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Risk identification and analysis as practiced by construction firms in Ghana

By

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DECLARATION

I hereby declare that this submission is my own work towards the MSc 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, except where due acknowledgement has been made in the text.

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ABSTRACT

The significance of risk management has caused the construction industry to recognized risk management as a vehicle to ensure the safety operations of the construction industry as a whole. However, the leading challenges associated with risk management within the construction industry has led to exploring the general practices adopted by construction firms during the processes of identifying and analyzing risk at the various project phases. The study utilized both qualitative and quantitative approach to access participants' understanding on risk analysis procedures as practiced by their respective firms. Grounded on literature, a questionnaire was designed to contain information on risk identification procedures and analyses adopted by professional in the construction industry. A questionnaire survey was conducted among building contractors who were purposively selected to elicit information pertaining to the study. Out of the fifty-five (55) questionnaires distributed to respondents in the Greater Accra Region of Ghana, only fifty-two (52) were returned and formed the basis of the analysis. The data were analysed using simple descriptive statistics and Relative Importance Index (RII). Results shows that, prevalence difficulties in the procedure of risk analysis practice, within the construction industry among others were as a result of lack of qualified personnel to critically analyze the procedures and administrative challenges. Therefore, it is recommended that, construction professional on successful projects, document challenges on risks so that they can be integrated into future projects to enhance risk management procedures. The study would aid project managers at the early stages of construction projects in the quest of averting risks.

Keywords: Risk management, risk identification, process, construction industry, Ghana

TABLE OF CONTENT

LIST OF TABLES

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DEDICATION

This research work is especially dedicated to Almighty God for His inspiration, mercy, guidance love and blessing on us. It is equally dedicated to my wife Mrs. Rita Tabi and our Children for their support and assistance during my two years stay in the university.

CHAPTER ONE

GENERAL INTRODUCTION

4.6 BACKGROUND OF STUDY

MacLeod (2005) stated that, a lot of organizations from different sectors of the economy have now come to embrace the significance of risk management and thus has caused a number of companies to recognized the Risk Management Department as the regulator of the said event so they could be uncovered to them. The built environment and its clienteles are extensively allied with a high mark of risk owing to the nature of construction business activities and the processes involved in the delivery of projects in the industry.

Uher (2003) defines risk as the "chance of failure or the likelihood of gathering threat or of suffering harm or loss". In construction projects, a risk may be defined as the possibility of disapproving event having an impact to the project. Since the purposes of construction projects are in most cases stated as goals recognized for purpose, cost, time and quality, the most domineering risk in the built environment is disappointment to meet these targets. The importance of risk management endows or aid the strategic project participants (that is, client, contractor, consultant and supplier) to encounter their responsibilities and decrease negative influences on construction project performance comparative to cost, time and quality objectives. Conversional Practitioners have deliberately inclined to associate construction project accomplishment with the three features of time, cost and quality results.

The existing cost-effective slump and encounters is highly competitive. The Ghanaian construction sector need contractors who are risk management conscious in order to overcome risks by themselves. This research aims to discover the risk examination and risk management procedure and practices by the Ghanaian construction industries.

Risk Management however may be seen as a logical approach of viewing critically within the spaces of risk challenges and thus discovering ways and means on how it should be treated. It is a management device that aim at recognizing and developing basis of risk and uncertainty control of the closeness of impact, and deciding suitable resolutions for it (Uher, 2003). An ongoing procedure of these risk within the construction industry have been shared into risk classifications, risk identification, risk analysis and risk reaction, where the reaction has been sub-divided into four actions, including retentions, reduction, transfer and avoidance (Berkeley *et al.*, 1991; Flanagan and Norman, 1993). An operative risk management schemes can be answered to the simplest minimum only when the kind of risks are confronted, but besides the nature of how to control it. This risk in diverse areas of construction projects, owed to the cumulative significance of risk management which has been famous as an essential in most businesses today. Again, it is owed to the set and ways and means to have an established means to regulate the numerous impacts brought by possible risks. (Schuyter, 2001; Baker and Reid, 2005).

Relatively through countless other industries, the construction industry is subject to many risks and other contests due to the exceptional features of construction activities, such as long period, complicated processes, abominable environment, financial intensity and

dynamic organization structure (Flanagan and Norman, 1993; Akintoye and MacLeod, 1997; Smith, 2003). However, attractive risk management seriously as a management tool, to manage risk and its associated variables constructively, has always been essential for a successful delivery of any project.

Other researches have obviously aimed at examining the impact of risks on one aspects to project cost. Chen *et al.* (2000), time. Schen (1997), safety. Tam *et al.* (2004), some researchers explored risk management within the construction project, with the framework of a specific project phase, such as conceptual/feasibility phase. Uher and Toakley (1999), design phase. Chapman (2001), construction phase. Abdou (1996), fairly than from the standpoint of a project life cycle. Furthermore, uncommon exercises have been studied unto risk, from the viewpoint of project stake holders.

1.2 STATEMENT OF THE PROBLEM

Most Ghanaian construction firm are at lost on what actually goes into identifying and analyzing risk management processes, since the industry can be highly difficult and burdened with insecurity and other challenges. Risk management is of highly technological and contemporary for many construction firms, where the absence of it is root of majority of risk found within the industry. The indecision about the consequence of outcome, when going in for a construction project has exposed many players in the industry on a higher form of risk (Kwakye, 2005). According to Asare (2004), construction challenges in most cases lie unseen even before tendering and the construction stages of a construction project in the Ghanaian setting. That is, majority of contractors have slight awareness or even no

information on the essence of risk identification and analysis Management. Other contractors even consider it as irrelevant to the success of their business. Consequently, to date, very few studies have been conducted to explore the procedures adopted in risk identification and analysis procedures specifically by construction firms in Ghana. This study seeks to explore on risk identification and analysis procedures carried out in the Ghanaian construction industry.

1.3 AIM

The study aims to explore, the procedures and practices adopted by D1K1 construction firms in Greater Accra Region of Ghana, during the processes of identification and analyzing risk.

1.4 OBJECTIVE

The specific objectives of the study are to:

1. Identify the key prerequisite of risk identification processes;
2. Identify risk analysis process and procedure as practiced by Ghanaian construction firms; and
3. Identify key factors relevant during the process of analyzing risk.

4.6 HYPOTHESIS/QUESTIONS

1. What are the prerequisite of risk identification processes?
2. How is risk analysis processes carried out by construction firms in Ghana? And

3. What are the key factors that enhances the processes and procedure of risk analysis?

1.6 SIGNIFICANCE OF THE STUDY

Risk Management is one of the nine knowledge areas spread by the project management institute. Moreover, risk management in the construction project management context is all inclusive and methodical way of identifying, analyzing and responding to risk in order to accomplish project objectives (Project Management Institute, 2015). Construction companies are no exemption; firms in the industry are exposed to countless risk than other types of businesses. General contractors, subcontractors, and specific trade contractors rely on construction insurance to keep their businesses and employees harmless and useful.

Risk management within the construction industry is a total shared and organized way of identifying, analyzing and responding to risk to enhance the overall project objectives (Institute of Civil Engineers, 2003). According to Eskesen *et al.* (2004), the use of risk identification and analysis procedures in the early stages of project (that is, inception stage, pre-contract and post contract stage) where various decisions has to be taken like the construction processes and technology, can influence the overall project objectives.

Dogbegah (2009) also suggests that, Ghanaian contractors on construction projects, when the project is wholly accomplished, they must premeditate and modules well noted, acknowledged and integrated in future projects to avoid duplications of errors. However, the essence of risk identification and analysis together with its development, would enable

full potential use of construction resource. Consequently, the absence of risk identification and analysis assessment on any project could always have a recurring negative impact at various levels, which could lead to project not meeting its intended objectives. The process of identifying and analyzing risk as practiced by Ghanaian construction firm could be improved by making management fully attentive and informed on probable occurrence. Where stakeholders would be involved in identifying various issues throughout the analysis processes.

1.7 METHODOLOGY

With this study, a two-stage approach was adopted, that is, field research and desk study. The field research includes the use of series of questionnaire designed for the gathering of data from the various professionals in the construction industry specifically in the Greater Accra Region of Ghana. The sampling technique engaged by the study was the purposive sampling method. Information on the questionnaires included the Likert scale rating for the dependent variables that allowed easy synthesis and easy categorization. Again, the study made use of a quantitative approach of enquiry. A critical review of pertinent literature was made with the intent of discovering the hypothetical paradigms supporting the subject as they helped in elucidating risk identification and analysis practiced in the Ghanaian construction setting. The review tracked down credible data from existing literature through books, unpublished thesis, journals, and publications of corporate bodies. The data were further analysed using mean score rankings (index), relative importance index as well as descriptive statistics.

1.8 SCOPE OF THE STUDY

The focus of this study is on risk identification and analysis as practiced by Ghanaian construction firms specifically in the Greater Accra Region. The study is limited to construction firms in the D1K1 classification as well as consultancy firms who are with much relevant experience in context of the study. The region was chosen as the research scope as majority of construction firms are located there and many of these firms seek to find greener pastures there because of the increasing demand for housing facilities and other structures and additional economic benefits firms enjoy. Again, the choice of the Greater Accra Region was once more influenced by the convenience of data collection as result of the region's proximity to the researcher as it aided in quick retrieval of survey questionnaires.

1.9 ORGANISATION OF THE RESEARCH

The structure of the thesis is in five interdependent chapters which follows this outline: The chapter one makes presentation of the background to the study and as well the problem necessitating research efforts. The research aim and objectives, research questions, and the research scope are all contained in the chapter one. The chapter two contains the literature review. The review provided an extensive coverage on past works. The chapter three also makes a presentation of the research methodologies adopted for the study. The chapter four contains the analysis and presentation of the data and discussion of the study results. The last chapter being the chapter five presents a summary of the findings of the study, conclusion and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews the extant literature on the concept of construction risk management as approved by construction companies. The chapter therefore offers extensive argument and review of construction risk planning theories and the experimental evidence by prior researchers. Again, an overview of the construction industry was reviewed fundamentally with regards to the risk planning, risk identification, and risk analysis particularly in the construction environment. Key topics covered here would include risk management procedure; risk analysis techniques for construction projects; and the assessment of risk. Information mustered in this very chapter will be deliberated on in the chapter four for the purpose of discussions and analysis.

2.2 RISK MANAGEMENT PROCEDURE

The unclear nature of construction project decisions has introduced to some extent risk occurrences in many firms in the process of business. According to Kwakye (2005), most decisions in the Ghanaian construction industry are made under conditions of risk and uncertainty. He further outlines that, in the construction industry, risk often lies buried at both the pre-tender and post-tender stages of project. Risk encounter on a construction project may lead to the following challenges:

- Stoppage to work within budgeted cost
- Stoppage to work within schedule time

- Stoppage to assume the prerequisite technical paradigms for quality, functions, fitness for determination, safety and environmental protection (Asare, 2004).

The monetary and economic misfortune has had a conflicting influence on the Lithuania's economy and the built environment industry. In 2009, the Lithuania's GDP rate decreased by 14.7%. In 2010 to 2011, the GDP rate increased from 1.3% to 4.6%. Annual GDP rate decreased from its highest point of 6.7% gotten in the third quarter to 4.4% in the last quarter of 2011. New industries, precisely construction, trade, transport and communications were not affected by these economic fluctuations. In 2010, the gross cost further declined specifically in the construction sector by 42.3% and in the trade, transport and communication sectors by 16.6%. In 2011, an optimistic modification in the gross value added was perceived in all the sections of economic events. The major growth in the gross value added was spotted in all assemblies of economic events. The major improvement in the gross value added was noticed in enterprises striking in construction by 15% and trade, transport and communication services together by 7.3%.

The construction industry, one of the backbone of Lithuania's economy over the last decade, is being faced with thoughtful competitions like accumulative unemployment and adjourned or even cancelled investments. These events have as well transformed in clients' and contractors' approaches. A condensed directive and insufficiency of commands have intensely improved a struggle between companies of the construction sector. This improved burden has enhanced excellence, efficiency and reduced costs, and the requisite for project plans and management, which correctly and efficiently manage risk.

Tipili and Ilyasu (2014) acknowledged and assed the likely nature and the rates of strictness of risk features in construction happenings in the Nigerian construction industry. A self-administered questionnaire was set out to professionals in the industry for them to assist recognize the probability of risk influences and the impact of these risk dynamics on construction project performance. A total Number of eighty (80) questionnaires were sent to recognized or nominated construction professionals including Contractors, Architects, Quantity Surveyors and Civil Engineers. However, fifty-eight (58) remained returned which was later analyzed using expressive statistic and analysis of discrepancy, which was afterward uncovered rating levels were determined to enable the classification of the likelihood influence score been low, medium and high levels. The study outlines a disparity of the ranking of the degree of occurrences and impact within groups. Based on the complex nature of risk factors, cost related risk and time related risk were found to be the greatest probable to occur and have the most influence on project. Environmental risk factors understood to be the lowest risk variables, due to its minimum chance nature of incidences and minimum impact score.

Risk management falls within the nine knowledge scopes and it is within these scopes that construction risk management becomes a comprehensive and a calculated way of identifying, analyzing and retorting to risks to accomplish the project central objects (Tipili and Ilyasu, 2014). The paybacks of the risk management route include identifying and analyzing risks, and improvement of construction project management processes and effective use of resources. Flanagan *et al.* (2006) stated that, construction projects can be extremely complex and burdened with a whole lot of uncertainty. They further noted that

risk and uncertainty can possibly have severe negative consequences on the construction during the project level. Kpodo (2016) in his published articles also concluded that, increasing frequent disasters call for the need to acquire the requisite knowledge, adopt preventive measures, develop coping strategies and acquire the needed adequate insurance to become more resilient. He further argued that, the effective way of managing risk can either provide a sure way of both resilience to withstand negative events and the ability to take advantage of the opportunities for developments that are locked up in them. In his assessment, further, he realized that proactive risk management is a critical ingredient in the fight to end any challenges and the incapability to manage risk correctly positions important difficulties to finish deficiency and furthering mutual wealth. According to Kpodo (2016), risk management is a powerful instrument for development, building better and more secure future.

2.2 PREREQUISITE OF RISK IDENTIFICATION PROCESSES

2.2.1 Definition of Risk Management

Risk is said to be an event or a situation that might have a positive or a negative consequence on some project objectives in circumstance it transpires. Risks are disruptions in route or gab in knowledge which donates to project threat (Webb, 2003). Risk management may also be defined as a coherent way of observing at risk and then having taken extremely decisive on how each ought to be treated. It is a thoughtful management instrument that has goals of identifying risk and uncertainty, observing at their countless influence, and finding a fitting risk management reactions (Uher, 2003).

2.2.2 Strategies of Risk Management

Risk management falls inside the nine (9) awareness areas identified by the project management institute. However, risk management in the construction project management setting is a comprehensive and ongoing of having a better image of how the entire model is overviewed then these are identifying, analyzing and answering to risk to reach project specified objectives. The remunerations of the risk management procedure including identifying and analyzing risks, and enhancement of how construction project management methods can be sound profited and right real use of the prerequisite resources.

Parsons Transportation Group (2004) defined risk management as the making of strong decision to impact risk and, finally, having cost effective way to lower adverse risk and to take opportunities. The process involves getting ready for risk plan, prioritizes risk, identifies the causes of risk events, and finding a suitable way to change the possibility of risk events and their likely cost and time effects. This effort plan can be seen as the risk management plan, probably the most effective tangible result of the overall risk analysis process.

2.3 RISK MANAGEMENT PROCEDURE

The procedure adopted in risk management is to certify that risk are aggressively identified, analyzed and coped by the project team including the project manager and other stakeholders throughout the life cycle of the project (Wang and Chou, 2003).

2.3.1 Identification of Risk

Risk identification is the initial and perhaps the utmost essential way in the risk management process. It is a tool that helps to identify the various sources of risks prevailing at a particular point in time. It includes the identification of pressing risk conditions on a particular construction project and a big picture of risk responsibilities (Wang and Chou, 2003). Risk identification serves as a road map to develop the basis of the rest of the procedures involved; that is, analysis and supervisory of risk management. Effective risk identification safeguards operative risk management. Carbone and Tippett (2004) stated that "the identification of project risks is a vital stage in delivery of a successful project". The PMBOK Guide (2008) defines project risk as "uncertain event that if it happens has a positive or negative consequence on at least one project objective". There are many likely project problems or risks that could have greater challenges or even failures on the construction project. It is very important to quickly act on risk factors events to prevent danger.

2.3.2 Risk Analysis process and procedure

When all the risks have been outlined and identified, the next road map is to analyze the probable risk occurrences and their impact on a project. One way of forecasting opportunities or risk challenges is when the stakeholder still has ways to resolve or put measures to improve on conditions which would be a very good decision to help identify the probable risks (Neil and Ellinas, 2014).

2.4 RISK ANALYSIS TECHNIQUES FOR CONSTRUCTION PROJECTS

Over the years, risk associated with the construction industry has always been series of them as the emerging responses are coming up to offset their danger consequences within the project cycles (Thaheem et al., 2012). Project risk analysis techniques can be categorized into two key groupings; qualitative and quantitative techniques, with associated sub-categories of semi-quantitative and simulation techniques (De Marco and Thaheem, 2014).

2.4.1 Quantitative Risk Analysis

These are scientific figures or statistical ways of using numerical measures to ascertain how project risks can affect the entire project plan either by cost or time objectives (Project Risk Management Handbook, 2012). The impact of this outcome has a consequence on the fiscal directory and how often they occurred can be correctly appraised and differences seen by making comparisons between previous information and successive project at hand (De Marco and Thaheem, 2014). The existing quantitative techniques includes:

Decision tree analysis: As the name implies, this quantitative technique is like a tree which is in a form of diagram use in forecasting future probable events (Schuyler, 2001).

Expected monetary value: This technique takes keen in aspects on likelihood phase of the scheme conditions and is grounded on a gain matrix (De Marco and Thaheem, 2014).

Expect judgment: Founded on skilled personnels' sentiments to calculate the displeasure rate and attainment possibilities of the whole project (De Marco and Thaheem, 2014).

Fault Tree Analysis (FTA): Potential derivative risk events are derivative from a top event (Delcano, 2002).

FUZZY Logic: A simple way to reach a definite conclusion based on vague, imprecise, noisy or missing input (Konstandinidou et al., 2006).

Probability distribution: Continuous probability distribution signify the uncertainty in standards such as periods of plan actions and costs of project constituents (Del Cano, 2002; PMI, 2009).

Sensitivity analysis/tornado diagram: Helps to decide which risks have the most probable influence on the project using a Tornado diagram. An exertion is prepared to capture how greatly risk impacts a specific metric like revenue or earnings (Lyons and Sktmore, 2004).

2.4.2 Qualitative Risk Analysis Technique

This arrangement does not function on numerical or statistical argument of data, it presents outcomes in forms of descriptions, recommendations and ordinal scores (Hubband and Evans, 2010). Qualitative techniques can be list of risk, risk levels, or risk maps. These practices rank risks for succeeding analysis or exploit by evaluating and scrutinizing their chances of existence and impact. The risk is assessed in more conceptual terms like high, medium or low, depending on the collected opinions and risk tolerance margins in the business. The key qualitative analysis technique includes:

Brainstorming: Greatest probable answers of project risk are produced and determined under the leadership of a facilitator (Berg, 2010).

Cause and effect diagram: Also known as the Ishikawa or fishbone diagram, it is valuable for identifying and analyzing causes of risk (Del Cano, 2002).

Check lists: A comprehensive aide-memoire for the identification of possible risks founded on previous comparable projects (Del Cano, 2002).

Delphi: A facilitator used a questionnaire to lobby philosophies around the key project risks a project risk professionals contribute an anonymously (Berg, 2010).

Event Tree Analysis: (ETA) Models the range of likely out emanates of one or a grouping of initiating events and usually provides qualitative descriptions (Del Cano, 2002).

Risk Breakdown Matrix (RBM): An 'activities and threats' Matrix, where the risk number for individually activity and the utmost common whole risk are assessed (Hillson et al., 2006).

Risk data quality assessment: Appraises the degree to which a risk is assumed and the truthfulness, quality, reliability and truthfulness of the risk data (De Marco and Thaheem, 2014).

2.5 THE ASSESSMENT OF RISK

Normally two comprehensive classes, specifically qualitative and quantitative analyses are used in numerous literature on risk valuation. A qualitative analysis will improve on the key issues to be identified. Risk structures could be understood by a data-driven system or by qualitative schemes like interviews, brainstorming and checklists. When used in the progression it brings about assessment procedure which covers explanation of each risk and the level of influence or the kind label of the risk; it might be either high, medium or even low in terms of whichever way risk impact and the probability of its occurrence (Zou et al., 2007).

Qualitative risk analysis assesses the impact and the likelihood of the identified risk and finding prioritized solution for the risk for advance analysis or direct prompt mitigation (Carr and Tah, 2001).

Table 2.1 Risk impact level

Impact	Definition
High	High influence risks could result in high overpriced or loss of assets; risk that dramatically interrupt damage or obstruct procedure scheme; or can seriously result in serious injuries to persons or even cause death to schedule personnels.
Medium	Medium risk may result in the costly loss of assets; risk that violate, harm or obstruct procedures; or risk that source human injury
Low	Little influence risks may outcome in the harm of some assets or may conspicuously disturb procedures
Risk impact level	*Adapted from NIST'S Risk Management Guide for information Technology systems cited by Loriline internal Auditor, 2007.*

2.5.1 Risk Priority

The risk priority digs into the level of risk and the possible mitigation or decision to be taken for that particular risk.

Table 2.2 Risk Probability

No.	Risk	Type	Probability (p)	Impact (T)	Rating (P x 1)	Category
1.1	A	Threat	4	9	36	Low
1.2	B	Threat	6	8	48	moderate
1.3	C	Threat	7	8	36	Moderate
1.4	D	Opportunity	8	8	64	High
1.5	E	Threat	2	9	18	Insignificant
Threat probability Table (source: Adopted from MSc. Const. Risk Management Assignment Group '2'						

2.5.2 Risk Monitoring, Control and Reporting

Risk monitoring, levels would be tasked, monitored and reported throughout the project life cycle. A status report will be adopted for reporting on the top risk list and will be maintained by the project team and all project change requests will be analyzed for their possible impact to the project risk. Where there are various changes management will be notified for specific actions to be taken accordingly.

2.5.3 Risk Contingency Protocol

During the cause of the project all risk which were not accessed during the beginning would be taken through the entire process of risk management as and when they are identified.

2.5.4 Project Governance and Risk Management

Neil and Christos, (2014) “Increasingly organizations are linking project governance to risk management through the use of project and programed boards”. However, the various roles and responsibilities of project team will vary depending on the size of the organization, project board members represent the management of the organization. They provide oversight to ensure that projects are more likely to succeed and deliver the expected benefits. They also authorize changes to the project phase and key information in providing risk management process. Project board strategy reflects an appropriate response. For example, payment delays are a common problem for many suppliers, which result in high levels of project capital that need to be self-funded. Certain levels may be tolerated, but an organization will manage the risks if they understand their own tolerances and set internal practices accordingly.

2.5.5 Risk Governance

Whiles project control is to creating itself, as a component of best way of doing things in project management by the comparison the application of risk control still in its early stage. This has since been increased further by using the rules of good control to the showing, assessment, management, monitoring and communication of risks as promoted by the International Risks Governance Council (IRGC) in 2003. Risk governance provides guidance on how risk-related plane making should take place by directing on the elements of the risk management functions (e.g. people, processes) and the way they interact (e.g. information exchange). It also enhances on the need for supporting and reconciliation of

many different understanding across organizational hierarchies as well as organizational, industry, national and international boundaries.

Changes that has always been outlined as risk on the risk register with ways of controlling actions, shall eventually provide comfort to a project board, this should project strategies on track and realistic. A few of bigger institutions now link the risk allowance in the project estimate for the levels of expenditure that are authorized to be spent by the project members in controlling changes. Example the London 2012 Olympic Delivery Authority (O.D.A), with overall oversight of a multibillion pound complex delivery programme of capital and operational project had to put in the way series of layers of assurance. A system of Olympic programme and project boards were set up to oversee change linked to the quantified assessment of risk allowance and contingencies. Given the immovable deadline and tight budget, these regular reviews against targets not only gave comfort on project progress but also provided proactive confidence on "forecast" out comes, budgets, contingencies and achievability of hard deadlines (Neil and Christos, 2014).

2.5.6 Risk Policy, Risk Appetite and Risk Tolerance

A good risk governance enhances a risk policy and ensure a good system for risk management to be in place. A risk policy needs a board to consider or review all the risks that it faces and communicate appropriately the type and extent of the risk it is willing (risk appetite) and able (risk tolerance) to accept as it seeks to achieve its objective.

Also, it is important that the policy is kept "live" through sufficiently regular updates so that those using it are confident that it reflects the current risk appetite (Ritten and Martens, 2012). An organization's risk appetite should be responsive, to changes within its environment and to its own capabilities. A risk appetite can only be an effective appetite needed to fall within the boundary of what it can and cannot tolerate. Being able to define the organization's risk tolerance requires that development of meaning measures of the impact specific risks will have their ability to survive those risks. For example, payment delays are a common problem for smaller contractors. They may be able to tolerate certain levels of late payments over certain periods of time but are they clear about where their limits lie? A well-articulated risk appetite is one that expresses its limits through identifying what it will and will not tolerate, with this exercise cascaded down from strategic risks to operational and task risk (Ritten and Martens, 2012).

Table 2.3 Risk policy, risk appetite and risk tolerance

Risk category	Risk appetite	Risk limit – acceptance	Risk limit – unacceptable
Reputation	Moderate	A negative article in the local press of no more than one week in duration	A major item of negative coverage on a main stream channel
Operational delivery	Low	The project does impact normal service delivery for more than four hours	The project does not impact, normal services delivery for more than 24hours
Financial	Low	The project budget can be extended up to five percent in justified and board approval instances	No level of fraud acceptable
Compliance legal/regulatory	Moderate	Prepared to accept challenges where chance of a successful win are more than 50 percent	Not prepared to accept challenge with less than 50 percent chance of a successful win
Safety	Low	One minor accident that does not require hospital treatment per quarter	Any serious injury or fatality to workers or public
Risk policy, risk appetite and risk tolerance (source: MSc. Const. Risk Management Assignment Group '2' class of 2016)			

2.5.7 Risk Allocation

Negotiation of a good risk allocation is however directly impacted by good competitions of a level of bench marking during the period of assessment of work. In a highly aggressive market environment where companies are trying to retain or expand market share and many be willing to accept greater risk exposure then clients can relatively easily transfer risks to the supply chain. However, when there are various sources of work or when

working as a niche supplier with leverage in the market, the supply chain will be able to negotiate more favorable terms or appropriate remuneration for risk taking. Accepting the transfer of risks within the supply chain provides an opportunity to take greater returns and is ideally done so when there is a clear strategy for their management. In appropriate risk transfer places both the owning party and client at risk through non-delivery (Yate and Sahegyi, 2001).

2.5.8 Risk Governance Through Contract

Construction at the project level is a total combination of various organization in the industry to partner the construction process as stakeholder for a project success. A stage in the project governance also looks at the complex nature of the contracting system which may be taken care of by a sector of organization to see through proper contracting among the contracting system through the project whole life cycle. A good drafted contract shall validly outline or proportion various responsibility of relationship among all the parties involve.

Construction contract can also be seen as a good binding when any party in the contracting decides to transfer or sublet any of their portion to any party involve. From a client's point of view, they provide the right to supervise and monitor a contractor and connect performance levels to any payment stages. From the contractor's point of view, they provide protection from unreasonable demands or unfair practices (e.g. unreasonable delay in payments).

Construction environment is in its best trying to work towards efficient and more collaborative approach to enhance good project delivery, when there is a great impact of changes in the economic climate and partly from a very growing entity of truth of success of this kind of approach (such as the London Olympics). As a result, contract even since have had to develop shifting from "traditional" templates to alliancing and frame work agreements.

2.5.9 Monitoring and communicating risk

(Project Management Body of knowledge, 2000) have an over view of monitoring, planning and scheduling and keeping all data identified as project risk for effective project planning and execution of a smooth work to reduce the probability of project risk. Risk monitoring and controlling data helps in keeping relevant information for successive project implementations. A good project communication enables the project team to have fore knowledge for any anticipated occurrences of risk that can occur within the project level, communication from the design team until the final completion of the project help to quickly rectify probable negative occurrences' which may affect a greater stage of project monitoring and controlling.

2.5.10 Technical Risk in construction

(Project Management Institute, 2008) quoted in it meaning of project risk as "an undefined event or state that, if it transpires, contributes a positive or negative result on at least one project objective". Here are many probable risks which might lead to the dissatisfaction of

the construction project, inside the project, it is very essential which ever risk causes are acting concurrently.

Construction project may suddenly get into trouble even whenever they are well planned and managed. Basic abnormalities for this are that of technical risks affecting the projects are more complex than they have been allowed for and consequently they should be sorted out for mitigation measures to be taken. Technical risk is assumed to be engineering problems due to human errors. Project failure is considered as a gap in succeeding to meet project objectives. Technical gap is any problem which is cause unto the project which affects the project objectives. However, the segment of technical risk comes under any events which can have negative impact on the project successes or development e.g. equipment and materials failures, structural design failure unskilled personnel employed at the project site etc. (Xenidis and Angelides, 2012).

(Construction Information Services, 2014) outlines technical risk to be incomplete structural designs, improper site feasibility studies and information seeking over a source and availability of resources appropriateness of specifications. Likewise, the outlines of technical risk may be seen as errors in design misinformation and failure on construction plants and equipment (Shen et al., 2001). Majority of technical risks are as a result of or from project stake holders and are equally rectifiable (Rezakhani, 2012).

2.5.11 Identification of Technical Risk

Whenever trying to identify technical risk, it is very important to monitor and identify in order to find a reasonable measure to handle them. Risk identification is one of the imperative measure within the risk management processes (Garrido et al., 2011). In identifying technical risk, the Risk Incorporation (2012) outlined these twelve methods:

(a) **Brainstormin**g: is technical skills that ensures when the approach is unstructured, the team leader try to use random probability input from the group. It is mostly for a shallow risk analysis the reliability is not up to 100%.

(b) **Surveys**: this method however uses a list of questions set for a particular group, for the risk assessment to be evaluated, the only challenge is that inaccurate information may come out when the target people are not ready to help access the problems for information to be collected.

(c) **Interviews**: are to some extent very effective to gather information when assessing risk base on the clarity of questions being asked.

(d) **Working Groups**: are keen way to analyse a particular area or topic in a discussion process to identify risk that may not be obvious to the risk identification team.

(e) **Experiential Knowledge**: this is gathering of data or information from experience construction personals who have been in the system for a very number of years or periods

(f) **Documented Knowledge**: this is the gathering of evidence or data that have stayed and stored on a particular area of specialization. This remains a bench mark for information that offers intuition on the risk in a certain specific area.

(g) **Risk Lists**: these are frequently a list of risk that have been found in comparable metropolises and circumstances. Carefulness need be used when using this type of information to confirm if only its very significant and appropriate to the present state.

(h) **Risk Trigger Question**: these are list of circumstances or actions in a specific part of a metropolis that can inform to risk identification. These are conditions or areas where risks have been cited within the place of work. These trigger queries might be gathered in parts such as act, cost, schedule, software, etc.

2.5.12 Types of Risk Considered as Technical Risk

Some of the risk related to technology, complexity and interfaces, performance and reliability, quality process and analytics are considered technical risk. The U.S Department of Transportation (2006) classified technical risk to design and construction phase, with the design phase's technical risk arising from:

1. Client participation in design
2. Insufficient and unfinished design
3. Change in climatic conditions
4. Mistake as a result of inadequate of structural or geotechnical or even foundation
5. Poorly choice of materials
6. Take off data (traffic demand, water consumption demand, etc.)
7. Need for design exceptions.

Whilst technical risks in relation to the construction phase can be seen as follow:

1. Incorrect contract period of estimations
2. Construction processes
3. Construction occupational safety
4. Work permissions
5. Utilities
6. Late, incomplete or wrong surveys
7. Late deliveries and disruptions
8. Workers and site safety
9. Innovative projects
10. Inappropriate equipment and materials
11. Environmental risks (such as project near to a wild river, flood plain, coastal zone, high sensitivity for paleology area and so on).

2.5.13 Incidental Risk

The nature of controlling innumerable construction projects is being highly inclined by the following related risk due to poorly project management performance (European commission, 2011)

1. Undecided or unachievable project objective
2. Unfortunate scoping
3. Unfortunate estimation
4. Budget base on incompletes data
5. Insurance problems

6. Contractual problems
7. Adjournments
8. Quality concerns6
9. Scarce time for testing materials

CHAPTER THREE

RESEARCH METHODOLOGY

4.6 INTRODUCTION

A good and a constructive research work has a direct bearing on the kind of research methodology or design used for the enquiries during the processes of the research's work, Naoum (2003) outlined that, immediately you have the purpose of your research work, and gone through series of literature on the area of the research one should be in the position of framing the research work in details. The major element in any research design is to have specific research methodology which encompass a form of data gathering. The research design, the research method and questionnaire design, sampling method and size and how data was gathered and prepared for analysis was considered under this chapter. The research design addresses the research problem and also serve as an outline to provide answers to the research questions. The research method emphasizes how the questionnaires were designed, sampling size and analysis of data as well as the scope of the research.

4.6 RESEARCH DESIGN

Research design as defined as Creswell (2009) is the information needed to provide mounting answers to the research questions in every study and indicates the gathering and analysis of the data. Burns and Grove (2003) simply puts research design as the plan for carrying out a research study. There are three types of research designs and they are: Descriptive Research Design, Explanatory Research Design and Exploratory Research Design. The descriptive research is designed to give a clear picture of a situation as it naturally happens (Burns and Grove, 2003). Thus, situations are usually described using

descriptive research design. Profile of persons, situations or events are the basic object of measurement in descriptive research. It is also employed for the justification of current practices, make judgement and to develop theories. Brown (2006) explains that the insights and understanding of a situation or an issue is possible by exploratory research. He further emphasized that, to address new issues on which there has been little or no previous research then employing exploratory research is the best. Explanatory research design deals with the clarification of the existence of a relationship that exist between two or more aspects of a situation or phenomenon as well as forecast future happenings. This is mostly considered by research questions or hypothesis which specifies the direction and nature of the relationship between the variable being examined. Therefore, this research employed both descriptive and the explanatory research design to expand the understanding and gave a full picture of the procedures and practices adopted by construction firms during the processes of identification and analyzing risk.

4.6 RESEARCH METHOD

A logical and coherent research method is essential for conducting a research. Fellows and Liu (2008) define research methodology as the ethics and measures of logical thought applied to a scientific investigation. The three-advance method of research are: qualitative, quantitative and triangulation/mixed methods. According to Creswell (2009);

Table 3.1 Quantitative, mixed and Qualitative Research method

Quantitative method	Mixed method	Qualitative methods
Pre-determined	Both pre-determined and emerging methods	Emerging methods
Instrument based questions	Both open – and closed – ended questions	Open – ended questions
Performance data attitude data; observational data and census data	Multiple forms of data drawing on all possibilities	Interviews data observation data, document data and audio-visual data
Statistical interpretation	Across data bases	Text and image analysis.
Statistical interpretation	interpretation	Themes, patterns and interpretation.

Source: Creswell (2009)

The study employed both qualitative and quantitative research method. The qualitative research method was employed to support and clarify related outcome on the quantitative study on the processes of identification and analyzing risk in the construction industry. Face to face interview was used to enable respondents to comment about issues which were not touched in the questionnaire and also gave them the opportunity to elaborate more on some questions which were asked. The following are justification why quantitative research method was adopted, the nature of the study is deductive because it seeks to draw conclusions on the procedures and practices adopted by construction firms during the processes of identification and analyzing risk from which appropriate statistical tools are used to analyze findings, draw reasonable conclusions and make final recommendations. As a result of this, questionnaires were designed to serve as a means to seek the opinions of construction professionals such as quantity surveyors, project managers and engineers,

architects among others, concerning the key prerequisite of risk identification processes, risk analysis process and procedure as practiced by Ghanaian construction firms and identify key factors relevant during the process of analyzing risk. These key personnel were chosen as they are directly involved in the construction processes and knowledgeable in managing and controlling construction risk.

4.6 DATA SOURCE

The researcher employed primary source of data with the main purpose of gathering information that can be analysed, enable interpretation, and aided the investigator to grow unique information such as eye witness accounts, and personal observations. Data was collected directly by the use of questionnaires and interview on key personnel in the built environment both the consultancy and those at the project site. The key objective on these data collection was accessed by trying to have an informed information about the impact of risk in the construction industry at the project level and analyze its and tried to identify some of the useful suggestion which would help minimize its effect or impact on projects.

3.5 POPULATION AND SAMPLE SIZE DETERMINATION

3.5.1 Target Population

Population as Taylor-Powell (1998) defined refers to a group or units of interest located in a geographic area of interest during the time of interest. The study is limited to construction firms in the Accra Metropolis in the Greater Accra region of Ghana. Thus, construction firms with the classification, D1K1 were considered for the study. This classification of companies is well established and demonstrate satisfactory requirement of

safety records with high risk management levels in the Ghanaian construction industry. The region was chosen as the research scope as majority of construction firms are located there and many of these firms seek to find greener pastures there because of the increasing demand for housing facilities and other structures and additional economic benefits firms enjoy. Again, the choice of the Greater Accra Region was once more influenced by the convenience of data collection as result of the region's proximity to the researcher as it aided in quick retrieval of survey questionnaires.

The population of the study is the number of registered D1K1 building contractors based on the Ministry of Works and Housing in the Accra Metropolis. The target population was 120 as at 2014 in the Greater Accra Region.

4.6.1 Determination of the Sample size

It is effectively problematic to exam every person of a population. Thus, it is impracticable to reach every person of a population when collecting data.

In order to obtain a sample, the Kish Formula was used to determine the sample size. Kish Formula states that:

$$n = \frac{n'}{\left(1 + \frac{n'}{N}\right)}$$

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

Where

v = the standard error of sampling distribution = 0.05

s^2 = the maximum standard deviation of the population

Total error = 0.10 at a confidence interval of 95%

$s^2 = p(1-p)\ where\ p = 0.50$

$= 0.50(1 - 0.50)$

$= 0.25$

p = the proportion of the population elements that belong to the defined region.

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

$$= \frac{0.25}{0.05^2} = 100$$

N = 120

Therefore

$$n = \frac{100}{\left(1 + \frac{100}{120}\right)} = \frac{100}{(1 + 0.833)} = 54.55 \approx 55$$

The sample size formula provided the minimum number of questionnaires that were to be administered. The sample size was found to be fifty-five (55) D1K1 construction firms. For every firm that was visited, one person was administered with questionnaire. Construction professionals such as project managers, site managers and engineers were the targeted respondents for the study. These key personnel were chosen as they are directly involved in the construction processes and knowledgeable in managing and controlling construction risk. Purposive sampling technique was used to pick the respondents. Purposive sampling as Mugenda and Mugenda (1999) defined is the sampling technique that permits the researcher to adopt samples that have the prerequisite info with reverence to his/her study goal.

4.6.1 Questionnaire Design

Grounded on the literature review, a pilot test of the questionnaire and interview were developed to determine the genuineness, validity as well as reliability of the study. Generally, the questionnaire was premeditated to gather data from construction professionals. These questions were grouped into section A. & B.

In section A, respondents' contextual information (demographic information of respondents) were considered to ascertain the respondents' knowledge about the study as well as ensure the validity and reliability of the study. Part B focused on the main objectives of the study and this was develop based on the information obtained from the literature review. Questions were scaled from 1-5 with the account: (Strongly Agree, Agree, Disagree, and Strongly Disagree and Uncertain). Questions in this sector implore data on factors to consider in determining risk identification and analysis adopted by Ghanaian construction projects in Ghana.

4.6.1.1 Distribution of Questionnaire

Respondents were given four (4) days to answer the questionnaires and return the filled questionnaires. After the fourth day, all respondents were personally contacted to retrieve the completed questionnaire.

4.6 Data Analysis

Adèr (2008) defined data analysis as a process of editing, altering, and displaying data with the goal of emphasizing important information, deductions, suggestion, as well as making

supportive conclusion. Data collected from the questionnaire were analysed, concise, and construed consequently with the support of descriptive statistical techniques.

The gathered questionnaires were amassed in greater units and were processed and entered into Statistical Packages for Social Sciences (SPSS version 20) to cross-tabulate the relations concerning the variables. The results were analyzed statistically using Relative Importance Index (RII) for the significance ranking of the factors identified. The aim of the analysis is to establish the relative importance of the various factors that will be identified. The relative importance index (RII) will be calculated using the formula (Fagbenle *et al.*, 2004).

$$RII = \frac{\sum Pi\ Ui}{N\ (n)}$$

Where RII = Relative Importance Index

Pi = Respondent's Rating

Ui = Respondent's placing identical weighting or rating on the factors

N= Sample size

n = The highest attainable score on the factors.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSIONS OF RESULTS

4.1 INTRODUCTION

Generally, study discusses respondents' view on the procedures and practices adopted by construction firms in Greater Accra Region of Ghana, during the processes of identification and analyzing risk. With the objective of identifying the key prerequisite of risk identification processes, risk analysis process and procedure as practiced by Ghanaian construction firms as well as identify the relevant key factors required during the process of analyzing risk. The analyses of simple descriptive statistics and Relative Importance Index.

Fifty-five (55) questionnaires were administered, employing a purposive sampling technique, out of the 55 questionnaires distributed, 52 questionnaires representing 94.55% were completed and retrieved. Afterward, considering the removal of outliers and missing values as a result of incomplete data, 52 completed questionnaires were grounded as valid for the analysis. The analysis of the results is grounded on these number of questionnaires recovered and accordingly shaped the bases of the conclusions of this study. The high response rate of 94.55% can be attributed to the fact that questionnaires were administered personally to respondents and successive follow-ups thereafter.

4.2 Respondents' Demographics

Respondents' demographics gives the background information on the various respondents of this study. It includes respondents' profession, educational background, years of experience, and the organization of the respondent. The contextual information

(demographic information of respondents) were considered to ascertain the respondents' knowledge about the study as well as ensure the validity and reliability or otherwise, and generate confidence in the data collected.

4.2.1 Respondents qualification

Every project in the construction industry is subject to different professionals with different levels of qualification be it execution of roads, bridges, dams, buildings etc. Individual role in a project team is in most cases founded on the qualification of the professional. Ones' qualification also has a lot to do with his or her level of experience as well as technical know-how on a particular task. Consequently, it is important from the researcher's perspective in taking into account respondent qualification.

Table 4.1 Respondents qualification

Qualification	Frequency	Percentage (%)
PhD	4	8%
MSc.	15	28%
BSc.	20	38%
HND	5	10%
Diploma	8	15%
Total	**52**	**100%**

(Source: Field Data, 2016)

The table above indicates the professional educational background of respective specialization. The highest frequencies were 20, 15 and 8 respectively. These segments represent a percentile of 38%, 28% and 15% representing a total of 81%. The remaining 19% belongs to educational categories of Doctor of philosophy (PhD) 8%, and Higher

National Diploma (HND) representing 10%. The results characterize the perception of respondents with a higher degree of intellectual dimensions as well as the quality of the findings.

4.2.2 Professional Background of Respondents

Table 4.2, show the various professional backgrounds civil engineers, Quantity Surveyors, Architects and project Engineers. From the table, it was seen that, the first three professional with the highest numbers are 48% (N = 25) representing Quantity Surveyors, 29% (N = 15) as project Engineer with civil Engineer representing constituting 29% (N = 15) and approximately 10% (N = 10) of the respondents were architects. The respondents survey included major construction professionals who are mostly found on construction site and knows what is actually on the site thus perceived as appropriate, representative and valid for data analysis.

Table 4.2 Professional Background

	Frequency	**Percent (%)**
Quantity surveyors	25	48%
Civil Engineers	15	29%
Project Engineers	15	29%
Architects	5	10%
Total	**52**	**100%**

(Source: Field Data, 2016)

4.2.3 Post Qualification Experience

Indication on the table below, shows that 67.2% (N = 18+17) of the Participants have working experience over 10 years within the construction industry of which, 26.9% (N = 14) have working experience within the bracket of 10 years, the least of the working experience once are up to 5% (N = 4) representing 7.6% of working experience. The participants with working experience within 5years does not have any effects on the nature of data complied, but rather the combination of these experiences within the industry makes suggestion more dependable and credible. Thus, the length of practice in the organization is crucial for knowledge on the construction site and risk management as well as analysis in general. Further, the balances of a variety of levels of experience will therefore enable a generalized and realistic view as far as this research is concerned.

Table 4.3: Post Qualification Experience

Years	Frequency	Percent (%)
0-5	4	7.6%
5-10	14	26.9%
10-15	18	34.60%
15-20	17	32.6%
Total	**52**	**100%**

(Source: Field Data, 2016)

4.2.4 Prerequisite of Carrying out Risk Identification and Analysis by Participants

When participants were asked whether they have the prerequisite in carrying out risk identification and analysis 73.07% (N = 38) testify to the fact that, they are well versed in the identification of risk as well as its analysis. However, 26.92% (N = 14) said indicated

they have no knowledge. The information given by the respondent indicate that they have the prerequisite in carrying out risk identification and analysis base on their post qualification experience. They further commented that, they do all this analysis through all the various stages of the project level to identify all the threat and opportunities before going in for a project and these has actually realized them with greater profit margin over the years and this has always been their companies' cultural dimensions all the time.

Table 4.4 Prerequisite of carrying out risk identification and analysis by participants

	Frequency	**Percent (%)**
YES	38	73.07%
NO	14	26.92%
Total	**52**	**100%**

(Source: Field Data, 2016)

4.2.5 Risk analysis and its importance on a project

The participants were asked if they conduct and follow risk identification and analysis procedure within their firm and how important has this decision contributed to their company. 96.15% cited yes risk analysis has always been their outlook when going in for a project and most of these are local contractors and expatriate owing to the fact that, risk analysis and identification is one of the major prerequisite for their country to look at in other for them to have any financial assistance for any project especially the foreign contractors. Thus, they see this as very important to make these analyses for any project at hand. On the other hand, 3.84% indicated that they do not take any risk analysis and even do not see these as very important.

Table 4.5: Risk analysis and its importance on a project.

	Frequency	**Percent (%)**
YES	50	96.15%
NO	2	3.84%
Total	**52**	**100%**

(Source: Field Data, 2016)

4.3 Risk Identification and Procedure

In the survey, majority of the participant have their working know-how more than 18years in the construction project management. Based on their employed proficiencies and various places where they have worked, it was obviously recognized that, the participants have adequate awareness associated with project risk management. This makes their contribution more resourceful and trustworthy source of vital information which was very important for the study.

This is how the participants responded to how their risk identification and analysis procedures carried out on their various projects.

1. Risk management planning
2. Risk Identification
3. Qualitative risk analysis
4. Quantitative risk analysis
5. Risk response planning
6. Risk monitoring and control

Risk management procedure/Planning.

The procedure adopted in the risk management procedure by the respondent in the Ghanaian Construction firm, needed to recognized and aggressively identified, analyzed and managed by the project members including the project manager and other stake holders during the phases of the project. Therefore, to minimize the impact of the risk, they should be identified as soon as possible.

Risk identification

A very important stage in the procedure of handling risk is to identify probable risk. Risk are about events that, once transpires, causes harms. Hence, risk identification can begin with the basis of difficulties, or with the problematic itself. Brainstorming is a good way of identifying risks since various stack holders will bring to bear their experiences. Risk identification will involve the project team and its appropriate stake holders. Risk identification and categorization and risk breakdown structure helps to comprehensively identify all risk.

Risk Analysis

All risks identified by the project team are assessed for its identification on the range of possible project outcomes. Qualitative and quantitative analysis are used to determine which risks are the top risks to pursue and respond to and which risk can be ignored.

Quantitative Risk Analysis

The results from the risk analysis brainstorming session too will be analyzed and figures or values given to all risk events identified and prioritized with color coding to show the extent of risk.

Risk response planning

All risks identified as major needs attention, the project team members monitor to ensure that the risk are attended to.

The following approaches are used to address them:

- Avoid – Eliminate the threat by eliminating the cause
- Mitigate – Probability way to reduce the identified risk
- Accept – Nothing will be done rather evaluate to see the possible opportunity
- Transfer – Make another party responsible for the risk

For each risk that will be mitigated the project team identify ways to prevent the risk from occurring or reduce its impacts or probability of occurring. Some of the actions to take are added to the task including project schedules and adding resources etc. For each major risk that is to be mitigated or accepted, an action plan is always outlined to ensure the minimization of its impact on the project.

Risk monitoring, controlling and reporting

Risk levels will be tracked, monitored and reported throughout the project lifecycle. A status report will be adopted for reporting on the top 8 risk list which is maintained by the

project team and all project change requests will be analyzed for their possible impact to the project risks. Where there are changes Management will be notified.

4.3.1 Relative importance weighting (index) and factor analysis

Respondent were asked to assign relative importance index (RII) to the respective key factors which enhances the processes and procedures of identification and analysis in the Ghanaian construction firm. They were given options to choose from 1 – 5. Results are displayed in the tables 4.5.

Table 4.6 Relative Importance index (RII) of the Key Relevant Factors during the Process of Analyzing Risk.

No.	Factors	Weight (%)	Rank
1.	Organizational level of awareness of risk	91%	***1st.***
2.	Motivation of team members	80%	***2nd***
3.	Difficult models for risk identification and analysis	65%	***3rd***
4.	Serious training effort is required	68%	***3rd***
5.	Communication skills among team members	62%	***4th***
6.	Training efforts are required	58%	***5th***
7.	Risk contest by senior management	53%	***6th***
8.	Resources availability	41%	***7th***
9.	It is a tradition change as it is process changes	39%	***8th***
10.	Integrating the process	31%	***9th***
11.	Technical capabilities in risk assessment with the Ghanaian construction set up	26%	***10th.***

(Source: Field Data, 2016)

4.3 Discussions of survey results

The general sections of this discussions are on the analysis of the information gathered on the data above from respondents of this study. These sections are to examine the relative importance key relevant factors during the process of analyzing risk adopted by construction firms in Ghana.

4.4 Discussion of prerequisite for risk identification and analysis by Ghanaian construction firms

Majority of the participants involved in this study cited that they do have the necessary prerequisites in the analysis of risk procedures. This was mostly found in the D1K1 contractors due to the size of their company and the scope of work they do. D1K1 contractors have most of their professionals who carry out these procedures on almost all of their construction projects. Since promoters or financiers of D1K1 contractors are always interested in these procedures before any financial assistance is offered, respondents believe that when the analysis of risk procedures are properly done, it enhances a successful completion of their projects. On the other hand, on the side of the minority, they believed they have always used their intuition and experience to work, which according to them has not always worked in their favours in terms of achieving the anticipated project outcome.

4.5 Discussion on whether participants have ever carried out documentation of risk identification and procedure analysis by their respective firms

According to Dogbegah (2009), "a project before and after completion, needs to be well studied and modules learnt and acknowledged and integrated in the subsequent project to prevent reappearance of errors". Minority of the participants said they do not actually carry-out the risk procedures on their projects as they argued that the procedures are highly technological and thus would not have any significant impact on their project. They claimed that they are adapted to the traditional ways of handling risks like the use intuition and past experience on previous project. However, this was mostly found with contractors whose personnel's have academic qualifications below first degree. On the other hand, majority of the respondents who carry out these processes were those with personnel's having the required qualification.

4.6 Discussions on how risk identification and procedures are carried out by the respective contractors and professional by their firms

In the survey, majority of the respondents have their working experience beyond 18years as they clearly pointed out how these procedures are being carried out in their respective firms. Those with fewer numbers of experiences in the industry could not show any significant procedures adopted by their firms. However, those with enough working experience and technically good with very good qualification were able to elaborate significantly the various procedures adopted in the risk analysis processes. Further comments cited by these class of professional and contractors revealed that, a good and

analytical processed carried out in risk analysis contributes a great positive impact on the success of their projects.

4.7 Discussion on key factors which enhances in the processes of risk identifications and analysis procedures

A relative index analysis was used to summarize the challenges facing the procedures during risk analysis by firms in the construction industry of Ghana. A number of factors were ranked with weightings according to their impact on risk identification and analyses procedures. The identified challenges were classified into two categories; the first category being the technical challenges include personnel's in the various firms not having the prerequisite experiences and technical no-how and simply just do not understand the essence of these exercises. The second category includes the challenge of some firms not having the resources to assist personnel's in carrying out the analysis during the various stages of the entire processes.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

This chapter shows the results of the study based on the various analysis and discussions that has been made within the earlier sections. The chapter summarizes the findings and the conclusions of the study relative to the main objectives. The conclusion encompasses the procedures connected to risk identification and analysis as practiced in the various Ghanaian construction firms and the findings for the procedures adopted at the various stages of the construction cycle. In addition, the chapter includes also suggestions as well as recommendations for further research in the future.

5.2 Summary of findings

The study gave explanations on how the various procedures of risk identification and analysis are carried out at the various stages during project implementations in the construction industry of Ghana. The following sequence of procedures, prerequisite and factors used at various stages of the study are as follows:

- It was established that majority of contractors within the D1K1 category have the prerequisite for their risk analysis and identifications procedures. Since firms under such category are noted to be sophisticated in their execution of construction projects, qualified personnels and professionals are employed and are up-dated on current trends.
- The study also shows that professionals within the industry critically follow the procedures of risk analysis and identifications. It was recognized that just a few

contractors were noted not to have taken the procedures seriously; further response from these respondents indicated that they see the processes not have any impact on the success of their respective businesses.

- The study again perceived that lack of training and updating of construction staffs on current risk management, poor project communication and absence of motivation hinder the infusion of construction project risk management into the industry.

5.3 Conclusion

The essence of this research is to explore risk identification and analysis procedures, as practiced by Ghanaian construction firms. These developments is to aid and enhance a good risk analysis procedure to enable a good model systems of risk procedures for construction projects managers. And also to better inform players in the industry a system of procedures to follow to enhance and mitigate any challenges and also informed contractors to understand the procedures during any phase of the project resolutions. Risk analysis procedures is highly competence based which requires highly experience and well informed professional to undertake these analyses if and only the project objectives are to be realized. However other sector of the construction firms and personnels also think that, the processes of analyzing is so complex and does not matter much to them. From the data collected it has been clearly shown that, the processes when properly adopted enhance a better decision making.

5.4 Recommendations

- Risk identification and analysis procedures should be integrated into contract document by consultants and promoters, strictly insist stakeholders to adopt all preambles within the schedule document as this would help in improving the processes and procedure.
- Construction firms ought to have a good risk analysis check list from previous projects and lessons learnt so that they can be integrated into future projects. And also, risk management training should be incorporated into undergraduate schools.
- Construction firms should resource their risk managers very well, by exposing them on area of training. Also, risk analysis procedures should be a prerequisite to be demanded by Consultants as this would reinforce the decision by contractor in following the various processes.

5.5 Recommendations for further studies

With regards to the findings of the study, these recommendations as outlined below are prescribed to enhance risk identification as well as risk analysis in the Ghanaian construction industry.

- Future area of research could also expand on how project managers develop risk analysis procedure, with major aim of achieving financial reporting documents.
- Additional further examination of risk management procedure being integrated into contract document and strictly enforce would strengthen the procedure.

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APPENDIX:1

QUESTIONNAIRE FORM

INTRODUCTION

My name is Charles Tabi, MSc. Construction Management student from the Department of Building Technology in the Kwame Nkrumah University of Science and Technology, Kumasi.

This research questionnaire is focused on soliciting information from practicing contractors, project managers, engineers, architects and quantity surveyors owing to their experience, it is aimed at:

To explore, the practice adopted by construction firms in Ghana during the process of identification and analyzing risk.

Information's provided will be used for an academic purpose only and will be kept confidential and the findings will also form the basis for developing a good risk identification and analysis practice framework to be adopted by the Ghanaian construction firms within the industry. I should be grateful for your cooperation in dedicating some time off your busy schedules to complete this questionnaire. In case you have any questions or comments, kindly contact me on 0241063130/0208593323 or via email: chapmancom2001@yahoo.com

Your time and cooperation is unreservedly appreciated.

Thank You.

Please tick [√] or click in the box [☒] where appropriate

Section A = background information

1. What is your academic qualification?
   a) Bsc. Honors ( )
   b) Diploma ( )
   c) Msc ( )
   d) PhD ( )

2. What is your professional background?
   a) Architect ( )
   b) Consulting quantity surveyor ( )
   c) Contractors quantity surveyor ( )
   d) Project manager ( )
   e) Civil engineer ( )
   f) Other (please specify)……..

3. How many years of experience do you have been working in the construction industry?
   a) 0-5 years ( )
   b) 6-10 years ( )
   c) 11-15 years ( )
   d) 15-20 years ( )

4. Which company classification do your organization belong to etc. ?
   a) D1,k1 Company ( )
   b) Other specify ( )

5. Please indicate the type of firm with which you work.
   a) Construction contracting firm ( )
   b) Construction consulting firm ( )
   c) Integrated construction firm (design and built) ( )

6. Do you have the prerequisite to carry out risk identification process by your organization.
   a) Yes ( )
   b) No ( )

7. Have you ever conducted any risk analysis and identification process by your firm, and also do you consider it as important to your firm.
   a. Yes ( )
   b. No ( )

8. Do your organization considers risk identification and analysis essential on any of your projects
   a. Yes ( )
   b. No ( )

9. How is risk identification and analysis carried out at the various stages on a construction project by your firm ?.

   ……

   ……

   ……

   ……

SECTION :B

Please identify or rank the following key factors relevant during the practice and process of risk identification and analysis Procedure in the Ghanaian construction industry by ticking (√) or clicking in the box where appropriate.

1=Strongly Agree, 2 = agree, 3 = Disagreed, 4 = Uncertain,5=Non

Key factors of risk analysis and identification procedures		RANKS				
		1	2	3	4	5
1	Technical capabilities in risk assessment within the Ghanaian construction set up					
2	Organizational level of awareness of risk?					
3	Training efforts are required?					
4	Integrating the process?					
5	It is a traditions change as it is process changes?					
6	Serious training effort is required?					
7	Risk contest by senior management?					
8	Resources availability?					
9	Difficult models for risk identification and analysis?					
10	It is not an easy process or software change rather requires process adaptation?					
11	Communication skills among team members?					
12	Motivation of team members?					
13	If any other specify?					

Please kindly recommend any comment or recommendation on the process of risk identification and analysis which may be adopted within the industry……

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……

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Thank you