UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

CRITICAL RISK FACTORS IN ACCIDENT CAUSATION IN THE CONSTRUCTION INDUSTRY. PERCEPTION OF CONSTRUCTION MANAGERS IN THE NORTHERN REGION OF GHANA

TETTEH MOSES

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BY

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A Project submitted to the Department construction and Wood, Faculty of Technical Education, School of Research and Graduate Studies, University of Education, Winneba in Partial Fulfillment of the Requirements for the award of Master of Technology Education (Construction Technology) Degree.

AUGUST, 2018

DECLARATION

STUDENT'S DECLARATION

I, TETTEH MOSES, declare that this Dissertation with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE: ……………………………………

DATE: …………………………………………….

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidance for supervision of Dissertation as laid down by the University of Education, Winneba.

NAME OF SUPERVISOR: **NONGIBA ALKANAM KHENI (PhD)**

SIGNATURE: ………………………………………

DATE: …..

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My sincere thanks goes to Almighty God for guiding, leading and seeing me through in all spheres of all my endeavours and pray that He leads me to the pinnacle of success and to discover the uncovered.

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DEDICATION

This research work is dedicated to the Almighty God, who in diverse ways made it possible for this research to be reality, my wife, madam Mabel, my children, Manfred Junior, Tetteh Moses Caleb Junior, Tetteh Moses Shilla and Tetteh Moses Emmanuela, alias Big Big and to all my siblings.

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ABSTRACT

The aim of the study was to examine risk factors in accidents at construction sites at the Northern Region of Ghana. The research approach used for this study is quantitative approach. The study population consisted of site managers and project managers. Questionnaire and interview guide were used to gather primary data. Statistical Package for Social Sciences (SPSS version 16.0) was used to analyse data. The findings of the revealed that the accident risk factors in construction site were, injury (ranked 1st), health damage (ranked 2nd), lack of training and low level of education or illiteracy ranked 3rd and 4th respectively. The key types of accidents on construction site includes falling from height, slipped, tripped and falling on same level, contact with moving machinery or object being machined, stroked against fixed or stationary objects, trapped by collapsing or overturning object, and injured whilst lifting or carrying objects. The top two killers in construction works are were identified as “fall of person from height” and “contact with electricity or electric discharge”. Based on the findings the study recommends that regular safe working cycle, safety meeting, regular site inspection, safety site work and different awards to motivate employees. It is also recommended that regulations should be put in place by the industry regulating body to ensure safety of workers at the various construction sites in Ghana.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Workplace safety improvements are shaped by knowledge and assumptions about how accidents happen. "What causes workplace accidents?" has been a burning question across the world, particularly in the construction industry in which accident rates remain high relative to other industries (see, for example, Safe work Australia, 2012). Understanding how accidents occur is important in order to distinguish between factors that are relevant and require some action, and factors that are unimportant and can be ignored (Swuste, 2008). However, many national accident surveillance systems do not capture sufficient information to be used effectively for prevention purposes. For example, a broad classification of compensation claims by 'mechanism (e.g., 'struck by moving object, fall from height etc.) and agency of injury (e.g. mobile plant or transport) does not help us to understand the way in which an accident event 'unfolded,' the range of causal factors involved or the interplay between these causal factors (Cooke et al., 2011). Without this knowledge, the ability to develop appropriate prevention initiatives is fraught with difficulty. In an attempt to advance a better understanding of the causes of accidents many writers have developed accident causation models or theories about how accidents happen. Accident causation models "represent, classify and efficiently organize" safety-related knowledge and provide a theoretical framework for the investigation of incidents and the identification of hazards present in a workplace (Arboleda and Abraham, p.274-275). Hollnagel (2002) describes accident causation models as a common frame of reference representing an unspoken but commonly held view of the way accidents happen. Hollnagel (2002) goes on to argue that accident causation models are helpful because they make communication and understanding more efficient. The practical usefulness of different accident causation models has been the subject of much debate and discussion (see, for example, Lehto and Salvendy, 1991).

The ability of 'generic' accident causation theories to explain accidents in different industrial contexts has been questioned as researchers have shown that accident causes vary substantially between industries (Williamson et al., 1996). Consequently, a number of construction industry-specific accident causation models have been developed in recent years. These models incorporate organizational and technological characteristics that have been empirically linked to project safety performance, such as client/owner's procurement approach (see, for example Huang and Hinze, 2006) and the design of the permanent structure (see, for example, Behm, 2005). The difference between the causal links in organizational or system incidents and occupational incidents has also been argued. Much of the work by researchers such as Reason (1990, 2006) focusses on organizational incidents that typically link closely to systemic failures. The difference between these two types was highlighted in the Deepwater Horizon incident in the Gulf of Mexico, where an occupational health and safety audit had declared the project site to be performing excellently, at the same time as there were significant failings in the process safety elements which then led to disastrous consequences with multiple deaths and very significant environmental impacts (Bly, 2010).

1.2 Problem Statement

The construction industry has earned the reputation of being highly hazardous industry because of the disproportionately high incidence of accidents and fatalities that occur on construction sites around the world (Rowlinson, 2010). Likewise, ILO (2015) avers that data on health hazards of casual workers in building construction industry indicates that each year at least 60,000 fatal accidents occur on construction sites around the world or one fatal accident in every ten minutes. Mitullah and Wachira (2012) confirmed that many construction operatives are employed on temporary and casual basis and therefore the employment conditions are not properly defined thus offering little protection on workers' health and safety.

A study conducted by Buchanan (2011) revealed that construction workers were unwilling to leave dangerous work situations because they recognised the turnover of workers and hence, worried that they would be replaced if they complained about health hazards on construction site. Further, a casual visit by the researcher to several building construction sites in the Northern Region revealed that most construction firms engage workers to do more hazardous activities at the sites with no consideration for proper health and safety measures.

Construction health and safety risks are always a grave concern for both practitioners and researchers all over the world. Thus, construction has been regarded as the most hazardous place in which to work with a high level of health and safety risks (ILO, 2015).

The research gap of this study is that, there is a lack of empirical evidence concerning an assessment of critical risk factors in accident causation in the construction industry: perception of construction managers in the Northern Region of Ghana. Therefore, this study examined the critical risk factors in accident causation in the construction industry: perception of construction managers in the Northern Region of Ghana to provide empirical evidence of this gap.

1.3 Aims and Objectives of the Study

The aim of the study was to examine risk factors in accidents at construction sites at the Northern Region of Ghana.

The specific objectives of the study were to

- Identify the risk factors in accidents in construction site in Northern Region.
- Identify the key types of accidents on construction site in the Northern Region.
- Examine measures that can help eliminate or reduce the frequency of risk factor accidents at construction site in the Northern Region.

1.4 Research Questions

The research seeks to answer the following questions

- What are the risk factors in accident in construction site in the Northern Region?
- What are the key types of accidents on construction site in the Northerns Region?
- What are the measures that can help eliminate or reduce risk factors in accidents at the construction site in the Northern Region?

1.5 Significance of the Study

It proposes a design solution to the relating to accidents at the construction site. These findings, will be relevant to construction foremen to understand their roles at the construction site. The findings of this study will act as a resourceful document to be maintained in library for public consumption and research. On the other hand, the research will be relevant for seminars and workshop in tertiary institutions. Markets will equally derive a lot of benefit from the study, as it will create an avenue for them to maintain lands for a purpose.

1.6 Scope of the Study

The scope of this research contextually looks at the risk factor accidents at the construction sites using the various construction companies in the Tamale Metropolitan Region. The focus was on construction companies in Tamale. Respondents were made up of construction workers, foremen, health workers in the Metropolis and construction firm owners who are directly involved in construction.

1.7 Limitations of the Study

Construction firm owners and foremen do not understand the concept of risk factor accidents and safety issues at the construction site. Unwillingness of the participants to give responses to the research questions. Time available to the researcher to dig into the topic is another constraint. Lack of research materials for current literature review.

1.8 Organization of the Project

This study will be limited only to clothing and class distinction in Ghana. In order to provide sequential flow of ideas to the study, the study has been divided into five (5) main chapters. The study is organized as follows:

The first chapter contains the Introduction, definition and the background which introduces the topic and touches on some of the issues with regards to public relation. Review of all available and Related Literature forms the second chapter and looks at the theoretical and empirical theories on informal communication. Thirdly, the method used in gathering the data forms the third chapter. Chapter four contains the data analysis presentation and discussion of the findings. The conclusion and recommendations will form the chapter five of this study.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Introduction

The preliminary chapter presents the background to the study which illuminates the subject matter in a way which easily leads to defining the problem to be investigated in this thesis. It is then followed by the objectives of the study, significance of the study and scope and limitations of the study. The chapter ends with the structure of the study which gives an overview of the thesis.

2.2 Definitions of Construction Accidents

An accident can be defined as an unplanned, undesirable, unexpected, and uncontrolled event. An accident does not necessarily result in an injury. It can be in term of damage to equipment and materials and especially those that result in injuries receive the greatest attention (Hinze, 1997). All accidents, regardless of the nature of the damage or loss, should be of concern. Accidents that do not cause damage to materials or equipment or injury to personnel may foretell future accidents with less desirable results.

Risk, danger, hazard, and accident are closely related to construction safety. However, these words have different meanings between laymen and professional. They may lead to confusion to laymen. Lee (1991) explained that the definition of risk. Risk means the probable loss over a specific period of time. It focuses on the probability. It can be indicated by the probabilistic occurrence of an event or an accident combined with the consequences of that event. In the paper of Raafat (1989) "*Product Liability and Risk*

Strategy", published in the journal of Health and Safety March 1989 UK, risk is defined as: Risk = Probability of Failure x Severity. In other word, risk is the quantitative values of the probability and the severity. For example, the risk of an explosion of an air receiver is the probability of explosion combined with the severity of the consequence of the explosion.

Lee (1991) also defined danger as the presence of a situation which can inflict injury or damage if an error is made. If an operator makes an error or the machine malfunctions, injury may be inflicted. Hazard relates to occupational health stated in Lee (1991). It takes time for a disease arises from occupation in a hazardous environment. In Britain, 90% of the 100,000 chemical substances used at work are not tested for toxicity. Control of Substances Hazardous to Health Regulation (COSHH Regulation) enacted in 1988 in order to improve the awareness of health hazards from chemicals.

According to the Shorter Oxford English Dictionary (1995) the word accident was first recorded in the Middle English period. The Oxford Dictionary of English Etymology (1966) notes that the word accident was first recorded in the fourteenth century, in the writing of Chaucer, meaning 'something that happens'. Most dictionary definitions definition imply an element of change, for example 'an event in condition occurring by chance or raising from unknown or remote cause' Webster (1954). Hinze (1997) defined accident as an unplanned, undesirable and non-controlled event. An accident does not necessary result in an injury, it can also result in damage to equipment and material. Nevertheless, those accidents result in injuries could especially receive the greatest attention. The United States Department of Labour defines an accident as any unexpected or unforeseen occurrence that interrupts or interferes with the orderly progress of the activity in question." In Canada, the Workmen's Compensation Act, Ontairo (1970) defines an accident as "a chance event occasioned by a physical or natural cause." However, there is no general legal definition of an accident in Hong Kong. There is only specific definition of accidents in individual section. Under the Boilers and Pressure Vessels Ordinance (Chapter 56), an accident means "an explosion of a boiler in pressure vessel in any part of a boiler or pressure vessel and renders it liable to explode or collapse or is calculated to weaken it and renders it liable to explode or collapse". Although accident is not legally defined in Hong Kong, there is a related term under the Employees' Compensation Ordinance (Chapter 282). In the ordinance, it says reportable accident is one when injured or sustains fatal injury arising out of or in the course of his employment.

2.3 Accident Causation Model

Accident causation model is not a new model to identify the root problem of safety in construction and other industry. The objective of this model is to provide tools for better industrial accident prevention program (Abdelhamid and Everett, 2000). As described by Heinrich (1980) accident prevention is an integral program, a series of coordinate activities, directed to the control of unsafe personal performance and unsafe mechanical conditions, and based on certain knowledge, attitudes, and abilities. The famous models that were developed that relate to accident causation are namely domino theory that was invented by Heinrich in 1930 and multiple causation theory that was developed by Petersen in 1971.

2.3.1 Domino Theory

Accident causation model was pioneered by Heinrich in 1930, which discussed accident causation theory, the interaction between man and machine, the acts, the management role in accident prevention, the costs of accident, and the effect of safety on efficiency. Malaysian Journal of Civil Engineering (2008).

Heinrich developed the domino theory (model) of causation that consist of five dominoes namely ancestry and social environment, fault of a person, unsafe acts and condition, accident, and injury. This five dominoes model suggested that through inherited or acquired undesirable traits, people may commit unsafe acts or cause the existence of mechanical or physical hazards that result in injury (Abdelhamid and Everett, 2000). This theory has pointed two main things; first, people are the fundamental reason of caused accident. Most of the accident occurs are caused by wrong doer of the worker. Secondly, the management should be responsible for the accident prevention. The management should provide workers with safety facilities to prevent the workers from hazardous environment. Heinrich's domino sequence was a classic in safety and health thinking and teaching for over 30 years in many countries around the world. However, in the late 1960s the domino sequence was updated by Bird to reflect the direct management relationship involved with the causes and effects of all incidents and accidents, which could downgrade a business operation (Heinrich et al, 1980). The theory put forward by

Bird has the same concept of illustrated dominoes as Heinrich's but the five elements were different. Bird's updated domino elements are lack of control – management, basic causes – origins, immediate causes – symptoms, incidents – contact, and people – property – loss. Bird's approach has emphasized more on the management role to prevent losses. In addition to that, Adams (1976) and Weaver (1971) had also put forward the updated version of the domino theory. Adam had the same view as of Bird's but emphasized more on the organisational structure of the management. The objective of an organisation, how certain works were being planned and executed would certainly have an impact on accident prevention (Heinrich et al, 1980). Weaver had put forward the same concepts of elements or factors as of Henrich's. However, he stressed on the important to recognized the root of unsafe acts or conditions which eventually emphasized on bigger management roles in preventing accidents (Heinrich et al. 1980).

2.3.2 Multiple Causation Model

This model was presented by Petersen in 1971 that has totally different concept with the domino theory that influenced many researchers during Heinrich time. This model was inspired by his believed that many contributing factors, causes, and sub-causes are the main culprits in an accident scenario. Under this concept, the factors combine together in random fashion, causing accidents. By using multiple causation model, the surrounding factors to the accident would be revealed (Abdelhamid and Everett, 2000). The set questions will be used to identify the root causes of the accident. For example, for stepladder accident, the question would be "why the defective ladder was not found in normal inspection, why the supervisor allowed its use, whether the injured person knew that he should not use the ladder, and so on". The questions asked is not pointed only to the injured person, but also to the management, supervisor, and other person or department that relate to the accident. The answer of these questions could be used to identify the root cause of the accident, and also can be used as an improvement tools for inspections, supervisions, training, better definition of responsibilities, and pre-job planning by supervisors. Multiple causation model also pointed out that the root causes of accident normally relate to the management system such as management policy, procedure, supervision, effectiveness, training, etc. (Abdelhamid and Everett, 2000).

2.3.3 Human Error Theories

The approach of this theory is pointed to the worker as the main factor of the accident. This approach as mentioned by Abdelhamid (2000) studies the tendency of humans to make error under various conditions and situations, with the blame mostly fall on human (unsafe) characteristics only. But this theory does not blame the workers as the main problem for accident, other factors such as design of workplace and tasks that do not consider worker (human) limitation also take part as the reason why accident happened (Abdelhamid and Everett, 2000). In general, the overall objective of human error theory is to create a better design workplace, tasks, and tools that suitable with human limitation. There are some theory that related to the human error theory such as behavior model, human factor model, and Ferrel theory. Most of these theories address the human (worker) as the main problem that makes an accident happen such as permanent characteristic of human, the combination of extreme environment and overload of human capability and conditions that make human tends to make mistake (Abdelhamid and Everett, 2000).

2.3.4 Goals Freedom Alertness Theory

Goals freedom alertness theory was developed by Dr Willard Kerr. This theory regarded an accident as a low-quality work behavior. Accident is similar to production waste during manufacturing. If the level of worker awareness increases, the level of quality and safety rate arises also. According to Kerr, alertness can only be obtained within a positive the workplace climate. The more positive the workplace climate, the greater the level of alertness and work quality. As this state of alertness decrease, there is an increased Brauer, R L, 1990, *Safety and Health for engineers*, New York: Van Nostrand Reinhold probability of an accident. The goals-freedom-alertness theory states that safe work performance is the result of a psychologically rewarding work environment. Kerr believes that" great freedom to set reasonable attainable goals is accompanying typically by high quality work performance." He claimed that a climate 'richer' in diverse economic and non-economic opportunities will be associated with the achievement of a higher level of alertness. That alertness will result in high-quality work and accident-free behavior.

The essence of the theory is that management should let a worker have a well-defined goal and should give the worker the freedom to pursue that goal. The result will be that the worker focuses on the task that leads to that goal. The worker's attentiveness to the job will reduce the probability of being involved in an injury. In one study, Kerr (1950) concluded that more injuries in one firm occurred in the departments with the lowest intercompany transfer rates and those with the lowest promotion potential, he concluded that workers with little chance of transfer or promotion would develop attitudes of relative indifference to their work environment. The indifference would lead to lowered alertness and more accidents. There are two stages in this model, danger build-up and danger release. The danger builds up stage refers to a situation in which the possibility of injury is present. In the danger build-up stage, if danger warnings are perceived and recognized, and decision is made to avoid the danger and the person is physically able to avoid the danger, then the result will be no hazard. In the second stage, the accident has already occurred. The potential victim's response to this situation is determined by his or her perception of the imminent danger, decision as to how to respond. This model is useful for determining the source of human errors involved in accidents and helps to differentiate between errors arising as a result of lapses in concentration and those resulting from incorrect knowledge or errors of judgment.

2.3.5 Motivation Reward Satisfaction Model

This theory builds based on Dr. Willard Kerr's Goals Freedom Alertness theory. (Heinrich et al. 1980) stated "freedom to set reasons ably attainable goals is typically accompanied by higher quality work performance". If an accident occurs, according to this theory, it is due to alertness. Factors affect these variables will either promote or prevent accidents. Because motivation is influenced by multiple variables, for example job safety. Money or praise is not considered to be the primary motivation factors.

Rewards can be in form of doing a good job, learning new skills, expanding personal knowledge, and being a member of a successful team.

2.3.6 Human Factor Theory

The human factor theory is based on the concept that accidents are the result of human error. Factors that causes human error are: overload, inappropriate activities and inappropriate response. Overload means a person is burdened with excessive tasks or responsibilities. Inappropriate activities are usually due to not properly trained. Inappropriate response is resulted when an employee detects a hazardous condition but does not correct it.

2.3.7 Energy-release Theory

Accidents occur when energy is out of control which means putting more stress on a person or property than they can tolerate. The energy involved or changing the structure that the energy could damage. Haddon and Johnson focus on energy as the source of the hazard. By identifying the energy sources and preventing or minimizing the exposure, accidents will be prevented.

2.3.8 Accident-proneness Theory

This theory focused on personnel factors related to accident causation. It is assumed that when several individuals are placed in similar conditions, some will be more likely than others to sustain an injury. That sustaining an injury is not simply chance occurrence. Farmer and chambers (1929) defined accident proneness as "a personal idiosyncrasy predisposing the individual who possesses it in a marked degree to a relatively high accident rate." This theory has the underlying assumption that even when exposed to the same conditions, some people are more likely to be involved in accidents because of "their innate propensity for accidents" (Shaw and Sichel 1971). Dahlack (1991) referred to accident proneness as a personality trait. Since risk taking is not a permanent or fixed trait, accident proneness might then change over time.

2.3.9 Adjustment-stress Theory

The adjustment-stress theory states that safe performance is compromised by a climate that diverts the attention of workers. The theory was developed to explain the remaining variance to complement the goals-freedom-alertness theory. The adjustment-stress theory contends that "unusual, negative, distracting stress" placed on workers increase their "liability to accident or other low-quality behavior: (Kerr 1957). This theory states that negative factors in the worker's environment create diversions of attention and that the lack of attention can be very detrimental to safety. According to the adjustment-stress theory, the factors that divert attention and increase the probability of an accident may be brought to the job, or they may be generated on the job. The mental diversions created or generated on the job are of primary importance to managers, as it is the practices and policies of managers that are often the source of such on-the-site job stress. Such stress may arise from unrealistic demands placed on workers. The two common sources of such mental diversion include pressure to keep cost below some level that may not be realistic and pressure to meet an unrealistically tight deadline. Stress can be from the source outside the job e.g. family.

2.3.10 Distractions Theory

The distractions theory states that safety is situational. It is assumed that workers want to succeed in accomplishing their assigned tasks. The theory focuses on task achievement will stop once an injury occurs. According to this constraint, the worker has the greatest probability of accomplishing a given task when the worker's focus on the distraction is minimal. Conversely, the probability of task achievement is minimal when there is a high level of focus on the distractions posed by the hazards. Distractions theory simply points out that productivity is compromised when the distraction due to hazards is high. However, the attention paid to the hazard is a form of distraction. The way to improve the productivity is not to reduce the focus on the hazards, but to remove or reduce those hazards. Since the hazard is no longer posing a serious threat to the worker, the distraction is not as intense, and consequently task achievement is not compromised to any great extent.

2.4 Causes of Accident

Historical research on accidents in the construction industry concentrated on the analysis of data derived from existing (often compensation-based) accident reporting schemes, (see, for example, Culver, 1993; Hinze and Russell, 1995; Hunting et al., 1994; Kisner and Fosbroke, 1994; and Snashall, 1990). This approach was limited by incomplete and/or poor-quality data. For example, Daniels and Marlow (2005) suggest that the level of reporting of non-fatal construction injuries in the UK construction industry is as low as 46%. Studies by BOMEL (2001) and Gyi et al. (1999) revealed the quality of accident data collected by construction companies to be poor, limiting the ability for systematic analysis and identification of causes. The majority of early analyses of construction accident causation focused heavily on workers behaviours and attributes and the immediate surrounding circumstances of an accident. For example, Hinze (1996) identified worker distraction as a causal factor and Abdel Hamid and Everett (2000) reported training, attitudes and work procedures to be the predominant causes of construction accidents. Whittington et al. (1992) identified construction company headquarters, the worksite and individual workers to be the source of accident causes in the ratio of approximately 1:2:1.

Suraji et al. (2001) developed a model of risk factors for accidents in construction operations, distinguishing between problems with workers' actions, site conditions and construction practices (proximal causes), and linking these to project, contractor and process management influences (distal causes). The role played by distal factors is now well recognized in the analysis of construction accidents. For example, Priemus and Ale (2010) use James Reason's model to explain how the systemic failure of barriers at the design, construction, permitting, inspection and use stages of the Bos and Lommerplein estate project in Amsterdam, resulted in serious structural safety problems. Manu et al. (2010) similarly refer to proximal and distal factors in their development of a method by which to analyse the extent to which various construction project characteristics contribute to accidents. These characteristics include the nature of the project, the method of construction, the extent of physical site restrictions, project duration, design complexity, the extent and nature of subcontracting arrangements, the procurement system and the level of construction (high or low rise). Manu et al (2010) suggest that many of these characteristics can be traced back to the clients' brief, design decisions and project management decisions.

Building on the work of Rasmussen, Mitropoulos et al. (2005) developed a systemic model of construction accident causation, which posits that the construction activity and context characteristics combine to create hazardous conditions. At the same time, production pressures elicit efficient work behaviours. However, when efficient work behaviour and hazardous situations coincide workers are exposed to hazards. According to Mitropoulos et al. (2005), hazard exposures can be mitigated by workers' efforts to control conditions and/or a tendency for competent action. When hazard exposure coincides with human error and/or changed conditions the potential for an accident is present. The incorporation of construction activity and context characteristics, which include task unpredictability, is helpful in understanding construction accidents because they reflect the constantly changing construction site environment. Hale et al. (2012) adapted a Human Factors Analysis and Classification Scheme (HFACS), previously used in the aviation industry, to analyse the causes of construction fatalities. The HFACS framework adapted for construction classifies unsafe acts according to whether they are deliberate (violations) or errors and further subdivides each of these classifications. Thus, deliberate unsafe acts can be routine, situational or exceptional and errors can be rule-based, knowledge-based or skill-based. The framework identified preconditions that could give rise to these unsafe acts, as well as organizational and environmental influences which give rise to these preconditions. HFACS framework was then used in in-depth interviews with government health and safety inspectors to explore the causes of fatal accidents. The framework was found to be particularly useful in improving accident investigators' consideration of human and organizational factors. Garret and Teizer (2009) also developed a construction safety error analysis, educational, and classification tool. Accident don't just happen, they are caused. According to Ridley 99 per cent of the accident are caused by either unsafe acts or unsafe conditions or both (Ridley, 1986). As such, accidents could be prevented. The unsafe act is a violation of an accepted safe procedure which could permit the occurrence of an accident. The unsafe condition is a hazardous physical condition or circumstances which could directly permit the occurrence of an accident. Most accident results from a combination of contributing causes and one or more unsafe acts and unsafe condition. Accident theories and models discussed in the previous section have evolved from merely blaming workers, conditions, machineries into management roles and responsibilities. Nowadays, accident models are being used to better explain the causes of accident so that appropriate actions could be taken to make improvement. However, in order to effect permanent improvement, we must deal with the root causes of accident.

A review of the literature indicates that finding the factors and causes that influence construction accidents has been the passion of many researchers. Kartam and Bouz (1998) did a study in Kuwaiti construction and noted that the causes of accidents were due to worker turnover and false acts; inadequate safety performance; improper cleaning and unusable materials; destiny; low tool maintenance; supervisory fault; and Malaysian Journal of Civil Engineering (2008) misplacing objects. Abdelhamid and Everett (2000) conducted a more comprehensive study in the USA and classified the causes into human and physical factors. Human factors were due failed to secure and warn; Failed to wear personal protective equipment (PPE); horseplay; operating equipment without authority; operating at unsafe speed; personal factor; remove safety device; serviced moving and energized equipment; took unsafe position or posture; used defective tool or equipment; and other unsafe action. While, physical factors were due to; unsafe act of another person(s); disregard known prescribed procedures; defects of accident source; dress or apparel hazard; environmental hazard; fire hazard; hazardous arrangement; hazardous method; housekeeping hazard; improper assignment of personnel; inadequately guarded; public hazard; and other unsafe conditions.

Lubega et al (2000) did a study in Uganda and concluded the causes of accidents were mainly due to lack of awareness of safety regulations; lack of enforcement of safety regulations; poor regard for safety by people involved in construction projects; engaging incompetent personnel; non-vibrant professionalism; mechanical failure of construction machinery/equipment; physical and emotional stress; and chemical impairment. Pipitsupaphol and Watanabe (2000) did a study in Thailand construction sites and classified the causes into the most influential factors i.e. unique nature of the industry; job site conditions; unsafe equipment; unsafe methods; human elements; and management factors. They further concluded that major immediate causes were due to failure to use personal protective equipment; improper loading or placement of equipment or supplies; failure to warn co-workers or to secure equipment; and improper use of equipment.

Toole (2002) also did a study in the USA and suggested that the causes of accidents were due to lack of proper training; deficient enforcement of safety; safety equipment not provided; unsafe methods or sequencing; unsafe site conditions; not using provided safety equipment; poor attitude toward safety; and isolated and sudden deviation from behavior. Tam et al (2004) did a study in China and noticed that the causes of accidents were due poor safety awareness from top leaders; lack of training; poor safety awareness of project managers; reluctance to input resources for safety; reckless operation; lack of certified skill labor; poor equipment; lack of first aid measures; lack of rigorous enforcement of safety regulation; lack of organizational commitment; low education level of workers; poor safety conscientiousness of workers; lack of personal protective equipment (PPE); ineffective operation of safety regulation; lack of technical guidance; lack of strict operational procedures; lack of experienced project managers; shortfall of safety regulations; lack of protection in material transportation; lack of protection in material storage; lack of teamwork spirits; excessive overtime work for labor; shortage of safety management manual; lack of innovative technology; and poor information flow.

2.5 Risk of Construction Accidents

Accident can be defined as unexpected, undesirable, and uncontrolled situation that can result in lost to humans, property and the environment (Suraji, 2000). In construction project context, the accident of construction project is an accident which is related to work of workers working at construction projects; the accident includes accident that occurs on the way to workplace from home or vice versa (PT. Jamsostek).

Occupational accident is caused by the low are the lack of safety program (Rowlinson, 2003). According to Davies and Tomasin (1990), safety is a hazard risk free, including physical injury and health damage risk for a period of time. Davies (1990) concluded that work safety in civil engineering context is a way to maintain the safety of someone who is building, operating, maintaining, devastate, and other technical works. Hinze and Haslam in Kamardeen (2009), suggested occupational accident that frequently Proceedings of the 4th International Conference on Engineering, Project, and Production Management (EPPM 2013) occurs in construction project involved some types of accidents defined into eight categories.

- *Falling from height* - involves workers falling from higher floors to lower floors/ground level, and falling from ground level to excavation level.
- *Struck by falling object/ moving vehicles* – primarily involves workers being struck by equipment, private vehicles, falling materials, vertically hoisted materials and horizontally transported materials,
- *Excavation-related accident* – encompass cave-in, contact with underground utilities, subsidence of nearby structures, falling of materials/vehicles/objects on to people working in the excavation, fumes, gases, and inrushes of water at the bottom of excavations.
- *Accident by operation of machinery/ tools* – caused by toppling of machinery, collapse of the parts of machinery, and unsuitable or unsafe hand-held tools.
- *Electrocution* – caused by contact with electric current from machines, appliances, light fixtures, faulty electrical equipment and tools, and contact with overhead/underground power lines.

- *Fire/ explosion* – resulting from explosion of pressure vessels or gasoline pipes, and fire due to welding/hot works
- *Failure of temporary structures* – involves the failure or form works and scaffoldings.
- Others – e.g. slipping on the same level, oxygen deficiency in confined spaces, lightning strike, etc.

Previously, a prior study on factors leading to occupational accident based on safety perspective has been done. Tam et al. (2004) concluded the risk-prone activities on construction sites, and highlighted factors effecting construction site safety. The study concluded that the commitment of contractors to safety were of grave concern, including lack of training, lack of certified skill labor, low education and lack of provision of personal protection equipment. Zou and Zhang (2009) conducted comparative study on the perception of construction safety risks in China and Australia. This study perception of safety risk factors included five issues which are legal and regulatory issues, education and training related issues, employee related issues, technical issues and organizational management related issues.

The study results revealed that the main perception of safety risks of construction industry in China came from human and/or procedure related issues, with "low/no safety education" paramount, followed by "inadequate fire prevention and electrical prevention procedures," etc. In contrast, the major safety risks perceived in Australia were related to the environment and physical site conditions with "contamination of land, water and air" ranked first, followed by "unforeseen excavation of soil," etc. To minimize construction safety risks in China, this paper suggested that the government should develop collective legislation and safety protection procedures, and enforce safety education and training to all site participants. Risks related to Proceedings of the 4th International Conference on Engineering, Project, and Production Management (EPPM 2013) environmental and site conditions were generally realized by the Australia construction industry, which were not highly acknowledged in China. This may also bring imminent attention in this regard to the Chinese government.

A contractor company, as the main executor of the construction project, is required to enforce carry out the project safely. Based on the ownership, there are some kinds of construction companies in Indonesia. They are:

- Private companies are companies which capital is wholly owned by the private sectors and there is no government intervention. There are three kinds of private company, there are three kinds, namely:

Private company, a private company owned by the State Indonesia;

Foreign private companies, a private company owned by foreign nationals, and

Mixed private company (joint-venture), a private company owned by the state Indonesia and foreign nationals.

2.6 Cost of Accidents

There are both direct cost and indirect cost of accidents. Direct costs of accidents are those directly attributed to or associated with injuries. Direct costs include cost of ambulance service, medical and ancillary treatment, medication, hospitalization, disability benefits and lost wages of injured workers. These costs are usually covered by workers' compensation insurance policies. Compensation to the injured workers is also one of the costs to the company. Since an accident not only implies personal injuries, loss due to the damages of equipment or material is also one of the direct costs of accidents.

Indirect cost of accident is usually related to the loss of productivity and added administrative effort. Productivity will be immediately affected once accident occurs. A study of 582 medical case injuries, the lost productivity of the injured worker on the day of the injury was 3.7 hours. An additional 8 hours of productive work would be lost, due to the injury of the worker after the day of accident. Upon returning to work, it was further estimates that the worker might not be as productive as was he did before the accident occurred. Furthermore, the crew would be affected by the injured worker who was receiving treatment. Firstly, the crew is forced to work shorthanded. Obviously, this results less drops of productivity of the crew. Secondly, the supervisory personnel like site manager and safety manager will be responsible to ensure that treatment for the injured worker is promptly acquired. It was estimated that approximately 2.7 hours of supervisory time were consumed for each of accident.

Table 2.1: Summary of Indirect Cost Related to Medical Case Injuries

Involved Parties	Indirect Cost
Injured Worker	3.7 productive hours on the day of injury
	8 productive hours subsequent to the day of injury
Transporting the Worker	3 productive hours on the day of injury
	3 hours of vehicle time and millage
Crew Cost	12 hours lost by reduction of a crew from 5-4
Workers Idled by Watching	5 hours of other workers time
Damaged Material	2 hours of work time to repair
	2 hours of work time to restore work condition
Replacement Worker	0.06 hours loss of productivity
Supervisory Time	2.7 hours to assist injured worker
	1.5 hours to investigate the accident
	1 hour to complete the report

Source: Hinze, 2000

One of the papers written by Heinrich (1941) listed the following indirect costs:

- cost of lost time of injured worker
- cost of lost time of other workers who stop work
- cost of time lose by foreman, supervisors, or other executives
- cost of time spent on the case by first-aid attendant and other staff
- cost due to damage to equipment, tools, property, and materials
- incidental cost due to interference with production
- cost to employer under employee welfare and benefit system
- cost to employer for continuing wages of injured worker
- cost due to loss in profit due to reduced worker productivity
- cost due to loss in profit due to idle equipment
- cost incurred because of subsequent injuries partially caused by the incident

- cost of overhead (utilizes, telephone, rent, etc.)

Since accidents are associated with undesirable cost, both direct and indirect costs, it generated another terminology: the cost of safety. The cost of safety are those cost incurred as a result of emphasizing safety issue, including personal protective equipment and safety programme. Construction practitioners usually focus only on the cost of safety rather than the cost of accident. They ignore safety issue to reduce the cost of safety. However, the direct and indirect cost of accident may override the cost of safety, which result a greater lost suffered by the company.

2.7 Safety Management

Rowlinson (2003) regards safety as an integral part of the management process of a construction project. In order to achieve safety working environment, safety management system is essential.

Planning

Planning is the process of determining in advance what should be accomplished. At this stage, the contractor is required to identify in advance what safety and health objectives should be accomplished by a safety management system as appropriate under the Safety Management Regulation. Then, the contractor has to prioritize the safety and health objectives and determine the ways and means to achieve them. In order to identify the objectives, the contractor should conduct an initial status analysis of the existing arrangements for managing safety and health. Performance standards and periodic status analyses should be established and conducted in order to monitor the performance of the safety management in operation. Furthermore, risk assessment should also be carried out to decide on priorities and objectives for hazard elimination and risk control. The two major considerations in assessing "risk" are the severity of the hazard and the probability of loss/ injury caused by the hazard. Based on the results of the assessment, it is possible to establish the business policy with the lowest risk.

The five steps of "risk assessment" are as follows:

- Identify the hazard in the workplace and in the nature of the work, estimate the severity of the hazards and the probable losses / injuries that they will bring, then determine the level.
- Estimate the degree of probable loss of life and property
- Evaluate whether the existing precautions are sufficient to eliminate the "risk" or reduce it to minimum to avoid losses/ injuries or death, or whether safety measures should be enhanced
- Recorded the results of each assessment including precautions already adopted or required to be enhanced, and inform all employees on the findings
- Conduct regular review of the assessment and revise when necessary

Developing

After planning the appropriate safety management system, the next step is developing. Developing is the process of determining how the safety and health objectives should be realized. At this stage, the contractor is required to define, document and endorse a safety policy to spell out the safety and health objectives identified at the planning stage. The policy should include a commitment to achieve a high standard of occupational safety and health in compliance with legal requirements and trade practices for continuous improvement. Adequate resources should be provided to implement the policy. An effective safety plan should be prepared for carry out the safety policy. In the safety plan, clear direction and series of action should be clearly stated and clear guidance should be provided for managers and workers to work together to achieve the objectives of the safety policy.

2.7.1 Implement a Safety Management System

The implementation of a safety management system involves organizing and implementing.

2.7.1.1 Organizing

Organizing means that prescribing formal relationships between people and resources in the organization in order to achieve objectives. At this stage, the contractor should ensure all employees have the necessary authority to carry out their safety and health responsibility and to make arrangement for employees at all levels to take part in safety and health activities.

2.7.1.2 Implementing

Implementing is the process of carrying out or putting into practice the plans to achieve the desired objectives, with appropriate and adequate control to ensure proper performance in accordance with the plans. The contractor should determine and execute operation plans to control the risks identified and to meet the legal requirement as well as other requirements regarding safety management. Adequate and effective supervision should be provided to ensure that the policies and plans are effectively implemented.

2.7.2 Maintain a Safety Management System

Maintenance of a safety management system involves measuring and auditing or reviewing, thus the contractor can know whether the safety management system is working well or needs improvement, therefore maintaining the system in an efficient and effective state.

2.7.2.1 Measuring

Measuring means that checking performance against preset standards in order to find out whether improvement is needed. The measuring stage provides a “feedback loop” for the stages of development and implementation of a safety management system and help to reinforce and maintain its ability to reduce risk and to ensure the continued efficiency, effectiveness and reliability.

2.7.2.2 Auditing/ Reviewing

Apart from routine monitoring the occupational safety and health performance, auditing or reviewing is essential to assess the performance of the system. Safety audit and safety review includes collecting, assessing and verifying information on the efficiency, effectiveness and reliability of a safety management system. Auditing or reviewing constitutes the “feedback loop” to the planning stage which reinforce, maintain and develop ability to reduce risks and ensure the continued efficiency, effectiveness and reliability if the safety management system. In addition, there should be information flowing between the development, implementation and maintenance stages and the auditing or reviewing stage so as to ensure the correct operation of the safety management system.

2.8 Summary of the Literature

In construction projects in Indonesia, accident risks at state companies and private companies are higher than those at foreign private companies. It suggests that the projects which were carried out by state companies and private companies are high risk accident. Factors which are mostly included in high risk accident category, both at state-owned companies and nationwide private companies, are equipment factors, followed by environment factors, human factors, and organizational factors. Whereas, management factors are considered medium risk accident. This reveals that the preceding factors become the priority of occupational accident prevention efforts. Whereas, human factors and organizational factors are medium risk accident, and environment factors, equipment factors and management factors are low risk accident for foreign private companies. The issues need to get priority in accident prevention in Indonesia construction projects include most of the factors such as “lack of safety equipment specifications”, poor working surfaces and platforms”, “low education level of workers”, “lack of organizational commitment”, and “Low/no safety resource”.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes and discusses the research methodology used to accomplish the research objectives proposed in Chapter one. It starts with a brief overview of the research objectives. Following this, the selection of a positivist paradigm is discussed and, more specifically, the research strategy used for this study is explained. This chapter also outlines the selection process of population and sample size used in this research study. It also describes the data collection process, explains the structure and development of the research questionnaire and provides a brief overview of ethical considerations that were addressed in this research. Finally, the data analysis method for this study is discussed.

3.2 Study Area

The Northern Region is one of the ten regions of Ghana. It is located in the north of the country and is the largest of the ten regions, covering an area of 70,384 square kilometers or 31 percent of Ghana's area. The Northern Region is divided into 26 districts. The region's capital is Tamale.

The Northern Region is bordered on the north by the Upper West region and the Upper East region, on the east by the eastern Ghana-Togo international border, on the south by the Black Volta River and the Volta region, and on the north-west by the Upper West region and Burkina Faso, and on the west by the western Ghana-Ivory Coast international border. Northern region is the largest region in total area, and is made up of 26 districts.

The Northern Region is much drier than southern areas of Ghana, due to its proximity to the Sahel, and the Sahara. The vegetation consists predominantly of grassland, especially savanna with clusters of drought-resistant trees such as baobabs or acacias. Between January and March is the dry season. The wet season is between about July and December with an average annual rainfall of 750 to 1050 mm (30 to 40 inches). The highest temperatures are reached at the end of the dry season, the lowest in December and January. However, the hot Harmattan wind from the Sahara blows frequently between December and the beginning of February. The temperatures can vary between 14 °C (59 °F) at night and 40 °C (104 °F) during the day.

More than 75% of the economically active population are agricultural. The low population density is partly caused by emigration, in addition to geography and climate. The Northern Region has a low population density, and, along with the official language of English, most inhabitants (52%) speak a language of the Oti–Volta subfamily in the Niger–Congo language family, such as Dagbani, Mamprusi or Konkomba. The Dagbon Kingdom, of the Dagomba people, is located in the region.

3.3 Research Design

Durrheim and Painter (2006: 36) define research design as a “strategic framework, a plan that guides research activity to ensure that sound conclusions are reached. This involves plans for data collection, the instrument for gathering information, how information gathered would be processed and analyzed to give meaning to the research findings. Gwimbi and Dirwai (2003) defined a research design as a structure or plan of the research which provides glue that holds a project together, groups or samples, observations or measures, programmes or treatments and other aspects of methodology.

The research design used for this study is quantitative approach. Investigative research is a method of knowledge generation that integrates two truth-seeking traditions. One is investigative journalism, an outstanding example of which was the investigation of Watergate by Carl Bernstein and Bob Wood-ward. Using this example, M. Levine (1980) argues for greater use of investigative reporting as a research method. The other falls under the rubric of field research, ethnography, case study, and so forth in social science. Investigative research has the advantage of bringing the investigator to observe closely and directly the phenomenon of interest. Although it does not preclude other techniques for gathering data, investigative research tends to rely on disciplined, naturalistic, and in-depth observations over a time span in diverse contexts. It is particularly suitable for uncovering, understanding, and reporting social phenomena that may be hidden from or not easily accessible to observers.

3.4 Population of the Study

A population is defined as all elements (individuals, objects and events) that meet the sample criteria for inclusion in the study (Basil 2003). The study population consisted of site managers and project managers.

3.5 Sampling Technique and Sample Size

Sampling is the process whereby a researcher chooses his/her sample. This involves the statistical method of obtaining representative data or observations from a group. This was done in a predetermined manner (Saunders et al, 2007). Sampling technique provides a range of methods that enables you to reduce the amount of data you need to collect by considering only data from a sub group (known as a sample), rather than all possible cases or elements (Saunders et al, 2007). The purpose of taking a sample is to obtain a result that is representative of the whole population being sampled without going to the trouble of asking everyone.

Purposive sampling technique was used to select the survey respondents and the related respondents because it seeks to get all possible cases that fit particular criteria (Lindet al, 2005). According to Nwana (1992) and Saunders (1990), if the size of the population is a few hundreds, a 40% or more sample will do; if several hundreds, a 20%; if a few thousands, 10%; and if several thousands, 5% or less sample size will do. Based on the above-cited criteria, 40% of the required and needed respondents were chosen. (Refer to table 3.1).

Table 3.1: The number of contractors

Distract	Number of Contractors	%
Tamale Metro	20	57
Yendi Municipal	9	26
Savelegu	6	17
Total	35	100

3.6 Data Collection

The data for this study was gathered through the use of primary and secondary data sources.

3.6.1 Primary Source

The primary data refer to data consisting of data and information obtained by the researcher directly from the case study through semi-structured interview guide, to site managers and project managers, these semi-structured interview guide provided accurate answers to the research questions of this study.

3.6.2 Secondary Source

The secondary data consist of literature materials by well-known writers and authors in the field of construction accidents and other related topics. Information was gathered from published sources, (books, articles and course literature with useful information for the study), the internet and some information on construction accidents.

3.6.3 Data Collection Instruments

According to Creswell (2005) no single technique or instrument may be considered to be adequate in itself in collecting valid and reliable data. Therefore, two major tools were used to obtain adequate and reliable information for this study. These include interviews and questionnaires of both structured and semi-structured nature. This study used data collection tools which involve observation, interview and questionnaires. According to Kothari (2004), a questionnaire is a method of collecting data which uses a set of questions for collecting data. In this method data are collected with the help of questions. Through this method, selected respondents of this study had to answer questions on their own and bring back to the researcher. Both structured and semi structured questions were used in helping the researcher to get answers and relevant information from respondent.

3.7 Data Analysis Procedure

The answered questionnaires and interview sheets were grouped according to the categories of respondents. Questionnaires for each category of respondents were numbered serially to ensure easy coding, checked for blank options and out of range responses. The coded responses were fed into the computer using the Statistical Product for Social Sciences (SPSS version 16.0) for Windows which is capable of analyzing data fed into it. The data was then summarized into tables and figures using descriptive statistics. Specifically, the study used frequencies and percentages.

3.8 Ethical Consideration

As this study require the participation of human respondents, certain ethical issues were addressed. The consideration of these ethical issues is necessary for the purpose of ensuring the privacy as well as the safety of the participants; this is because in Ghana most information that comes to the public is different from what is actually happening on the ground. Among the significant ethical issues that were considered in the research process included consent and confidentiality. In order to secure the consent of the selected participants, the researcher relayed all-important details of the study, including its aim and purpose. By explaining these important details, the respondents were able to understand the importance of their role in the completion of the research. The confidentiality of the participants was ensured by not disclosing their names or personal information in the research. Only relevant details that helped in answering the research questions were included.

Chapter Summary

The chapter provided information on the research strategy, the research population and sample size, limitation of the study, data collection, procedures and the data analysis techniques used.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

The aim of the study was to examine risk factors in accidents at construction sites at the Northern Region of Ghana. The specific objectives of the study were to identify the risk factors in accidents in construction site in Northern Region. Secondly, identify the key types of accidents on construction site in the Northern Region and thirdly examine measures that can help eliminate or reduce the frequency of risk factor accidents at construction site in the Northern Region. The analysis of the study was based on these research objectives. This was to bring in some coherence and consistencies in handling the data that was collected from the sampled population.

4.2 Response Rate

The researcher sent a total of 42 questionnaires to gather information from the respondents. Out of 42 questionnaires sent out for primary data, 35 questionnaires were received while 7 questionnaires were not received. therefore, the analysis of the study was based on 83% response rate (see Figure 4.1).

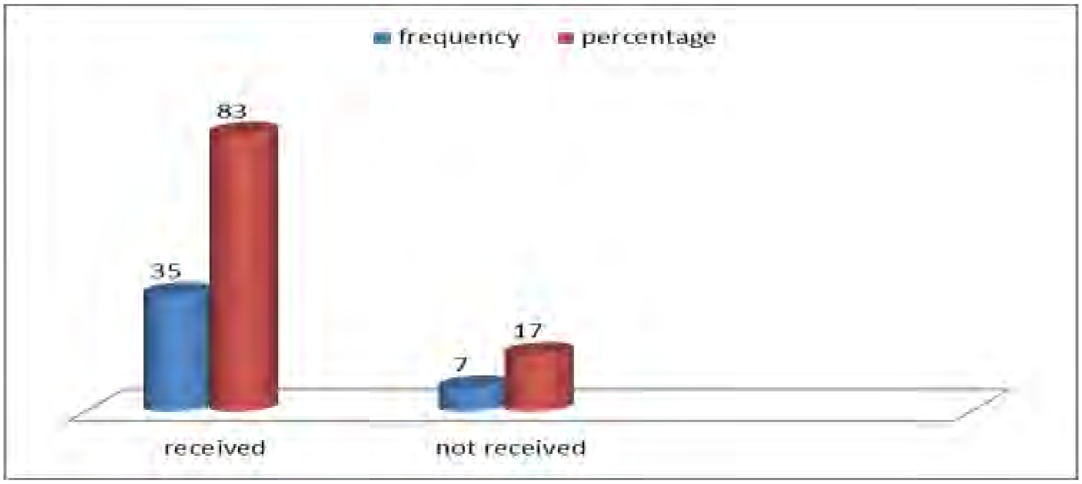

Figure 4.1 Response rates of questionnaires

4.3 Demographic Characteristics of Respondents

Every research result must have an introductory background of analysis involving the demographic characteristics of the respondents involve in the results. This is to show the faces of the respondents as to how the socio-economic backgrounds of the respondents are. These socio-economic backgrounds indicate the cultural and gender issues of the respondents involved in the findings. The cultural issues of the respondents are a cross-sectional issue that includes their occupation, religion, marital status among others while the gender issue involves the gender characteristics of the respondents of the respondents which include both male and female. No research results will ever be complete with the socio-economic characteristics of the respondents. Major research findings pay quality attention to the background information of the respondents or the demographic characteristics of the respondents. This is to give the results a fair indication of the analysis as how these characteristics will affect the entire project. The positioning of the entire results is very significant since the demographic characteristics or the background information has an impact and effect on the analysis.

4.3.1 Gender of Respondents

The entire results must border on gender issues since these characteristics of the respondents play a major role as to the structure of the questionnaire should be. It also affects the asking of the questions when applying the interview guide. In furtherance of the entire work, the gender issue must ensure a fair balance of the responses from the respondents. The gender issue gives a clearer overview of the entire analysis since the research itself involves human beings. These beings must be categorised in order for the findings to be fair and the responses being precise in terms accuracy. From the findings of this study, the gender issues play a major role since it involves the educational sector where gender issues are very critical. Gender issue is very critical because, the construction sector employs a fair balance of gender equality as it major employees. Males and females are employed in the construction sector but the male employees are more. These research results considered all other factors involving gender issues in the construction sector before furthering the findings itself. Figure 4.2 shows that thirty-four (34) of the respondents were males representing 97% while one (1) respondent representing 3% was female.

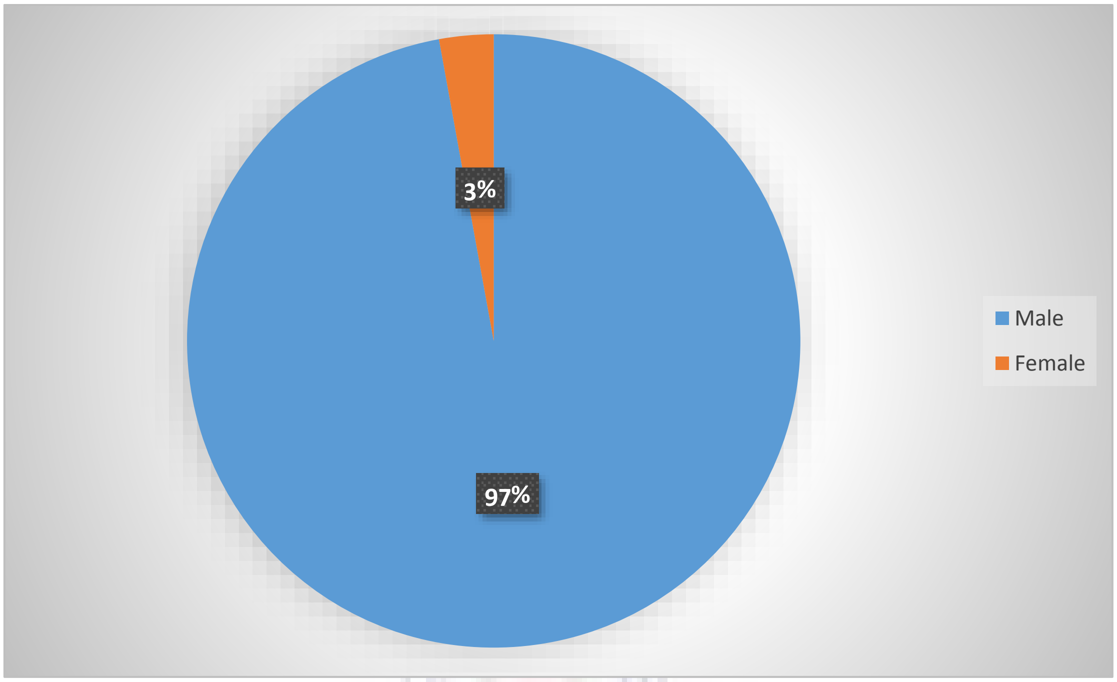

Figure 4.2: Gender Distribution of Respondents

Source: Field Work, 2018

4.3.2 Age of Respondents

Critical to any research findings is the age of the respondents. The age of the respondents plays an important role in the research because it helps the researcher to know the means to structure the questionnaire and know how to conduct the interview. Since the ages of the respondents are not always known, it is always important that the researcher assumes his respondents within a bracket of age category. Very relevant to this study, the research findings categorise the age of the respondents within a certain frame of importance. From Figure 4.3 the study observed that two (2) respondents representing (6%) were less than the age of 25 years while one (1) respondent representing (3%) were within the ages of 25-30 years. twelve (12) respondents representing 34.% were within the ages of 31-35 years whiles five(5) respondents representing 14% were within the ages of 36-40 years.

Five(5) respondents representing 14% were within the ages of 41-45 years whiles two(2) respondents representing 6% were within the ages 46-50 years. Four (4) respondents representing 11% were within the ages of 51-52 years while five (3) respondents representing 9% were within the ages of 56-60 years. One (1) respondents representing 3% were within the age of sixty years and above as illustrated in figure 4.3.

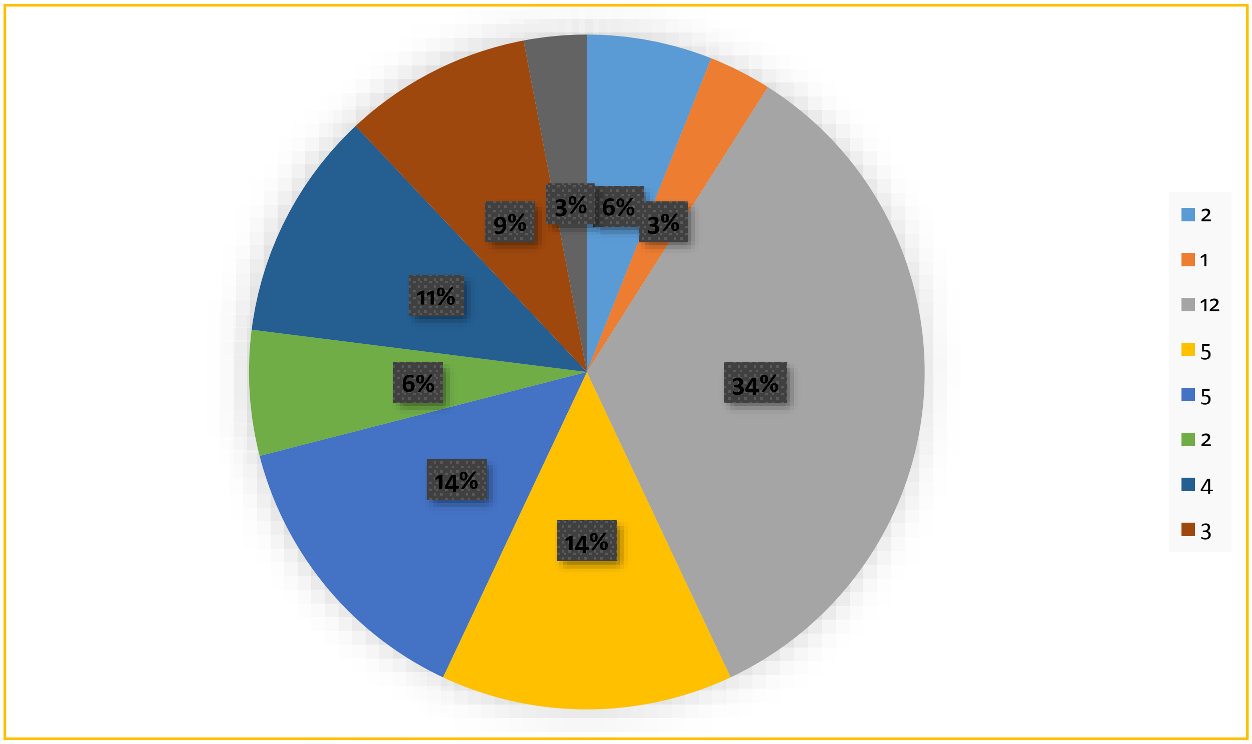

Figure 4.3: Age Distribution of Respondents

Source: Field Work, 2018

Table 4.1 indicates that 13 respondents representing 37% affirmed that they have more than 10 years working experience, 9 respondents representing 26% have 6-10 years working experience, 8 respondents representing 23% have 1-5 years working experience while 5 respondents representing 14% have less than 1 year working experience.

Although the government has put great effort of education and training the work with safety related courses in co-operate with different parties, the effectiveness of these training facilities is quite limited due to a few reasons. The number of people who benefit from the course is relatively small. Most construction workers learn their skills through on the job and relatively few learn about construction safety. Low education level of workers results in workers may not assimilate safety messages spread by the Labour Department. Tight working schedules lead to reluctance to release site foremen and workers to and attend safety training courses.

Education and training level are the human factors affecting the accident rate as mentioned in the Human Factor Theory. The theory pointed out that accidents are the result of human error, and improper training is one of the human errors. Besides, Bird and Loftus' Domino theory also stated that lack of knowledge or skill is one of the personal factors creating the basic cause of accidents. Due to the short and rush construction period and tight budget in construction works, some semi-skilled or not well-trained workers may involve in the construction. Table 4.1 shows the experience of the respondents.

Table 4.1 Experience of Respondents

Working experience of respondents	**Frequency**	**Percentage**
Less than 1 year	5	14
1-5 years	8	23
6-10 years	9	26
More than 10 years	13	37
Total	**35**	**100**

N=35, Source: Field survey, 2018

Table 4.2 shows that 13 respondents representing 26% fell from height and were injured, 12 respondents representing 24% slipped, tripped and fell on same level, 7 respondents representing 14% had a contact with moving machinery or object being machined, 4 respondents representing 8% stroked against fixed or stationary objects, trapped by collapsing or overturning object, and injured whilst lifting or carrying objects. The top two killers in construction works are "fall of person from height" and "contact with electricity or electric discharge". Fall of person, improper manual handling and poor housekeeping have accounted for a significant percentage of industrial accidents in construction works.

These results are in agreement with Lee (1996), fall of person from height is the top killer in the construction industry. In contributes from 32% to 63% of the fatal accident toll between 2012 and 2016. The statistics also shows that the deceased person fell from bamboo scaffolds, working platforms/false-works or unfenced dangerous places in nearly half of the fatal cases. According to Lee (1996), experience has shown that the chance of having a fatal injury when falling through a distance of two meters is very high. When a worker has to work above two meters from the foot-hold surface, he is regarded as working at height.

Maintenance workers are likely electrocuted when carrying out repairing work. The cause of electrocution is mainly due to the poor insulation of electric wire and the unearthed metal casing. Once leakage current flows from the accidentally energized metal casing of the electric applicants and then passed through the worker's body to the earth, the workers will receive an electric shock. In addition, there are a few other reasons causing electrical hazard, for instance electrical installation and equipment are not properly inspected and regularly maintained; improper connection of electrical equipment. Illustrated in table 4.2 below.

4.4 Types of Construction Accidents

Table 4.2: Types of accidents in construction site

Types of Accidents	Number (Percentage %)	
	Fatal	Non fatal
Fall of person from height	2 (14)	13(26)
Contact with electricity or electric discharge	1 (7)	3(6)
Contact with moving machinery or object being machined	1 (7)	7(14)
Trapped by collapsing of overturning object	- ( )	4(8)
Striking against or struck by moving object	1(7)	4(8)
Striking against fixed or stationary object	1 (7)	3(6)
Injured whilst lifting or carrying	2(14)	4(8)
Slip, trip or fall on same level	6(43)	12(24)

Source: Field Work, 2018

4.4.1 Rate of Accidents at the Construction Site

Maintenance and repair works are now under the spot light of the society. There is a growing concern for the increased accidents at construction sites. Statistics shows that the number of industrial accidents arising from construction sites contributed over 30% of the accident toll in the construction industry in recent years.

Table 4.3 indicates that in 2012 11,925 workers reported construction accidents as against 9,206 in 2013, 6,239 in 2014, 4367 in 2015 and 3833 in 2016. This means that within the 5 years period construction work-site accidents reduced by 8,092. However, in the subsequent years it has been indicated an increasing in construction site accidents for the past five years. An upward increase in construction site accidents indicates poor safety measures and supervision introduced in our construction site by site managers. Poor construction regulation is another challenge leading to construction accidents. Table 4.3 shows that below.

Table 4.3: Rate of accidents in construction site

Rate of accidents	2012	2013	2014	2015	2016
All reported construction accidents	11,925	9,206	6,239	4367	3833
Accidents rate per 1,000 workers	149.8	114.6	85.2	68.1	60.3
All reported accidents in construction works	3,401	2,582	1,925	1,485	1,454
Number of reported accidents in construction works in Public sector sites	475	331	250	158	104
Number of reported accidents in construction works in private sector sites	2,927	2,251	1,675	1,327	1350
Percentage of construction accidents to all reported accidents	28.5%	28.0%	30.9%	34.0%	37.9%

Source: Field Work, 2018

4.5 Risk Factors in Accidents in Construction Site in Northern Region

Table 4.4 assessed the risk Factors in Accidents in Construction Site in Northern Region Table 4.4 revealed that most of the respondents agreed that working at height is a factor risk factor that influences accidents in construction sites with a mean score of 4.285 and standard deviation of 0.811 (ranked 1st). Moreover, working under the influence of drugs also contributes to accidents in the construction sites with a mean score of 4.0 and standard deviation of 0.709 (ranked 2nd). Also, lack of training also influences accidents at the construction sites with a mean score of 3.8 and standard deviation of 0.994 (ranked 3rd). Furthermore, low level of illiteracy contributes to workplace accidents with a mean score of 3.6 and standard deviation 1.067 (ranked 3rd). To add more, some respondents disagreed that low level of education or illiteracy influenced workplace accidents with a mean score of 2.08 of standard deviation 1.274 (ranked 4th). Finally, the respondents disagreed that personal ambition contributes to workplace accidents in the construction sites with a mean score of 2.032 and standard deviation of 1.306 (ranked 5th).

These results are in agreement with Hassanein and Afify (2007), they indicated that the risk factor in construction business is very high. Construction objects are unique and built only once. Construction objects life cycle is full of various risks. Risks come from many sources: temporary project team that is collected from different companies, construction site, etc. Moreover, the size and complexity of construction objects are increasing which adds to the risks. This is in addition to the political, economic, social conditions where the object is to be undertaken. Object risk can be defined as an uncertain event or condition that, if it occurs, has a positive or negative effect on at least one project objective, such as time, cost, and quality. The risks cause cost and time overruns in construction projects. Risk management is activity process about defining sources of uncertainty (risk identification), estimating the consequences of uncertain events/ conditions, generating response strategies in the light of expected outcomes and finally, based on the feedback received on actual outcomes and risks emerged, carrying out identification, analysis and response generation steps repetitively throughout the life cycle of an object to ensure that the project objectives are met. Risk management in construction is a tedious task as the objective functions tend to change during the object life cycle.

Risk management processes of construction project describe the work of all project life cycle. The risk assessment problem is analysed by many authors. Proper risk allocation in construction contracts has come to assume prominence because risk identification and risk allocation have a clear bearing on risk handling decisions. Hassanein and Afify (2007) analysed risk identification procedure for construction contracts. Albert et al. (2008) pointed on the investigated risk assessment. El- Sayegh (2008) presented risk assessment and allocation problem, Han et al. (2008) described web-based integrated system, Gao (2009) presented strategies with the adjustment. Graves and Ringuest (2009) analysed probabilistic dominance criteria for comparing uncertain alternatives. Lahdelma et al. (2009) investigated uncertainties in multi-criteria decision problems. Cost-effective solutions that meet the performance-life costing is being adopted. The risk management in construction object's life cycle stages can be divided into: macro, meso and micro levels. The result is illustrated in the form below.

Table 4.4: Risk Factors in Accidents in Construction Site Distribution of Respondents

Risk Factors	Frequency N	Mean	Standard Deviation	Ranking	Comments
Working at height	35	4.285	0.811	1st	Agree
Worker being under the influence of drugs	35	4.0	0.709	2nd	Agree
Lack of training	35	3.8	0.994	3rd	Agree
Low level of illiteracy	35	3.6	1.067	3rd	Agree
Low level of education or illiteracy	35	2.08	1.274	4th	Disagree
Personal ambition	35	2.032	1.306	5th	Disagree

N=35, Source: Field Work, 2018

4.6 Interviews Responses on Safety Practices

The study into the critical risk factors accident causation in the construction site could not be completed with engaging physically with those involved. The questionnaires introduced both theoretical and applied mode of issues on the ground while the interview guide produced the actual responses from the technical point of view. Those engaged in the interview were the technical personalities who are responsible with the day to day activities at the construction site. Their views and responses were very critical and relevant to the problem under study. From the interview guide, the responses from these technical personalities are considered below.

4.6.1 Interview with A- The Industry Workers Union

A is the representative of the Industry Workers Union which is affiliated to the Ghana's Trade Unions.

A representing the voice from worker, commented that "*the insurance scheme is not effective in protecting the safety of workers. Contractor company only required to buy labour insurance for its employees. In order to minimize the cost on insurance, some company will force workers to be entitled as self-employed. Therefore, these workers cannot enjoy the protection of the insurance scheme. In addition, A also pointed out that these workers are usually poorly educated and trained, many of them even without any certification e.g. green card or silver card*".

A pointed out that "*high level of subcontracting is one of the big reasons explaining the poor safety performance in Ghana's construction industry. He illustrated the situation with a real case. A client wanted to do some repair and maintenance work for his home, including repair the aluminum window frame. A worker fell of height when he was removing the scaffolding, and died. The client employed a maintenance company, the company subcontract the project to B company to repair the window, B company subcontract to C company to dismantle scaffolding. The worker is employed by company C and entitled as self-employed. The family of the deceased worker sues the client. Responsibility cannot be well determined, and some sub-contractor may close down and escape from legal responsibility. In regard of the protection of workers, A mentioned that the industry has urged the government to develop a fund for central accident claim*".

4.6.2 Interview with Mr. XYZ- Ghana Builders Association

Mr. XYZ is the Secretary General of the Ghana Construction Association. He is a professional civil engineer with more than 20 years' experience in the industry. Mr. XYZ commented that "*although the accident rate in Ghana construction industry is keep dropping, the accident rate is still very high. In the past, the accident is unacceptable, which is more than 300/1000workers. In 2006, the accident rate drops to 59/1000 workers. Nevertheless, when comparing with other developed countries, the accident rate in Ghana is still very high. However, Mr. XYZ also pointed out that numbers may not reflect the real situation".*

The definitions of accident rate in different countries are different. Some foreign countries only take into account the local workers not immigrated workers. In Ghana, the coverage of the definition is quite wide.

When being asked about the increasing accident rate in construction works, Mr. XYZ revealed that "*there was no actual figure for number of accidents in construction works in the past. So, it is difficult to say whether there is an increasing trend. Mr. XYZ also pointed out that accident is usually analysis by activities, e.g. fall from height. However, the working environment may be different for each case. For instance, two cases of fall from height, one occurs when installing windows in new construction work, another one occurs when installing windows in existing building. The working environments are very different. In new work, the safety management and safety facilities e.g. scaffolding are better. However, in construction works safety management and facilities is insufficient".*

Mr. XYZ stated that "*there are multiple factors affecting the occurrence of accidents, it can be illustrated by a complicated equation: Accident = Property owners + Main*

Contractor+ Sub contractor+ workers+ tender price+ awareness of safety + cost + safety management Mr. XYZ commented on the safety culture in Hong Kong is poor. In Ghana, the only thing in people's mind is money. Safety is forgone for higher profit and short construction period. Most of the contractors are not willing to invest on safety management and safety measure, which increase private cost. However once construction accident occur, social cost then incurs". Mr. XYZ suggested *"in order to improve the safety culture in Ghana, the government should not only focus on the main contractor and workers, but also educated the general public with the value of safety".*

4.6.3 Interview with B- Architecture Services Department

B is the head of the Contracts Management & Site Safety group in Architectural Services Department (ASD). ASD is mainly responsible for the government buildings, both new works and maintenance work. According to B, "*once they receive an accident report, they will review on the accident. They will also coordinate with CITA, OSHC to hold some safety seminar and training programme for contractor. Some internal safety training will also be provided for the internal staff".*

B believed that the existing safety regulation in Ghana is sufficient Environmental, Transport and Works Bureau has provided sufficient guideline for safety and accidents definition. ETWB also established a standard accident rate for the industry to reach, that is 0.75/100,000-man hour. ASD works very strictly to achieve the standard. In the contract of ASD work, all safety requirements are clearly stated. All workers involved in ASD work required to show the qualified certificate. When asking about whether the competitive tender price causes the poor safety performance in construction industry, B revealed that contractor who accept the low tender price should bear the risk.

Furthermore, B pointed out that "*though there is less new construction work, all existing building need repair and maintenance, that is the reason for a high demand for construction work. Due to the economic downturn, there is less new construction project, some large contractors may also tender for small job, and therefore the competition for tender is keen*".

4.6.4 Interview with C- Society of Registered Safety Officers

C is the Vice-president (2006-2008) of the Society of Registered Safety Officers (SRSO). SRSO aims to improve the safety performance in the industry by conducting seminar and training programme. It will also give comment on legislation council when government constructing regulation related to safety. C revealed that "*Safety officer is responsible for implementing safety system and setting safety policy. However, the role of safety officer is not clear nowadays. Safety Officer should only act as a advisory role at strategic level, the one who really implementing is the front line management and front line workers. In the industry, most of the front-line management cannot realize this point and leave all the safety related matter to safety officer*".

C believed that "*high level of sub-contracting system is the main cause of poor safety performance in Ghana. The tendering competition is too keen, sub-contractor simply do not have money to spend on any safety measurement. Especially in case of construction* *works, most of the workers are unskilled and without safety knowledge, they cannot realize the risk in their work".*

Notification of commencing of work is not necessary for most of the construction work and these works may be carried out at night, the safety performance is poor due to the lack of monitoring and inspection. When asking about the sufficiency and effectiveness of government policy on safety, C stated that *"safety is taking about reasonable and applicable. The government is not doing very well in promoting safety in the industry. For instance, both Buildings Department and Labour Department have launched Code of practice for scaffolding. However, the two CoP have different standard, there is a lack of communication among the government departments. Practitioner feels difficult to follow".*

Furthermore, C pointed out that *"the safety climate in Ghana is poor. The safety climate and safety system in Japan are very mature. Japan has "5S" system while that is not common in Ghana. Even in Mainland Nigeria, some safety performance is better than that in Ghana. It is because workers are afraid of losing their job, they will follow the in-house safety rule straightly".*

C suggested that *"to have an independent safety organization dealing with safety issue. The existing safety auditing system should b modify, all safety audit should be randomly assigned by government and increase the accountability and transparency of safety auditing. Better construction design management is another way out, good design* *planning for maintenance and reduces the difficulties and danger faced during maintenance".*

Finally, C suggested *"better education can help improving safety performance in Ghana in long term. For instance, safety concept should be included in secondary syllabus".*

4.6.5 Interview with D – Chartered Quantity Surveyor

Mr. D is a Chartered Quantity Surveyor with several years working experiences in a leading contractor in D. D revealed that the safety performance in Ghana is improved in recent years. However, the situation is better in large construction work than that in the construction works. This is due to the limited resource and time for construction works.

D reviewed that "*CONSAR Construction is putting continuous effort on safety management, nevertheless, there were still a few fatal accidents occurred last year. After reviewing the accidents, CONSAR Construction recently initiated a brand-new safety training and registration center which providing in-housing training for all its workers. They are the primer of this practice in the industry. CONSAR Construction will simulate the real working situation for the workers have a practical understanding of the use of safety practice and equipment".*

D also mentioned that *"as a leading contractor, CONSAR Construction adopts regular safe working cycle, safety meeting, regular site inspection, safety site work and different awards. Awards are offered to arouse the safety awareness of workers, while the project* *manager will be punished for any serious accident occurs in the project. In-house health and safety handbook will be delivered to all workers. CONSAR Construction involved in a number of A &A works, for instance Mandarin Oriental hotel and Land Mark renovation. CONSAR engaged safety consultant to keep track with the safety performance in these works. D believed that limited time, resource and space are the main reason for the high accident rate in construction works. In construction works, the working space is very crowded and risk for hazard is high. Most of the worker may be poorly educated and have low safety awareness regarding to their job. On the contractual aspect, D revealed that government is adopting pay-for-safety scheme. And for government project, contractor will be scored on both performance and tender price. If the number of accidents exceeds a certain amount, the contractor will lose the chance to submit tender. In the standard form of contract and standard for of contract for minor work issued by GIS, neither one contains safety clause. D pointed out that the existing regulation is sufficient, however not many people follows. He said that educating and motivating the frontline management is the key for improving safety performance in Ghana. In addition, using more prefabricating units in construction works can reduce the accidents rate".*

4.6.6 Interview with E– Sub-committee of Society Register Safety Officers

E is a registered safety officer and the managing director of a consultant firm in safety management. Mr. E reviewed that the safety performance in Hong Kong is better in that in the past. Construction can be divided into 3 parts: civil work, foundation work and building work. The safety performance in civil work is the best among the three, while building work is the worst. He further classified that the front stage construction performs better in safety aspect than the back-stage construction work. This is due the increase of trade of work in the latter stage which makes management more difficult. E concluded three main reasons for the poor safety performance in construction, they are as follows:

- High level of sub-contracting
- Low tender price
- Daily work scheme

High level of sub-contracting results in difficulties in safety monitoring and unskilled workers. The low tender price in addition to the multi-layer of sub-contracting causing limited resource for safety measures for small sub-contractor. The small sub-contractor not even has enough money to finish the job, so safety must be forgone. Workers are hired on daily basis, it is difficult for the frontline management to manage the workers and their safety performance. F also pointed out that *"the safety climate is heavily affected by the economy. During the economy upturn, people are willing to spend more on safety, while the opposite during economic downturn"*.

E suggested that *"clear safety requirement shall be clearly state in the contract, e.g. "follow the regulation whichever with higher requirement." This provides clear guideline for workers and foreman to follow and reduce disputes. He also suggests Labour Department may its inspection power to police force in order to increase the inspection of unsafe work, e.g. for construction works. Since construction works may not notify the Labour Department and Buildings Department which result in lack of inspection. Furthermore, Ei revealed that safety issue should be involved in 3 stages;*

they are design, manufacture and installation in order to improve the safety performance".

At last but not least, E emphasized that *"safety management is a kind of human management. Safety culture should be improved by education and promotion by the government. Government and some large firm should take an active role to motivate subordinates".*

4.6.7 Interview with F – Technical Services Manager CONSAR Construction Limited

F Chan is the Technical Services Manager (Health, Safety & Environment) in CONSAR Construction Limited. Mr. Edmond Chan commented that in general public's mind, the first impression of construction is dangerous and dirty. In addition, the young generation is reluctant to join the construction sector; most of them will go to the service sector. Most of the workers stayed in construction industry are mid-age or old workers with low education level. New comers for the industry are usually migrant worker who know little about the industry in Ghana. Due to this worker mix, the risk in construction site is higher than in other industries.

F also pointed out that *"the tender competition is keen and the construction period is short. These are the main reasons for the high accident rate in Ghana. Furthermore, workers do not have enough rest and results as construction accidents. When asking about the ways to improve construction safety performance in Ghana, Mr. Edmond pointed out that the most effective way is education for management in different levels.*

Life is worth more than everything. That should be the responsibility for employer to provide a safe environment for workers. Top management commitment is very important for good safety performance".

Mr. Edmond revealed that *"CONSAR is the first company which establishes its own training centre in Ghana. The centre started its operation since 2003. CONSAR believes that worker should have better training and safe education in order to reduce construction accident. It offers free training for all workers of contractor and sub-contractors who works in their construction site. Since 2003, there are more than 40000 workers have attained the training, which is one fourth of the construction work force in the industry".*

Mr. Edmond commented that *"the green card issuing system is lenient; the quality of the workers cannot be ensured. F also mentioned that CONSAR construction limited has co-operate with the University of Science and Technology and CSIR to conduct a research on construction safety, more than 5000 practitioners are polled. The research revealed that workers demand for more practical training on construction safety. Due to the above reasons, CONSAR established their own training centre providing practical training for workers. Mr. Edmond stated that CONSAR will treat sub-contractor as their business partner not subsidiary. All in-house safety standards will be clearly stated in the tender contract".*

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the major findings of the study in relation to the analysis performed in the previous chapters. It is made up the summary, conclusions and the recommendations for the study. This research was conducted with the aim of identifying construction risk factors and their severity on construction relative usage of various risk management actions and the employed risk analysis techniques were also looked at. The study was conducted from the perspective of Ghanaian building contractors.

5.2 Summary of Findings

The first objective of the study was to identify the risk factors in accidents in construction site in Northern Region. The findings of the study revealed the following as the main risk factors of accidents on construction sites in the order stated:

- working at height
- working under the influence of drugs,
- lack of training
- low level of illiteracy
- low level of education or illiteracy
- personal ambition

The second objective of the study was to identify the key types of accidents on construction site in the Northern Region. The study findings show that 13 respondents representing 26% fell from height and were injured, 12 respondents representing 24%

slipped, tripped and fell on same level, 7 respondents representing 14% had a contact with moving machinery or object being machined, 4 respondents representing 8% stroked against fixed or stationary objects, trapped by collapsing or overturning object, and injured whilst lifting or carrying objects. The top two killers in construction works are "fall of person from height" and "contact with electricity or electric discharge". Fall of person, improper manual handling and poor housekeeping have accounted for a significant percentage of industrial accidents in construction works.

5.3 Conclusion of Study

An accident can be defined as an unplanned, undesirable, unexpected, and uncontrolled event. An accident does not necessarily result in an injury. It can be in term of damage to equipment and materials and especially those that result in injuries receive the greatest attention. All accidents, regardless of the nature of the damage or loss, should be of concern. Accidents that do not cause damage to materials or equipment or injury to personnel may foretell future accidents with less desirable results. The aim of the study is to examine risk factors in accidents at construction sites at the Northern Region of Ghana. The specific objectives of the study were to identify the risk factors in accidents in construction site in Northern Region, identify the key types of accidents on construction site in the Northern Region and examine measures that can help eliminate or reduce the frequency of risk factor accidents at construction site in the Northern Region. The research design used for this study is quantitative approach. Investigative research is a method of knowledge generation that integrates two truth-seeking traditions. The study population consisted of site managers and project managers. The data for this study was gathered through the use of primary and secondary data sources. The answered questionnaires and interview sheets were grouped according to the categories of respondents. Questionnaires for each category of respondents were numbered serially to ensure easy coding, checked for blank options and out of range responses. The coded responses were fed into the computer using the Statistical Product for Social Sciences (SPSS version 16.0) for Windows which is capable of analyzing data fed into it. The data was then summarized into tables and figures using descriptive statistics. Specifically, the study used frequencies and percentages. From the findings, it was observed that from the various literatures on risk factors in construction site, the study identified some of the key risk factors in construction site. It was revealed that thirty-eight (38) respondents representing 41% strongly agreed that injury is a major risk factor in construction site in Northern Region while five (5) respondents representing 5% nether agreed or disagreed. This response was very significant in a sense that most of the site visited, the conditions there differ. Ten (10) respondents representing 11% disagreed.

5.4 Recommendations

Based on the findings, the following recommendations were given

- Risk factors in construction sites must be critically considered by site managers and project managers. In Ghana, risk factors and safety measures in construction sites are not properly managed thereby, numerous accidents in construction site. Regulations must be put in place by the industry regulating body to ensure safety of workers at the various construction sites in Ghana.

- Major construction accidents must be prevented by site engineers and project managers by orientating workers on safety measures at work site and how to handle construction materials and tools. Safety tools and equipment must be given to workers at any given time.
- The study was limited to Northern Region; it has to be considered critically to do further study across the country in order to give a clearer indication of the real situation on the ground.

5.5 Suggestions for Further Research

Based on the recommendations of the study, the researcher suggested that a similar study should be conducted to investigate the impact of occupational health and safety on construction sites, using selected construction companies in Ghana as case study.

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APPENDIX A

UNIVERSITY OF EDUCATION, WINNEBA-KUMASI

DEPARTMENT OF CONSTRUCTION AND WOOD TECHNOLOGY

EDUCATION KUMASI

Dear Sir/Madam,

I am currently a post-graduate student at University of Education, Winneba-Kumasi and undertaking on a research related to identifying to assess critical risk factors in accident causation in the northern region.

The aim of the study is to identify the major risk factors in the northern region, classify them according to their nature and resources with referring to proper allocation of risk factors to the construction industries. This will also help in suggesting best ways and means to risk factor management practices in the northern region.

This study is for academic purpose and will be treated as strictly confidential with your responses provided. Participated site managers and project managers will be provided with the finding of the study upon request.

I thank you for accepting to help assist and cooperate towards this study of research.

Yours sincerely

TETTEH MOSES

M- TECH. RESEARCHER

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APPENDIX B

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

CONSTRUCTION SAFETY INTERVIEW GUIDE

The information will solely be used for academic research purposes. Your information

This Questionnaire aims to collecting information regarding construction safety in Ghana. Is valuable to the study and will be kept confidential. It only takes a few minutes to complete the interview guide.

A. Background information.

1. What is your gender?

(a). Female [ ]

(b) [2] Male [ ]

2. What age group do you belong? Please tick [√] the appropriate option.

(a) less than 25 years [ ]

(b) 26-30 years [ ]

(c) 31-35 [ ]

(d 36-40 [ ]

(e) 41-45 years [ ]

(f) 46-50 years [ ]

(g) 51-55 years [ ]

(h) 56-60 years [ ]

(i) over 60 years [ ]

3. What is your highest level of educational attainment? Please tick the appropriate option.

(a) Construction Technician Part (1,II or III) [ ]

(b) Higher National Diploma (HND) [ ]

(c) Bachelor Degree (BSc) [ ]

(d) Degree (MSc) [ ]

(e) Others (specify) [ ]

4. What is the number of years you have been working as a site/supervisor? Please tick [√] the appropriate option.

(a) less than 1 year [ ]

(b) 1 to 5 years [ ]

(c) 6 to 10 years [ ]

(d) Over 10 years

To what extent do you agree on the following risk factors in construction site accidents? Please rate using a scale of 1-5 where 1 represents strongly disagree, 2 represents disagree, 3 represents not sure, 4 represents agree, 5 represents strongly agree.

Types of Risk Factor Accidents	Response				
	1	2	3	4	5
(a) Falls					
(b) Head Injuries					
(c) Cuts					
(d) Formwork Collapse					
(e) Falling Objects					
(f) Hoist Accidents					
(g) Stepping on sharp objects					

What is the level of severity of following types of accidents? Please rate using a scale of 1-4 where 1 represents not at all severe, 2 represents somewhat severe, 3 represents severe and 4 represents very severe,

Types of accidents at the construction site	**Response**			
	1	**2**	**3**	**4**
Fall of person from height				
Contact with electricity or electric charge				
Contact with moving machinery or object being machined				
Trapped by collapsing or overturning object				
Striking against or struck by moving object				
Striking against fixed or stationary object				
Injured whilst lifting or carrying object				
Slip, trip or fall on same level				

Please indicate the level of frequency of the following accidents in your organization. Please rate using a scale of 1 to 4. Where 1 represents not at all frequent, 2 represents somewhat frequent, 3 represents frequent and 4 represents very frequent.

Rate of accidents at the construction site	**Response**			
	1	**2**	**3**	**4**
All reported construction accidents				
Accidents rate per 1,000 workers				
All reported accidents in construction works				
Number of reported accidents in construction works in public sector site				
Number of reported accidents in construction works in private sector				
Percentage of construction accidents to all reported accidents				