

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

**EVALUATION OF KNOWLEDGE AND APPLICATION OF SAFETY
CONTROL TECHNIQUES IN THE GHANAIAN CONSTRUCTION
INDUSTRY**

By

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CONSTRUCTION MANAGEMENT

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DECLARATION

I hereby declare that, this study submission is my own work towards the Master of Science in Constructions Management, and that, to the best of my knowledge, contains no material previously published by any person nor material which has been accepted for the award of any other degree of the university, except where due acknowledgement has been made in the text.

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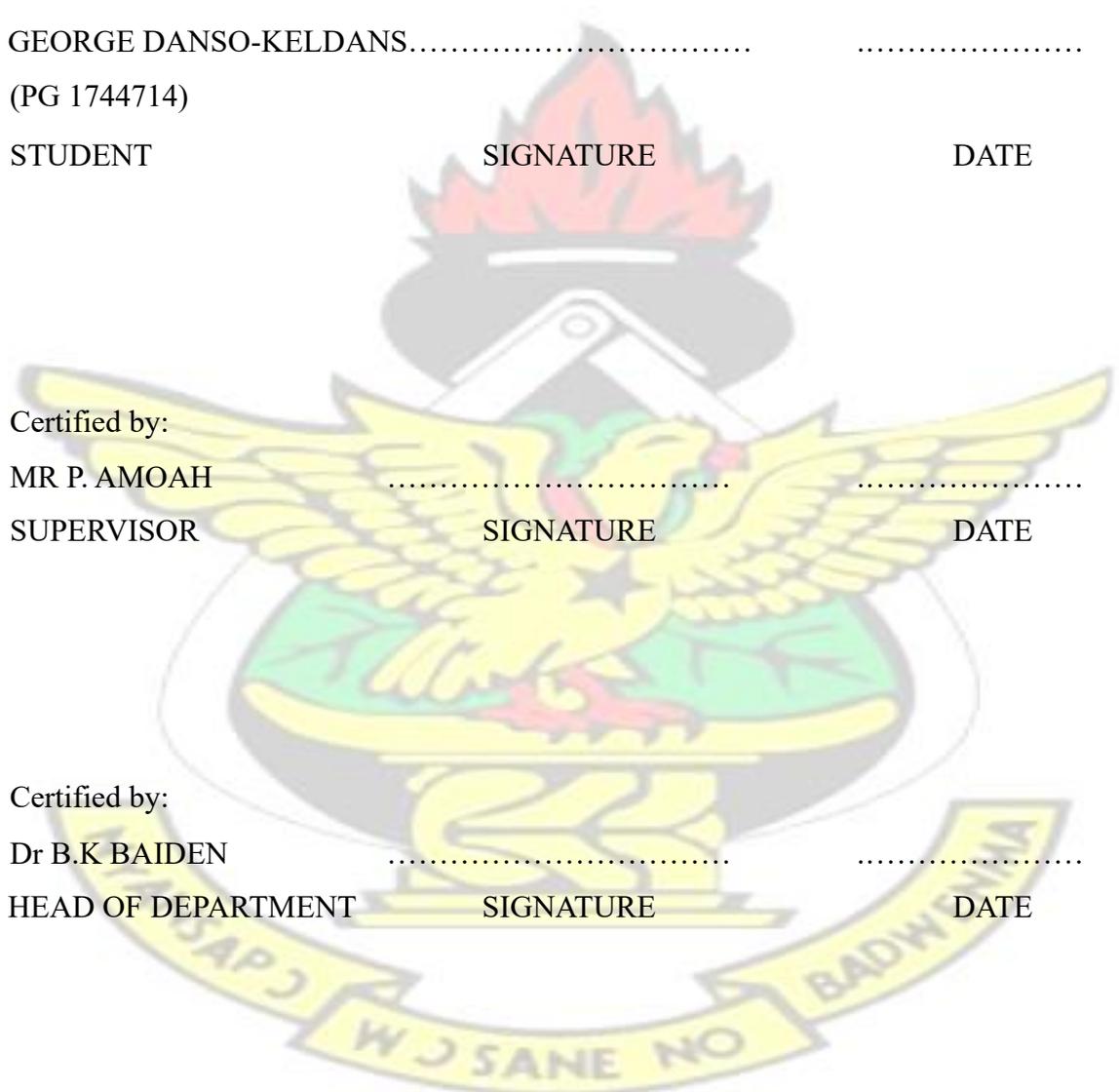
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DEDICATION

This research study is dedicated to the memory of my late mother, Madam Afua Badua whose simplicity and focus to life gives me so much inspiration and motivation for everything I do.

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My gratitude goes to the Almighty God on whose mercies we live a borrowed life.

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ABSTRACT

In spite of all the efforts made to enhance the occupational health and safety (OHS) of the Ghanaian construction industry, damages and cases of dust related diseases and other ill health continue to be high in the industry. As results of these and other related cases in the industry, OHS management continues to be key issue requiring innovative solutions. Much studies and legislations have been made towards improving safety and health performances in the industry with a view to achieving a better OHS management in the industry, nevertheless the problems persist. Innovatively considered and contributing to the existing body of knowledge, this study was carried out to evaluate the consciousness and utilization of safety control techniques in the Ghanaian built environment. To achieve this aim, a questionnaire survey was conducted among respondents involving health and safety officers, site supervisors, site engineers, project managers, assistant project managers and project coordinators in the GCI who were purposively sampled for the study. Respondents' responses were subjected to detailed analysis using Relative Important Index (RII) and descriptive statistical (percentages, frequencies and bar chart) through the use of computer applications known as Statistical Package for Social Sciences (SPSS) and Microsoft Excel. The findings of the study revealed that professionals in the GCI are aware of safety control techniques and hence applies these techniques to ensure safety on construction projects. The professionals involved in the study further agrees generally that there are ten (10) common safety control techniques used in the GCI of which 8 are notable, as were confirmed by the study analysis and results. Conceivably however, the six (6) most important safety control techniques used in the GCI are in the order of ranking, *Safety Records; Safety rules and regulations; Safety management; Safety policies; and Safety promotion*. Reckoning its originality, this study is the only study that has focused on the application of safety control techniques in the GCI among the numerous health and safety studies conducted to date. The outcome of this research

will therefore be valuable to policy makers and stakeholders in the construction industry who seeks innovative ways of improving safety in the industry.

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CHAPTER ONE INTRODUCTION TO THE STUDY

1.1 BACKGROUND TO THE STUDY

An integral sector of the economy of developing countries is the construction industry. Seen as a catalyst for the development of the economy, the construction industry yields about 11% of Gross Domestic Product in most developing economies (Giang and Pheng, 2010). The Ghanaian construction industry creates an essential platform and vehicle in the attainment of development objectives, offering protective covering, provision of jobs and infrastructure (Dadzie, 2013). In spite of its significance, the industry is still regarded hazardous with regular accidents coupled with high fatality injury rate to site workers (Muiruri and Mulinge, 2014). In Menzel and Gutierrez (2010), the physical environ of the site, nature of the site work operations, the choice of method and nature of work on site contribute to the hazardous and liability of workers to health and safety risks.

Many construction activities are inherently health and safety hazards like operations at altitudes, below ground works, operating in limited environ and nearness to falling materials, manual handling, operating machinery, vulnerability to live wires, poor site conditions, and ergonomics (Phoya, 2012). However, there are legal tools and statutes in most developing nations to regulate building activities at site and aid reduce risks. Differences exist in the characteristics of construction work activities in developing countries and that of developed nations (Jaselskis and Talukhaba, 1998). Therefore, there may be variations in the Health and Safety policies and procedures in different economies and this requires conceptualizations.

However, in any distinct economy the construction industry remains hazardous, contributing massive figures of fatalities (Takala, 1999). While in technologically advanced countries, efforts have been made in attaining minimum statistics in accident figures in the construction industry, the situation is blur for developing nations, especially Sub-Saharan Africa which Ghana is inclusive (Kheni et al., 2008). Construction fatality statistics in emerging economies are unsatisfactorily rising and projected to upsurge due to industrialization (Hämäläinen et al., 2006). Nonetheless, the application of safety control techniques in the built environment of developing economies inevitably contributes to a reduction in fatal risks to the industry workers, practitioners and end users. An assessment of the knowledge and application of safety control techniques in the construction industry of developing countries is therefore imperative to help improve upon safety and health performance in the industry. It is in this direction that, the purpose of this study is muted, i.e. evaluate the awareness as well as utilization of safety control techniques in the Ghanaian Construction Industry (GCI).

1.2 PROBLEM STATEMENT

For most developing countries, Ghana being no exception, health and safety concern in construction project deliveries are not given the urgency, and that engagement of safety measures during construction activities is regarded as problem (Mbuya and Lema, 2004). Health and safety measures has been acknowledged as a consideration used alongside the conventional factors of cost, quality and time, to measure the success of projects for the reasons and considerations that health and safety are human factors, legislation and financial issues (Adan, 2004). It is a fact that effective management of health and safety principles has been a tough battle and a plague for most and some category of contractors in Ghana, as they do the initial planning on paper to win contracts but finds it challenging integrating the required comprehensive management

plan of health and safety principles into the construction process. This has led to the emergence of the Ghanaian Construction Industry (GCI), as well as the Construction Industry over the world relatively prone to health and safety risks and thus recording numerous accidents over the years.

Aforementioned, the construction industry in Ghana have recorded several accidents which can be attributed to poor health and safety management. The observation of the application of safety control techniques in built industry will inevitably contribute to the curbing of safety and health related problems in the industry. This study is therefore articulated with the aim to evaluate the consciousness and application of safety control techniques in the Ghanaian Construction Industry (GCI).

1.3 RESEARCH AIM AND OBJECTIVES

This section will present the aim and objectives of the research.

1.3.1 Research Aim

The main purpose of this study is to evaluate the consciousness and application of safe control techniques in the Ghanaian Built Environment Industry.

1.3.2 Objectives of this Research

For the purposes of achieving the aims of the study, the following objectives were set:

1. To assess the awareness of safety control techniques among professionals in the Ghanaian Construction Industry (GCI); and
2. To ascertain the various types of safety control techniques used in the Ghanaian Construction Industry (GCI).

1.4 SCOPE OF THE STUDY

The construction industry in Ghana and across the globe is simultaneously known as a major financial force and one of the most dangerous industries (Mohammed, 2003). It is therefore essential to control and ensure the health and safety of persons who are directly or indirectly impacted adversely by construction activities in the industry. Contextually, this research study captured matters concerning safety control techniques in the Ghanaian Construction Industry. The study focused on establishing the cognizance of construction professionals in Ghana on safety control techniques and their application in the industry is also of much importance to this study.

Geographically, this research study concentrated on qualified construction practitioners of selected

D3K3 and D4K4 construction firms functioning in Accra, the capital city of Ghana. The study originates from the fact that majority of Ghanaian contractors principally operate within and from Accra. And with this greater percentage of Ghanaian contractors found in Accra, it is expected that the generalization of the study results obtained in this geographical area to represent the Ghanaian situation would be in no doubt. (Osei-Hwedie, 2010).

1.5 RESEARCH METHODOLOGY

To conduct this study successfully on safety control techniques on built environment industry, several methodological approaches were adopted. A detailed review of available relevant literature was done and specialist conceptions acquired from the industry on safety control techniques sought. The Adoption of quantitative methodology in the accumulation of proper information empowered the investigation

and elucidation of the study findings. The identified safety control techniques were scrutinized and finalized to form part of the structured survey questionnaire.

Using the quantitative approach, the structured surveyed questionnaire was used as the main instrument to gather data from construction practitioners in the Ghanaian Construction Industry (GCI) covering issues related to the objectives of the study. The questionnaire was separated into two main parts. The first, demanded background data of the respondents whilst the second part focused on issues regarding the research objectives. Prior to administering the questionnaires, pilot survey was carried out among 15 experienced professional (i.e. 5 Health and Safety Supervisors, 5 Site Supervisors and 5 Project Managers) in the Ghanaian Construction Industry because of their in-depth understanding and knowledge in local construction issues and for that matter their knowledge in the study subject area.

This study used the non-probability sampling methods which includes purposive and snowball sampling. This method allowed the researcher to acquire a huge figure of completed questionnaires quickly and sparingly. The questionnaires were distributed to targeted health and safety officers, site supervisors, site engineers, project managers, assistant project managers and project coordinators of selected registered D3K3 and D4K4 construction firms operating in the Greater Accra region of Ghana. Data analysis was done using statistical tools such as the descriptive statistics, the relative importance index and Cronbach's Alpha for reliability statistics. The relative importance index (RII) was used to rank identified factors according to their place value or influences on the delivery of projects (Adesi, 2013). This is to identify the relative importance of the identified factors or variables via RII to the research objectives.

1.6 JUSTIFICATION OF THE STUDY

As mentioned by Muiruri and Mulinge (2014), accidents in the construction industry do not only affect in substantial agony and distress but also downgrade productivity, quality, time and destructively affect the environment; consequently adding to construction cost. This has led to the upsurge in health and safety research studies in the construction industry thereby adding in recent times to build a body of knowledge that can be relied upon to improve health and safety management in the industry.

This study makes significant aids to the existing body of literature on construction health and safety by focusing its attention on safety control techniques. Benefiting academia, knowledge on construction safety control techniques which are highlighted and scattered in different Built Environment (BE) research publications would be gathered into one body in the literature review of this research. This will enhance construction health and safety education in both private and public academic institutions which will go a long way to merit effective construction health and safety management.

Safety control techniques being a vital aspect of health and safety management, helps in controlling the hazards posed by construction activities to anyone who is directly or indirectly affected by these activities. Practically, the adoption and application of safety control techniques in the Ghanaian Construction Industry (GCI) will inevitably contribute to proper wellbeing and security administration within the industry, thereby curbing the numerous accidents and ill-health issues occurring in the Ghanaian Construction Industry. Since little or nothing can be said about the knowledge of practitioners on safety control techniques and their level of application in the

Ghanaian Construction Industry, a study to evaluate the knowledge and application of safety control techniques in the industry is therefore timely and appropriate. In conducting this study, the identification and documentation of effective safety control techniques that can be adopted by construction practitioners and stakeholders in the construction industry within Ghana and over the world to improve the health and safety practices would have been achieved.

Additionally, construction companies and policy makers can fall on information provided by this study in designing effective safety policies. The integration of effective safety control techniques identified by this study into safety policies will enhance healthiness and security practices within the Ghanaian Construction Industry.

1.7 ORGANISATION OF THE RESEARCH

The study report is organized into five (5) autonomous and yet dependent chapters. Chapter one provides an introduction and background to the study, it gives such information as the research questions, objectives and justification of the study. Chapter two presents extensive review of available literature pertinent to the subject of the study based on information provided by other researchers. It also identifies the gaps in previous literature reviews on the topic that this study seeks to address. Chapter three encompasses the methodology adopted for the study; research design of the study; research strategy, research purpose, data collections and the scientific analytical tools used, sample frame, sample size and sampling methods.

The fourth chapter is made up of the compilation and analyses of all data obtained from the study in relation to its objectives. Interpretations and discussions of the results derived from the analysis from the previous chapter three are also captured in this chapter.

The last Chapter, chapter five introduces the summary and succinct highlights of the different findings of the study and its conclusions. Fitting recommendations are likewise made under this section in light of the research findings to enhance construction health and safety management.

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CHAPTER TWO LITERATURE REVIEW

2.1 INTRODUCTION

Focusing on the improvement of construction health and safety in the built environment industry, the object has been to thoroughly carry out a comprehensive and intense global assessment of extant literature on construction safety, in order to discover concepts pertinent to the aims and agenda of the study. The literature review presented in this chapter delves into subjects such as; a conceptual explanation of construction health and safety (CHS); general overview of the construction industry; construction safety in Ghana, health and safety legislations in Ghana; history of construction health and safety; working definitions of safety control techniques; safety control techniques used in the construction industry; challenges of safety control techniques in the construction business; and the significance of health control procedures in the construction business.

2.2 A CONCEPTUAL EXPLANATION OF CONSTRUCTION HEALTH AND SAFETY

Generally, Occupational Health and Safety practices have been given little research attention (Regional Committee for Africa Report, 2004; Puplampu B. B. and Quartey, S. H. 2012). As a result, Occupational Health and Safety has remained outside the typical organizational and administration studies (Barling et al. 2002) until recent times (cf. Yankah, 2012; Phoya, 2012; Adesi 2013; Amartey, 2014). Although research improvement on Occupational Health and Safety continues to be significant, the situation is blurred for Construction Health and Safety specifically. Therefore, this segment of the study makes attempts in expounding the concept of Construction Health and Safety.

As defined by Hughes (2007), protecting the body and mind of both individual and multitude from acquiring illness can be termed as health. Yankson, (2012) argued that,

Construction Health and Safety can be termed as people being safe and healthy at workplaces to better performance of workers. Conversely, Hughes definition delves more into the status quo of the individual irrespective of how the personality of the firm fares. Yankson's, in addition to Hughes account, stresses on the performance of the firm. To reach a more elaborate consensus from this discussion, this study defines Construction Health and Safety as "the concern to seek the physical and psychological welfare of construction personnel and other stakeholders in and around the construction site in order to boost productivity of the firm". This study's definition is in concord with Occupational Health and Safety Act 651, which defines the term in pursuance as the conditions affecting the wellbeing of any individual in the workplace. Hence, Occupational Health and Safety is linked with affiliated workforce practices, the availability of welfare facilities, hazards prevention practices and mechanisms and not excluding safety training and management (Khrais et al., 2013)

The construction industry is a leading employer in most emerging economies (Cotton et al., 2005). But, it is also one sector which has caused and continues to do immense damage to human life, deforming most people, leaving a stigma of heavy emotional depths for both victims and firms as well. Debatably, the international Labour Organization (ILO) (2005) estimated that, on daily basis, about 6000 people connected to construction works lose their lives due to site activities or related ailments emanating from construction works activities. Good Health and Safety practices if put in place would contribute to good working environment as people spend most of their time at the workplaces and therefore their working environment should be made safe, favorable and conducive. (Yankson, E. 2012). Deduced therefore this study's definition of Construction Health and Safety as the concern to seek the physical and psychological

welfare of construction personnel and individuals in and around the construction site in order to boost productivity is appropriate.

2.2.1 History of Construction Health and Safety

Over the past centuries, many studies have been done on Construction Health and Safety, the outcomes of which has been since time, integrated labour surroundings and dwellings. (Kwankye, E. A. 2012). For instance, Hippocrates (460-377 BC) investigated on the hazardous consequences of untidy slave environment. Notably Caesar (100-40 BC) also had responsible personnel in charge of health conditions of the army. From ancient days, there have been many attempts and interventions developed to improve construction safety. This segment accounts for the genealogy of construction Health and Safety.

At the dawn of the middle Ages, George Bauer (1492-1555) penned numerous books on quarrying and metallurgy, distinguishing numerous creative and innovative techniques for improving mining shafts ventilation for workers, (Raouf and Dhillon, 1994). The father of Occupational Health and Safety, Bernadino Ramazzini, (1633-1714), reported comprehensively on safety matters concerning mining. In the midst of the mechanization age, James Watt and Eli Whitney in the late 1700s indicated in their study that workers recognised work demises as a component of the working circumstances without regarding the pecuniary implications. This was so and possible because workers were perceived as volunteers, abundant and hence expendable (Leigh, 1998). Nevertheless, Ramazzini discussed and recommended numerous preventive strategies for minimizing disease and injuries at workplaces and especially on construction sites, (Tayyari and Smith, 1997). Despite these facts, these primitive safety „patriarchs“ lacked vision to apply methodological protection at places of work and

services. Their pioneering works undoubtedly, forms the grounds for today's techniques for minimizing work place illness accidents and injury.

2.3 THE CONSTRUCTION INDUSTRY IN GHANA: A GENERAL OVERVIEW

Civil and building construction companies in Ghana is made up of a huge number of companies with distinct capacities as certified and classified by the Ministry of Water Resources, Works and Housing (MWRWH) as D1K1, D2K2, D3K3, and D4K4. The bigger construction firms, both in financial and other related resources are categorized D1K1 contractors are also established on aspects such as yearly earnings.

Construction firms in category D2K2, are regarded as Medium size firms and D3K3 AND D4K4 are regarded as minor firms. Currently, the bigger firms, according to MWRWH are classified as financial class 1, and competent of executing projects up to US\$500,000 or GH¢ 750,000.00, while financial classes 2, are classified as competent of executing projects up to US\$ 200,000 or GH¢ 740,000.00 . The study's focus firms, falling under classes 3 and 4 take on projects up to US\$ 100,000.00 and US\$ 75,000.00 or (GH¢ 370,000 and GH¢ 277,500.00) respectively. The management of these minor companies barely invests in human and other resources, which are principal components for the effective growth of a company (Mitullah et al, 2003). Nonetheless, the construction industry remains the backbone and biggest propeller of the Ghanaian economy. It is one of the major contributors of Ghana's Gross Domestic Product (GDP), contributing about 8.5% (Ghana Statistical Service, 2007).

2.4 CONSTRUCTION SAFETY IN GHANA: A GENERAL OVERVIEW

The construction industry is regarded as among the foremost riskiest industrial sector where employees are more liable to fatal accidents. In spite of recent attempts by

construction professionals to mend safety on site, the sector still reports of uneven digits of occupational-related fatalities (Mouleeswaran, 2014).

In developed countries, the use of statues control techniques concerning safety in the built industry and the operations of safety supervision procedures are expected and indeed do account for the diminishing accidents at construction sites. The situation however, is blurred for a developing country like Ghana. Safety and health watch matters during work activities is pitiable in most construction firms sites in Ghana. This could be due to lack of response to technology since huge portion of work is still executed by human labor, leading to galloping accidents on site. Subsequently, the country's sector has diverse administrative units with distinct duties to observe variously for safety adherence, yet, there is not a single organized policy that regulates Occupational Health and Safety management in Ghana. Most mishaps on construction sites could be eschewed if dynamic safety precautions are effectively executed. (Yankah, K. 2012).

The construction industry in Ghana like most developing countries is manual labour concentrated, leading to the maximization of human vulnerability to work hazards. For this reason, it is of prime importance to effect a better safety record to aid analyze frequent accidents. Puplampu and Quartey (2012) in their review on prime matters on Occupational Health and Safety activities in Ghana clearly emphasized the fact that the subject of policy agenda is usually observed as the most difficult barrier because of the inoperability of legal structures and policies.

More so, the Ministry of Health Report (2007) revealed some Occupational Health and Safety challenges in Ghana. These comprise feeble Occupational Health and Safety infrastructures, weak as well as insufficient Occupational Health and Safety policies

among others. The table below depicts a typical roles of parties in ensuring health and safety in construction activities as given by Laryea, S. and Mensah, S., 2010.

Table 2.1: Roles of parties in ensuring health and safety in construction

Client	Contractor	Regulatory Agency	Employee
<u>Select the right person</u>	Avail safe access to site	Guidance notes	Wearing PPE
Provide sufficient time	Avail welfare facilities	Safety signals	Take care of machinery
Offer building team with information	Safety precautions at height	Education on health and safety	Defects report
Ensure that team communicates and cooperates	Safe scaffolds	Enforcement	
Ensure suitable management arrangements are in place	Safe ladders	Health and safety law	
Ensure adequate welfare facilities are on site	Roof work safety precautions		
Ensure proper site layout	Safe excavations		
Select a main contractor	Safe manual handling		
Ensure a health and safety plan	Safe stacking and emptying of merchandise		
Proper keep of health and safety records	Safe traffic, vehicles and plant		
Protecting the public	Safe tools and equipment		
	Safe lifts and cranes		
	Safe storage, handling and disposal of hazardous substances		

Source: Adopted from Laryea and Mensah (2010)

2.5 HEALTH AND SAFETY LEGISLATIONS IN GHANA

Adei and Kunfaa (2007) suggest that, the performance capacity of workers aids nourish the societal growth. To achieve a flourishing economy, WHO (1994) suggest that, workers health status during work is vital for effective performance. Though the lack of a national work health and safety policy continues to exist today, the Factories,

Offices and Shops Act of 1970, Workman's Compensation Law as well as the Labour Act are regarded as the prime legal documents on OSH. In spite of these legal frameworks, associated fatalities cost Ghana around 7% of GDP (Ghana News Agency, 2003).

2.5.1 Factories, Offices and Shops Act

This is a legal document of the Government of Ghana which ascertains specific fundamental safety regulations and demands for factories, offices and shops, not excluding construction site safety. This act consists of eleven (11) parts and eightyseven (87) sections. It also includes schedules.

Legal validation of the inclusion of factories as construction sites

With regards to the 83rd section of this Act, any site where artifacts are created or fabricated intentionally to execute a construction or engineering activity in a manner where persons hired for labor is termed as a Factory. As a result, factories are categorized as construction sites under this Act.

Amoah (2007) emphasized that, the Act spells out the following safety precautionary measures:

- Demise or incapacitation of workers by fatalities for more than three days from earning wages should be reported to the inspector
- Every workplace should be equipped with adequate firefighting equipment to serve as a protection against fire and explosions.
- Floors, stairs, scaffolds, ladders etc. must be substantially built and maintained.
- Grooming and oversight of inexperienced workers must be adopted.

- Machines should be constantly cleaned.
- All sites should be fenced to exclude trespassers
- All lift of hoist should be of operative motorized erection, substantial materials whilst achieving enough stability and duly kept.

2.5.2 Labor Act 2003

Among the Acts of the Government, is the Labour Act of Ghana, which makes provisions regarding health and safety of labors. Part fifteen (XV) of the Acts covers the Occupational Health, Safety and Environment. This part has four (4) sections; sections 118,119,120 and 121. Section 118 talks about General health and safety conditions and has five (5) sub-sections. Section 119 talks about exposure to imminent hazards and has three (3) sub-sections. Section 120 requires the employer reporting occupational accidents and diseases and section 121 talks about specific measures. Section 118-General Health and Safety Conditions.

2.6 SAFETY CONTROL TECHNIQUES USED IN THE CONSTRUCTION INDUSTRY

Procedures and methods used consecutively in work, level and degree of knowledge applied, mutuality in labour and machinery relation, as well as the diversity of awareness and consciousness in safety adherence, among others, are components that lend to the complex nature of construction works at sites around the world (Bhattacharjee et al., 2011). A major interest of most construction site activities is the erratic and sophisticated quality of operation. This has prompted the use of several relevant techniques to control safety in the construction industry. CPWR (2008) affirmed, the overall expense on injuries was \$13 billion in the year 2002. Giving prior and proper consideration to safety control will reduce the occurrence of construction

sites accidents and subsequently reflects in a reduction in costs in construction works and the economy.

Ahmed et al. (2000) opined that virtually in all countries worldwide, construction work and related activities are the principal sprouts to fatalities. In agreement with Ahmed's assertion, Armstrong (2006) indicated that, yearly, thousands of individuals are injured or killed as a result of construction activities. To enjoy superior occupational safety performance in the construction industry, safety control techniques needs to be implemented to improve safety in the industry, and these includes the following;

2.6.1 Selecting contractor with good safety performance

According to (Dorji and Hadikusumo, 2006), safety performance standards are fundamentally utilized for investigating relation between supervisors and companies. Furthermore, Levitt and Samelson (1987) suggest that they are utilized as a medium for locating challenging sections. More so, a prime factor in the nurturing and bearing of different facets of performance on site is the capacity to measure the performance (Laufer and Ledbetter, 1986). Dorji and Hadikusumo adds that, diverse approaches of assessing safety performances exist.

2.6.2 Safety rules and regulations

In the United States of America, the OSHA principles for the construction industry itemize the essential requirements for a minimum standard of safety and health (Koehn et al., 1995). Usually, employers do not take responsibilities for construction accidents on site, however experience construction accident lawyers avail themselves to help fight for the rights of construction workers (*Ibid*).

2.6.3 Safety Policies

A safety policy is a binding and written document of rules and objectives personifying the company's dedication to health and safety at workplace (CSAO, 1993). Primarily, the need for any prosperous safety control program is to evidently make workers aware that their managers are interested in eliminating accidents (Amartey, 2014). Hammer (1981) suggests that, the competent way for the safety policy to perform well is to guarantee that their junior staff executes them. Significantly, this policy should delegate duties for safety in all departments of the company and be realistic and enforceable (Peyton and Rubio, 1991). This policy must be a simple and concise statement of the overall objectives of the company safety control program. Significantly, Agumba and Haupt (2008) advise that workers should further be involved in developing health and safety policy, providing written suggestions on health and safety, being informed of the provisions of health and safety plans, being involved in health and safety inspections, being consulted when the health and safety plan is compiled, and being involved in the growth of health and safety rules and safe work procedures.

2.6.4 Utilization of comprehensive safety programs

Comprehensive safety programs such as Risk Assessment procedures can be undertaken at all times to ensure that the existing controls, training and safeguards are still performing their desired functions. Adei and Kunfaa (2007) consider that if performed it will primarily gear towards what was perceived to directly lead to increased productivity, or as a result of investigation of an accident. Al-Kilani (2011) suggests that, all stakeholders to a construction project ought to be incorporated in a certain way in the safety program, that is, an all-in responsibility. Fales (1990) adds that, the best plan for accident prevention is to have a company safety program. Usually,

a safety program which has a massive impact consist of administrative discussions on safety, availability of safety brochures, delivery of safety machinery, creation of protected environment whilst assigning a trained safety representative to oversee site activities (Aksorn and Hadikusumo, 2009). Consequently, Peyton and Rubio (1991), the OSHA has defined twelve fundamental components of a proficient safety program. In order to minimize economic threat, organizational backing for safety programs in developing countries ought to be regarded as a financial requirement, because accidents have tuned out to be expensive to most contractors (Koehn et al., 1995).

2.6.5 Safety management

In developed economies like United State of America, safety activities in construction works are controlled by government agencies such as the Occupational Safety and Health Administration (OSHA), which offers rigid conventions and guidelines to impose safety and health criteria on work places (Dorji and Hadikusumo, 2006). Legal documentation singly cannot minimize fatality percentages except professionals and management executes effective decisions to incorporate safety norms and patterns into daily practices. The monitoring and control of safety and environmental impacts are major issues in all construction projects. Bennet (2003) reasons that, if we think of time, cost and technical performance as objectives to be optimized, or at least balanced, then we could consider work place safety and the impact of operations on the environment as constraints on the attainment of those objectives.

2.6.6 Safety promotion

Management must and ought to take the opportunity to make comments about the company safety effort and the company's commitment to safety during interactions with work operatives. Top management can and must maximize safety awareness by

taking time to discuss safety issues along with costs and schedule concerns whenever they are on site. Awareness of top management's concern for safety reduces the tendency to place production concern above all else and equip employees with the knowledge that the company considers safety as a success route (Yankah, 2012). That expectation ensures that project managers will be informed of safety related issues and problems and be more safety conscious.

2.6.7 Safety records

There is the need for a more dynamic and efficient accident data collection base in position (cf. Dorji and Hadikusumo, 2006). This could be a possible dispensation of uniform data retrieval forms and setups to firms. Construction firms ought to vividly describe their accident data to the safety agency responsible for keeping the records at steady intervals for essential information gathering, observation of the safety registers and dissemination of information, (Dorji and Hadikusumo, 2006). In the absence of the safety records, the effects of accident on sites cannot be analyzed in social and financial terms. Table 2.2 illustrates a summary of safety control techniques used in the construction industry.

Table 2.2: Summary of the safety control techniques used in the construction industry

Safety control techniques	Literature sources
Personnel selection	Guastello (1993); Chau et al. (2002) Chignell et al. (1986); Karwowski et al. (1988);
Technological interventions (1993);	Kjellen (1990); Sjostro (1990); Malm and Souminem (1990); Guastello Bernold et al. (2001); Li and Bernold (2005);
Behavior modification	Loafman (1986); Guastello (1993); Sulzer-Azaroff and Austin (2000); Langford et al. (2000);

contractor with good safety performance	Laufer and Ledbetter (1986); Selecting Levitt and Samelson (1987); Dorji and Hadikusumo (2006);
Poster campaign	Hale and Glendon (1987); Saarela et al. (1989); Saari (1998);
Quality circle	Saarela (1990); Rosenfeld et al. (1991); Guastello (1993);
<u>Safety rules and regulations</u>	Koehn et al. (1995);
Exercise and stress management	Murphy (1984); Cady et al. (1985); Gebhardt and Crump (1990); Ivancevich et al. (1990); Wolff (2009);
Near-miss accident reporting	Carter and Menckel (1985); Guastello (1993); Gyi et al. (1999);
Safety policies	Hammer (1981); Peyton and Rubio (1991); CSAO (1993); Dorji and Hadikusumo (2006); Amartey (2014);
Safety climate	Dedobbeleer and Beland (1991); Niskanen (1994); Robbins (2004); Williamson et al. (1997) Gosh et al. (2010);
Zero injury technique	CII (1993); Hinze and Wilson (2000);
Application of ample safety programs	Fales (1990); Peyton and Rubio (1991); Koehn et al. (1995); Adei and Kunfaa (2007); Aksorn et al. (2009); Al-Kilani (2011);
Safety promotion	Levitt and Samelson (1987); Bennet (2003) Dorji and Hadikusumo (2006); Amartey (2014); Larcher and Sohail (1999) Kartam et al., (2000); Yankah, K. (2012)
Safety records	Dorji and Hadikusumo (2006)

2.7 THE IMPORTANCE OF SAFETY CONTROL TECHNIQUES IN THE CONSTRUCTION INDUSTRY

Globally, Construction Health and Safety risks have always been crucial interest for industrialists and scientists (cf. Phoya, 2012). More so, features of construction culture in developing countries differ from that of the developed. And hence safety control techniques differ in methodological applications but with similar beneficial outcomes. The usual positive effect noticed illustrates the importance of a solid safety culture. According to McGraw hill construction (2013), equal trade opportunities inspire

workers to alert hazardous environment, whilst offering safety analysis results in fatality estimates. Additionally, positive business outcomes are realized since there is a capacity to engage in novel agreement and thereby better the project quality because of proper safety activities (McGraw hill construction, 2013).

Health and safety legislation has been developed to ensure safe management of construction businesses, (Kheni, 2008). Consequently, health and safety management has evolved from measures adopted in safety control to more systematic and proactive technique aimed at reducing the risk of hazards in the industry (ibid). However, with the extensive workforce it employs, health and safety issues have become significant, since the industry still has the reputation of being one with the highest fatality and accident rates. Managing health and safety related issues, helps to ensure that construction firms achieve their health and safety objectives (cf. Fernandez et al., 2007; Rajendran and Gambatese, 2009). Moreover, it is important for employees to be empowered and involved in health and safety matters. For instance, a provision made in conditions of employment for being able to refuse to do dangerous and unsafe work (Teo et al. 2008; Agumba and Haupt, 2008). Proactive observations in Health and safety activities constitute a vehicle to improving work performances. According to Azimah et al. (2009), safety control techniques does not only resolve health and safety constraints, but also enhances overall legal compliance.

2.8 CHAPTER SUMMARY

The general development of safety control techniques has been deliberated upon, accompanied with a background on the conceptual attributes of safety techniques, revealing that it is a worldwide concern craving attention.

The various existing Ghanaian health and safety legislations were identified and as indicated from the study, Ghana lacks a national Occupational Health and Safety policy and hence the nation relies on the main legislative documents on Occupational Health and Safety, i.e.; The Factories, Offices and Shops Act, Workman's Compensation Law, and Labor Act 2003. Brief discussions on the history of Construction Health and Safety reveals the various interventions by „Safety Patriarchs“ during the distinct Ages of Civilization. Objectively, the chapter has dealt with issues concerning safety control techniques, revealing from literature, the safety control techniques such as personnel selection, technological interventions, the use of safety policies and safety records and challenges of safety control techniques such as; lack of response from technology, lack of safety promotion, inadequate engineering and administrative controls.

In conclusion, the significance of safety control techniques discloses the significant impact of these techniques for construction industry development.

CHAPTER THREE RESEARCH METHODOLOGY

3.1 INTRODUCTION

In this chapter, the research methodology adopted to execute the investigation is expressed. How the data was collected, handled and utilized in addressing the various issues brought up by the research aim and objectives are covered. Data analysis technique employed in evaluating the collected data, taking into account how the sample population and sample size were arrived at, among other important methodological approaches used are outlined also under the chapter. In summary, it describes the entire approach adopted to address the research aim and objectives. It is also in this chapter that the background reasoning behind the chosen research

methodology is described and all methodological choices made for the conduct of the study justified.

The chapter in brief explains, the “what is done”, “how it was done” and the “whys” aspect of the study’s fundamental positions.

3.2 RESEARCH DESIGN

Kothari (2004) defined the term “research design” as the procedure of circumstances for gathering and enquiry of data in a way that targets to link significance to the research purpose with economy in process. The reason for research design is to make available an outline for answering study problem, (Wood and Haber, 1998). In the previous two decades, research methodologies have expanded to a stage at which specialists or inquirers have numerous inclinations (Creswell, 2003). Three regularly used design; qualitative, quantitative and blended techniques are the most utilized.

These three methodologies are not as different as they first appear. Qualitative and quantitative methodologies are not to be seen as perfect inverses or inconsistencies; rather, they mean different closures on a continuum base (Newman and Benz, 1998).

Qualitative research is actually an umbrella term incorporating a broad assortment of systems, for example, interviews, contextual investigations, discourse analysis and ethnographic examination. Data collected qualitatively are not basically or much of the time arithmetical and in this manner can't be inspected by utilizing numbers. Henceforth, a quantitative methodology is on a very basic level about gathering arithmetical insights to clear up a particular event, particular inquiries show up quickly suitable to being answered by method for quantitative systems thus, for this study, the

quantitative examination configuration is received and the contention legitimization of this decision introduced underneath.

Quantitative research approach practically used for this study denotes elaborating occurrences by which accumulating arithmetical statistics are scrutinized using statistically founded approaches in specific figures (Aliaga and Gunderson, 2000). Wadsworth (1997) expressed that quantitative research speaks about "what number of; to what degree, or the amount of viewpoint, which includes tallying and other information investigation. The prime point of quantitative research is to develop and adopt scientific simulations, philosophies, premises concerning the natural occurrences (Sarantakos, 2005). The study strategy makes utilization of surveys, reviews and tests to accumulate information that is reviewed and organized in numbers, which permits the information to be described by the utilization of statistical analysis (Hittleman and Simon, 1997).

The selection of quantitative research approach is deemed justifiable for this study because the approach is deductive which implies that it is associated with verification of theories and hypothesis testing. It also employs the use of questionnaires and existing databases which this study seeks to employ. It also involves the use of statistical tools in analyzing large sample size from a population to get an outcome that can be generalized.

3.3 RESEARCH STRATEGY

There are six (6) primary research methodologies occupied with research design: Historical exploration delineates verifiable confirmation and is helpful when the examination inquiry stresses on something from the past; Interpretive exploration fixates on contemporary circumstances, and in light of the fact that these are essentially

'sneaky', social events, they are best embraced utilizing the subjective procedure that obliges data marvels, for example, the impacts of present day business enterprise on students in Ghana; Experimental research is the most ordinary exploration technique as it is perceived as the exhaustive control of variables (frequently in a lab foundation), with the point of attributing causality. This is ordinarily quantitative, as it manages evaluated and controlled circumstances; Simulation research is the recovery of some component of the physical surroundings and are generally intrigued by deciding the likely achievement of a configuration.

A typical gadget in this technique is the PC, since it can settle a whole accumulation of variables. Sensible argumentation exploration is a game plan of coherent stages inside of a shut framework, traditionally of the fields of rationality or science. Along these lines, one may use this system to clarify a philosophical treatise on configuration of a paper for instance, or a relative investigation of paper sizes.

This study fixated on the 6th system called the Correlation Research. Correlational examination is revealing of examples in a particular setting or condition (Mertens, 1998). It is commonly valuable for a continuation on going before exploration. Infrequently, interesting examples rise up out of a study for occasion in exploring the variables affecting the entrepreneurial choices of Ghanaian development students, one may likewise see that some apparently unbiased investigations of different students from different fields or nations are and have a tendency to be comparative.

3.4 THE SURVEY PROCESS

Cohen et al. (2005) claimed that analysts who inculcate positivist recognition utilize a scope of customary alternatives, for example, questionnaires and surveys. Kraemer (1991) opined that survey exploration is utilized to quantitatively characterize careful

elements of predefined masses which comprise of relationship between variables. Kraemer (1991), further pointed different qualities of survey research by stating that the information fundamental for the study exploration are gathered from individuals by utilizing certain offer of the masses from which revelations can later be completely attributed to the people. As indicated by Glasow (2005), independent and dependent variables are utilized to layout the scope of survey research; and that before the beginning of the study, the scientist must predicate a model of relationship existing among the variables.

Study design comprise of two stages; the improvement of testing plan and the inference of the populace estimate from the sample data. The sample plan includes the choice of test; determination of a suitable sample mass; and the decision of media through which the study will be overseen, which embodies phone interview, up-close and personal interviews and sent reviews surveys making use postal or electronic mail (Levy and Lemeshow, 1999; Salant and Dillman, 1994).

With regards to the above works, as exhibited beforehand in the surviving writing literature review, the method of reasoning for receiving the review process for this study is implanted in the rationality that the study procedure empowers information to be assembled from substantial number of respondents so as to sum up the aftereffects of the study. Furthermore the examination procedure was embraced in light of its capacity to take into consideration the conglomeration of the feelings and state of mind of respondents on the different features of development experts under scrutiny remembering the example for this study includes experts classified as health and safety officers, site supervisors, site engineers, project managers, assistant project managers

and project coordinators of selected registered and operating D3K3 and D4K4 construction firms in the Greater Accra region of Ghana.

3.4.1 Research Scope and Boundaries

The research was limited to Ghana's capital city, Accra. Geographically, because of its tactical position and significance in the chronicles of construction operations in Ghana. Given that pecuniary development is chiefly slanted to the capital, above 60 percent of the registered building contractors tend to work formally in the Greater Accra region (Ahadzie, 2007) whereas the residual nine regions put collected, yields the remaining 40% (Ahadzie, 2007). An added reason for limiting the survey to this region was entrenched in the intensified construction deeds in the Greater Accra region. Further, the study limits its scope to only professionals in D3K3 and D4K4 construction firms in the geographical scope. This is more so because majority of Ghanaian construction firms are registered under the financial class of D3K3/D4K4, and it is these class of construction firms that the research believe have major issues regarding health and safety since they are regarded as small firms with limited resources.

3.5 POPULATION AND SAMPLING PROCEDURES

3.5.1 Population and Sample Frame

A precondition to sample selection is to characterize the imprint people as intently as could be expected under the circumstances (Salant and Dillman, 1994). Despite what might be expected, it is mostly impractical to know the genuine populace consequently Attewell and Rule (1991) suggested that a theoretical sample may be utilized; theoretical specimen purposively chooses associations that show the coveted qualities that are the center of the specialist's study. This study seeks to evaluate the knowledge

and application of safety control techniques in the Ghanaian Construction Industry. The population for the study includes all health and safety officers, site supervisors, site engineers, project managers, assistant project managers and project coordinators of selected registered D3K3 and D4K4 construction firms operating in the Greater Accra region of Ghana.

The composition of the sampling frame comprised of: 5 health and safety officers; 31 health and safety supervisors; 30 site supervisors; 19 site engineers; 19 project managers; 12 assistant project managers and 1 project coordinators; this sum up to a population of 117. This sampling frame was drawn from 36 D3K4 and D4K4 construction firms in Accra.

3.5.2 Sample Size Determination and Sampling Technique Adopted

3.5.2.1 Sample size determination

With the sampling frame determined for the study, the popular Kish (1965) method of determining sample was used as in most empirical studies, and demonstrated in the works of Bolstein and Crow (2008).

The sample size for the study therefore is defined as;

$$n = \frac{n^1}{1 + n^1/N}$$

Where; n = sample size

N = total population size

$$n^1 = \frac{s^2}{v^2}$$

s = maximum standard deviation in the population element at a confidence interval of 95%

$s^2 = (1 - p) p$ = the proportion of population elements v = standard error of the distribution at 0.05

$$s^2 = 0.5(1 - 0.5)$$

$$s^2 = 0.25$$

$$n^1 = \frac{0.25}{0.05^2}$$

$$n^1 = 100$$

Now, $N = 57$

$$\text{And so therefore, sample size, } n = \frac{100}{1 + 100/57}$$

$$n = 36$$

So the Sample Size (n) for this study = 36 D3K4 and D4K4 construction firms.

3.5.2.2 Sampling Techniques

Sampling includes the assortment of various study parts from a characterized study populace. Where the populace is wide to regard hoarding data from every one of its individuals, an example of people is chosen trusting that the specimen is an agent of the populace (Degu and Yigzaw, 2006). The overall aim of all sampling methods is to obtain a sample which appears as a genuine descriptive of the target population. Research studies utilize basically a little portion of the populace, alluded to as an example. This is on account of utilizing an example is more down to earth and less exorbitant than gathering information from the whole populace. Nonetheless, Polit & Hungler (1999) stated that, the real danger of utilizing a chose test is that it may not adequately mirror the practices, characteristics, or convictions of the populace.

The principle inspecting system embraced for this study attempt in light of its motivation, outline, and functional result of the examination theme is purposive testing.

Purposive inspecting procedure is a non-probability testing strategy which embodies the cognizant determination of specific subjects to be incorporated in the study (Polit and Hungler, 1999). It is very suitable for circumstances where there is a need to reach a targeted sample quickly and where sampling for balance is not the primary concern. Also, the purposive sampling technique was used because the researchers' choice of certain classes of respondents who have been included in developing construction projects and are consequently experienced in construction health and safety issues to answer the questionnaires made it suitable for the study

In addition to the purposive sampling technique, the snowball sampling technique were used to satisfy the sample size for the study. The snowball sampling was applied in satisfying the sample size due to the challenges experienced in surveying the populace size of the class. Snowball testing is a method for discovering exploration subject (Atkinson and Flint, 2001). This technique is seen as a reaction to defeat the issues connected with disguised or difficult to-achieve populaces. Hence, the choice of snowball sampling used for identifying respondents with extensive information that were relevant to the study. This process continued till a representative sample size of one hundred and seventeen (117) respondents was obtained.

3.6 DATA COLLECTION AND INSTRUMENTATION

This facet of the research methodology deals with data gathering tools, methods, and techniques. It offers comprehensive clarifications to each of the techniques utilized as a part of tending to the aims, objectives, and research questions. Information gettogether is imperative in exploration, as the information adds to an enhanced understanding of a hypothetical foundation (Bernard, 2002).It should be noted that clear description of

these important components of the research design and methods are critical to communicating what was done in addressing the research concerns.

3.6.1 Data Sources

Data collection was prepared via both secondary and primary sources. The primary data involved the gathering of the experiential data through survey questionnaires. The secondary data (literature review) was separated from recognized proofs utilizing plain sheets and other applicable materials. The information extricated from literature shaped the theoretical basis for the research. Both direct and circuitous sources gave the information.

3.6.2 Data Collection Instrument

Casting through quantitative approach of enquiry, the main instrument used in the collection of the primary data from the respondents was a structured questionnaire survey. The respondents read the questions, interpreted its anticipated meaning and provided the likely responses. The content of the questionnaire was flawless and straightforward. The format of the survey was made simple to peruse and charming to the eye with a precisely outlined arrangement that made it less demanding to take after. The substance of the poll was predominantly shut finished with spaces for respondents to show their favored decision by ticking the spaces gave that coordinated the decision against the thing being measured.

3.6.3 Questionnaire Design

A structured closed-ended questionnaire was employed for its benefits such as: stressfree to probe and rapid response; needs no writing from respondents, and their scrutiny is unequivocal (Naoum, 1998). Safety control techniques used in the

construction industry were identified from comprehensive literature review. These safety control techniques are interpreted into simple, easy questions in clear-cut form with avoidance of technical terms towards the aim of diminishing the possible of blunders from the respondents in assessing the awareness of the safety control techniques in the Ghanaian Construction Industry. After preliminary approval of the study supervisor, a pilot survey was conducted among 15 experienced professional (i.e. 5 Health and Safety Supervisors, 5 Site Supervisors and 5 Project Managers) in the GCI for the reasons that their experiences and thorough thoughtfulness and knowledge in the field of construction, and for that matter knowledge in the study subject will be invaluable. The primary objective of the pilot study was to confirm or otherwise the fullness of the research instrument in apprehending the pertinent information relevant for the purpose of this study. Adjustments and alterations were then amalgamated into the questionnaires. The questionnaire was grouped into two main parts, addressing the research objectives. The first part requested social demographics of the participants and the second section addressing the research objectives.

The questionnaire designed included; close-ended questions and scaled response queries. A five point Likert scale was engaged to measure the concentration of respondent's view.

3.6.4 Questionnaire Format

Accessible literature proposes that the ideal length of survey extents from one side of A4 paper to eight pages of A4 paper (Naoum, 1998; Oppenheim 2000; Saunders et. al., 2000; Fellows & Liu, 2003; Polgar & Thomas, 2005). This research however composed a questionnaire covering five pages as gave in the Appendix A.

3.6.5 Content of Questionnaires

The nature of the reactions and reaction rate is routinely impacted by the sort of inquiries and the path in which inquiries are planned and submitted (Donkor, 2011). Grounded on this obsession it was then critical to ensure that the right inquiries are asked, significantly grasped and questioned in the right way (Wahab, 1996).

The next step after having recognized the respondents for the questionnaire and their features was to focus on the scheme of the real queries that solicited the requisite information for the study. The questionnaire consisted of thirteen (13) questions of mainly closed-ended and scaled-response type. The questions were typeset on standard A4, white colour sheets with front cover page. The questions were further divided into two (2) sections, A and B. While section A solicited information regarding the background information of respondents, Section B concentrated on queries related to the research objectives. The complete particulars of the survey are committed as an appendix to this research study (See Appendix A).

3.7 DATA ANALYSIS

This section of the research methodology presents the methods adopted for analysing data collected with regard to each of the study objectives.

To evaluate the awareness of safety control techniques among professionals in the Ghanaian Construction Industry (GCI)

To collect data for achieving this objective, respondents in the GCI were asked clear and simple questions that require them to provide answers such as „yes“, „no“, „never“, „often“, etc. to express their level of knowledge on various types of safety control techniques used in the construction industry. Data accumulated under this section were

essentially analysed descriptively with the help of simple frequencies and percentiles to evaluate how knowledgeable respondents were on various safety control techniques in the Ghanaian Construction Industry. According to Taylor-Powell in 1996, percentile is a commonly used statistics for expressing information as a proportion of a whole. He mentioned that, percentiles tend to be simple to understand and are a good way to display relations and contrasts either among classifications of responses or classifications of respondents. This was therefore adopted to compare the responses of the respondents in order to ascertain whether professionals in the GCI have knowledge on safety control techniques.

To identify the various types of safety control techniques used in the GCI

Analysis of data regarding the various types of safety control techniques used in the Ghanaian Construction Industry was done using the Relative Importance Index (RII) and a mean score method. P-values also adopted to determine the statistical significance of each factor. Scaled question were asked where the respondents were obliged to rate the significance of every technique on a 5point Likert scale using 1 for not important, 2 for less importance, 3 for neutral, 4 for important and 5 for very important and then, the Relative Importance Index was computed using the following equation:

$$\text{Relative Importance Index : } \frac{\sum w}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N}$$

Where W is the weighting given to each factor by the respondent, ranging from 1 to 5, (n1 = number of respondents for not important, n2 = number of respondents for less importance, n3 = number of respondents for neutral, n4 = number of respondents for important, n5 = number of respondents for very important). "A" is the highest weight (i.e. 5 in the study) and N is the total number of samples.

The relative importance index ranges from 0 to 1 (Tam and Le, 2006).

3.7.1 Cronbach's Alpha for Reliability Statistics

This technique is used to calculate the dependability of survey among respective fields and the mean of the entire fields of the survey. The normal range of Cronbach's coefficient alpha (α) value between 0.0 and + 1.0, and the higher values reflects a higher degree of core reliability (George and Mallery, 2003).

$$\alpha = \frac{Kr}{1 + (K - 1)r}$$

The nearer the Alpha (α) is to 1, the better the internal reliability of matters in the tool being assumed. The method that regulates alpha is impartially simple and makes use of the items (variables), k, in the scale and the average of the inter-item correlations, r.

3.8 CHAPTER SUMMARY

This chapter has deliberated research methods and given motives for the choices to accomplish the research aims and objectives. It described the research design and methodology, comprising the theoretical positions of the research, research strategy, and research design adopted for this study. The approaches and procedures used in the data gathering and analyses were also presented. The chapter concluded with the research process and addressed issues such as scope of questionnaire survey, data sources, sampling and sample size determination, questionnaires progress, content of the questionnaires, and data analysis methods.

CHAPTER FOUR ANALYSIS OF DATA AND DISCUSSION

4.1 INTRODUCTION

The data gathered from 117 construction professionals working within 36 selected D3K3 and D4K4 construction firms operating in the Greater Accra Region of Ghana are documented in this chapter. Respondents involving health and safety officers, site supervisors, site engineers, project managers, assistant project managers and project coordinators were purposively selected for the study. The study focused attention on evaluating the consciousness and use of safety control techniques in the GCI. The analysis was done thoroughly using descriptive statistics in terms of frequencies and percentiles. Also, the use of Relative Importance Index (RII) was acknowledged during the analysis of data. Data analysis was done and the results presented in line with the specific objectives of this study namely: to evaluate the awareness of safety control techniques among the GCI professionals; and to classify the several kinds safety control techniques used in the built environment. For an integral section of the analysis of data, a reliability statistics was conducted to test the validity and reliability of the survey instrument. The researcher administered 137 questionnaires and was able to retrieve 117 completed questionnaires which were all deemed valid for analysis after data screening. This signifies a response rate of 85.4%.

4.2 ANALYSIS OF DEMOGRAPHIC DATA

The intent of the gathered data was to explain respondents' background information as well as evaluate its impact on the study outcome. This section illustrates the data analysis pertaining to respondents' profile.

4.2.1 Financial Class of Firm

Table 4.1: Financial class of respondents' firm

Financial class	Frequency	Percent
-----------------	-----------	---------

D3K3	90	76.9
D4K4	27	23.1
Total	117	100.0

Source: Filed Survey, 2015

The focus of this study was mainly on D3K3 and D4K4 financial class of construction firms as registered by the Registrar General in Ghana and the Ministry of Water Resources Works and Housing. The study targeted these class of firms because majority of construction firms in Ghana fall under these categories. The rationales behind the questions were to inquire whether the respondent professionals involved in this study operate in D3K3 and D4K4 construction firms. Table 4.1 presents the total supply tally of the respondents with regards to their hierarchical and economic status of their respective firms. The results indicate that respondents working in D3K3 financial class of construction firms dominated the study (76.9%) and the remaining 23.1% works in D4K4 financial class of construction firms (see Table 4.1). This is an indication that indeed all the 117 participating respondents of this study works within D3K3 and D4K4 construction firms in Ghana which were the main focus of the study.

4.2.2 Respondents Age

Table 4.2: Respondents Age

Respondents Age	Frequency	Percent
21-25 years	1	0.9
26-30 years	23	19.7
31-35 years	23	19.7
36-40 years	28	23.9
41-45 years	28	23.9
46-50 years	13	11.1
Over 50 years	1	0.9

Total	117	100.0
--------------	------------	--------------

Source: Field Survey, 2015

The outcomes in Table 4.2, illustrate that most of the respondents (23.9%) each were among the age category of 36-40 and 41-45 years. This is followed by 19.7% each in the age category of 26-30 years and 31-35 years. About Eleven % of the respondents were captured in the age range of 46-50 years, while 0.9% each, representing a very small percentage were in the age category of 21-25 and Over 50 years. Judging by these results, it could be concluded that the construction industry is dominated by young and energetic professionals. Another possible reason for this could be that due to the strenuous, intense and complex nature of the construction work activities, young and energetic professionals are preferred in the sector to old professionals in the industry. Nevertheless, the old professionals, counting on their experiences may sometimes be preferred in the industry.

4.2.3 Highest Academic Qualification of Respondent

Knowing the educational background of respondents in this study was useful in the sense that respondents with some form of formal education may be able to read and

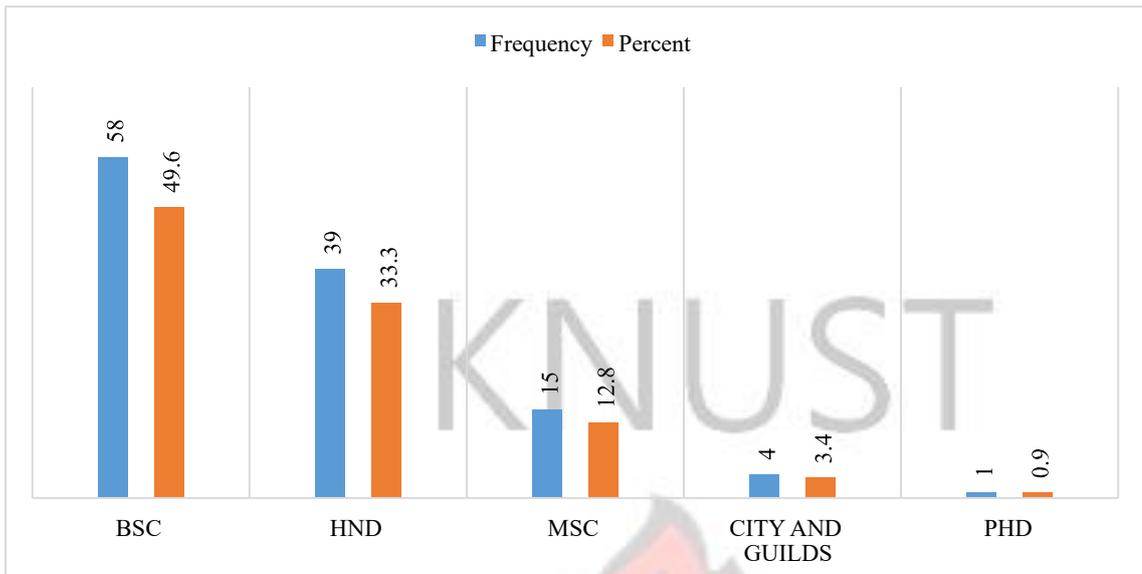


Figure 4.1: Highest academic qualification of respondent

Source: Field Survey, 2015

understand clearly the asked questions and given accurate responses which may affirm the reliability and credibility of the study findings. Drawing from Figure 4.1 above, it is observed that most of the respondents were BSc holders (49.6%) followed by HND holders (33.3%), MSc holders (12.8%), City and Guilds Cert. (3.4%) and only 0.9% of the respondents had a PhD. This could be an indication that professionals in the Ghanaian construction industry are highly educated and therefore literate to read, understand and write. However, very few of the respondents had a very high educational qualification such as PhD. This could mean that most professionals in the field of construction and related work activities concentrate on having long years of experience rather than a higher academic qualification. With these academic backgrounds of the respondents in this study, the confidence in the validity of responses provided could be credible.

4.2.4 Position in the Ghanaian Construction Industry

Table 4.3: Respondent's position in the Ghanaian Construction Industry

Position	Frequency	Percent
Health and Safety Supervisor	31	26.5
Site Supervisor	30	25.6
Site Engineer	19	16.2
Project Manager	19	16.2
Assistant Project Manager	12	10.3
Health and Safety Officer	5	5.2
Total	117	100.0

Source: Field Survey, 2015

Reference to the aim of the study, the respondents targeted were Health and Safety Supervisors, Site Supervisors, Site Engineers, Project Managers, Assistant Project Managers and Health and Safety Officers in the GCI. The selection of these respondents was hinged on their field experiences in the subject under study. Measures were put in place to make sure that respondent fell under the targeted group before issuing with a questionnaire. Further to this, the prepared questions requested respondents to indicate their status in the built environment industry. From Table 4.3, most of the respondents fell under Health and Safety Supervisors (26.5%) while the least percentage (5.2%) of the respondents were Health and Safety Officers. 25.6% were site supervisors. Site engineers and project managers accounted for 16.2% each while the remaining 10.3% were assistant project managers. Health and Safety Supervisor and Site Supervisor therefore dominated the study.

4.2.5 Number of Years worked in the Ghanaian Construction Industry

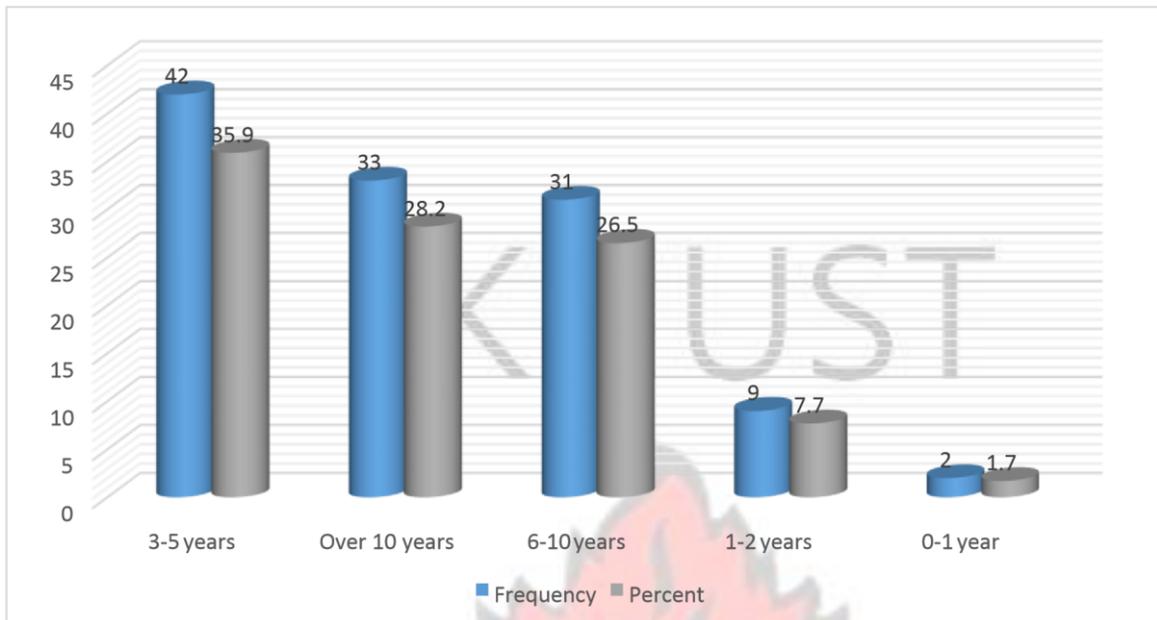


Figure 4.2: Number of Years worked in the Ghanaian Construction Industry

Source: Field Survey, 2015

It was anticipated that the number of years that a respondent has worked in the Ghanaian Construction Industry may have a direct relationship with the reliability and credibility of information that an observant respondent provides for the purpose of this study. Regarding this fact, the working years of respondent in the Ghanaian Construction Industry (GCI) was regarded as a significant component in this study. Data analysis regarding this observation was done and the results exemplified in Figure 4.2. From Figure 4.2, majority (35.9%) of the respondents have worked for 3 to 5 years in the local Ghanaian Construction Industry. 28.2% have worked for over 10 years, 26.5% have worked for 6 to 10 years, 7.7% have also worked for over 1 to 2 years and 1.7% have worked for a period of 1 year in the Ghanaian Construction Industry. Taking the overall statistic into consideration, it could be seen that most of the respondents have long work experiences in the Ghanaian Construction Industry, and having worked for

many years in the industry, one would believe that the respondents gave an accurate credible responses reflecting the prevailing condition of on the subject under study.

4.2.6 Average Number of Construction Projects Respondent have been involved in Ghana.

The intent of this part of the background information was to ascertain the average number of construction projects respondents have been involved in Ghana. A respondent's involvement in a number of construction projects is worthy, as respondents acquires more knowledge on the study area and thus gives relevance to the quality of information given.

Drawing from Table 4.4, 40.2 percent of the respondents have continuously been involved in an average number of 4-7 construction projects. 23.1 percent have been involved in over 10 construction projects averagely. Whilst an average number 8-10 projects have been undertaken by 17.1 percent of the respondents. 15.1 percent of respondents have been involved in 2-3 projects averagely, and lastly 4.3 percent of the respondents have been involved in 1 project only. Deducing from the outcome, one can concluded that the respondents had the essential experience and essential knowledge and therefore boost the confidence of the study outcome.

Table 4.4: Average number of construction projects respondent have been involved in Ghana

Average Number of Construction Projects	Frequency	Percent
4-7 projects	47	40.2
Over 10 projects	27	23.1
8-10 projects	20	17.1
2-3 projects	18	15.4

1 project only	5	4.3
Total	117	100.0

Source: Field Survey, 2015

4.2.7 Percentage of Projects Undertaken which involved Safety Control Techniques

This portion of the background presents the percentage of projects undertaken which involved safety control techniques. This was essential as the prime pivot of this study fulcrum around safety control techniques. Drawing on from Table 4.5, 30-40% of projects which involved Safety Control Techniques have been undertaken by 27.4 percent of the respondents. 20-30% of the projects involving the use of Safety Control Techniques have been undertaken by 19.7 percent. Meanwhile, 17.1 percent of the respondents undertook below 10% projects which involved Safety Control Techniques. Also, 13.7 percent of the total sample were involved in 40-50% of projects which involved safety control techniques. Lastly, very few of 9.4% represented by the total sample undertook 10-20% of projects which involved safety techniques. With most respondents „having participated in projects involving health and safety, the quality of the data illustrates the relevant results.

Table 4.5: Percentage of projects undertaken which involved safety control techniques

Percentage of projects	Frequency	Percent
30-40%	32	27.4
20-30%	23	19.7
below 10%	20	17.1
Over 50%	16	13.7
40-50%	15	12.8
10-20%	11	9.4

Total	117	100.0
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Source: Field Survey, 2015

4.3 KNOWLEDGE AND APPLICATION OF SAFETY CONTROL TECHNIQUES IN THE GHANAIAN CONSTRUCTION INDUSTRY

In order to elicit the needed accurate response data from the respondents for credibility in this area, the questions under this section were carefully couched and formulated towards the prime needs of the study to prevent any ambiguities in the minds of the respondents. Data collected from the field regarding the achievement of the specific objectives of the study were analysed rigorously and the results is presented and discussed as follows.

4.3.1 Evaluation of Awareness of Safety Control Techniques among Professionals in the Ghanaian Construction Industry (GCI)

4.3.1.1 Knowledge on Safety Control Techniques

From Figure 4.3, a significant rate of 82% of the total sample assured awareness in safety control techniques in the Ghanaian Construction Industry, whilst, 18% had no awareness of safety control techniques. These results clearly indicate that most professional in the industry are responsive to various safety control techniques. The data provided offers a valid and experienced indication in the area of safety control techniques.

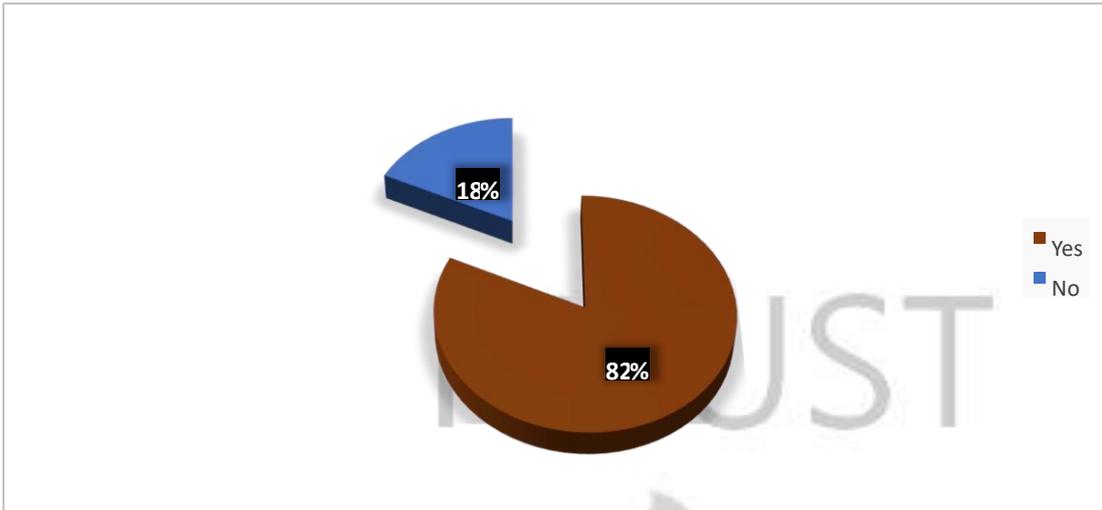


Figure 4.3: Knowledge on Safety Control Techniques

Source: Field Survey, 2015

4.3.1.2 Level of Knowledge on Safety Control Techniques

From Figure 4.4, 58% of the respondents are not very knowledgeable in safety control techniques. However, 42% of the respondents showed to be very knowledgeable. This outcome may be construed to strengthen more and validating the relevance of this study.

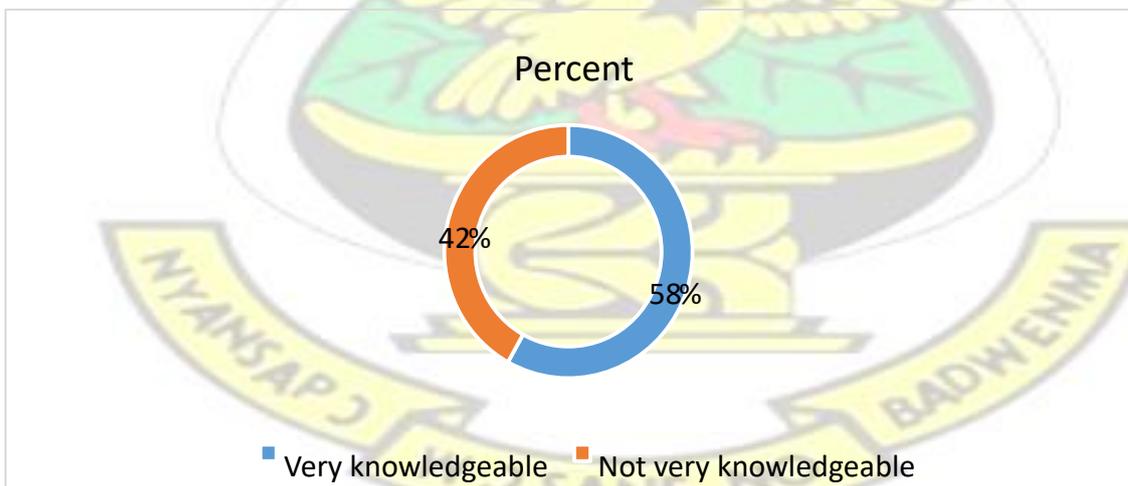


Figure 4.4: Level of Knowledge on safety control techniques

Source: Field Survey, 2015

4.3.1.3 Application of Safety Control Techniques to Ensure Safety on Projects

An integral part of this research was to assess the application of safety control techniques in the Ghanaian Construction Industry (GCI). From Figure 4.5, a significant figure of 87% of the respondents applies safety control techniques in their projects; however, a minimal figure of 13% does not apply safety control techniques in their construction projects. This depicts that the respondents are massively associated with safety control techniques hence providing a high validity of accurate data response.

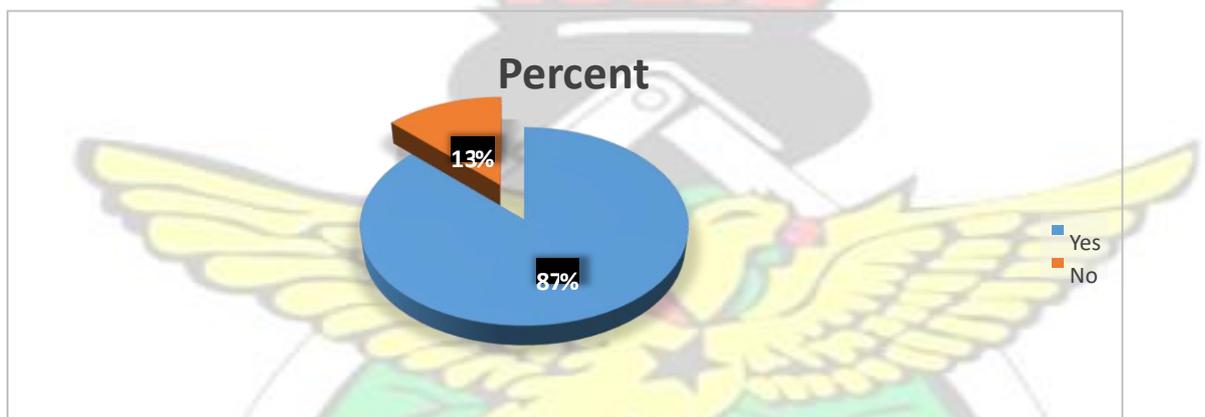


Figure 4.5: Application of safety control techniques to ensure safety on projects

Source: Field Survey, 2015

4.3.1.4 Frequency of Safety Control Techniques Application on Projects in the GCI

From Table 4.6, 40.2% of the respondents apply safety control techniques on projects quite often. 33.3% applies safety control techniques on projects very often, and 14.5% often. However, 12% of the respondents do not often apply safety control techniques on their projects.

The implication of the above statistics is that majority of construction practitioners in the Ghanaian Construction Industry often apply Safety Control Techniques on their

Construction Projects. Affirmatively it indicates the importance of safety control techniques as expressed by previous researchers in their literatures on safety management in construction industry.

Table 4.6: Frequency of safety control techniques application on projects in the GCI

Frequency	Frequency	Percent
Quite often	47	40.2
Very often	39	33.3
Often	17	14.5
Not often	14	12.0
Total	117	100.0

Source: Field Survey, 2015

4.3.1.5 Basis for the Application of Safety Control Techniques to Ensure Safety on projects in the GCI

Drawing from Table 4.7, 69.2% of the total sample of 117 applies safety control techniques on a daily basis. Whiles, 12.8% applies safety control techniques on a weekly basis. However, 11.1% of respondents never applied safety control techniques on any basis. Meanwhile, on a monthly basis, 4.3% of respondents agreed to applying safety control techniques. Lastly, 2.6% of respondents applies safety control techniques annually. These encouraging results could mean better prospects of a near accident free construction industry in Ghana.

Table 4.7: Basis for the application of safety control techniques

Basis	Frequency	Percent
Daily basis	81	69.2
Weekly basis	15	12.8
Never	13	11.1

Monthly basis	5	4.3
Annually	3	2.6
Total	117	100.0

Source: Field Survey, 2015

4.3.2 Safety Control Techniques used in the Ghanaian Construction Industry (GCI)

One of the major objectives of this study was to determine the categories of safety control techniques used in the Ghanaian Construction Industry. In order to achieve this objective, an extensive and intense literature review was conducted from a global perspective to unveil various safety control techniques used in the construction industry worldwide. Safety control techniques identified were scrutinized and utilized in designing a section under the survey questionnaire for respondents to ascertain the status of these techniques in Ghana. The identified safety control techniques through the literature review includes: safety promotion; poster campaign; safety programs; utilization of comprehensive safety programs; selecting contractor with good safety performance; among others.

These techniques were tabulated as part of the survey questionnaire and given to respondents to first indicate by providing a „yes“ or „no“ answer to whether or not each of the identified safety control techniques are applicable in the local industry and secondly, to rate them in their opinions in line with the prevailing situation in the Ghanaian Construction Industry, the level of importance of those techniques which are applicable to the local industry on a Likert scale of 1-5, where 1=Not important, 2=Less important, 3=Neutral, 4=Important and 5=Very important. Field data obtained from the survey response in this regard were analyzed using a simple statistical tool, Relative Importance Index (RII) for the ranking of the factors. The aim of the analysis, as it were,

was to establish the relative importance of the various benefits. The relative importance index (RII) was calculated using the formula (Fagbenle *et al.*, 2004).

$$RII = \frac{\sum P_i U_i}{N(n)}$$

Where RII = relative importance index

P_i = respondent's rating of the importance of the benefit

U_i = respondent's placing identical weighting or rating on the benefit N= sample size

n = the highest attainable score on the benefit.

The analysis results are illustrated in Table 4.8. The „yes“ and „no“ section of the table indicates which techniques are reported by majority of the respondents as being used in the local industry to control safety and those which are reported by majority of the respondents as not being used.

The „yes“ section indicates „being used“ while the „no“ section indicates not in used.

Taking majority responses into consideration, it is deduced from the results in Table

4.8 that the following ten (10) safety control techniques in the opinion of respondents are used in the local industry: safety records, safety rules and regulations, safety management, safety policies, safety promotion, poster campaign, safety programs, utilization of comprehensive safety programs, selecting contractors with good safety performance and personnel selection while the following are not in used in the GCI: behavior modification, technological interventions etc.

To determine the most important safety control techniques among the ten (10) techniques (as mentioned above), an assumption was made that: all factors with RIIs

equal to or above 50.0% and with a mean score of 3.5 and above are important safety control techniques regarded.. This means that looking at the overall results presented in Table 4.8, eight (8) out of the ten (10) safety control techniques were agreed by the respondents to be the most important safety control techniques used, since these eight factors obtained RIIs greater than the hypothesized RII and a mean of 50.0% and 3.5 respectively. The eight (8) most important safety control techniques used as revealed by the findings of this study are as follows: Safety Records; Safety rules and regulations; Safety management; Safety policies; Safety promotion; Poster campaign; Safety programs; and Utilization of comprehensive safety programs, in descending order of importance. However, the essentially safety control techniques are shown in table 4.8.

Table 4.8: RIIs and mean values for Safety Control Techniques used in the Ghanaian Construction Industry (GCI)

Safety Control Technique		Yes (%)	No (%)	Mean	RII (%)	Rank
1	Safety Records	80.2	19.8	4.45	89.0	1
2	Safety rules and regulations	93.2	6.8	4.15	83.0	2
3	Safety management	70.1	29.9	4.06	81.0	3
4	Safety policies	84.6	15.4	3.99	80.0	4
5	Safety promotion	70.9	29.1	3.91	78.0	5
6	Poster campaign	85.5	14.5	3.86	77.0	6

7	Safety programs	84.4	15.6	3.59	72.0	7
8	Utilization of comprehensive safety programs	57.3	42.7	3.54	71.0	8
9	Selecting contractor with good safety performance	59.8	40.2	3.45	69.0	9
10	Personnel selection	59.0	41.0	3.28	66.0	10
11	Behavior modification**	46.2	53.8	3.03	61.0	11
12	Technological interventions**	40.2	59.8	2.91	58.0	12
13	Quality circle**	22.2	77.8	2.61	52.0	13
14	Exercise and stress management**	23.9	76.1	2.49	50.0	14
15	Near-miss accident reporting**	28.2	71.8	2.33	47.0	15
16	Safety climate**	19.7	80.3	2.26	45.0	16
17	Zero injury technique**	26.5	73.5	2.25	45.0	17

**Depicts not used in the GCI

Source: Field Survey, 2015

4.3.2.1 Safety records

Dorji and Hadikusumo (2006) is of the view that in the construction industry, it is very important to have a more dynamic and efficient record of accidents. Accident data is an essential part of safety records that can serve as a possible information data retrieval

form. These records become vital monitoring tool on the safety performances of firms at any point in time. Dorji and Hadikusumo further mentioned that, analyzing the effects of accidents on construction sites in social and financial terms is only possible if a well-documented safety records does exist. In affirmation to this assertions, the findings of this study reveals that safety records are the most important safety control techniques used ,as validated in the results of this study; ranking 1st with an RII of 89.0% and a mean score of 4.45 (see Table 4.9 above). The construction industry has long been tagged as a hazardous, its safety management is therefore important. However, safety management is and will only be meaningful in the industry if safety record are well kept and can be used to monitor safety performance. This study has confirmed this importance.

4.3.2.2 Safety rules and regulations

Safety rules and regulations gained respondents agreement as the second most important safety control technique used. This factor scores an RII value of 83.0% and a mean score of 4.15 (see Table 4.9 above). An indication that laid down rules and regulations governing safety practices in the construction industry is very necessary in the quest for effective and efficient control of safety in the construction industry. With several efforts being put in place to set out standards for health and safety management in the industry, this technique becomes invaluable.

It is confirmed as an important technique needed for controlling safety in the construction industry by the findings of this study.

4.3.2.3 Safety management

Safety management in the construction industry is important due to the hazardous nature of the industry, posing massive risks to the health and well-being of its workers and the environment. The hazardous nature of the industry has left construction industries around the world with no other portion than to adopt innovative techniques for controlling the safety of its workers and the environment as a whole.

Safety management is ranked 3rd with an RII of 81.0% and a mean score of 4.06 (Table 4.9). In developed economy like that of United State of America, safety activities in construction is controlled by government agencies which offers rigid conventions and regulations to impose safety and health criteria on construction work sites (Dorji and Hadikusumo, 2006). However, legal policy documentation singly cannot minimize fatality percentages in the industry, except professionals and management execute effective decisions to incorporate norms and patterns into daily practices.

4.3.2.4 Safety policies

Ranking 4th among the important safety control techniques used, as revealed by the findings of this study is safety policies. From Table 4.9 above, safety policies obtained an RII of 80.0% and a mean score of 3.99. Primarily, the need for any dynamic safety control program is to evidently make workers aware that their managers are interested in eliminating accidents (Amartey, 2014). Agumba and Haupt (2008) agrees that safety policy is an important safety control technique in the construction industry and advises that workers should further be involved in developing health and safety policy, providing written suggestions on health and safety, being informed of the provisions of health and safety plans, being involved in health and safety inspections, being consulted when the health and safety plan is compiled, and

being involved in the growth of health and safety rules and safe work procedures are all laudable considerations.

4.3.2.5 Safety promotion

Another important safety control technique according to the findings of this study is safety promotion, Ranking 5th, with an RII value of 78.0% and a mean score of 3.91 (see Table 4.9 above). Promotion of a safety culture in the industry cannot be over emphasized. An effective and efficient control of safety is needed and management must take the opportunity to make comments about the company's safety effort and the company's commitment to safety during gatherings. Top management can maximize safety awareness by taking time to discuss safety along with costs and schedule concerns whenever they are on site. Awareness of top management's concern for safety reduces the tendency to place production concern above all else and lets employees know that the company considers safety as a success route (Yankah, 2012). That expectation ensures that project managers will be informed of safety related issues and problems and be more safety conscious.

4.4 VALIDITY AND RELIABILITY TEST OF THE SURVEY INSTRUMENT

Validity test infers the ascertainment of whether the study or the exploration instrument utilized as a part of leading the test of the examination work when utilized as a part of somewhere else with the same or comparable variables with the prior information utilized, will deliver fundamentally the same result. Henceforth, the unwavering quality of an estimation can be thought to be the degree to which an estimation is free from suitable blunders. This infers that research can be said to be dependable just when it creates the same result after rehashed utilization. The purpose behind testing

unwavering quality of exploration work is to guarantee that variability of the generalization of the conclusion holds, (Bayode and Adebola, 2012).

Table 4.9: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Number of Items	Standardized Items
.737	.842	44

Cronbach's alpha is a measure of inner consistency, how firmly related an arrangement of things are as a gathering. It is thought to be a measure of scale dependability. The Cronbach's alpha coefficient, in this case study is .737 (see Table 4.9). This value is above .7, so the scale can be considered reliable with the sample.

4.5 CHAPTER SUMMARY

Results from rigorous data analysis, indicates that controlling safety in the Ghanaian Construction Industry is of much interest to corporate construction professionals in the local industry as well as the industry academician, and that, there are a number of scientific techniques adopted for controlling safety in the industry. Very popular among these techniques includes: safety policies, safety rules and regulations, safety promotions, safety management, records, among others. Analysis conducted delved deeply into evaluating the awareness of construction professionals in the Ghanaian Construction Industry on safety control techniques, and based on the data gathered relating to the several parameters the study used to conduct this evaluation, the outcome is that professional in the Ghanaian Construction Industry had some fair knowledge on safety control techniques. It must be noted that the analysis was done in line with the research objectives and according to the items on the survey questionnaires. Descriptive

statistics and the Relative Importance Index (RII) were employed as the analytical tools and the findings of the study are used to make recommendations in the final chapter that follows.

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CHAPTER FIVE SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This final chapter of the study report, outline the brief outcomes from the endeavour, its conclusions and recommendations. Avenues for further research in line with this study are also made here.

5.2 SUMMARY OF FINDINGS

The findings obtained and pertaining to the study objectives are briefly presented under points 5.2.1 and 5.2.2.

5.2.1 Awareness of safety control techniques among professionals in the Ghanaian Construction Industry (GCI)

In addressing this objective, several parameters were used in the survey questionnaire to evaluate the awareness of respondents on safety control techniques in the Ghanaian Construction Industry. Questions such as whether or not a respondent is knowledgeable about safety control techniques, whether or not respondents use safety control techniques on projects, how frequent and the basis on which safety control techniques are used etc. were asked to evaluate the awareness.

Data collected from the field and subjected to thorough analysis, indicated that most professionals in the industry and therefore Construction firms are much aware of safety control techniques and have very good knowledge on them. 82% of the study respondents justified this. Majority of the respondents validated that to ensure safety on construction projects, safety control techniques are often applied on a daily basis.

A significant percentage of the respondents also mentioned that safety control techniques are applied on weekly basis in the industry.

Drawing from the above outcomes, it is demonstrated that professionals in the Ghanaian Construction Industry have a significant level of awareness on safety control techniques when it comes to safety management issues

5.2.2 Identification of the various types of safety control techniques used in the Ghanaian Construction Industry (GCI)

To achieve this objective, a review of extant literature on safety control techniques in the construction industry was conducted from a global point of perspective. The depth of the literature review conducted under the study identified seventeen (17) safety control techniques used in the global construction industry. These 17 safety control techniques were formulated into questions on the survey questionnaire requesting respondents to identify which ones they were familiar with and used in the Ghanaian Construction Industry. For each one of them, respondents were further asked to indicate its level of importance in the Ghanaian Construction Industry when it comes to controlling safety. Analyzing their responses, it was found that 10 out of the 17 identified safety control techniques are commonly used in the Ghanaian Construction Industry: safety records, safety rules and regulations, safety management, safety policies, safety promotion, poster campaign, safety programs, utilization of comprehensive safety programs, selecting contractor with good safety performance and personnel selection while behavior modification and technological interventions among others are hardly used.

Among the 10 most commonly used techniques in the Ghanaian Construction Industry according to the findings of this study, 8 of them are most important in the following diminishing order of importance: Safety Records, Safety rules and regulations, Safety management, Safety policies, Safety promotion, Poster campaign, Safety programs, and Utilization of comprehensive safety programs.

5.3 CONCLUSIONS TO THE STUDY

After conducting this study on safety control techniques in the construction industry as a means of evaluating the knowledge and application of safety control techniques in the Ghanaian Construction Industry, the study makes the following conclusions:

- The study agrees with opinions of other construction researchers that the construction industry is a hazardous industry and for that matter health and safety management is a key issue in the industry;
- Similar to all construction industries across the world, the Ghanaian Construction Industry sees the need to apply control and safety techniques in safeguarding its workers and protect their environment. Hence, the industry uses techniques that are essential in controlling safety in the industry; and
- That the study also concludes with the observation that keeping safety records is very important for health and safety management in the Ghanaian construction industry.

5.4 RECOMMENDATIONS

Centered on the outcomes of this research, these recommendations are forwarded to concerned bodies, stakeholders and practitioners in the construction industry to help amend the supervision of health and safety at worksites.

1. Participants in building activities ought to provide the initiative to educate professionals in the industry.

2. In order to monitor the safety performance of the firm, effective keeping of data of fatalities at worksites and places ought to be acknowledged.
3. Management of every construction firm in the industry must make it a habit to promote and encourage good safety cultures and discourage bad ones; and
4. The control of safety on projects must be a topmost aim of project managers and every project stakeholder.

5.5 AVENUES FOR FURTHER RESEARCH

Opportunities for further research still exist in line with this study, taking into consideration, its limitations. The study focused attention on safety control techniques in the GCI; therefore, further studies could be investigating into the following fields;

1. Advance studies on the impact of the application safety control techniques on the overall health and safety management in the Ghanaian Construction Industry; and
2. Future studies to explore the challenges of the application of safety control techniques in the Ghanaian Construction Industry.

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APPENDIX

QUESTIONNAIRE

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF ART AND BUILT ENVIRONMENT

SURVEY QUESTIONNAIRE

TO ALL WHOM IT MAY CONCERN

Dear Sir/Madam RE: FINAL YEAR RESEARCH PROJET- MSc CONSTRUCTION MANAGEMENT

I am a final year MSc Construction Management student of KNUST. In fulfilment of the requirements for graduation, I am carrying out research on „Assessment of knowledge and application of safety control techniques in the Ghanaian Construction Industry. Your participation in this research will be greatly appreciated in order to find solutions to problems regarding construction health and safety in Ghana and other economies around the world. Your participation in this survey will enable me add to knowledge and improve construction health and safety management.

I wish therefore to assure you that any information you provide will be treated with the strictest confidence and will only be used for the purpose of this research.

I count on your favorable consideration.

Yours faithfully,

Supervisor

Signature

Signature

SECTION A: Background Information

Please tick [] the most appropriate answer or option for each question only where it is applicable. Where you are required to state please write your answer in the space provided.

1. Please Indicate the financial class of your firm

D3K3

D4K4

2. Age of respondent

below 21 years

21-25 years

26-30 years

31-35 years

36-40 years

41-45 years

46-50 years

Over 50 years

3. Highest academic qualification

City and Guilds

HND

BSc

MSc

PhD

Others..... (Please indicate)

4. Please indicate your position in the Ghanaian Construction Industry

-] Health and Safety Officer
-] Site Supervisor
-] Site Engineer
-] Project Manager
-] Assistant Project Manager
-] Project Co-ordinator
-] Health and Safety Supervisors

5. Number of years you have worked in the Ghanaian Construction Industry

-] 0-1year
-] 1-2 years
-] 3-5 years
-] 6- 10 years
-] Over 10 years

6. Please indicate the number of construction projects you have been involved in Ghana

-] None
-] 1 project only
-] 2-3 projects
-] 4-7 projects
-] 8-10 projects
-] Over 10 projects

7. What percentage of the projects you have been involved have safety control techniques been applied?

-] below 10%
-] 10 – 20%
-] 20 – 30%

30 – 40%

40 – 50%

Over 50%

SECTION B: Knowledge and application of safety control techniques in the Ghanaian Construction Industry

8. Do you have any knowledge on safety control techniques in the Ghanaian Construction Industry?

Yes

No

9. If your answer to question 9 above is „yes“, how knowledgeable are you on safety control techniques in the Ghanaian Construction Industry? Very knowledgeable

Not very knowledgeable

10. Please do you apply safety control techniques in the Ghanaian Construction Industry to ensure safety on projects?

Yes

No

11. If your answer to question 11 above is „yes“, how often do you apply the safety control techniques on projects in the Ghanaian Construction Industry? Very often

Quite Often

Often

Not Often

12. On what basis do you apply safety control techniques to ensure safety on projects you have been involved in the Ghanaian Construction Industry?

Daily basis

- Weekly basis
- Monthly basis
- Annually
- Never

13. Kindly indicate the by ticking “Yes” or “No” if the following safety control techniques are used in the Ghanaian Construction Industry.

Also indicate how important or not each of the safety control techniques used in the Ghanaian

Construction Industry is. Use a scale of 1=not important, 2 = less importance, 3= neutral, 4 = important and 5 = very important

No	Safety Control Technique	Yes	No	1	2	3	4	5
1	Personnel selection							
2	Technological interventions							
3	Behavior modification							
4	Selecting contractor with good safety performance							
5	Poster campaign							
6	Quality circle							
7	Safety rules and regulations							
8	Exercise and stress management							
9	Near-miss accident reporting							
10	Safety Policies							
11	Safety Climate							
12	Zero injury technique							
13	Utilization of comprehensive safety programs							
14	Safety management							
15	Safety promotion							
16	Safety records							
<i>Others, please specify</i>								
17								
18								
29								
20								
21								

THANKS FOR YOUR PARTICIPATION

APPENDIX II

Table 4.9: RII computations for Safety Control Techniques used in the Ghanaian Construction Industry (GCI)

Safety Control Technique		Rating					Total	ΣW	Mean	RII (%)	Rank
		5	4	3	2	1					
1	Safety Records	75	27	12	1	2	117	521	4.45	89.0	1
2	Safety rules and regulations	57	40	13	4	3	117	486	4.15	83.0	2
3	Safety management	56	33	20	4	4	117	475	4.06	81.0	3
4	Safety policies	44	42	25	3	3	117	467	3.99	80.0	4
5	Safety promotion	51	36	18	9	3	117	458	3.91	78.0	5
6	Poster campaign	46	39	21	6	5	117	452	3.86	77.0	6
7	Safety programs	26	46	34	7	4	117	420	3.59	72.0	7
8	Utilization of comprehensive safety programs	23	47	36	7	4	117	414	3.54	71.0	8
9	Selecting contractor with good safety performance	22	44	38	9	4	117	404	3.45	69.0	9
10	Personnel selection	17	61	17	16	6	117	384	3.28	66.0	10
11	Behavior modification	14	50	26	18	9	117	354	3.03	61.0	11

12	Technological interventions	12	47	28	22	8	117	341	2.91	58.0	12
13	Quality circle	14	36	28	33	6	117	305	2.61	52.0	13
14	Exercise and stress management	24	25	21	40	7	117	291	2.49	50.0	14
15	Near-miss accident reporting	24	21	21	46	5	117	273	2.33	47.0	15
16	Safety climate	14	27	27	47	2	117	264	2.26	45.0	16
17	Zero injury technique	18	21	29	43	6	117	263	2.25	45.0	17

Source: Field Survey, 2015

