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Impact of Sub-Contractor Risk Management on Construction Schedule Performance

By

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DECLARATION

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

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ABSTRACT

Numerous construction projects are faced with late completion dates due to technical difficulties. These delays may also be attributed to the increasing complexity of projects and the underestimation of the complexity of a project. Due to the increasing complexities of projects, subcontracting is the order of the day so that firms can focus on their core competencies. However, there are situations where subcontractors disrupt the success of a construction project. Therefore, this study aimed at investigating the impact of sub-contractor risk management on schedule performance of construction projects. Four (4) objectives were established which were to determine the significant factors of subcontractor risk in construction project management, determine the significant factors of Schedule performance in construction project management, determine the relationship between factors of subcontractor risk and Schedule performance in construction project management and determine to what extent the risk factors impact schedule performance in construction project management. With these objectives, an extensive literature review was conducted from which variables on sub-contractor's risks and schedule performance were identified. The variables were subsequently used in the development of a structured questionnaire. The questionnaire was distributed and fifty-four (54) were retrieved and used for the analysis of the study. The analysis was done using the mean score ranking and the multiple regression analysis. From the analysis, it was realized that, the most significant risk was site co-ordination risks followed by poor organization and co-ordination of subcontractor, poor workmanship by the sub-contractor and lack of proper communication. With the second objective, it was realized that, the first ranked factor was high technical ability of the project manager. This was followed by the competence of the construction manager, effective communication and the availability of resources as and when required. With the third and fourth objectives, it was realized that, lack of proper communication, excessive change orders, legal disputes, material shortages and poor organization and co-ordination shown significant relationship with schedule performance. Generally, the results indicated that, there is a significant relationship between sub-contractor risk factors and schedule performance in the Ghanaian construction industry. From these findings, it was recommended that, contractors should adopt strategic risk management procedures in managing sub-contractor risk, project managers must communicate effectively with sub-contractors and main contractors in order to eliminate any form of misunderstanding and contractors must actively be involved in the site organization of sub-contractors to avoid work interference. This study was also limited to only schedule performance construction success criterion. Lastly, this study was also limited to the number of dependent variables that could be used as multiple regression uses only one dependent variable.

Keywords: complexity of projects, risk, schedule performance, strategic risk management, subcontractor risk management.

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DEDICATION

This work is dedicated to God Almighty for His support and travelling mercies throughout the study of the programme. I also dedicate it to my surviving parent; Mama Jane Adevu, my yet to be born children, my Wife; Mrs. Vida Ahiawodzie, my Siblings, all my Nephews and Nieces.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Most construction projects involve consultants, main contractors and subcontractors. Subcontractors may include specialist sub-contractors, trade sub-contractor and labor-only sub-contractor. Numerous studies have indicated the significance of the involvement of sub-contractors in construction projects (Abbasianjahromi *et al.*, 2013; Hartmann, 2010; Arditi and Chotibhongs, 2005; Ng *et al.*, 2008a and 2008b; and Wang and Liu, 2005). According to Arditi and Chotibhongs (2005), there are economic benefits in subletting parts of a project to sub-contractors as it improves the efficiency in managing resources. Kumaraswamy and Matthews (2000) describe Subcontractors as those who have specialize in the undertaking of a specific work, who may also play the role of representatives of the production system of the contractor organization in providing services in the areas of materials supply, human resource, equipment hiring, tools and designs. A construction subcontractor is that organization that enters into a contract with the prime contractor to execute portions of work for the main contractor. In many instances, subcontractors who are hired to carry out specific tasks in construction projects, play a vital role. Usually, the general contractor undertakes the core tasks and engages various specialty subcontractors to execute what is left. Benjaoran (2009) has observed that subcontracting is prevalent in housing and building construction projects than is the case of industrial and engineering projects. This can be attributed to the increasingly complex and specialized nature of buildings and the need for the provision of special services. However, there are numerous risks associated with the involvement of sub-contractors in a construction project.

Every human endeavor involves risk. PMBOK (2008), defines risk as an uncertain event or condition which if occurs has a positive or negative effect on the project objectives. Risk also have been defined as the effects of uncertainty on project objectives (ISO 321000). Thus, risk must be viewed as having both positive and negative impact on a construction project. Therefore, positive risk must be identified and exploited while negative risk must be eliminated or avoided. The success or failure of any process critically depends on how risks are dealt with (Dey, 2002).

Research has shown that, the construction industry is more susceptible to risk compared to the other industries. Researchers like Flanagan and Norman, (1993), Kim and Bajaj (2000) and Tah and Carr, (2000) attested to this fact. The productivity, performance, quality and cost of a construction project may be significantly affected if these inherent risks are not identified and dealt with (Mills, 2001). Edward and Bowen (1998), stipulated that, risk management is an imperative tool in dealing with construction risks in order to contain its effect. There are a number of scenarios which shows that the non-achievement of time, cost and quality objectives of a construction project can be due to the absence of risk management techniques in project management (Dey, 2002). In Ghana, many construction projects suffer from under-performance in terms of time (Fugar and Agyakwah, 2010).

Chan and Chan (2004) described construction schedule as the duration for completing a project. The schedule of a project is normally arranged to allow the building to be used by a date determined by the client. Time is one of the major factors that is used to measure the success of a project (Swan and Khalfan, 2007). Thus, the component of time may suggest to project managers and all stakeholders that the project was completed smoothly and on schedule. Therefore, project managers prefer contracts with reasonable amount of time to execute completely. The timely completion of a construction project is seen as the hallmark of the design and built industry.

However, construction delays have become a major component of construction projects as projects continue to experience delays even with the vast advancement in technology and management understanding (Stumpf, 2000). With this background this study aims at ascertaining the impact of sub-contractor risk management on construction schedule performance.

1.2 PROBLEM STATEMENT

Numerous construction projects are faced with late completion dates due to technical difficulties (Koppenjan et al., 2011). According to Williams (2005), these delays may also be attributed to the increasing complexity of projects and the underestimation of the complexity of a project. Flyvbjerg et al. (2010), indicated that, about 60% of projects experience delays. Subcontracting aspects of a project has been seen to yield good results when utilized effectively. Albino and Garavelli (1998), stipulated that, the performance of a main contractor can be linked to that of the subcontractors. Mbachu (2008), also had the same assertion indicating that, the main contractor and the consultant's ability to achieve a project within a given time is to a large extent dependent on subcontractor's performance. This indicates the huge significance of subcontractor's performance on a construction project. However, there are situations where subcontractors disrupt the success of a construction project (Maturan, 2007). Other research findings have linked the failure of a construction projects in terms of time to subcontractors (Buertey et al., 2014; Koppenjan et al., 2011; Flyvbjerg et al., 2010). Thus, there are inherent risk in the engagement and performance of subcontractors. According to Thomas and Flynn (2011), the benefits for engaging subcontractors may not be realized if they are not properly managed. These works were done in other countries where the subcontracting culture may not be the same as in Ghana hence the need for this study which looks at the Ghana situation

Furthermore, little research has been conducted to ascertain the inherent risk associated with subcontractors and its management processes. Therefore, this study is being conducted to ascertain the impact of sub-contractor risk management on construction schedule performance.

1.3 AIM OF THE STUDY

The aim of the study is to investigate the impact of sub-contractor risk management on schedule performance of construction projects.

1.4 RESEARCH QUESTIONS

This study seeks to answer the following questions;

1. What are the significant factors of subcontractor risk in construction project management?
2. What are the significant factors of Schedule performance in construction project management?
3. What is the relationship between factors of subcontractor risk and Schedule performance in construction project management?
4. To what extent does the risk factors impact schedule performance in construction project management?

1.5 OBJECTIVES OF THE STUDY;

The objectives of the study are as follows to determine;

1. the significant factors of subcontractor risk in construction project management;
2. the significant factors of Schedule performance in construction project management;
3. the relationship between factors of subcontractor risk and Schedule performance in construction project management; and

4. to what extent does the risk factors impact schedule performance in construction project management.

1.6 SIGNIFICANCE OF THE STUDY

The outcome of this study will aid in the effective management of subcontractors so as to achieve a high performance. Studies has shown the huge benefits of subcontracting aspects of a project to experts. However, their contribution could be undermined if not properly managed. Therefore, the outcome of this study will identify the inherent risk associated with subcontractor's performance and how to effectively manage them. Furthermore, the outcome of this study if properly applied can aid improve schedule performance as this study will quantify the correlation between risk management and project schedule performance.

1.7 SCOPE OF THE STUDY

This study is limited to only Building construction firms in the Accra metropolis. This scope was chosen because of the abundance of construction firms who have worked as subcontractors before in the metropolis. Contextually, the study was limited to risk associated with sub-contracting in the construction industry.

1.8 RESEARCH METHODOLOGY

This study adopted the survey research strategy. Also, the research method adopted is quantitative. Thus, structured questionnaire was developed and distributed to the respondents to gather information. The data was converted to numerical representations and analyzed using mathematical tools. Details of the methodology is shown in the chapter three (3) of this thesis.

1.9 STRUCTURE OF THE REPORT

This research is categorized into five (5) chapters. Chapter one (1) entailed the introduction which was divided into nine (9) different sub-sections. Chapter two (2) entailed the literature review

followed by the chapter three (3) which discussed the methodological approach adopted for this work. Chapter four (4) considers the data analysis and discussion of results. The last chapter which is chapter five (5) presents the summary of findings, conclusion and recommendation.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

The literature review aids in gathering existing information on the subject of study. It involves gathering thoughts, arguments and criticisms on the study subject area. This review begins with a discussion on the state of subcontracting in the Ghanaian construction industry. This is followed by a review on the construction sub-contractor, their duties and challenges in performing their duties. Subsequently, the subcontractor risks are discussed followed by a discussion on the concept of schedule performance. This will finally aid in providing answers to the research questions later in the study.

2.2 RISK MANAGEMENT

Risks have been defined as the effect of uncertainty on the objectives of a project (ISO321000). Risks may be viewed as having both positive and negative consequences on a project (Klemmeti, 2006). Positive risks are good and contribute to the benefit of the project objectives. Positive risks are desired and must be explored to obtain the maximum positive outcome of a project. Negative risks do not help achieve a successful project since project is not delivered to the client on scheduled time, cost and quality. This also affects the contractor and other stakeholders of the project. Negative risks involved in construction projects can mostly lead to cost overrun, schedule delay and poor quality during the progression of the projects and at their completion. To minimize the negative consequences of the negative risks during construction phase of a project, risk management practices should be used from the very beginning of the building construction (Baloi, 2003).

Risk management, an organized approach to identifying and impacting risks that affect organizational goals is indeed required to maximize and minimize positive and negative risks respectively. Risk management practices encompass risk planning, identification, analysis, response, monitoring and control of risk on the project with the object of increasing the probability and impact of positive events and decreasing the probability and impact of negative events in the project (PMBOK, 2008). Risk management planning refers to steps taken to come up with a guide that defines how the conduct of risk management activities will be done; Risk analysis refers to estimating the likelihood and impact of the risk; Risk response is concerned with establishing alternatives and actions to improve opportunities and decrease threats to project objectives; monitoring and controlling of risk means implementing risk response plans, tracing identified risks, monitoring residual risks, identifying new risks and examining risk process efficacy throughout the project (PMBOK, 2008). The construction project risk management process is discussed below;

2.2.1 Risk planning:

Entails putting in place as a team a blue print or laid down procedure that foretells how any risk inherent in the project will be dealt with. Indeed, if you fail to plan you have already plan to fail therefore this first stage of the risk management process is very vital as it provides enough resources and timing requirements for managing the risks and sets the stage for the other processes.

2.2.2 Risk identification

This involves searching or identifying inherent threats that are prominent in the project using tools and techniques like: checklists, brainstorming, root cause analysis, Delphi techniques, charts, cause and effect diagrams, influence diagrams, SWOT analysis and interviewing. This

identification process is an art not science (Barkley, 2004) based on years of experience and gut feelings.

2.2.3 Risk analysis

This involves evaluation and prioritization of risks identified. It takes two forms; first Qualitative risk analysis followed by Quantitative risk analysis. The Qualitative risk analysis aims at assessing the priority of risks identified taking cognizance of their relative likelihood of manifestation, their resultant threat on project objectives should they occur, without ignoring other factors like time period of response and the tolerance level of risk by the organization with regards to project objectives (PMBOK, 2008). Some techniques used in Qualitative risk analysis are: expert judgement, probability and impact matrix and risk data quality assessment. It also prepares the ground for the Quantitative risk analysis. The Quantitative risk analysis focus on risks that were prioritized by the qualitative risk analysis making use of techniques like probability distributions, sensitivity analysis and expected monetary value analysis (decision tree diagrams) to quantitatively analyze the effect of those risk events.

2.2.4 Risk response:

This refers to the set responses that were outlined by the project team regarding the various risk events at the initial stage of the project. This is a proactive attitude towards risk events as contended by Loosemore et al., (2006) and will do the project team a lot of good as far as the management of risk is concerned on the project. There are a number of risk response approaches that the project team can rely on; risk avoidance, acceptance, mitigation, transfer and sharing, however the decision is best arrived at through the use of decision tree to compare alternative outcomes.

2.2.5 Risk monitoring and control:

The monitoring aspect deals with observing changes that has taken place as the project progresses with regards to risk whilst the control deals with the risk responses as risks emerges and are dealt with on the project. This is accomplished through the updating of the risk (PMBOK,2008).

2.3 THE CONSTRUCTION SUB-CONTRACTOR

Construction projects has become more complex due to their increasing size and use of modern technologies (Koppenjan et al., 2011). Furthermore, Aritua et al. (2009), indicated that, in order to stay more competitive, companies must focus on their core competencies. This has led to organizations sub-contracting part of their works to other organizations (sub-contractors) who has expertise in that area while they focus on their strengths. Subcontractors enter into an agreement with the principal contractor to undertake some specific aspects of the main contractor's work (Samuel, 2009). Fah (2006), described subcontractor as one who enters into a subcontract; individual or a company who have been hired to perform part of the work under main contractor and have no direct contractual relationship with the client. Subcontracting is a common practice in the construction industry due to complexities and technologies need in some construction projects.

A general contractor may rely on a sub-contractor to perform specific aspects of a construction project such as electrical works, mechanical works, drywall, steel erection and so on (Gunderson et al., 2012). Subcontracting offers many advantages to the main contractor, however there are inherent challenges for the main contractor in managing their projects successfully (Williams, 2005). Mbachu (2008), established in an earlier study that, the performance of the general contractor is strongly influenced by the performance of the subcontractors. The selection of an unsuitable sub-contractor can result in defective work and therefore consumes additional cost and completion time (Kale and Arditi, 2001).

2.3.1 Categories of subcontractors

According to Mbachu (2008), subcontractors have been categorized into three (3). The first category is trade subcontractors. They are specialized on specific trades such as paintwork, electrical work etc. The second category is specialist subcontractors which provide specialist

services such as plumbing, insulation etc. The third category is known as labor-only-subcontractors that perform labor-only services like skilled artisans.

However, Ng et al. (2008), categorized subcontractors into equipment-based subcontractors who are specialized plant and equipment dealers and labor-based subcontractors who are engaged for their specialized labor resources. Also, Enshassi and Medoukh (2007), indicated two types of subcontracting. These are specialist subcontracting and volume subcontracting. They indicated that, specialist subcontractor is engaged only when the main contractor is not able to execute the work himself due to reasons like not his specialty. Volume subcontracting is used when a company appoints a subcontractor due to work overload and has to obtain additional capacity from another source or contractors.

In the contractual perspective, subcontractors can be classified as domestic and nominated subcontractors (Yik et al., 2006). This categorization of subcontractors has been approved by other researchers like Masrom and Asrul (2007). Nominated subcontractors are appointment by the client and his advisors whereas the domestic subcontractor is appointed by the main contractor. The client appoints Named Subcontractor but the main contractor has oversight responsibility over the named contractor's work and payments. Nominated subcontractors are described as named subcontractors who go into a contractual arrangement with the principal contractor to execute part of the main contractor's work, supply or fix any materials or goods (Yik *et al.*, 2006; Samuel, 2009). Associated General Contractors of America (AGCA) have described domestic subcontractor as the independent contractors who execute the works, normally for a portion of the works described in the contract document.

2.3.2 Benefits of sub-contracting

Most construction companies engage the services of sub-contractors to execute specific, predetermined aspects of the construction project (Ng et al., 2008). Traditionally, sub-contracting firms perform the duties of a trade sub-contractor to the general contractor (Enshassi et al., 2008). There are numerous benefits in engaging the services of a sub-contractor on a construction project. The advantages originate as a result of the fact that, the subcontractor organization is specialized in that particular construction task. Furthermore, subcontracting firms are highly competent and are legally ready to execute the relevant work section and take responsibility for the related warranties. Subcontracting also saves time and increase productivity as task get done faster due to high specialty of sub-contractors. Quality of work is also highly ensured and a reduced cost. There are two avenues for cost savings. These are remuneration and performance of the work. Outsourcing work to an external party ensures that the work is well done and eliminates the possibility of rework. According to Maturana et al. (2007), the birth subcontracting in the construction industry has influenced the industry and it has encouraged specialization and aided in the transfer of risk from the general contractor to the subcontractor.

2.4 RISK IN SUB-CONTRACTOR MANAGEMENT

Subcontractor management possesses numerous benefits for the construction industry, however, it possesses numerous risks that may hinder the progress of a construction project. These risked are identified and discussed below

2.4.1 Site coordination risks

Subcontractors normally blames their failure to accomplish site works competently and successfully on poor site organization by main contractor. Subcontractors have likewise accused main contractors of poor site management leading to under-utilization of subcontractors (Andy

and Andrew, 2010). Studies have revealed that such challenges can be traced to issues such as project information, working program, preparation for work place, interface between skills, access to site and plant and material support (Othman, 2007).

2.4.2 Contractor's financial risks

Basically, inefficient management, lack of accurate estimates and delayed payments by the client can plunge the main contractor into serious financial problems. Consequently, this may lead to delayed payment from the main contractor to his subcontractor (Al Hammad, 1992). Othman (2007) has noted that one of the most crucial ingredients in fostering closer relationship between a contractor and his subcontractor in the long-term is timely payment to the latter. Each party is always overly suspicious in all business dealings with the other party due to lack of trust. The relationship between the two could be seriously mired if the main contractor is perceived a poor paymaster (Othman, 2007).

2.4.3 Non-adherence to the construction schedule

As part of the contractual agreement signed between the client and the main contractor, the project duration is spelt out and included in the contract. The main contractor will schedule his construction activities and that of his subcontractor(s) to meet the identified project duration. If any party delays the execution of his scheduled construction activities, it may subsequently affect the entire construction process (Al Hammad, 1992). According to Sambasivan and Soon (2007), high degree of subcontracting leads to high risk of delays and consequently, inefficiency in the construction industry. During the construction process, it is common for the main contractor to blame his inability to fulfill the agreed project deadlines on subcontractors. Accordingly, misunderstanding may ensue between the general contractor and subcontractor (Al-Hammad, 1992). Proctor (1996), opined that time overruns occur partly due the failure of the contractors to

thoroughly appreciate a subcontractor's work sequence. Hence, failure on the part of the main contractor to factor the subcontractor's work sequences in determining the project schedule.

2.4.4 Lack of proper communication

The success of construction project in relation to timely completion is significantly affected by the effectiveness of communication between the contractor and his subcontractors. Inappropriate means of sharing and disseminating information among project parties may seriously affect the construction project (Al- Hammad, 1992). Some of the information communicated in construction developments cover subjects such as project timelines, purposes and constraints. Absence of explicit and appropriate communication of applicable information on instructions and requirements from the clients to subcontractors affect their ability to meet schedule constraints. Making change orders very late in the project and lack of sufficient time for planning prior to project take-off accumulates undue burden on the subcontractor and subsequently culminates into sub-standard outcome, or even unacceptable specifications. According to Huang et al. (2008), difficulties in communication might result in serious inefficiencies such as improper planning and scheduling and absence of a suitable information update system. When contractors poorly communicate information to their subcontractors, it may cause wrongful pricing on the part of the sub-contractor.

2.4.5 Lack of safety

According to Enshassi *et al.* (2008), the rate of accident occurrence involving subcontractors' employees on multiplex construction projects is very high, principally when multiple subcontractors are engaged in one project. According to Al-Hammad (1992), non-adherence to health and safety regulations and standards by the contractor or his subcontractor have resulted in injury and even death to workers on construction sites.

2.4.6 Insufficient working-drawings or scanty specifications

According to Al-Hammad (1992), the skills required to execute the construction works well, is dependent on the clarity of drawing details and specifications provided. Working with uncompleted drawings will bring about interpretation difficulties, which could lead to incorrect judgment that influences negatively on the quality of the project and eventually lead to disputes between main contractors and subcontractors. According to Alinaitwe *et al.* (2007), challenges between main contractor and subcontractor due to incomplete drawings leads to low productivity.

2.4.7 Amendments

It is common for the client to demand for an amendment when it turns-out to be needed to alter the original designs and the specifications. The component cost for performing a specific work section once revision is made, may be the cause of a main contractor-subcontractor differences (Al-Hammad, 1992). This assertion was agreed on by Enshassi *et al.* (2007) who revealed that, design changes and specifications in the course of construction results in low work output.

2.4.8 Delay in shop drawings and sample material approval

In construction contracts, the subcontractor is typically obliged to turn in shop drawings or sample materials for the main contractor's endorsement. Delays in the approval of the submitted materials or drawings must be blamed on the inefficiency of the main contractor. Disagreement may result between the main contractor and the subcontractor as to who is the cause of those delays in the execution of the work (Al-Hammad, 1993). Huang *et al.* (2008) noted contractor-subcontractor interface problems may arise due to delays in approval because of unclear drawing.

2.4.9 Material shortage

Continuous supply of materials to the production process is key sustaining the continuity of the construction work. Any shortage of material is detrimental to progress of the work by either the

contractor or his subcontractor, thus conflict may arise between the two parties (Al-Hammad, 1993). Along with the observation by Enshassi *et al.* (2007) and Alinaitwe *et al.* (2007), shortage of material gives rise to main contractor-subcontractor problem interface and may lead to low productivity.

2.4.10 Legal disputes

According to Jannadia *et al.* (2000), disputes are a reality in every construction project and occur due to so many reasons. These legal disputes may arise between project participants, For instance; between clients and contractors, between the main contractors and subcontractors and even among the subcontractors. These types of disagreements may affect the relationships and negatively impact on performance of the contractor or his subcontractor and thus the overall outcome of the project (Al-Hammad, 1993)

2.5 SCHEDULE PERFORMANCE

Construction schedule is the duration for the completion of a construction project (Chan and Chan, 2004). The inability for a contractor to meet the schedule stipulated in a contract document leads to delays. According to Al-Kharashi and Skitmore (2009), construction delays is one of the most frequently occurring problems in the construction industry. Sambasivan and Soon (2007), also indicated that, time overruns may lead to disputes, litigation and even complete abandonment of projects. The delays in a construction project may be caused by numerous factors. The factors are discussed below;

2.5.1 Competence of the construction manager

According to Jha and Iyer (2007), a competent construction project manager has the technical capability and monitoring capabilities. He makes his people committed for the project through effective leadership. He effectively delegates authority to his subordinates which also act as a

source of motivation for the workmen. Thus, if a construction manager has the ability to achieve all this, he effectively manages and control the project schedule to avoid delays and setbacks.

2.5.2 Top management support

Owner's support the project by taking appropriate action whenever the project faces operational difficulties. Top management extends support to the project by selecting a project manager of proven track record at an early stage and by keeping short and informal line of communication (Jha and Iyer, 2007). Also, a supportive top management backs up the project plan prepared by the site management team. Taking part in construction control meetings and making the resources available for the planned duration also show support for the project. Therefore, supportive top management critically affects the smooth flow of a construction project.

2.5.3 Monitoring and feedback

Monitoring and feedback is a very critical factor in ensuring the successful execution of a construction project in terms of time. It is also seen from the literature review that monitoring, feedback, and coordination are given importance by most of the studies for the successful outcome of a project and identified as a key factor responsible for success of many projects (Baker et al. 1974).

2.5.4 Favorable working conditions

This factor comprises attributes like scope and nature of work, well defined in the tender, favorable social environment, favorable climatic condition at the site, and monitoring and feedback by client. Jha and Iyer (2007) indicated that, favorable social environment creates a cordial atmosphere to the non-local construction team at their locality. Generally, due to unemployment problems in certain underdeveloped areas, the locals expect their men to be appointed for work. Therefore, if they are not favored the locals tend to cause hindrances in the progress of work. Thus, favorable

social environment is also considered as favorable working condition and the factor is named accordingly.

2.5.5 Commitment of all project participants

Project participants include internal and external participants, such as project team, contractors as internal participants, and stakeholders like client, suppliers, etc. as external participants. Commitment basically refers to the willingness of these project participants towards a pooled effort. According to Jha and Iyer (2007), for the project to be successful not only internal factors are needed but external factors like political and economic environment are also needed. Delegating authority viz top management delegating to project manager, which in turn delegates down to other team members also show the team commitment.

2.5.6 Competence of owner's advisory team

Taking timely decisions, and regular monitoring and feedback of the progress of the project are some of the characteristics of a competent owner. The competence of the advisory team of the owner can have a huge say in the project performance in-terms of schedule.

2.6 EFFECTS OF SUB-CONTRACTOR RISK ON PROJECT SCHEDULE

Risk are inherent in any construction endeavor. Inappropriate management of risk in a construction project may have devastating effect on the outcome of a construction project (Klemmeti, 2006). Similarly, if risk associated with subcontracting are not properly managed, it will affect the performance of a construction project, especially time. Tam et al. (2011), postulated that, the use of subcontracting in an inappropriate manner in the construction projects can lead time overruns. They indicated that, these time overruns may be caused by factors like setting of impractical time for subcontract work, subcontractor's inefficiencies, subcontractor delays in responding to instructions and delays in solving disputes. However, Arditi and Chotibhongs

(2005), postulated that, one of the benefits of engaging a subcontractor is the ability of complete works quickly. There is an increase in productivity when subcontractors are effectively managed. Therefore, subcontractor engagement and effective management in a construction project can affect the performance of a construction project in terms of time.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter explains how the research was executed in order to achieve the aim and objectives of the study. Fellows and Liu (2008), indicated that, in any social research, the methodology indicates the main ideologies and steps which applies to the research. The research methodology also gives shape to the overall approach to the research linked to the paradigm including methods (Mackenzie and Knipe, 2006). This chapter will discuss the research methodology under the following sub-headings; philosophical point of the research, framework for the study, design of research instrument, data collection and data analysis.

3.2 PHILOSOPHICAL POSITION OF THE RESEARCH

There are two (2) basic philosophical positions in research. These are positivism and constructivism (Crotty, 1998). According to Ramenyi and Williams, (1998), the research phenomenon under study and its objectives depicts the type of philosophical position to adopt. In this study, the positivist stance was adopted on the ontological level. The objectives indicated in chapter one of this report lends themselves for measurement therefore, it makes sense to adopt positivist position as the realities can be observed through the use of appropriate measurement instruments. The positivist philosophical position relies on precise measures and it usually involves quantitative data collection.

3.3 RESEARCH PROCESS

Fellows and Liu (2008), indicated that, there is no rigid process for conducting research as the processes are mostly dynamic. The research process adopted for this research involved an in-depth

review of literature on subcontractors and schedule performance. The review of literature begun with a review of risk management followed by a review of the construction sub-contractor. Subsequently, literature was reviewed on risk in sub-contractor management which was followed by a review of the concept of schedule performance. After the literature review, a structured questionnaire was developed to aid in the collection of data from the respondents. The data was subsequently analyzed using appropriate statistical tools to draw conclusions and make recommendations.

3.4 RESEARCH DESIGN

Cresswell (2009), described the research design as the stipulated plan of how the data required in answering the research questions will be collated in order to achieve the research objectives. Marczyk et al. (2015), indicated that, the adoption of a suitable research design draws the boundaries for the study and also presents a consistent process in fulfilling the research objectives and questions. Yin (2009), indicated that, the research design also has an impact of the selection of an appropriate and suitable data collection and analysis instrument so as to adequately achieve the research aim. Fellows and Liu (2008), identified four (4) distinct types of research designs. These are explanatory, exploratory, descriptive and predictive. However, in construction management research works, the mostly used research designs are the explanatory and descriptive research design. These research designs are described below.

The descriptive research design is basically adopted to give an accurate profile of a person, events or situations. Also, the descriptive research design involves the systematic description of facts and features of a given population or area of interest. The explanatory research design involves the development of causal explanations which hinges on one phenomenon affecting the other. Based on the aim of the study which states that “investigating the impact of sub-contractor risk

management on schedule performance of construction projects” the explanatory research design was deemed most appropriate for the study.

3.5 THE RESEARCH METHOD

The research methods give an indication of how the data was collected. There are three (3) research methods available for social researches. These are quantitative, qualitative and mixed research methods. For the purpose of this study, the quantitative research method was mainly used. Quantitative research methods seek to collate information for describing a concept involving a larger number of participants and to study relationships between facts and how they align to theories and findings of past researchers (Fellows and Liu, 2008). Rubin and Babbie (2005), indicated that, the quantitative research method can be viewed as the process by which researchers translate data to the form of numbers and analyze its by using statistical tools.

The authors further stated that the advantage is in the reduction of data to an intelligible and interpretable form to allow the relations of research problems to be analyzed and tested, and reasonable conclusions made. The data is therefore tangible, solid and consistent; they are measurements of concrete, countable, sensate characteristics of the world (Naoum, 2007; Fellows and Liu, 2008).

3.6 POPULATION, SAMPLE SIZE AND SAMPLING TECHNIQUE

The population for this study was construction firms who operates in the Accra metropolis. The number of construction firms in the Accra metropolis could not be ascertained, as there were no records of any available and reliable sample frame on construction firms who have worked with sub-contracting firm before. The population therefore is an infinite one. However, due to the nature of the study, only construction firms who have worked with sub-contractors on a construction project before were sort for. Thus, the purposive sampling technique was utilized for the selection

of the sample. The purposive sampling technique is a non-probability sampling technique where researchers sampling is tied to their objectives. Using the purposive sampling technique, seventy-eight (78) questionnaires were distributed to respondents deemed suitable to answer the questionnaire. This number therefore became the sample size which represent a satisfactory sufficient respondent for the study due to lack of available data on the desired population. However, fifty-four (54) was used for the analysis as the remaining responses could not be retrieved from respondents.

3.7 QUESTIONNAIRE DEVELOPMENT AND ADMINISTRATION

Questionnaires distribution is a very common way of gathering information from respondents. The questionnaire as shown in the appendix of the study consisted of two sections (section A and section B). The section A concentrated on the background of the respondent. In the section A, the respondents were asked to indicate their category, their number of years of experience, their level of education and number of projects handled.

The section B was developed based on the objectives of the study. The section B consisted of three (3) questions. The first question concentrated on sub-contractor risks. The respondents were asked to indicated significance of sub-contractor risks in the Ghanaian construction industry using the five-point Likert scale of 1 = Not significant; 2 = Slightly significant; 3 = Moderate; 4 = Significant; 5 = Very significant.

The second question concentrated on significance of the factors that affect schedule performance in the Ghanaian construction industry. Similarly, the five-point Likert scale of 1 = Not significant; 2 = Slightly significant; 3 = Moderate; 4 = Significant; 5 = Very significant was utilized.

Finally, the last question concentrated on the impact of sub-contractor risk factors on schedule performance. The five-point Likert scale of 1 = No impact; 2 = Minimal impact; 3 = Moderate impact; 4 = High impact; 5 = Very high impact was adopted.

The questionnaire was self-administered by the researcher. It was also supplement by e-mail distribution. The data collected lasted for eighteen (18) days. In all seventy-eight (78) questionnaires were distributed. However, fifty-four (54) was used for the analysis.

3.8 TOOLS FOR THE ANALYSIS

The collected data was first entered into the Statistical Package for Social Science (SPSS) version 20 and subsequently analyzed using the mean score ranking and multiple regression analysis. The objective one and two were analyzed by ranking using the mean score ranking tool. The objective three and four were analyzed using the regression analysis method. Regression analysis is used to study the relationship between two or more factors/variables. Also, the regression analysis method can be adopted to observe changes in the dependent variable with changes in the independent variables. There are two (2) fundamental forms of regression. These are simple linear regression and multiple linear regression. The multiple linear regression was adopted for this study as linear regression is used to study the relationship between one independent and one dependent variable. However, since this study has more than one independent variables, the multiple regression analysis was used as it studies the relationship between one dependent variable and multiple independent variables.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION

4.1 INTRODUCTION

This chapter analyze the data collected from the respondents in order to achieve the four (4) objectives of the study. It is worth stating that, the unit of measurement here is individual construction firms who have worked with subcontracting firms before. The objectives were to determine the significant factors of subcontractor risk in construction project management, determine the significant factors of schedule performance in construction project management, determine the correlation between factors of subcontractor risk and Schedule performance in construction project management and to determine to what extent does the risk factors impact schedule performance in construction project management. The initial aspect of achieving the objectives involved the review of literature which was used to develop a questionnaire to collect data from the respondents. The next part of achieving the objectives is the analysis of data collected. The data was analyzed using the mean score ranking and the multiple regression analysis. Prior to the analysis of the objectives, the background of the respondents was analyzed using frequencies. The outcome of the analysis is discussed in this chapter.

4.2 BACKGROUND OF THE RESPONDENTS

This section discusses the background of the respondents. The summary of the background of the respondents is shown in table 4.1. The first question of the background of the respondents wanted to ascertain the category of the respondents as a construction firm. In Ghana construction firms are categorized as D1K1, D2K2, D3K3 and D4K4. From the responses, majority of the respondents were D2K2 firms whiles none of the respondents were D4K4. Eleven (11) of the respondents were

D3K3 and seventeen (17) were D1K1. The category of the respondents depicts their financial class and other resource holdings (plant and labor).

Table 4.1: Background of the respondents

DESCRIPTION	FREQUENCY	PERCENTAGES (%)
Category of construction firm		
D1K1	17	31.48
D2K2	26	48.15
D3K3	11	20.37
D4K4	0	0.00
Years of experience		
Below 5 years	2	3.70
6-10 years	14	25.93
11-15 years	18	33.33
16-20 years	14	25.93
Above 20 years	6	11.11
Education Level		
CTC	0	0.00
HND	1	1.85
BSc	41	75.93
Post graduate	12	22.22
Number of projects		
Below 5	2	3.70
6-10	13	24.07
11-15	19	35.19
16-20	11	20.37
Above 20	9	16.67

Source: Field survey, (2018).

The second question was designed to ascertain the number of years of experience of the respondents. The years of experience of respondents gives an indication of his familiarity and knowledge of the processes of the firm. From the responses, majority of the respondents had 11-15 years of experience. The least had below 5 years of experience constituting only two (2) respondents. This gives an indication that, the responses given by the participants will be highly dependable.

The third question asked the respondents to indicate their highest level of education. This also gives an indication of the knowledge level of respondents. Majority of the respondents had BSc degree constituting forty-one (41) in number of the respondents. However, none of the respondents had CTC qualification.

The last question under the background of the respondents sought to ascertain the number of projects the participants have been involved in. The options were below 5, 6-10, 11-15, 16-20 and above 20. The majority of the respondents indicated that they had executed 11-15 projects constituting nineteen (19) respondents.

4.3 SUB-CONTRACTORS RISKS

The first objective of the study sought to determine the significant factors of subcontractor risk in construction project management. In achieving this objective, literature review was conducted on sub-contractors risks and the variables identified were used and developed into a questionnaire. The respondents were asked to indicate how significant the factors identified are in the Ghanaian construction industry as sub-contractor risks using the five-point Likert scale of 1 = Not significant 2 = Slightly significant 3 = Moderate 4 = Significant 5 = Very significant. Their responses were analyzed using the mean score ranking technique. A summary of the ranking is shown in table 4.2.

The most significant risk was site co-ordination risks. Subcontractors normally blame their inability to perform site works efficiently and effectively on poor site organization by main contractor. Subcontractors have also accused main contractors of poor site coordination leading to under-utilization of subcontractors (Andy and Andrew, 2010). Studies have shown that such problems can be traced to issues such as project information, working program, preparation for work place, interface between trades, access to site and plant and material support (Othman, 2007).

The second ranked factor was poor organization and co-ordination of subcontractor. If a subcontractor has poor abilities in organization and coordinating his works on site, it can affect the overall delivery process of the project and hence a significant risk factor for the contractor.

The third ranked factor was poor workmanship by the sub-contractor. Poor workmanship also has an influence on the quality and schedule performance of project delivered. This risk normally occurs when the sub-contractor is nominated as the main contractor may not conform to his ways of work schedule.

The fourth ranked factor was lack of proper communication. The success of construction project in relation to timely completion is significantly affected by the effectiveness of communication between the contractor and his subcontractors. Inappropriate means of sharing and disseminating information among project parties may seriously affect the construction project (Al- Hammad, 1992). Some of the information communicated in construction projects cover issues such as project timelines, objectives and constraints. Lack of explicit and timely communication of relevant information on instructions and requirements from the clients to subcontractors affect their ability to meet schedule constraints. Making change orders very late in the project and lack of sufficient time for planning prior to project take-off accumulates undue burden on the subcontractor and subsequently culminates into sub-standard outcome, or even unacceptable specifications.

Table 4.2: Sub-contractor's risks

DESCRIPTION	MEAN	SD	RANK
Site coordination risks	4.34	0.452	1 ST
Poor organization and co-ordination of sub-contractor	4.00	0.564	2 ND
Poor workmanship by the sub-contractor	3.88	0.816	3 RD
Lack of proper communication	3.80	0.549	4 TH
Inadequate site investigation	3.75	0.998	5 TH
Lack of sub-contractor commitment	3.70	0.592	6 TH
Contractor's financial risks	3.70	0.905	7 TH
Errors in cashflow forecast	3.66	0.667	8 TH
Poor specification	3.59	0.782	9 TH
Lack of safety	3.50	0.891	10 TH
Non-adherence to the construction contract	3.47	0.884	11 TH
Shortage of work personnel	3.47	0.942	12 TH
Legal disputes	3.38	0.903	13 TH
Frequent design changes	3.33	0.894	14 TH
Theft on site	3.30	0.912	15 TH
Unsuitable contract clauses	3.23	0.924	16 TH
Excessive change orders	3.19	0.988	17 TH
Insufficient working-drawings or scanty specifications	3.14	1.163	18 TH
Delay in shop drawings and sample material approval	3.10	1.223	19 TH
Material shortage	2.97	1.144	20 TH

Source: Field survey, (2018)

4.4 SCHEDULE PERFORMANCE

The second objective of the study sought to determine the significant factors of schedule performance in construction project management. In achieving this objective, literature review was conducted on schedule performance and the variables that affects it were identified and used to develop a questionnaire. This also formed part of the section B of the questionnaire. The respondents were asked to indicate how significant the factors identified applies to the Ghanaian construction industry as factors that affects schedule performance using the five-point Likert scale of 1 = Not significant 2 = Slightly significant 3 = Moderate 4 = Significant 5 = Very significant. Their responses were analyzed using the mean score ranking technique. A summary of the ranking is shown in table 4.3.

The first ranked factor was high technical ability of the project manager. This was followed by the competence of the construction manager, effective communication and the availability of resources as and when required. According to Jha and Iyer (2007), a competent construction project manager has the technical capability and monitoring capabilities. He makes his people committed to the project through effective leadership. He effectively delegates authority to his subordinates which also act as a source of motivation for the workmen. Thus, if a construction manager has the ability to achieve all this, he effectively manages and control the project schedule to avoid delays and setbacks. Also, some of the information communicated in construction projects cover issues such as project timelines, objectives and constraints. Therefore, timely discharge of information aids the timely delivery of project in construction. Communication is a key aspect in any endeavor as it affects the effectiveness of an organization.

Table 4.3: Schedule performance

DESCRIPTION	MEAN	SD	RANK
High technical ability of the project manager	4.57	0.602	1 ST
Competence of the construction manager	4.48	0.841	2 ND
Effective communication	4.11	0.984	3 RD
Availability of resources as and when required	3.94	1.123	4 TH
Effective scope definition	3.87	0.891	5 TH
Frequent monitoring and feedback by client	3.74	1.014	6 TH
Favorable working conditions	3.72	0.883	7 TH
Support from top management	3.59	1.000	8 TH
Coordinating ability and rapport of PM with other contractors on site	3.46	0.903	9 TH
Competence of owner's advisory team	3.40	0.894	10 TH
Monitoring and feedback	3.33	0.952	11 TH
Commitment of all project participants	3.15	0.998	12 TH
Favorable political and economic environment	3.02	0.943	13 TH
Good timing of decision by the owner/consultant	2.98	1.096	14 TH
Favorable climatic condition at the site	2.89	1.039	15 TH
favorable social environment	2.87	1.397	16 TH

Source: Field survey, (2018)

4.5 SUB-CONTRACTOR RISKS AND SCHEDULE PERFORMANCE

The third objective of the study was to determine the relationship between factors of subcontractor risk and schedule performance in construction project management. The fourth objective was to determine to what extent does the risk factors impact schedule performance in construction project management. With these two objectives, the respondents were asked to rate the impact of subcontractor risks factors on schedule performance in the Ghanaian construction industry using the scale of 1 = No impact 2 = Minimal impact 3 = Moderate impact 4 = High impact 5 = Very high impact.

In order to make inference of the relationship and the extent of impact, the beta values, significance level and t-statistic values were calculated using the SPSS software version 20. The calculation was done at a confidence level of 10% ($\alpha = 0.10$; two-tailed test). Therefore, when the *t*-value is above 1.65, we can conclude that, there is a significant relationship. The Beta values shows the extent of the relationship. Beta values closer to 1 shows a significant relationship and vice-versa. From the values shown in table 4.4, lack of proper communication, excessive change orders, legal disputes, material shortages and poor organization and co-ordination shown significant relationship with schedule performance. Generally, the results indicated that, there is a significant relationship between sub-contractor risk factors and schedule performance in the Ghanaian construction industry.

Klemmeti (2006), indicated that, inappropriate management of risk in a construction project may have devastating effect on the outcome of a construction project. Also, Tam et al. (2011), postulated that, the use of subcontracting in an inappropriate manner in the construction projects can lead time overruns.

Table 4.4: Regression analysis

DESCRIPTION	BETA	T-STATISTIC	SIG
Lack of proper communication	0.297	3.375	0.002
Excessive change orders	0.218	1.813	0.079
Legal disputes	0.189	1.812	0.079
Site coordination risks	-0.242	-1.684	0.101
Contractor's financial risks	0.241	1.515	0.139
Non-adherence to the construction contract	-0.220	-1.806	0.080
Material shortage	0.338	2.216	0.033
Lack of safety	-0.003	-0.027	0.979
Insufficient working-drawings or scanty specifications	0.098	0.671	0.507
Delay in shop drawings and sample material approval	0.008	0.055	0.957
Inadequate site investigation	-0.007	-0.064	0.949
Poor specification	0.133	1.064	0.295
Frequency design changes	-0.088	-0.804	0.427
Errors in cashflow forecast	0.127	0.889	0.380
Shortage of work personnel	-0.002	-0.018	0.986
Lack of sub-contractor commitment	0.032	0.250	0.804
Theft on site	0.094	0.637	0.528
Unsuitable contract clauses	-0.107	-0.854	0.399
Poor workmanship by the sub-contractor	0.042	0.488	0.628
Poor organization and co-ordination	0.297	3.375	0.002

Source: Field survey, (2018)

They indicated that, these time overruns may be caused by factors like setting of impractical time for subcontract work, subcontractor' inefficiencies, subcontractor delays in responding to instructions and delays in solving disputes. There is an increase in productivity when subcontractors are effectively managed. Therefore, subcontractor engagement and effective management in a construction project can affect the performance of a construction project in terms of time.

4.6 SUMMARY OF CHAPTER

This chapter analyzed data collected from fifty-four (54) respondents. The data analysis was conducted with mean score ranking and multiple regression analysis. The first and second objective were analyzed using the mean score ranking. The third and fourth objective was analyzed using the regression analysis.

With the first objective, it was realized that, the most significant risk was site co-ordination risks. The second ranked factor was poor organization and co-ordination of subcontractor. The third ranked factor was poor workmanship by the sub-contractor. The fourth ranked factor was lack of proper communication.

With the second objective, it was realized that, the first ranked factor was high technical ability of the project manager. This was followed by the competence of the construction manager, effective communication and the availability of resources as and when required.

With the third and fourth objectives, making inference about the relationship and the extent of impact, the beta values, significance level and t-statistic values were calculated using the SPSS software version 20. From the analysis, it was realized that, lack of proper communication, excessive change orders, legal disputes, material shortages and poor organization and co-

ordination shown significant relationship with schedule performance. Generally, the results indicated that, there is a significant relationship between sub-contractor risk factors and schedule performance in the Ghanaian construction industry.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

The aim of the study is to investigate the impact of sub-contractor risk management on schedule performance of construction projects. In order to achieve the aim of the study, four (4) objectives were established which were to determine the significant factors of subcontractor risk in construction project management, determine the significant factors of Schedule performance in construction project management, determine the relationship between factors of subcontractor risk and Schedule performance in construction project management and determine to what extent does the risk factors impact schedule performance in construction project management. With these objectives, an extensive literature review was conducted from which variables on sub-contractor's risks and schedule performance were identified. The variables were subsequently used in the development of a structured questionnaire. The questionnaires were distributed and fifty-four (54) were retrieved and used for the analysis of the study. The analysis was done using the mean score ranking and the multiple regression analysis. This chapter discusses the summary of the findings, limitations, further studies, conclusion and make recommendations.

5.2 SUMMARY OF THE FINDINGS

The data analysis was done with mean score ranking and multiple regression analysis. The first and second objective were analyzed using the mean score ranking. The third and fourth objective was analyzed using the regression analysis.

With the first objective, it was realized that, the most significant risk was site co-ordination risks. The second ranked factor was poor organization and co-ordination of subcontractor. The third

ranked factor was poor workmanship by the sub-contractor. The fourth ranked factor was lack of proper communication.

With the second objective, it was realized that, the first ranked factor was high technical ability of the project manager. This was followed by the competence of the construction manager, effective communication and the availability of resources as and when required. A competent construction project manager has the technical capability and monitoring capabilities. He makes his people committed for the project through effective leadership. He effectively delegates authority to his subordinates which also act as a source of motivation for the workmen. Thus, if a construction manager has the ability to achieve all this, he effectively manages and control the project schedule to avoid delays and setbacks.

With the third and fourth objectives, making inference about the relationship and the extent of impact, the beta values, significance level and t-statistic values were calculated using the SPSS software version 20. From the analysis, it was realized that, lack of proper communication, excessive change orders, legal disputes, material shortages and poor organization and co-ordination shown significant relationship with schedule performance. Generally, the results indicated that, there is a significant relationship between sub-contractor risk factors and schedule performance in the Ghanaian construction industry.

5.3 LIMITATIONS

The limitations to the study are;

1. This study was limited to only building construction firms in the Greater Accra metropolitan district of the Republic of Ghana.
2. This study was also limited to only schedule performance construction success criterion

3. This study was also limited to the use of only one number dependent variable as multiple regression uses could adopt more than one dependent variable.

5.4 FURTHER STUDIES

There is an open avenue to measure the impact of sub-contractor's risks on project success using the structural equation modelling. This tool can take more than one dependent variable, therefore becomes an improvement on this study.

Again, one could also consider the measuring the impact of sub-contractor risk management on other construction success criteria such as cost and quality.

5.5 CONCLUSION

Numerous construction projects are faced with late completion dates due to technical difficulties. These delays may also be attributed to the increasing complexity of projects and the underestimation of the complexity of a project. This study demonstrated that, there are numerous risks involved in the engagement of subcontractors in a construction project. These risks have an impact on the schedule performance of the construction project. The study showed that, risk factors like ineffective communication, legal disputes and excessive change orders have a huge impact on schedule performance. Tam et al. (2011), indicated that, these time overruns may be caused by factors like setting of impractical time for subcontract work, subcontractor's inefficiencies, subcontractor delays in responding to instructions and delays in solving disputes.

There is an increase in productivity when subcontractors are effectively managed. Therefore, subcontractor engagement and effective management in a construction project can affect the performance of a construction project in terms of time. Construction projects have become more complex due to their increasing size and use of modern technologies. Therefore, in order to stay more competitive, companies must focus on their core competencies. This has led to organizations

sub-contracting part of their works to other organizations (sub-contractors) who has expertise in that area whiles they focus on their strengths. Thus, subcontracting is very important in project execution and hence the risk involved in their engagement must be effectively mitigated.

5.6 RECOMMENDATIONS

From the findings of the study, the following recommendations were made;

1. Contractors should adopt strategic risk management procedures in managing sub-contractor risk
2. Project managers must communicate effectively with sub-contractors and main contractors in order to eliminate any form of misunderstanding
3. Contractors must actively be involved in the site organization of sub-contractors to avoid work interference.

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APPENDIX

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF ART AND BUILT ENVIRONMENT
DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT
SURVEY QUESTIONNAIRE**

**IMPACT OF SUB-CONTRACTOR RISK MANAGEMENT ON CONSTRUCTION
SCHEDULE PERFORMANCE**

Dear Sir/ Madam

I am an MSc student at Kwame Nkrumah University of Science and Technology, Department of Construction Technology and Management currently undertaking a research on subcontractor's risk and schedule performance. Your experience and knowledge in the area of the research is very important and much appreciated. The information you shall provide shall be **STRICTLY CONFIDENTIAL** and for academic purposes only and findings from this research will be made available to you on request.

I appreciate your effort and time very much in advance.

Yours Sincerely,

Ahiawodzie Wisdom, MSc. Student, KNUST (0547666776 or wozi21@yahoo.com)

Dr Emmanuel Adinyira Project Supervisor, Department of Building Technology (KNUST)

SECTION A

RESPONDENT'S PROFILE

1. Please indicate the category of your company in the Construction industry?

☐ D1K1

☐ D2K2

☐ D3K3

☐ D4K4

2. Please indicate your years of experience in your profession?

☐ Below 5 years

☐ 6-10 years

☐ 11-15 years

☐ 16-20 years

☐ Above 20 years

3. What is your highest level of education?

☐ CTC

☐ HND

☐ BSc

☐ Post Graduate

Other; Please specify.....

4. Please indicate the number of projects you have handled as a main contractor?

☐ Below 5

☐ 6-10

☐ 11-15

☐ 16-20

☐ Above 20

SECTION B

SUB-CONTRACTORS RISKS

1. Please indicate how significant the following risks affects the main contractors project execution in the Ghanaian construction industry. Please use the response scale below:

1 = Not significant 2 = Slightly significant 3 = Moderate 4 = Significant 5 = Very significant

No.	Sub-contractor's risks	1	2	3	4	5
1	Lack of proper communication					
2	Excessive change orders					
3	Legal disputes					
4	Site coordination risks					
5	Contractor's financial risks					
6	Non-adherence to the construction contract					
7	Material shortage					
8	Lack of safety					
9	Insufficient working-drawings or scanty specifications					
10	Delay in shop drawings and sample material approval					
11	Inadequate site investigation					
12	Poor specification					
13	Frequency design changes					
14	Errors in cashflow forecast					
15	Shortage of work personnel					
16	Lack of sub-contractor commitment					
17	Theft on site					

18	Unsuitable contract clauses					
19	Poor workmanship by the sub-contractor					
20	Poor organization and co-ordination					

SCHEDULE PERFORMANCE

2. Please indicate the significance of the following factors that affects schedule performance in the Ghanaian construction industry. Please use the response scale below:

1 = Not significant 2 = Slightly significant 3 = Moderate 4 = Significant 5 = Very significant

No.	Variables	1	2	3	4	5
1	Competence of the construction manager					
2	Support from top management					
3	Monitoring and feedback					
4	Favorable working conditions					
5	Commitment of all project participants					
6	Competence of owner's advisory team					
7	Coordinating ability and rapport of PM with other contractors on site					
8	Effective communication					
9	Availability of resources as and when required					
10	Favorable political and economic environment					
11	Good timing of decision by the owner/consultant					
12	High technical ability of the project manager					
13	Effective scope definition					
14	favorable social environment					
15	Favorable climatic condition at the site					
16	Frequent monitoring and feedback by client					
	<i>If other please specify</i>					

RELATIONSHIP BETWEEN SUB-CONTRACTOR RISK AND SCHEDULE
PERFORMANCE

3. Please rate the impact of the following sub-contractor risks on schedule performance in the Ghanaian construction industry. Please use the response scale below:

1 = No impact 2 = Minimal impact 3 = Moderate impact 4 = High impact 5 = Very high impact

No.	Sub-contractor's risks	1	2	3	4	5
1	Lack of proper communication					
2	Excessive change orders					
3	Legal disputes					
4	Site coordination risks					
5	Contractor's financial risks					
6	Non-adherence to the construction contract					
7	Material shortage					
8	Lack of safety					
9	Insufficient working-drawings or scanty specifications					
10	Delay in shop drawings and sample material approval					
11	Inadequate site investigation					
12	Poor specification					
13	Frequency design changes					
14	Errors in cashflow forecast					
15	Shortage of work personnel					
16	Lack of sub-contractor commitment					

17	Theft on site					
18	Unsuitable contract clauses					
19	Poor workmanship by the sub-contractor					
20	Poor organization and co-ordination					