencies, and percentages tables

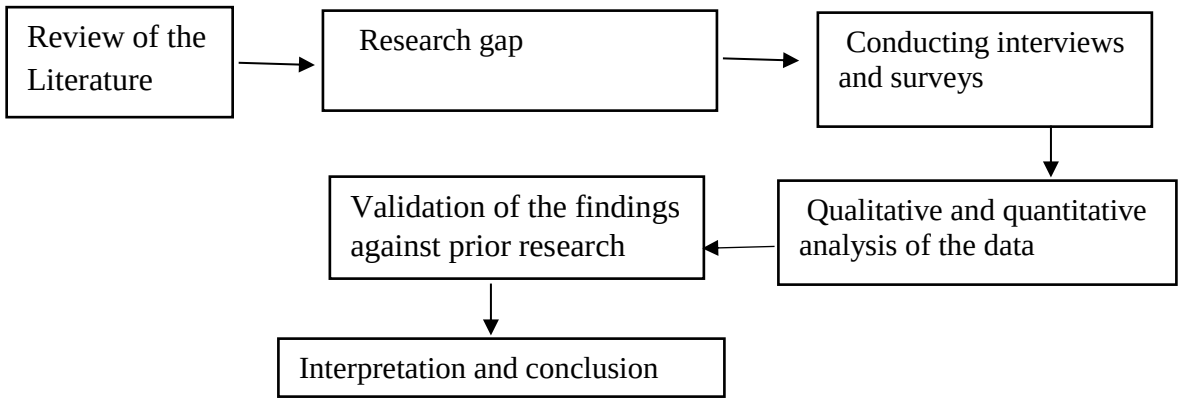


***Figure 3. 1: Methodology flow chart***

# CHAPTER FOUR

# RESULTS AND DISCUSSIONS

## 4.0 Introduction

Results were analyzed and findings discussed respectively in this chapter. The samples came from managers, supervisors, engineers, safety officers, procurement officers, masonry foremen, plumbers, electricians, masons, and casual laborers from 10 building sites in Nakawa division Kampala. Detailed information needed for the study were included in the questionnaires and interview guides that were used to collect the data. Such details comprised; preliminary data, cost of construction works and cost of OSH measures, cost of accidents on construction works, challenges limiting the implementation of OSH measures and ways of improving the implementation of OSH measures. The questionnaires and interview guides were analyzed with the use of the Statistics Package for Social Science (SPSS), Version 21. Frequency distribution and mean item scores were some of the descriptive statistics used, supported by bar charts

## 4.1 Preliminary Data

The respondents' demographic data, such as gender, age, educational background, employment history and nature of accidents is examined in this section

**Table 4. 1 : Bio data of the respondents.**

| **Bio data** | | **Frequency** | **Percentage** |
|---|---|---|---|
| **Gender** | Male | 171 | 79 |
| | Female | 45 | 21 |
| | **Total** | **∑f = 216** | **100** |
| **Age** | Below 20 years | 25 | 11.57 |
| | 20-29 years | 108 | 50 |
| | 30-39 years | 57 | 26.39 |
| | 40-49 years | 15 | 6.95 |
| | 50-59 years | 8 | 3.7 |
| | 60 and above years | 3 | 1.39 |
| | **Total** | **∑f = 216** | **100** |
| **Educational Background** | Primary school | 34 | 15.74 |
| | "O" level | 43 | 19.91 |
| | "A" level | 9 | 4.17 |
| | Vocational/Technical | 76 | 35.19 |
| | University | 47 | 21.76 |
| | Others | 7 | 3.24 |
| | **Total** | **∑f = 216** | **100** |
| **Work Experience** | 1-5 years | 62 | 28.7 |
| | 6-10 years | 107 | 49.54 |
| | 11-15 years | 29 | 13.43 |
| | 16-20 years | 14 | 6.48 |
| | 21 and above years | 4 | 1.85 |
| | **Total** | **∑f = 216** | **100** |

### *4.1.2 Gender*

Out of the 216 respondents, 171 (79%) were male while 45 (21%) were female. The gender ratios in the construction business have been stagnant for quite a long period of time. At building sites most men are hired as compared to women (Bryce & Gardner, 2019). Also, the industry is still shaped by the masculine ideology and the stereotype of

the brave, risk-taking, technically skilled, and strong male construction workers (Norberg & Maria, 2020)

### *4.1.3 Respondents' Age*

The purpose was to figure out the average age of the workers who actively participate in construction sites. According to table 4.1 above, 25 responders (11.57%) are younger than the age of 20 years, 108 respondents (50%) are between the ages of 20 and 29 years, 57 respondents (26.39%) are between the ages of 30 and 39 years, 15 respondents (6.95%) are between the ages of 40 and 49 years, 8 respondents (3.7%) are between the ages of 50 and 59, and the remaining 3 respondents (1.39%) are over the age of 60. This shows that the most productive age group in construction sector lies between 20- 29 years followed by 30-39 years.

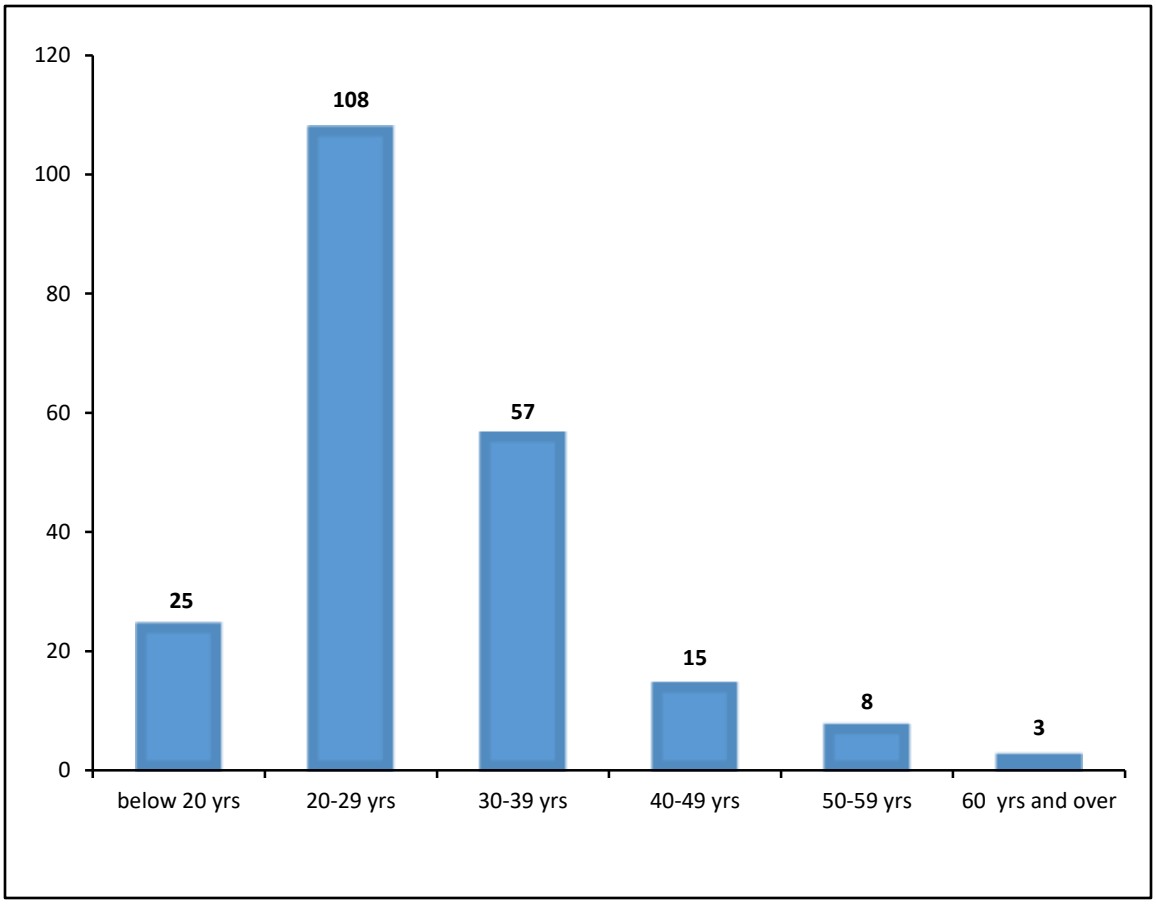


***Figure 4. 1: Age of the respondents***

### *4.1.4 Education background*

Indicating one's educational background was requested of the respondents as one of the study's purposes. Evoked responses in table 4.1. show that 47 respondents (21.76%), obtained university degree certificates; 76 (35.19%), obtained vocational/technical diploma and craft certificates; 9 respondents (4.17%), obtained "A" level certificates; 43 (19.91%), obtained "O" level certificates; 34 respondents (15.74%), obtained PLE passes; and the remaining 7 respondents, or 3.24%, obtained other certificates or received no certificates.

The data indicates that the majority of workers have finished university education (21.76%) and technical/vocational education (35.19%), which reflects the higher competency levels in construction in terms of practical skills and knowledge.

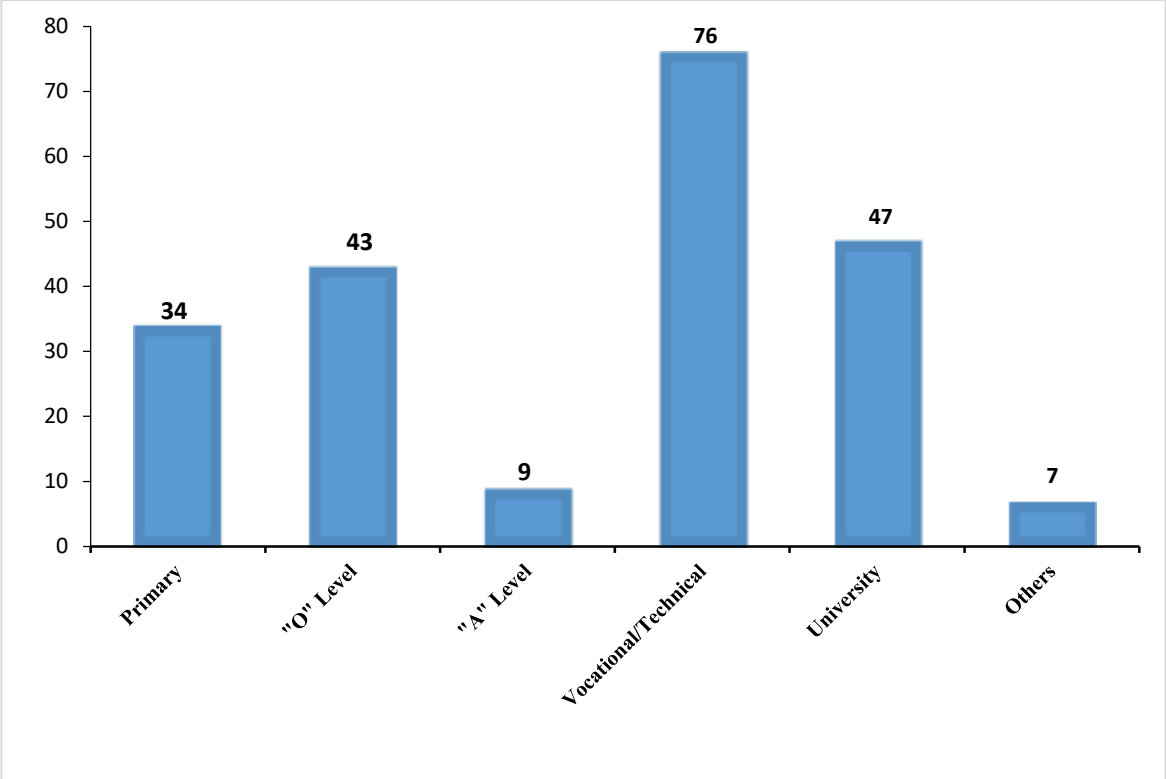


***Figure 4. 2: Education background of the respondents***

### *4.1.5. Working Experience*

The working experience of the study participants is shown in table 4.1. The purpose was to ascertain how long and steadily employees had been employed by the organization. The majority 124 representing 49.4% have worked for the organization between six to ten years; 72 representing 28.69% have worked between one to five years; 34 representing 13.55% have worked between eleven to fifteen years; 16 representing 6.37% have worked between sixteen to twenty years; and 5 representing 1.99% have worked for more than

twenty-one years. According to the information at hand, most employees have been in their current jobs for over five years, which has allowed them to develop the essential skills and demonstrate consistency in their work

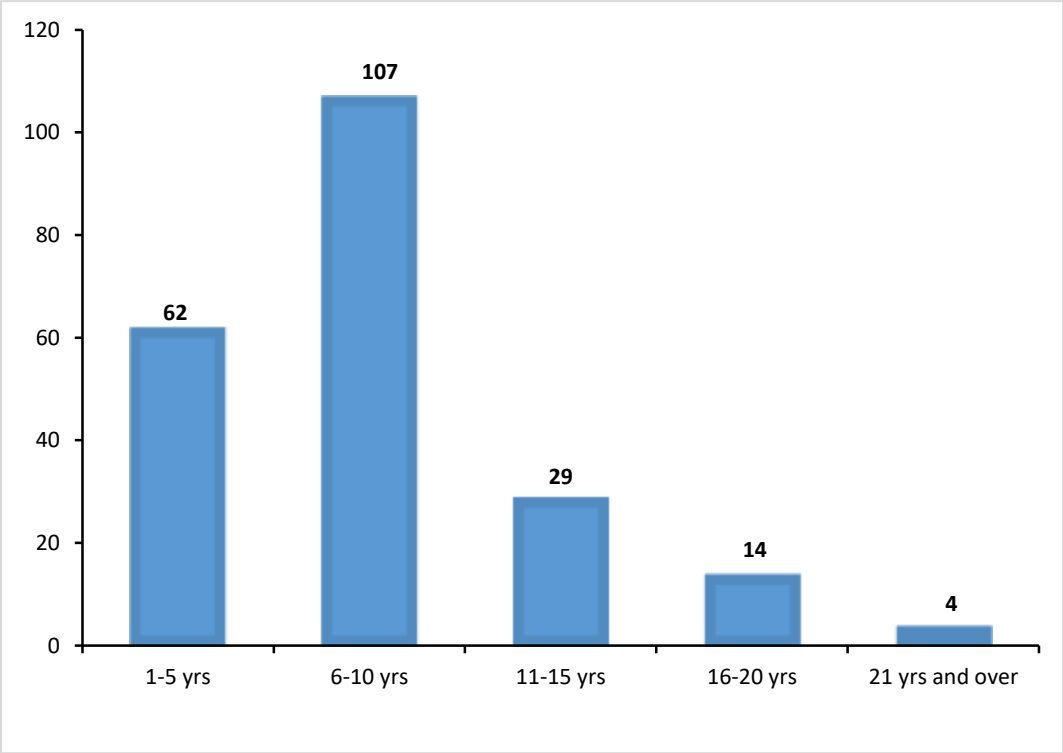


***Figure 4. 3: Work experience of the respondents***

**4.2 Cost of Construction Works**

The site location, cost of construction, site activities and the scope of work are shown in table 4.2 below

**Table 4. 2: Total construction cost and scope per site in Uganda shillings**

| Site | Site Location | Category of Indigenous Firm | Cost in Billion Uganda Shillings | % Cost | Site Activity Level | Scope of Work |
|---|---|---|---|---|---|---|
| A | Bukoto | A-4 | 1.15 billion | 13.83 | Window level, 1st floor | 5 bedrooms (storey, 2 floors) |
| B | Bugoloobi | A-3 | 1.3 billion | 15.63 | Gable wall | 4 bedrooms (storey,2 floors) |
| C | Kiwaatule | A-5 | 0.65 billion | 7.82 | Ring Beam | 7 bedrooms |
| D | Kyambogo | A-5 | 0.7 billion | 8.42 | Gable Wall | 4 bedrooms |
| E | Kyanja | A-5 | 0.51 billion | 6.13 | Finishes | 5 bedrooms |
| F | Mbuya | A-4 | 1.05 billion | 12.63 | 1st floor slab | 5 bedrooms (storey,2 floors) |
| G | Mutungo | A-5 | 0.55 billion | 6.61 | Wall | 4 bedrooms |
| H | Naguru | A-3 | 1.16 billion | 13.95 | Roof | 6 bedrooms (storey,2 floors) |
| I | Ntinda | A-5 | 0.57 billion | 6.86 | Wall | 4 bedrooms |
| J | Luzira | A-4 | 0.675 billion | 8.12 | Roof | 4 bedrooms |
| | **Total** | | **8.315 billion** | **100** | | |
| | **Average** | | **0.8315 billion** | | | |

The number of construction sites visited were 10, numbered from A to J. Each site was at a different location within Nakawa Division as shown in the table 4.2 above. The Average construction cost was 0.8315 billion shillings, with site H from Naguru recording the highest construction cost of 1.16 billion shillings while site E from Kyanja recorded the lowest construction cost of 0.51 billion shillings. The scope of work differed from one site to another as shown in table 4.2 above

### 4.3 Objective One: Cost of Occupational Safety and Health Measures.

This was achieved by asking the procurement officers the prices of each OSH item currently being used on their construction sites as well as asking prices from market places

like construction hardware. The overall results were summarised as shown in the table below

**Table 4. 3: Cost of OSH Measure per item in Uganda Shillings**

| S. No | OSH Measures | Item 1 | Item 2 | Item 3 | Item 4 | Sub Total |
|---|---|---|---|---|---|---|
| **1** | Safe work method | Ladders | Scaffolds | - | - | |
| | Cost | 6,850,000 | 9.200,000 | - | - | 16.050,000 |
| **2** | Training of workers | Tool Box Training | Induction Training | First Aid Training | - | 5,925,000 |
| | Cost | 900,000 | 3,200,000 | 1,825,000 | - | |
| **3** | PPE | Overall/Aprons | Hand Gloves | Safety Shoes/Gumboots | Helmet | 27,885,000 |
| | Cost | 7,730,000 | 315,000 | 17,880,000 | 1960.000 | |
| **4** | Warning signs | Warning Tape | No Parking Cones | Men at Work Caution | - | 1,210,000 |
| | Cost | 572,000 | 450,000 | 188,000 | - | |
| **5** | Lifting equipment | Hoist | - | - | - | |
| | Cost | 7,700,000 | . | - | - | 7,700,000 |
| **6** | First aid facility | Kit | - | - | - | |
| | Cost | 630,000 | - | - | - | 630,000 |
| | Total Cost | | | | | **59,400,000** |

**Table 4. 4: Cost of each OSH Measure in Million Shillings per site in Uganda Shillings**

| S. No | OSH Measures | A | B | C | D | E | F | G | H | I | J | ∑f |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | Safe work methods | 2.2 | 1.4 | 1.8 | 1.5 | 1.1 | 2.3 | 1.3 | 2.2 | 0.6 | 1.65 | 16.05 |
| **2** | Training of workers | 1.4 | 0.7 | 0.5 | 0.75 | 0.1 | 0.3 | 0.25 | 1.5 | 0 | 0.425 | 5.925 |
| **3** | PPEs | 4.9 | 2.25 | 1.64 | 3.8 | 1.51 | 6.82 | 1.51 | 3.128 | 1.066 | 1.261 | 27.89 |
| **4** | Warning signs | 0.12 | 0.17 | 0.1 | 0 | 0 | 0.739 | 0 | 0.08 | 0 | 0 | 1.209 |
| **5** | Lifting equipment | 1.7 | 2 | 0 | 0 | 0 | 0.25 | 0 | 0.23 | 0 | 0 | 7.7 |
| **6** | First aid facility | 0 | 0 | 0.1 | 0 | 0 | 0.25 | 0 | 0.23 | 0 | 0.05 | 0.63 |
| | Total OSH cost | 10.32 | 6.52 | 4.14 | 6.05 | 2.7 | 12.1 | 3.06 | 8.938 | 1.666 | 3.386 | 59.4 |
| | Average OSH cost | | | | | | | | | | | **5.94** |
| | Construction cost | 1150 | 1300 | 650 | 700 | 510 | 1050 | 550 | 1160 | 570 | 675 | 8315 |
| | Average const. cost | | | | | | | | | | | **831.5** |
| | | | | | | | | | | | | |
| | S.I.R | 0.897 | 0.502 | 0.64 | 0.86 | 0.53 | 1.201 | 0.56 | 0.771 | 0.292 | 0.502 | **0.714** |
| | Number of workers | 23 | 27 | 19 | 24 | 15 | 27 | 13 | 31 | 17 | 20 | **216** |

The occupational safety and health measures were investigated based on physical inspection/observation and costed in Uganda local prices. One site never conducted onsite training meetings because all its workers had experience and are familiar with construction works, five sites never had warning signs, six sites never had lifting equipment but lifted materials manually because their structures were not storey, six sites also never had first aid facility that risks of getting injuries are minimum in small projects like construction of bungalows. In case a worker gets injured, the site manager will buy medicine from the nearest clinic or transport him to the hospital using one of the company's vehicles.

$$\text{Safety Investment Ratio (SIR)} = \left(\frac{\text{Average Safety investment}}{\text{Average cost of work}} \times 100\right)$$

$$\text{SIR} = \left(\frac{5.94}{831.5} \times 100\right)$$

$$= \mathbf{0.714\%}$$

This finding shows that construction companies invest 0.714% on occupational safety and health measures.

The average cost of occupational safety and health measures was 5,940,000 shillings which represents 0.714 % of the average cost of construction cost of 831,500,000 shillings. This confirms the research done where S&H cost of construction companies was found to lie between 0.5% and 3% of the overall project cost (Smallwood, 2004), research where S&H prevention costs was observed to lie between 1-10% of the total cost

(Adekunle et al, 2020) and also another where safety cost was 1.92% of the total cost (Gurcanli et al., 2015).

Objective one was to investigate on the cost associated with occupational S&H measures during construction works in Nakawa Division. The average cost invested in S&H measures was 0.714 % of the average cost of construction. This means construction firms invested less in S&H measures.

## 4.4 Objective Two: Cost of construction Accidents.

The objective was accomplished by asking the OSH officers at site the nature of site accidents construction workers have ever suffered from while at the current site, cost of site accident and the work category they belonged as causalities.

### *4.4.1: Nature and Cost of Construction Site Accidents*

The nature of accidents considered include fatal injuries, severe injuries, minor injuries and near miss. The direct cost of accidents was calculated based on the medical bills, transport to hospital and the cost of site property damaged.

**Table 4. 5: Direct Cost of construction site accidents**

| Nature of Accident | Cause of accident | Number | Transport bills | Medical bills | Property damaged | Cost in Ug. Shillings |
|---|---|---|---|---|---|---|
| Severe injury | Fall from ceiling due to scaffold malfunction. Broken leg and arm | 1 | 450,000 | 1,990,000 | 160,000 | 2,600,000 |
| | Hit by falling hammer, no helmet | 1 | 380,000 | 3,460,000 | 60,000 | 3,900,000 |
| Minor injury | Falling objects | 6 | 80,000 | 310,000 | 90,000 | 480,000 |
| | Offloading blocks/bricks | 3 | - | 185,000 | 20,000 | 205,000 |
| | Slippery surface | 9 | - | 280,000 | 165,000 | 450,000 |
| | Lifting heavy loads | 68 | 570,000 | 3,880,000 | 310,000 | 4,760,000 |
| | Stepping on sharp objects | 2 | 20,000 | 70,000 | - | 90,000 |
| | Working on heights | 32 | 375,000 | 1,820,000 | 45,000 | 2,240,000 |
| Near miss | Falling objects | 6 | - | - | 105,000 | 105,000 |
| | Slippery surface | 22 | - | - | 162,000 | 162,000 |
| | Offloading blocks /bricks | 9 | - | - | - | 0 |
| | Trenching | 9 | - | - | - | 0 |
| **Total** | | | | | | **15,022,000** |

**-Transport bills**

a) Mean =312,500
b) Standard Deviation, SD =216,003.5
c) Coefficient of Variation, CV = 69.121%

**-Medical bills**

a) Mean =1,499,375
b) Standard Deviation = 1437320.5
c) Coefficient of Variation, CV = 95.861%

**-Property damaged**

a) Mean = 124,111
b) Standard Deviation = 87,811.5
c) Coefficient of Variation, CV = 70.752%

These results show that the standard deviation for direct costs is high with medical bills being the highest. These costs are spread further from the average. This shows high variability and unpredictability in costs.

The indirect cost was estimated as 1.6 times the direct cost extracted from OSHA Safety Estimator work. The results are shown in the table 4.6 below

**Table 4. 6: Direct and indirect cost of construction site accidents**

| **Nature of Accidents** | **Cause of Accident** | | **Number** | **%** | **Cost in million (Ug. Shillings)** |
|---|---|---|---|---|---|
| **1) Direct costs** | | | | | |
| Fatal(death) injury | | | 0 | 0 | 0 |
| Severe injury | Fall from ceiling due to scaffold malfunction | | 1 | 1.2 | 2.6 |
| | Hit by falling hammer, no helmet | | 1 | | 3.9 |
| Sub Total 1 | | | **2** | | **=6 .5** |
| Minor injury | Falling objects | | 6 | | 0.48 |
| | Offloading blocks/bricks | | 3 | 71.1 | 0.205 |
| | Slippery surface | | 9 | | 0.45 |
| | Lifting heavy loads | | 68 | | 4.76 |
| | Stepping on sharp objects like nails | | 2 | | 0.09 |
| | Working on heights | | 32 | | 2.24 |
| Sub Total 2 | | | **118** | | **=8.255** |
| Near miss | Falling objects | | 6 | 27.7 | 0.105 |
| | Slippery surface | | 22 | | 0.162 |
| | Offloading blocks /bricks | | 9 | | 0 |
| | Trenching | | 9 | | 0 |
| Sub Total 3 | | | **46** | | ***=0.267*** |
| **Sub Total** | | | ***∑f =166*** | ***100*** | ***$\sum f_1$ =15.022*** |
| **2) Indirect costs** | | (OSHA, between $3,000 to $4,999, indirect cost ratio is 1.6. therefore ***1.6 x (direct cost)*** | | | ***$f_2$=24.0352*** |
| **Overall Total** | | | | | ***∑F= 39.0572*** |
| **Average** | | | | | ***∑F= 3.90572*** |

The number of respondents who recorded accidents at their construction sites were 166 and those who did not record were 50 in number. This signifies that 77% of construction workers suffer from accidents. Majority of casualties fall in the minor injuries bracket at

71.1 %, near miss at 27.7%. Severe injuries at 1.2%, while fatal injuries at 0%. As shown in the figure 4.4 below

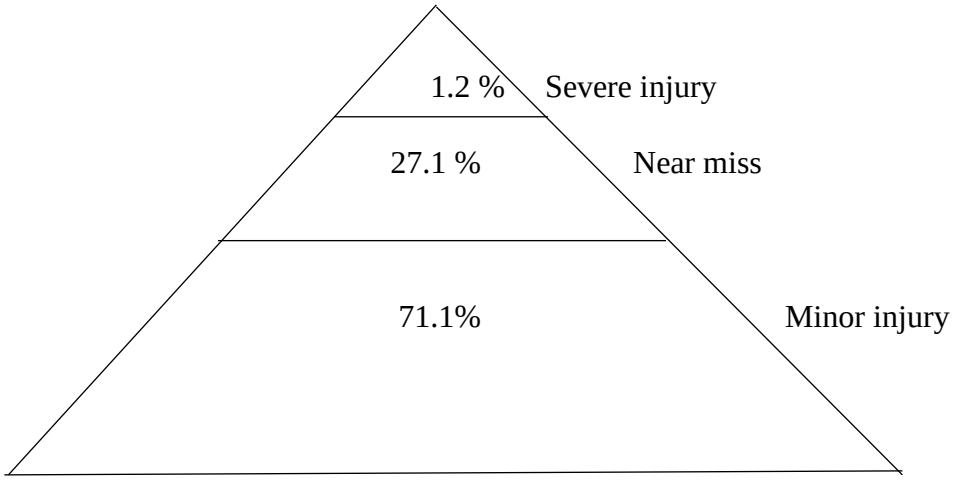


***Figure 4. 4: Accidental pyramid***

This satisfies the accidental pyramid theory developed by Bird in 1969 which showed that for each serious accident there are 10 less serious accidents. It is important to observe that while the proportion of severe injuries is small in comparison to minor injuries and near miss, this can mean possible loss of a limb or an injury that brings along permanent disability to a worker hence loss of gainful earning abilities in life.

Accident Loss Ratio (ALR) = $(\frac{\text{Average Cost of Accident}}{\text{Average cost of work}} \times 100)$

Minimum accident insurance cover of 0.3% (SWICO, 2020) is added to the average cost of accidents

$$\text{ALR} = (\frac{3.90572 + 0.3\ \%\ x\ 3.90572}{831.5} \times 100)$$

$$= (\frac{3.90572 + 0.01171716}{831.5} \times 100)$$

$$(\frac{3.91743716}{831.5}\times 100)$$

ALR = **0.471%**

This confirms research where accident cost is less than 1% of project construction cost (Sanni, et al, 2018) and where the cost of accidents to the total cost is 0.251 (Feng et al., 2015).

### 4.4.2 *Presentation of the Work Category of Accident Causalities*

The pie chart 1 below shows the work categories in which the construction site accident victims belong

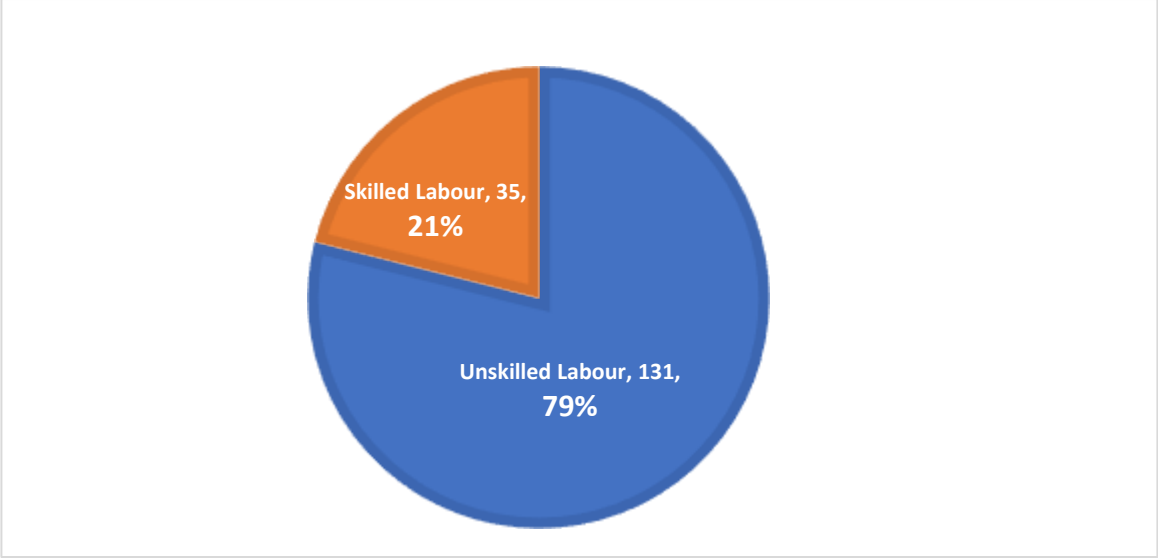


***Figure 4. 5: Work category of accident causalities***

The unskilled labor force includes all the helpers while the skilled labor force includes all the craftsmen, foremen, safety officers, site supervisors, site managers and site engineers. From Fig 4.5, the most affected category of workers in building construction sites were

the unskilled labor at 79% compared to the skilled labor at 21%. This is because they are involved in doing all risky works at the site like lifting of heavy loads (Nyaruai et al, 2016). The unskilled labor force lacks basic skills necessary for satisfactory workplace performance, However, employing the unskilled (those with limited education and training) is cost effective

Unqualified workers, molders, and plumbers make up 29%, 21%, and 13% respectively of the workforce that is susceptible to occupational accidents on construction sites (Faith, 2014).

The Patients were treated from Benedict medical centre, Paragon hospital, Bugolobi medical centre, Healing way hospital, Murs Ck medical centre, Mirembe health centre, Mbuya hospital, Naguru hospital, Mulago hospital, Nsambya hospital and Najjera hospital Objective two was to investigate the cost incurred due to construction accidents during construction works in Nakawa Division. The average cost incurred due to construction accidents was 0.471 % of the average cost of construction. This means that much as construction firms invest less in S&H measures according to the results from the first objective, the cost incurred due to accidents remains low although 77% of construction workers suffered from accidents

### 4.5 Effect of OSH Measures

The effect of OSH measures was derived by adding S&H investment costs got from objective one together with the costs incurred due to accidents in objective two

Therefore, the effect of OSH measures = SIR +ALR

= (0.714+0.471) %

= **1.185%**

The effect of OSH measures is 1.185% of the overall construction costs which is very low. This shows why contractors are not interest in investing in safety and health. Indigenous contractors prefer employees to buy PPE for their own consumption (Jonathan et al., 2017). Contractors prefer production over safety to save time and money (Benjaoran and Bhokha, 2010)

The cost of occupational safety and health (OSH) measures, construction cost and the cost of accidents in US dollars is shown from the table 5.4 below.

**Table 4. 7: Costs in US Dollars**

| **Cost** | **Uganda Shillings in millions** | **US Dollars @ exchange rate of 3,900** |
|---|---|---|
| Average Cost of OSH Measures | 5.94 | 1523.1 |
| Average Cost of Construction works | 831.5 | 21,320.51 |
| Average Direct costs of accidents | 1.5022 | 385.2 |
| Average Indirect cost of accidents | 2.40352 | 616.3 |
| Average cost of accidents | 3.90572 | 1,001.5 |

## 4.6 Objective Three: Challenges Hindering the Implementation of OSH Measures

The objective was accomplished by having the respondents respond to the degree of hindrance to the implementation of OSH measures, and the challenges hindering the implementation of OSH measures on their construction sites.

### *4.6.1 Degree of the limitation to the implementation of OSH Measures*

The respondents were asked whether the implementation of the OSH measures was very difficult, difficult, easy or very easy. Their degree of hindrance to OSH measures is shown in the pie chart 4.6 below

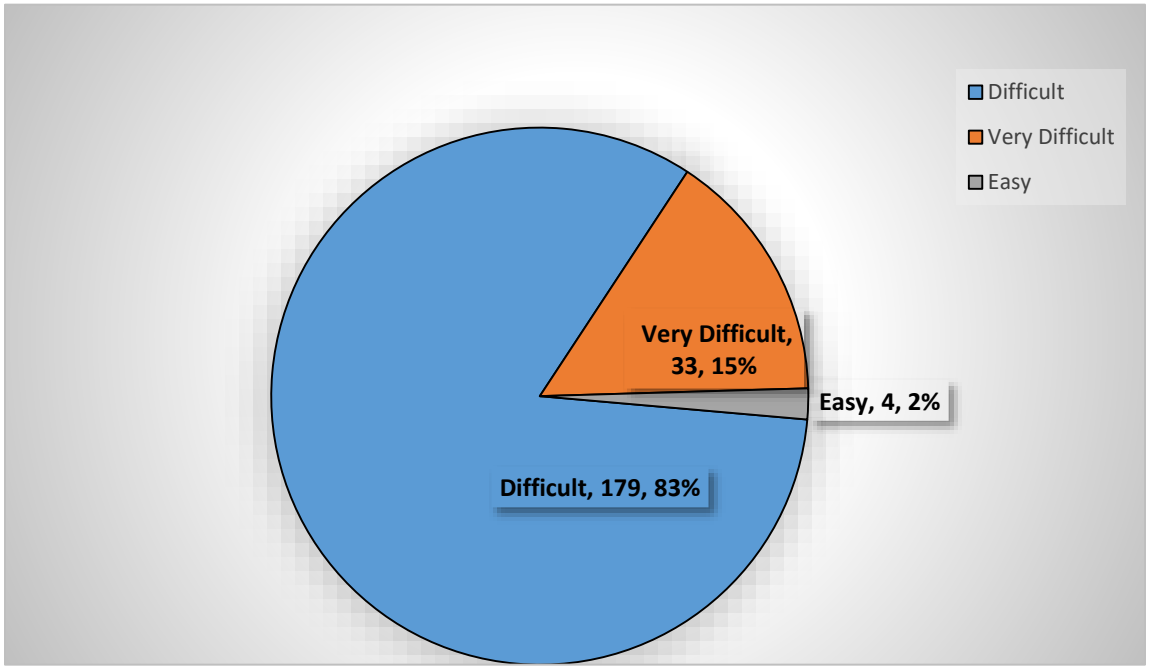


***Figure 4. 6*: *The degree limiting implementation of OSH measures***

From pie chart 4.6 above, 179 respondents representing 83% agreed that the degree of implementation of OSH measures is difficult, 33 respondents representing 15% agreed

that the degree of implementation of OSH measures is very difficult, 4 respondents representing 2% agreed that the degree of implementation of OSH measures is easy while non-agreed that it was very easy. This is consistent with the research on effectiveness of safety measures where the degree limiting implementation of OSH measures was difficult at 67% (Mishra et al, 2019) and research on compliance rate which state that the rate for S&H requirements among construction workers is below average and the main obstacles impeding compliance are a lack of adequate safety gear, a lack of OSH awareness, and a lack of compliance with those requirements (Charles & Clinton, 2018).

### *4.6.2 Challenges hindering the implementation of OSH Measures*

This was accomplished by having the respondent's use a five-point Likert scale ranging from strongly agree to strongly disagree to score the limitations hindering the implementation of OSH measures. This was done as seen in the table 4.7 below.

**Table 4. 8: Challenges hindering the implementation of OSH Measures**

| S. No | Challenges hindering OSH Measures | 5 | 4 | 3 | 2 | 1 | ∑f | ∑fx | Mean | Rank |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Negligence among workers | 127 | 71 | 8 | 3 | 7 | 216 | 956 | 4.426 | 1 |
| 2 | Inadequate supervision | 58 | 54 | 46 | 31 | 27 | 216 | 733 | 3.394 | 6 |
| 3 | Manual lifting of materials | 82 | 104 | 12 | 16 | 2 | 216 | 896 | 4.148 | 2 |
| 4 | S&H perceived as luxury | 12 | 60 | 34 | 66 | 44 | 216 | 578 | 2.676 | 8 |
| 5 | Excessive and extended working hours | 37 | 62 | 26 | 46 | 45 | 216 | 648 | 3 | 7 |
| 6 | Shortage of PPE | 65 | 85 | 22 | 26 | 18 | 216 | 801 | 3.708 | 3 |
| 7 | Lack of safety incentives | 49 | 99 | 35 | 19 | 14 | 216 | 798 | 3.694 | 4 |
| 8 | Lack of training and induction | 42 | 114 | 15 | 25 | 20 | 216 | 781 | 8.938 | 5 |
| | **Total** | | | | | | | | 28.66 | |
| | **Average** | | | | | | | | **3.583** | |

*5-Strongly Agree, 4-Agree, 3-Neutral, 2-Disagree, 1-Strongly Disagree*

Negligence was ranked first (Kadril et al. 2014), manual lifting was ranked second, shortage of personal protective equipment (PPE) was ranked third, lack of safety incentives was ranked fourth, lack of training and induction was ranked fifth, inadequate

supervision was ranked sixth, excessive and extended working hours was ranked seventh, S&H perceived as luxury was least ranked.

The average mean of 3.583 demonstrates that the magnitude of these challenges is very high and that is why the construction sector is the most hazardous among sectors. With lots of death, disabilities, early retirement and costly compensations for the injured workers, the cost of construction works will continue to rise if there is no proper framework developed for the implementation of these measures. The unskilled being the most affected proves that they work carelessly, they don't use PPE, have not acquired enough induction training, and are engaged in manual lifting of heavy materials like cement bags, bricks, metals at all times at the construction sites. Indigenous contractors prefer employees to buy this PPE for their own consumption. Most contractors in Uganda make ladders and scaffolds from their sites using locally available timber hence cost saving. workers too are more compliant to these measures only under supervision.

Atusingwize et al (2018), attributed failures to implementation of OSH measures in Uganda to policy gap, limited resources for purchasing PPE'S and funding other S&H measures, insufficient human capacity, lack of transparency, lack of accountability, absence of awareness and poor planning. Other challenges according to research in Uganda include; inadequate training of workers, poor service and maintenance of construction equipment, and congestion on building sites (Irumba, 2014)

Objective three was to identify the challenges faced while implementing occupational safety and health measures in minimizing the cost of construction works in Nakawa

Division. The challenges were identified with an average mean of 3.583 which demonstrates that the magnitude of these challenges is very high and 83% of the respondents agreed that implementation of OSH measures is difficult

### 4.7 Objective Four: Solutions necessary for Developing a Framework for Improving OSH Measures

The objective was achieved by asking the respondents on ways of improving OSH measures in their construction sites using a five-point Likert scale ranging from strongly agree to strongly disagree. This was done as seen in the table 4.8 below

**Table 4. 9: Ways of improving OSH measures on the cost of construction works**

| S. No | Ways of Improving OSH Measures | 5 | 4 | 3 | 2 | 1 | ∑f | ∑fx | Mean | Rank |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Appropriate lifting equipment | 178 | 36 | 2 | 0 | 0 | 2.16 | 1040 | 4.815 | 3 |
| 2 | Need for more training and induction | 180 | 36 | 0 | 0 | 0 | 216 | 1044 | 4.833 | 2 |
| 3 | Must wearing of PPE | 199 | 15 | 0 | 0 | 2 | 216 | 1057 | 4.894 | 1 |
| 4 | Stocking first aid facility | 96 | 120 | 0 | 0 | 0 | 216 | 960 | 4.444 | 5 |
| 5 | Clear positioning of warning signs | 63 | 148 | 5 | 0 | 0 | 216 | 922 | 4.269 | 7 |
| 6 | Standard safe work methods | 79 | 131 | 4 | 2 | 0 | 216 | 935 | 4.329 | 6 |
| 7 | Daily site safety inspections | 110 | 104 | 1 | 0 | 1 | 216 | 970 | 4.491 | 4 |
| 8 | Proper management for hazard identification and risk assessment | 56 | 143 | 8 | 0 | 9 | 216 | 885 | 4.097 | 8 |
| | **Total** | | | | | | | | 36.17 | |
| | **Average** | | | | | | | | **4.521** | |

*5-Strongly Agree, 4-Agree, 3-Neutral, 2-Disagree, 1-Strongly Disagree*

In order to improve safety and health, results in table 4.8 above show that the number one means of improving OSH measures is for all construction workers to wear PPE at all cost. Such as helmets, safety shoes, overalls, reflectors, ear plugs, gloves, goggles, nose masks. Other ways of improving OSH measures include; the need for more training and induction, then appropriate lifting equipment, Stocking first aid facilities, daily site safety inspections, Standard safe work methods, clear positioning of warning signs and signals

and finally proper management system for hazard identification and risk control assessment respectively.

When these measures are improved, accidents will reduce (ILO, 2017), rate of falling sick will reduce, production will boost (Shree and Murali, 2016), more construction materials will be saved from damage, saving in rework/repair, good relationships with employees, saving in insurance premiums, improvement in public reputation and improvement in work quality (Yoon SJ et al.,2013).

This is in line with a number of regulations that have been put in place to govern OSH in workplaces like the Construction Design and Management Regulations (CDM, 2015), Uganda's OSH Act, 2006, whose primary goal is to safeguard employees from workplace health and safety risks. Workers can acquire more knowledge and skills regarding potential dangers and their prevention through training and induction (Nwaogazie et al, 2016). Using the right lifting tools, such as construction lift cranes and hoists, while moving huge quantities of materials or items reduces the risk of long-term illnesses, fatalities, and accidents (ILO, 2017). Proper PPE use permits body and fall protection systems, protection for the eyes and face, hearing and breathing, as well as arm, foot and leg protection (OSH Act, 2006). Regular safety site inspection assures that employees have respectable working circumstances (ILO, 2017). Workers are informed of potential safety risks and hazards by clearly placed safety signs and signals during construction. Workers are prevented from falling by using standard safe work practices such using ladders, scaffolds, and safety nets (Brodskiy, 2019). A proper management system for hazard identification and risk control assessment controls safety through a combination of

engineered measures, such as avoiding risks, eliminating hazards or substituting them for less hazardous alternatives, minimizing the duration of hazardous exposure, isolation, and segregation (Hughes, 2008).

Objective four was to generate solutions necessary for developing a framework for improving the occupational safety and health measures in minimizing the cost of construction works in Nakawa Division. The solutions were generated with an average mean of 4.521 which demonstrates the urgency for developing a framework

## 4.8 Framework for Improving OSH Measures in Minimizing the Cost of Construction Works in Uganda

The framework developed will be used for improving OSH measures in minimizing the cost of construction works in Uganda. From the developed framework;

Safety levels should be 95% minimum to 99% maximum. These can be achieved under the following conditions;

Condition 1, All safety and health measures should be $\geq 95\%$, functional in sites with strict regular inspections during working hours.

Condition 2, Penalty of 100% of the accident costs should be fined to all those responsible for causing fatality and major injuries while a penalty of 50% should be fined to all those responsible for causing minor injuries at construction sites. This will improve safety and health since Ugandans hate paying fines.

The check to prove that minimum acceptable safety level for the framework has been achieved is rated as shown below;

Check; Fatal should be 0%, major injuries 0%, minor injuries <1% and near miss <3% of the number of construction workers

The developed framework is shown in the figure 4.7 below.

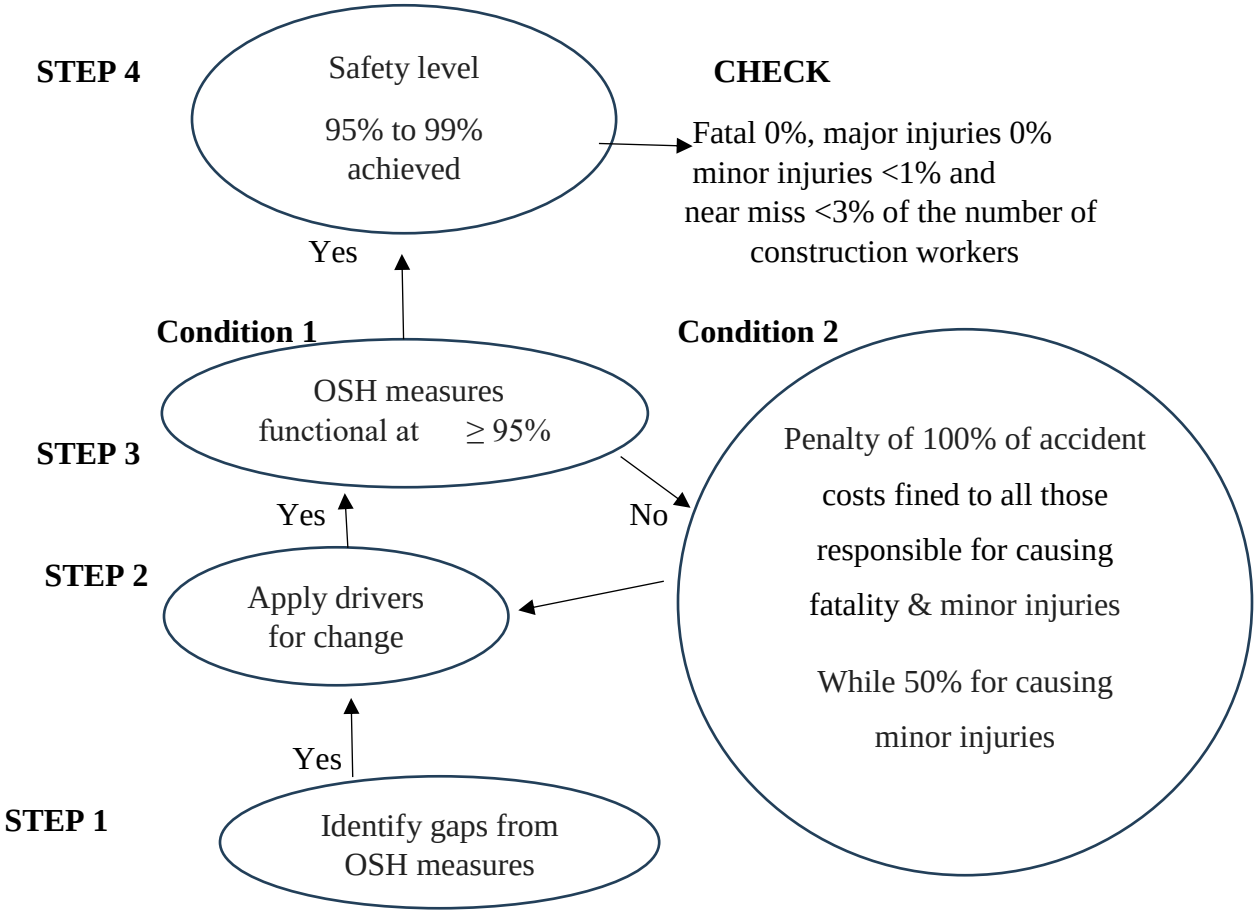


***Figure 4. 7 : the developed framework***

Details of the framework are shown in table 4.10, table 4.11 and table 4.12 below

**Table 4. 10: OSH measures, gaps, proposed changes, drivers for change and expected improvements**

| OSH Measures | Gaps | Proposed changes | Drivers for change | Expected improvement |
|---|---|---|---|---|
| -Training of workers | -Induction training<br>-Tool box training<br>-First aid training | -Implementation of a comprehensive safety training programs which includes; initial and ongoing training<br>-Specialized training on the equipment i.e. operating heavy machinery safely<br>-Use of safety training management software | -Education on relevant laws<br>-onsite safety training<br>-off site safety training.<br>-Safety incentive programs | -Behavior improvement<br>- Positive attitude towards safety and health<br>-More knowledge and awareness on Safety and Health<br>-Proper management system for Hazard Identification and Risk Assessment (HIRA) |
| -Safe work methods | Use of<br>-Ladders<br>-Scaffolds. | -Hazard identification and risk assessment i.e. need for regular inspection<br>-Use of Seasoned timber as ladders and scaffolds<br>-Use of metallic ladders and scaffolds | -Investment in safe work methods<br>-Inspection of safe nets, ladders, etc. before and after use<br>-Maintenance procedures | -Well conditioned and functional ladders, scaffolds etc.<br>-Site safety inspection culture<br>-Work completed efficiently and on time |
| -Material lifting procedures | Use of<br>-Hoists<br>-Cranes | -Use of safe lifting techniques i.e. training on proper manual lifting techniques<br>-Procurement of appropriate lifting Equipment | -Investment in lifting equipment<br>-Inspection of hoists, cranes, elevators etc. before and after use<br>-Maintenance procedures | -Having appropriate lifting equipment like hoists and cranes<br>-Site safety inspection culture<br>-Work completed efficiently and on time |
| -PPE's | -Overall/aprons<br>-Hand gloves<br>-Safety shoe /gumboots<br>–Helmet | -Supply of quality PPE on time<br>-Prioritization of PPE that is comfortable, properly fitting and | -Provision of required PPE resources by management<br>-Strict penalties on PPE usage | -Must wearing of PPE<br>-Enough functional PPE |

| | | | | |
|---|---|---|---|---|
| | | suitable for specific work environment<br>-Strict enforcement of PPE policies | | |
| -First aid and welfare facilities | -First aid box<br>- Welfare facilities like wash rooms | -Use of updated first aid trainings under guidance from regulatory bodies like Red Cross<br>-Stocking of first aid facilities<br>-Having access to quality welfare facilities | -Provision of required first aid resources<br>-Provision of welfare facilities | -Stocked First aid facilities<br>-Professional health personnel for the company<br>-Functional welfare facilities |

**Table 4. 11: Items and percentages of OSH measures**

| **OSH Measures** | **Item** | **Current %** | **Expected % after improvement** |
|---|---|---|---|
| -Training of workers | OSH Training | 41% (Irumba et al, 2014), 49.8% (Okwel et al, 2019) | 95 % |
| -Safe work methods | Ladders & scaffolding | 92% (Irumba et al, 2014) | 95% |
| | Fall protection equipment | 20% (Irumba, et al, 2014). | 95 % |
| -Material lifting procedures | General | 57% (Irumba, et al, 2014). | 95 % |
| -PPE's | General | 15.6% (Jonathan et al, 2017), 72% (Irumba et al, 2014). | 95 % |
| -First aid and welfare facilities | First aid box | 20% (OAG, 2016), 78% (Irumba, et al 2014). | 95 % |

**Table 4. 12: Difference between what is being used now and the proposed framework**

| OSH Measures | Item | Challenge | What is currently used | Proposed framework |
|---|---|---|---|---|
| -Training of workers | -OSH Training | -Lack of training and induction | -Currently there are few contractors who provide OSH trainings, 41% (Irumba et al, 2014), 49.8% (Okwel et al, 2019) | -Implementation of a comprehensive safety training programs which includes; initial and ongoing training<br>-Specialized training on the equipment i.e. operating heavy machinery safely<br>-Use of safety training management software |
| -Safe work methods | -Ladders<br>-Scaffolding | -Negligence among workers | -Currently use of defective ladders and the use of weak (Unseasoned) timber as ladders & scaffolding is common in construction sites. 92% (Irumba et al, 2014) | -Hazard identification and risk assessment i.e. need for regular inspection<br>-Use of Seasoned timber as ladders and scaffolds<br>-Use of metallic ladders and scaffolds |
| -Material lifting procedures | -Hoists<br>-Cranes | - Manual lifting of materials | -Currently there is inadequate safe lifting techniques in all sites and lack of hoists in 60% of the sites. 57% (Irumba, et al, 2014) | -Need for training on proper manual lifting techniques<br>-Procurement of appropriate lifting Equipment |
| -PPE's | -Overall/aprons<br>-Hand gloves<br>-Safety shoe /gumboots<br>–Helmet | -Shortage of PPE | -Currently there is inadequate supply, procurement delays and poor quality PPE especially gloves. 15.6% (Jonathan et al, 2017), 72% (Irumba et al, 2014) | -Supply of quality PPE on time<br>-Prioritization of PPE that is comfortable, properly fitting and suitable for specific work environment<br>-Strict enforcement of PPE policies |
| -First aid and welfare facilities | -First aid box<br>- Welfare facilities like wash rooms | Lack of first aid and welfare facilities | -Currently there is under stocking of first aid facilities, lack of basic first aid training, congestion on building sites and few welfare facilities. 20% (OAG, 2016), 78% (Irumba, et al 2014) | -Use of updated first aid trainings under guidance from regulatory bodies like Red Cross<br>-Stocking of first aid facilities<br>-Having access to quality welfare facilities |

# CHAPTER FIVE

# CONCLUSIONS AND RECOMMENDATIONS

## 5.0 Introduction

The research's conclusion and recommendations in relation to the study's objectives are contained in this chapter.

## 5.1 Conclusion

First objective investigated the cost of safety investment of occupational safety and health measures from the cost of construction works in Nakawa Division. The findings extracted from the interview guide and questionnaires show that the Safety Investment Ratio (SIR) was 0.71% which was very low. Risks of getting injuries are minimum in small projects like construction of bungalows compared to other structures like skyscrapers which helps indigenous companies save instead of investing much in safety and health. Most PPEs were purchased and owned by workers instead of the indigenous companies. Medicine was mostly budgeted to cater for the injured or sick workers only. Majority of ladders and scaffolds were made with local site timber hence cheap labor and materials.

Second objective investigated the cost of construction accidents from the cost of construction works in Nakawa Division. The findings extrapolated from the questionnaire and interview guide show that the Accident Loss Ratio (ALR) was 0.47% which was low too. Severely injured workers were rushed to hospital or clinic using one of the company's vehicles instead of hiring ambulance.

The overall effect of OSH measures, (SIR+ALR) was 1.18% which was still low. This low percentage result discourages indigenous companies from investing a lot in occupational safety and health (Okoye & Okolie, 2014), although 77% of construction workers are suffering from accidents.

Third objective identified the challenges faced while implementing occupational safety and health measures in minimizing cost of construction works in Nakawa Division. The findings extrapolated from the questionnaire and interview guide showed that adherence to OSH was difficult with negligence, manual lifting and shortage of personal protective equipment (PPE) as the major causes. The negative impact of these challenges requires high attention from both government and the contractors otherwise accidents and costly life will continue devastating construction frontliners (Emuze, 2017).

Fourth objective generated solutions for developing a framework necessary for improving the occupational safety and health measures in minimizing cost of construction works in Nakawa Division. The findings extrapolated from the questionnaire and interview guide showed need for enforcement of all construction workers to wear PPE at all cost, need for more training and induction, need for appropriate lifting equipment, stocking first aid facilities, proper management system for hazard identification and risk control assessment as key. This recognized the value of S&H (Hughes and Ferret 2008; Yoon SJ et al, 2013).

The framework developed will help improve on the H&S of workers by minimizing on the accident rate, boost production among others when its fully implemented. Therefore,

from both the examined literature and the research questionnaire results and guide, all the four research objectives were achieved.

### 5.2 Recommendations

In an attempt to effect S&H measures at the construction sites. The study produced a number of recommendations;

1. The effect of occupational safety and health measures on the cost of construction works in Uganda needs to be investigated on sites with fatal injuries.
2. The researcher looked at the effect of only six occupational safety and health measures on cost. Other measures such as fire protection and chemical storage too need to be investigated in Uganda.
3. The study was limited to only Nakawa Division. Research on the effect of occupational safety and health measures on cost needs to also be conducted in other divisions in Kampala and cities within Uganda before generalizing the results.
4. Finally, further analytical research of safety and health measures on innovative technology at construction sites in Uganda needs to be done.

### 5.3 Limitations of the Study

1. Only one division (Nakawa) in Kampala City was considered for case study. This division was considered because it had many bungalow sites with ongoing construction works compared to other divisions.

2. Only 10 sites constructing bungalows were considered. These sites were the only sites whose respondents provided clear data out of the 25 sites. This could have largely affected the research study.
3. Only six OSH measures were considered for costing. This was because it was not difficult to determine the costs per item of all OSH measures.
4. Among the sites considered, there was no fatal injury recorded yet fatal accidents occur on sites. Construction Sites which did not have fatal injuries were chosen because it was a general limitation across all sites in Uganda by the time research was carried out. No site from ongoing construction works had recorded fatal injuries.

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# APPENDICES

## Appendix I: Letter of Transmittal

Eluru John,
P. O. Box 1,
Kyambogo Kampala
January, 2022

The Management.
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Dear Sir/ madam,
RE: ACADEMIC RESEARCH FOR A MASTERS DEGREE PROGRAMME

Dear Sir/ Madam,

I Eluru John, a student at Kyambogo University is pursuing a Master's Degree of Science in Construction Technology and Management. As part of the prerequisites for the aforementioned degree, I must do a research project. The research is to assess the effects of occupational safety and health measures on the cost of construction Works in Nakawa Division, Kampala":

These questions are designed to help with this research. and for academic purpose. You were chosen at random as an employee of the above place and you are respectfully asked to set aside some time and respond voluntarily to the following questions. All of your responses will be kept confidentially.

Thank you.

Yours Faithfully,

……..…..

Eluru John.
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elurujohn1@gmail.com

## Appendix II: Questionnaire

**1. Identification**

Respondent's Position……

Name of Organization……

a) Gender:

☐ Male ☐ Female

b) Age:

☐ below 20 years ☐ 30 – 39 years ☐ 50 -59 years

☐ 20– 29 years ☐ 40 – 49 years ☐ 60 + year

c) Educational Background:

☐ Primary School ☐ O. Level ☐ A. Level ☐ Technical college

☐ University ☐ Others specify

d) Work Experience:

☐ 1 – 5 years ☐ 11 – 15 years ☐ above 21 years

☐ 6 – 10 years ☐ 16 – 20 years

**3. Cost of Construction**

a) Please indicate the overall total cost used for construction works by your construction company. i.e. Bill of Quantity (BOQ)

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b) Please tick the Occupational Safety and Health (OSH) measure item you are adhering to and indicate its cost below.

| S.NO | The following occupational safety and health measures are adhered in your construction site | Item 1 | Item 2 | Item 3 | Item 4 | Item 5 |
|---|---|---|---|---|---|---|
| 1 | Training | Tool box Training | Induction Training | First aid Training | Others trainings | |
| | **Cost** (Amount) | | | | | |
| 2 | Appropriate Lifting Equipment | Hoist | Crane | Others | | |
| | **Cost** (Amount) | | | | | |
| 3 | Personal Protective Equipment | Overall/Apron | Hand gloves | Safety shoes/Gumboots | Helmet | Others |
| | **Cost** (Amount) | | | | | |
| 4 | First-Aid Facilities | Kit | Others | | | |
| | **Cost** (Amount) | | | | | |
| 5 | Warning Signs and Symbols | Warning tape | No parking cones | Men at work cautions | Others | |
| | **Cost** (Amount) | | | | | |
| 6 | Safe Work Methods | Ladders | Scaffolds | Others | | |
| | **Cost** (Amount) | | | | | |

**3.Effect of Accident on cost of construction works**

a) Have you recorded accident in your construction sites in the last 2 years?

☐ YES ☐ NO

b) If your answer to the question above is **YES**, what was the nature of the accident(s)

☐ Fatal (Death) injury ☐ Severe injury ☐ Minor injury ☐ Near miss

c) In which work category did the accident victim belong?

☐ Unskilled labor ☐ Skilled labor ☐ Others

d) What in your opinion could have be the main cause of the accident(s)?

☐ Trenching ☐ Cost (Amount) …….

☐ Faulty equipment ☐ Cost (Amount)…….

☐ Moving Machinery ☐ Cost (Amount)……..…

☐ Slippery surface ☐ Cost (Amount)……..……

☐ Lifting of heavy loads ☐ Cost (Amount)……..…….

| | |
|---|---|
| ☐ Working on heights | ☐ Cost (Amount)…….……..…… |
| ☐ Falling objects | ☐ Cost (Amount)…….……. |
| ☐ Fall from ceiling | ☐ Cost (Amount) …… |
| ☐ Others | ☐ Cost (Amount)……. |

**4. Challenges affecting occupational safety and health measures in minimizing the cost of construction works**

a) Please indicate your level of agreement with the following statements by ticking on the scale that most closely reflects your level of agreement or disagreement. Using this code.5=Strongly Agree (SA), 4 = Agree (A), 3 = Neutral (N), 2 = Disagree (D),1= Strongly Disagree (SD)

| **The following are challenges affecting occupational safety and health measures in minimizing cost in your construction site** | **Strongly Agree (SA)** | **Agree (A)** | **Neutral (N)** | **Disagree (D)** | **Strongly Disagree (SD)** |
|---|---|---|---|---|---|
| Manual lifting of materials | | | | | |
| Shortage of personal protective equipment | | | | | |
| Inadequate supervision | | | | | |
| Lack of first aid and welfare | | | | | |
| Safety & health perceived as luxury | | | | | |
| Lack of training and induction | | | | | |
| Negligence among workers | | | | | |
| Excessive and extended working hours | | | | | |

b) Degree of hindrance to the implementation of OSH Measures

Is the implementation of the OSH measures very difficult, difficult, easy or very easy?

☐ Very difficult ☐ Difficult ☐ Easy ☐ Very easy

**5. Solution to improve occupational safety and health measures on the cost of construction works**.

Please indicate your level of agreement with the following statements by ticking on the scale that most closely reflects your level of agreement or disagreement. Using this code.5=Strongly Agree (SA), 4 = Agree (A), 3 = Neutral (N), 2 = Disagree (D),1= Strongly Disagree (SD)

| **The following can be done to improve occupational safety and health measures on the cost of construction works in your construction site** | **Strongly Agree (SA)** | **Agree (A)** | **Neutral (N)** | **Disagree (D)** | **Strongly Disagree (SD)** |
|---|---|---|---|---|---|
| More trainings and inductions | | | | | |
| Appropriate lifting equipment | | | | | |
| Must wearing of personal protective equipment | | | | | |
| Stocking of first-aid facilities | | | | | |
| Clear positioning and access of warning signs and symbols | | | | | |
| Standard safe work methods – scaffolds, ladders, etc. have safety tags | | | | | |
| Proper management system for hazard Identification and Risk Control Assessment | | | | | |
| Daily site safety inspections | | | | | |

## Appendix III: Interview Guide

a) In general, are you satisfied with the health and safety practices implemented at your work place? Leave a comment.

.....

b) which safety and health items are you currently using at your construction site

1. …….
2. ……...
3. ……..
4. …….

c) How much did you/your company purchase the safety and health items? Please indicate the amount?

1. ……
2. ……..……
3. ……
4. …….

d) From this construction site, have you ever suffered from an injury? Please indicate.

……..

e) How much sum of money have you spent treating it……

f) What challenges do you encounter with regards to health and safety in the organization?

1.....

2.....

3.....

g) Kindly suggest ways to improve the health and safety of employees at your workplace?

1.....

2.....

3.....

## Appendix IV: Work Plan

**Table A.1: Proposed Research Work Plan**

| **Period/Month** | **May 2021** | **June 2021** | **July 2021** | **Aug 2021** | **Sept 2020** | **Oct 2021** | **Nov 2021** | **Dec 2021** | **Mar 2022** | **April 2022** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Description of Work** | **$W_1$ - $W_4$** | **$W_1$ - $W_4$** | **$W_1$ - $W_4$** | **$W_1$ - $W_4$** | **$W_1$ - $W_4$** | **$W_1$ - $W_4$** | **$W_1$ - $W_4$** | **$W_1$ - $W_4$** | **$W_1$ - $W_4$** | **$W_1$ - $W_4$** |
| Review of literature | | | | | | | | | | |
| Research Title submission | | | | | | | | | | |
| Proposal development Experiment and observation | | | | | | | | | | |
| Proposal Submission | | | | | | | | | | |
| Questionnaire development | | | | | | | | | | |
| Data collection | | | | | | | | | | |
| Analyzing and interpreting the output | | | | | | | | | | |
| Data report writing | | | | | | | | | | |
| Final Report Submission | | | | | | | | | | |
| Presentation | | | | | | | | | | |