KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF ARCHITECTURE AND PLANNING

DEPARTMENT OF BUILDING TECHNOLOGY

RISK MANAGEMENT FORMALISATION AND CONTRACTOR PERFORMANCE

BY

EMMANUEL KANTAMANTO KYEI BSc. (Hons)

A Dissertation Submitted to the Department Of Building Technology in Partial Fulfilment of the Requirement for the Master of Science in Construction Management

NOVEMBER, 2014

DECLARATION

I hereby affirm that this idea is my own work towards the award of an MSc. and that to the finest of my knowledge, it comprises no material earlier published by another person nor material which has been recognized for the award of any other degree of this University or other, excluding where due credit has been made in the text.

Emmanuel K. Kyei (PG 9124213) …… ……..

Student Signature Date

Certified by:

Professor E. Badu …….. ……..

Supervisor Signature Date

Certified by:

Professor Joshua Ayarkwa …… …..……

Head of Department Signature Date

DEDICATION

This work is keen to God Almighty and for His support through this study. I also dedicate it to my single parent: Madam Vivian Kartey, my children: Nhyira Kantamanto Kyei, Emmanuella Adom Kyei, my Wife; Mrs Patience Kyei, my Siblings, and to all my Nephews and Nieces.

ACKNOWLEDGEMENT

My sincere appreciations go to the Almighty God who kept me throughout the course and offered me success. I wish to express thanks to my supervisor, Professor E. Badu for his supervision, contribution to the preparation and sharing of his vast knowledge on the topic. Moreover, thanks also go to Dr. J. K. Ofori Kuragu whose assistance made it possible to successfully complete this work. I desire to direct my thanks also to all the various Metropolitan, Municipal, District Assemblies, Building and Road Contractors who contributed to this project. Finally, for their love, sustenance and guidance, my personal thanks go to my wife; Mrs Patience Kyei, Eternal Consultancy Limited. Mr Ernest Kisi, Professor J. Ayarkwa, Surveyor Luis Satchmo Atongo (MD, AESL) and all the Building Technology Department Lecturers (K.N.U.S.T).

God bless you all.

ABSTRACT

Managing Risk in Construction is usually based on the skill and individual decisions made by site managers, particularly in lesser projects. Construction Site Manager should be a key individual, with a prevailing picture of being tough. This study tracks up a past study by a researcher who established that, managing construction project itself does not have such a large encouragement on the way risks are managed at a construction site. The construction site manager, as a distinct individual, is viewed as having a larger impact on the project performance related to risk. The question upraised in this study is; to what extent is risk management formalised in the Ghanaian construction industry? To answer this question, it is also vital to determine the extent to which it is possible to measure the effects of managing risk at construction site level. Average percentage score and correlation analysis were the main tools used to measure the extent of risk management formalisation, impact of risk management formalisation on project time and cost performance and determining the most prevalent techniques used in risk management. Statistical package for social sciences was used as software to run the analysis. The results showed that, risk formalisation was averagely among Ghanaian contractors. Per the scaling, companies partly make documentation as part of formal risk management system in their firm. There was weak positive correlation coefficient between risk formalisation and performance on project time and cost. Companies that agreed they have formalised risk, also indicated that, their project time completion was under schedule and vice versa. Similarly, those who agreed to risk formalisation also complete project under budget and vice versa.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

The construction business is a vital area of the Ghanaian economy. It subsidises an average of 10.9 % of the Gross Domestic Product (Ghana Statistical Service, 20I2). It engaged about 2.3 % of the economically on the go population in 2002 (Amankwa, 2003). The industry offers means of production for other industries or commodities to be spent. As Ghana seeks to become a mid-income nation by 2015, and with the current detection of oil in commercial quantities, the role of the construction industry is categorically significant.

"Risk identification, assessment, mitigation and monitoring are important elements of a successful project risk management system" (Kpodo, 2011). Risk management is therefore an important step in every project's success (Rezakhani, 2012). Zou et al. (2006) have noted significantly that, in the achievement of project objectives in terms of cost, time, quality, safety and environmental sustainability, it is important to manage risks in the construction process through a holistic and systematic approach to the identification, analysis, occurrence and impact of these risks.

Establishments from many businesses have known the increasing standing of managing risk, and many firms have recognized risk management departments to control the risks they are, or might be, unprotected to. The construction industry and its clients are widely allied with a tall degree of risk owing to the nature of construction business activities, methods, location and organization. Risk in construction has been the item of care because of time and cost over-runs connected with construction projects. Although, Fischer et al., (2011) has voiced risk as an

exposure to economic loss or gain ascending from participation in the construction process; Fidan (2011) have viewed this as an exposure to loss only. Defines risk in relation to construction as a variable in the process of a construction project whose variation consequences in uncertainty as to the final cost, duration and quality of the project. It is known generally that those within the construction industry are continually confronted with a variety of circumstances linking many unknown, unforeseen, frequently unwanted and often erratic factors. Edwards et al., (2009) and Dikmen et al., (2008) have all agreed that these conditions are not limited to the construction industry; it is documented that risk is built into any profitable establishment's profit structure and is a basic feature of a free initiative system.

1.2 PROBLEM STATEMENT

Risk management is very important to organisational success. The most successful businesses invest in risk management systems. Anecdotal evidence shows that many Ghanaian contractors do not have risk management procedures. Where these exist, there are no formalised programmes to implement risk management procedures. If risk management works for the best-in-class organisations, then contractors without risk management systems could be losing out of the potential benefits. But in the construction sector, not much research has been conducted to demonstrate the effectiveness of risk management processes and to confirm whether or not risk management formalisation affects contractor performance.

Ghanaian construction industry is replete with time and cost overruns. It is widespread and its financial and social impact is frequently deliberated. Delays are deceptive frequently producing in time filled, cost packed, disagreements, lawsuit, and far-reaching desertion of projects (Sambasivan and Soon, 2007). Many projects

are of such a nature that the client will suffer hardship, expense, or loss of income if the work is behind elsewhere the time stated in the contract. Then again, delay has cost consequences for the contractor: replacement costs of non-productive workers, supervisors, and equipment, expenses caused by disturbed construction and material delivery schedules and extra overhead costs. What is not clear is whether the formalisation of risk management procedures can improve the cost and time performance of contractors. This study therefore sought to explore formalisation of risk management procedures and its impact on time and cost performance.

1.3 AIM

The aim of the study was to explore the effect of implementing formal risk management procedures on the performance of Ghanaian contractors.

1.4 OBJECTIVES

In achieving the aim of the study, the following objectives were advanced.

- To evaluate the extent of risk formalisation amongst Ghanaian contractors;
- To examine the risk management formalisation impact on contractor time performance;
- To examine the impact of risk management formalisation on contractor cost performance; and
- To identify main risk management techniques used by Ghanaian contractors.

1.5 RESEARCH QUESTIONS

- To what extent is risk management formalised among Ghanaian contractors?
- What is/ are the impact(s) of risk management formalisation on contractor time performance?
- What is/are the impact(s) of risk management formalisation on contractor cost performance?
- What are the main risk management techniques used by Ghanaian contractors?

1.6 SIGNIFICANCE OF THE RESEARCH

Practical study has been done in the arena of risk management for construction projects, a substantial outcome of which was the proof of identifying of many risks that may power the construction task delivery. This research explored the challenges facing the industry in the area of risk management formalisation and tried to set also benchmark standards for ensuring risk management practices in the Ghanaian building business. This research is expected to go a long way to benefit researchers in academia and practitioners of the Ghanaian construction field. It is also expected that, the results of my findings would help provide useful information and suggestions of formalising appropriate risk management strategies to improve contractor performance on projects.

1.7 LIMITATION OF THE RESEARCH/SAMPLING

This research obtained a sample of Ghanaian contractors based in the Ashanti and Greater Accra Regions of Ghana. Findings of investigations reflected the entire Ghanaian contractor performance with respect to risk management practices.

1.8 RESEARCH METHODOLOGY

The research methodology designated for this risk management project comprised a comprehensive literature review, interview, a mail questionnaire to the construction industry experts (contractors) and an analysis of the survey data. In order to measure the impact of risk management formalisation in Ghana based on Contractors cost and time performance, a sequence of interviews focused, and structured questionnaires administered to contractors.

The research was experimental in nature. It established the impact of risk management and involved the use of quantitative techniques which adopted the appropriate statistical method for the analysis of data to be collected. The research also relied on primary data by going to the field to collect the data. This implored first-hand information for the data collected. Relevant literature review on the subject of impact of risk management formalisation was done.

1.9 SCOPE OF WORK

The scope of the research was focused on impact on risk management formalisation on Ghanaian contractor, time and cost performances. It was limited to D1K1 and D2K2 contractors in the Greater Accra and Ashanti Regions of Ghana.

1.10 REPORT STRUCTURE

The report was structured into five parts; the first section consisted of the introduction of the topic, the background of the research, spelt out the problem understudy, set out the aim and objectives and scope of study. Chapter Two: Literature review, talked about the concept of formalizing risk management procedures and its impact on time

and cost performance, Chapter Three: Research Procedure, Research Attitude; Research Method; Sampling Frame; Instrument, Plan and Administration. Chapter Four: Results, Analysis and Discussion and the final chapter were the Conclusion and Recommendations which reviewed the objectives and findings; Guidelines for future research.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

This part explores the various works on the Ghanaian construction industry to clarify the current position of the industry in respect to formal and informal structures. The chapter presents how formalized the running of the construction industry. A review on risk management is also reviewed.

2.1 THE CONSTRUCTION INDUSTRY OF GHANA

The construction industry of Ghana is a major contributor to the country's economy through the provision of infrastructure and employment of the labour force. The construction industry contributes 21.9 % of industrial output and 3.2 % of GDP (Baah-Nuakoh 2002). It also contributes about 2.2% of the country's labour force employment. In terms of the level of skill of persons employed by the sector, 67.2 % are unskilled, 24.8% are semi-skilled and 8 per cent are highly skilled (Ghana Investment Promotion Centre (GIPC), 2006).

The Ghanaian construction industry is plagued by problems that are frequently perceived in hearsays on the trades in other emerging countries. The glitches and matters are well illustrated by those which were stressed in a report on the roads sector of the industry (Ofori, 2001). Linked with other industries, the Ghanaian Construction engineering is low-tech and labour intensive (Ahiaga-Dagbui, et al., 2011). Construction interruption is also a main problem facing the Ghanaian

construction industry. It is rampant and its economic and social impact is often deliberated.

2.2 FORMALISATION OF THE CONSTRUCTION INDUSTRY

The construction trade of Ghana can be categorized into two main sectors; a formal and informal sector. The formal sector is largely based on the institutional structure and also the regulatory systems put in place by the British rule prior to independence, to facilitate implementation of physical development agenda of the government at the time. Currently the traditional mode of procurement inherited from the British system is the most popular form of procurement route for many projects in the country. Many authors have argued against the relevance of inherited systems and practices of the construction industry of Ghana noting that the level of expansion of industrialization and culture of Ghana is different from the UK from which such systems originate as cited in an Article first published by Wells and Sluys (2001).

The informal sector is made up of project participants similar to the formal sector but relationships between them are typically informal. Many construction SMEs operate in both informal and formal sectors. The construction firms in Ghana, like other evolving countries, depend on labour thorough methods. Normally, set-up like little-scale irrigation, boreholes for water, minor dams, feeder roads, structures are constructed using labour based methods (Kheni, 2007). Labour is cheap, therefore making the adoption of labour-based methods as a more economic option than equipment-intensive or capital-intensive methods. Due to difficulties of accessing credits for items such as the capital cost of equipment and machinery, many contractors are compelled particularly micro contractors, to specialize in labour-based construction methods.

The industry is also characterized with very few large foreign construction businesses. Foreign firms generally undertake large infrastructure projects while domestic (or local) contractors would, normally, bid for smaller projects within the limits of their capacity. The majority of small and medium-sized contractors are domestic contractors managed as family-run businesses. Entry barriers to the construction business are very relaxed resulting in a huge number of contractors chasing fewer jobs.

2.3 INSTITUTIONAL ENVIRONMENT

The happenings of several government departments and other organizations touch the construction industry of Ghana. Open establishments may interrelate right with the industry by regulating its activities or performance on behalf of government as investors, contractors, supervisors, clients, or paymasters (Edmonds and Mills, 1984). Non-governmental organizations, which significantly influence the activities of the industry, include trade unions, employers' 44 organization, private clients, donor agencies, specialized institutions, research societies, and set apart educational institutions.

Dual government agencies have direct duty for overseeing the construction business activities and enactment of public policy in the sector of construction. The Ministry of Roads and Transport (MRT) and the Ministry of Water Resources, Works and Housing (MWRW H).

Physical developments, particularly roads and housing are usually assumed after the relevant sections are satisfied that the task meets the requirements specified within the planning and building regulations of Ghana. Environmental concerns have to be communicated by the client and contractor.

2.4 RISK MANAGEMENT

2.4.1 The Concept of Risk

Risk management is mostly defined as a logical procedure of risk identification, risk analysis and evaluation, and risk monitoring and control (PMI, 2004). Samson et al (2008) however, posited that there does not exist any general risk definition. They contend that a new definition will be recognized every time an organization airs a new choice problem. Their declaration is in accord with the research of Grimvall et al (2003) on the same subject. They claim that to most folks, risk definition will to a high extent be dependent on the situation in which the risks may occur. Also, they argue that this state of knowledge will have some unfeasible consequences in projects where risks frequently occur in a number of diverse situations and with a lot of different actors involved. Most existing risk management literature explains risk as an event that arises with a certain prospect in blend with a consequence in the case of occurrence.

Grimvall et al (2003) discussed that the most vital part is that the entire organization approves with a definition comfortable with everybody. According to Samson et al. (2008), organizations generally accept some of the previously recognized definitions, nevertheless employees would come up rather with their own precise definition.

Winch (2010) deliberates that maximum risk meanings include the whole variety of both negative and positive results, which agrees to the definitions presented. Moreover, studies have shown that project leaders have a habit of the term “risk" almost only for the negative costs of an event. Winch (2010) criticizes this view and says that this attitude can lead to a lack of determination when it comes to managing the opportunities in a project. Winch (2010) claims against the use of risk as a term

for both positive and negative outcomes and calls it extremely unsuitable. As a substitute he proposes an implementation of a more suitable basis that separates the risk definition into threats and opportunities. When accepting this method, organizations can plan more effective approaches that manage threats and opportunities separately. To conclude it is claimed that the management of threats and the management chances will in many facets be different, and so essential to distinct.

2.5 RISK CLASSIFICATION AND PERCEPTION

Quite a few studies have been made in order to classify various risk categories to permit a design of an active risk classification system for construction projects. Currently, a number of allocation systems exist, unravelling risks into categories. Some literature gives the recommendation to allocate the risks based on its penalties on a project, while others propose a categorization based on the risk source (Hastak and Shaked, 2000). Furthermore, a risk allocation approach based on the level of knowledge can be performed by using the following four categories (Winch, 2010): Known knowns; Known unknowns; Unknown known and unknown unknowns.

A core for an active risk management plan is how an organization can succeed these thoughts. When an organization takes a job, they understand that risks will arise that will need extra expenditure of incomes, this is the recognized part. If the organization has the capacity to control the risks probability and its consequences it will be classified as a known, known. If the organization neither can guess its likelihood nor its consequences, they will face a known unknown. Additionally, unknown known are those qualms where knowledge about the uncertainty exists, but not among the people who manage it. As a final point, unknown unknowns, also called black swans, are unrecognized till they actually materializes. They will continuously happen without

notices, with a considerable impact, and the options to prepare the organization for its consequences are small (Winch, 2010).

Risk intuition is according to Grimvall et al (2003), the combined idea that debates why some people rate a specific risk as important, while others find it less important. The concept will be a key for the understanding of how risk should be managed in projects and how effective risk strategies should be designed.

Grimvall et al (2003) deliberate risk management in practical systems and say that there are a huge number of factors that will affect in which way humans skill risk. Risk accessibility is presented as one of the greatest major factors, which are risks that one can easily envisage and have one's own experience of. This form of risk will be gotten as more likely and so adjudged as a superior threat. Alternative factor that will touch the way one experience risk is risk voluntariness. Grimvall et al (2003) explain that humans are eager to take on up to ten times more risks if the result to carry out the event is founded on their own permitted will than if somebody else would make the decision. The third risk perception factor is built on the moment when the risk was discovered.

Lately exposed risks can be seen as a greater threat than risks that have been around for a longer time. Grimvall et al (2003) discuss that much of our risk perceptions can be explained by the irrational nature of the human being. Alessandri et al (2004), say that decision makers will often act illogically when it comes to decisions which comprise substantial risks. This is an effect of the limitation of the human ability to process various types of information concurrently.

An added line of attack is the one that clarify how people experience risk differently as a consequence of human and societal factors, such as sex, stage, learning level and social belonging. As an example, females rate general risks higher than males. Though, when it comes to individual risks, female rate risks in just about the same way as men. Besides, people's enlightening level will affect their risk perception. Research shows that very educated people rate risk lower than people with not as much of education. To minimize the effect of the differences in humans risk perception, an organization should assemble a heterogeneous decision-team (Grimvall et al 2003).

Grimvall et al (2003) dispute that most studies in the area of risk perception are done by psychologists which are specialized in social behavior. Conversely, some researchers address reproach against their point of opinion and claim that it accepts a far too same picture of a group. The detractors agree with the statement that there are variances between groups, but favours a view focusing on individual risk perception. The critics claim that the social factors are far more dominant than the human factors. This statement carries the discussion to whether humans are able to make objective assessments of risks or not. Studies have established that humans lean towards to overestimate risks with small probability and underestimate risks with high probability. This behavior can cause many letdowns in risk calculations, especially when it is based on a high proportion of small risks (Lidskog et al 1997).

Additional situation that will affect the limitation of an objective risk evaluation is the level of single risk acceptance. Winch (2010) uses the term risk propensity to expound that every individual has a specific risk acceptance function. These functions illustrate what people are willing to pay to avoid risks. He presents a regularly used approach

which splits the human risk propensity into three different behaviors. Risk averse, are people who have a negative slope of the risk-reward function, which illustrate a person who avoid risks when the reward is smaller than the risk exposure. Flanagan et al (2007), say that the risk averse behavior can results in a state where a number of projects are not accepted, even though it would be gainful. The second behavior is the risk taker (Winch, 2010). Risk takers are willing to accept a high numbers of risks under uncertain provision of remuneration. The behavior can let organizations accept projects with a chance to create a big return but with the possibility of big losses (Flanagan, 2007). The risk taking behavior can be explained by a positive slope of the risk-reward function. Finally, risks neutral are those who are indifferent between a specific risks profitability and its risk premium if they are equally big. The risk impartial behavior can be explained by a linear risk-reward function. Lyons and Skitmore (2004) investigated how risk acceptance may differ in the Australian construction sector. The result showed important differences in risk tolerance among construction actors. The result long-established that construction contractors were more willing to take risks than the range of consultants and project clients.

Project clients were classified as risk averse, risk takers as contractors and consultants as risk neutral. Lyons and Skitmore (2004) claim that research performed within the UK construction industry specifies a complete risk taking behavior in the construction industry. Ironically, a learning with respondents from several segments within the construction industry checks that a common categorizes themselves as risk averse or neutral to risk.

2.6 RISK MANAGEMENT PROCESS AND MODEL

Potts, (2008) averred managing risk within the construction industry has factually been either unnoticed or dealt with in a random way. Currently, managing risk techniques are top advanced within industries with heavy engineering events or in organizations where there are great levels of technical risk involved (Maylor, 2003). Flanagan et al (2007) assert that it is vital for most organizations to device an effective risk management system that allows least loss from occurred risks. By the risk management system, risks can be transferred into opportunities which can generate gain for the company. To able to make right choices and be competitive in the project processes, it becomes critical to take benefit of the experience and knowledge within the organization. Most organizations adopt an informal risk management approach, without realizing its content. The informal approach will often give the outlook of risk management as something subjective and uncontrolled. Subject related literature argues for a more formal attitude to the risk management process. The attitude should include a more systematic approach, with established routines, which should give involved parties guidelines and structure on how to manage risk in their daily business (Flanagan et al 2007).

In truth, even unimportant incidents can have substantial impact related with vast losses. These events can jerk a chain reaction that can hover the whole projects existence and in the long run, even be a threat for the existence of the business.

The risk management model can in a naïve method be divided into events that identify risks, activities that analyze its likelihood and influence and lastly activities where the handling plan is assessed and well-known. Maylor (2003) split up these activities into three event categories: identification, quantification and response. Risk

management literature enlightens this process differently, but as a whole, much of the described principles are the same. A popular of the literature explains the process as a circular model in order to stress risk management as an on-going and learning process throughout time (Winch, 2010; Baker et al 1998). In distinction, certain literature clarifies the model as a line of processes where the start and end activities are disconnected from each other (Simu, 2006). Criticism has been addressed contrary to these models and claim that its absence of interrelation is why the construction industry habitually looks the same incidents in assignments time after time (Winch, 2010).

The process of risk management entails of three prime phases, which agree with Pott's (2003) and Maylor's (2003) established models. The phases are risk identification, risk analysis and risk evaluation. The model is founded on ISO 31000. The risk management strategy has to be custom-made for the exact organization and its processes. It is impossible to design a risk management strategy that is suitable for all organizations (Flanagan et al 2007)

Eskesen (2009) claims that it is of great importance that the risk management processes begin early to enable a successful project outcome. The process should be started during a project's feasibility study and in the early planning phase. Reilly and Brown (2004) say that an early implementation will reduce the number of risks that affect the project objectives. Likewise, it should be done to guarantee the project team and shareholders that the planned events are rationally assessed. They claim that an execution of the initial risk management process will provide the contractor valuable information about precise threats, which makes it likely to compute a budget and a schedule. In conclusion, the process permits the parties to build a

mitigation plan to efficiently manage the known risks, and then define the project strategy.

2.7 RISK IDENTIFICATION

The process of identifying risk have a duty to be a set of on-going activities during the whole era of a project. As a construction project makes headway, it will be inflexible to make alterations as these will be allied with great costs. Hence, it will be decisive to identify project risks in a primary stage while it still can be administered (Smith et al 2006). The risk identification activities can be unglued into events where the project team pinpoints risks and events where the identified risks are divided into an appropriate structure (Chapman and Ward, 1997).

Agreeing to ISO 31000:2009, the first phase, before risks can be identified, is to inaugurate an organization's risk management context. This is the process where the company's objectives are stated and well-defined in external and internal limits. When instituting the external parameters, features of the company values, procedures, by-laws, monetary condition, stakeholder relationship and basic drivers are assessed. When defining the internal parameters aspects of the organizational structure, strategies, tactics, information systems and internal stakeholders have to be appraised. Eskesen (2009) advises a high involvement by the project team when establishing the context. It will be significant that all parties have a moral awareness about the context and have the chance to add in the process. The spent time and effort by the project team will result in an added effective process and a lessening of disagreements. When the background phase has been finalized, the risk identification process can commence.

The principal purpose with the risk identification process is to produce a list of risks with both negative and positive penalties, which is called risk register (PMI, 2004). Bajaj et al (1997) claim that if a risk is not identified it cannot be measured, reassigned or in any other sides managed. On the other hand, Potts (2008) claims that it is unmanageable to find all project related risks. He says that it will be counterproductive if a company considers that they can, and base the tender price on that hypothesis. Projects within the construction industry are exceptional projects, which results in a request of a specific identification phase for each project. Winch (2010) claims that the risk identification process is an important key to the whole risk management practices. This statement be in accord with Bajaj et al (1997), who claim that the main benefits of risk management ascend from the identification phase quite than the risk analysis. In contradiction they contend that the identification phase is one of the less formalized elements in the risk management process.

Winch (2010) states that risk identification performance is mainly centered on expertise from skilled personnel within an organization. People have a habit of remembering risks that have a negative impact on a project, rather than events with a better outcome than expected. This statement links with the information that Bajaj et al (1997) provide, where they claim that the primary basis for risk identification is internal and external experience and historical data. To surge experience within a project team, ISO 31000 advices organizations to include people with applicable knowledge and experience in the identification phase. Flanagan et al (2007) make a try to explain in further aspect how risks can be identified and what resources they will demand. Practice, understanding and advice from a third party appear to be the most essential elements in the process. They maintain that the best result will be

achieved when organizations combine several of these alternatives and not rely on one source alone.

The process of risk identification can be done with a number of techniques. Brainstorming, interviews and risk source identification are some of the most used methods within construction projects. Other important activities are contract studies, site visits and further project research. Bajaj et al (1997) asked 19 contractors how risks were identified in their organizations. The decision places of interest that the most used risk identification activity is the risk review, which was achieved by 70% of the respondents. Though it is essential to understand that it is difficult to design a risk identification technique which is suitable for all organizations and projects. The brainstorming technique assists people from dissimilar units and with diverse knowledge to share their point of view concerning risks. To get the best likely outcome, it will be critical to employ the right mix of persons with diverse background, gender and age (Smith et al 2006). Additional used method to identify risks is to implement a set of interviews with people from appropriate areas within the project. The respondents should have experiences from similar projects or other knowledge that will subsidize to the risk identification process.

The next phase after the identification age is to gather a risk register grounded on the respondent's answers. This can be done by one sole person from the project team or during a meeting where all respondents deliberate together the identified risks. In some conditions it can be puzzling to relate and sum-ups the identified risks, as it is difficult to decide whether some of them regard the same risks potential (Smith ET Potts (2008) says that Perry and Hayes (1985) constructed a comprehensive list of construction risks, where they identified over 100 potential risky project events.

Nowadays, many organizations accept some of these risk lists, but some desire to construct their own, which is suitable for their organization's projects.

2.8.0 RISK ANALYSIS/QUANTIFICATION

The main drive with the risk analysis is to measure the properties of the identified risks. Analyzing risk techniques can be divided into three types: qualitative, semi quantitative and quantitative methods (ISO 31000, 2009). Potts (2008) show that in an extra in depth analysis, decision makers should think through the interdependences of the existing risks despite the fact that it will involve more resources and the analysis can in practice be rather complex.

At the utmost central level, each documented risk should be analyzed and quantified freely from the other identified risks with respects to both its consequence and likelihood. Risk analysis technique choice will hinge on the identified risk's characteristics, the analysis drive, and the project size and as a final point the available resources (ISO 31000:2009). Likewise, Flanagan et al (2007) say that the choice of technique should be built on the expert's understandings and knowledge in risk analysis. In certain jobs, the used technique will be too detailed which makes the analysis a waste of resources and in some projects it will be too superficial to generate useful results. When a technique is chosen by judgment creators, there are three features that have to be well-thought-out. The first feature is usability, the delivered result has to be open and voiced in a clear language. Besides, the decision makers have to contemplate the practical parts of the analysis technique. The analysis gain has to be higher than the outlay of resources. To end with, decision makers have to ruminate the analysis dependability. The confidence level result's has to be satisfactory so decisions can be founded up on the result (Flanagan et al 2007).

Qualitative risk analysis techniques can be used to assess identified risks in a modest and fast assessment. So, the existing methods have become common in organizations where there is a limitation of time for the risk analysis (Baker et al 1998). Lyons and Skitmore (2004) claim that qualitative techniques are often used by contractors and consultants while clients tend to use the quantitative approach more frequently. The prime aim of assessing qualitative risk is to create a prioritized list of risks in order to identify those with the most negative impact, and require further treatment. The qualitative analysis is often used in small to medium-sized projects where the complexity is rather low (Smith et al 2006). Radu (2009) claims that qualitative analysis should be used when an organization's numerical risk data is inadequate or unavailable, which it tends to be in the early project phase. As a result, an organization's risk analysis has to be on track in a qualitative approach before it can be agreed on in a quantitative (Smith et al 2006). PMI (2004) claim that a small number of qualitative methods exists, where the most frequently used technique is the risk matrix analysis. Furthermore, Potts (2008) presents two qualitative methods; projected monetary value and the risk tree approach.

Probably the risks can be valued over a method where a precise probability for each risk is assessed. The likelihood can also be estimated in a probabilistic approach by designing a probability interval and then picking a number on the scale. The quantitative technique adopts the second approach while qualitative techniques adopt the first. A risk's probability is often rated in per cent of the likelihood of occurrence. The designed interval may include events that are most unlikely to events that are highly likely to occur throughout a project. The risks impact can be appraised in a similar approach. The impact is usually measured in a monetary or a time unit.

The influence interim may spring from events with serious costs to events with slight consequences (Maylor, 2003).

The outcome of analyzing risk qualitatively should be an urgency list of a project's potential risks. In disparity, the quantitative risk analysis will offer the decision makers with arithmetical knowledge about a project's risks appearances and its consequences. The outcome can be linked with the reputable risk taking standards, which give the decision makers direction for risk acceptance (Baker et al 1998). The desirable data to implement a quantitative calculation should be acquired from past databases or from expert's estimates. The appraisals will comprise a level of doubt as a consequence of subjective estimations. The quantitative techniques are quite time intense and involve a high level of knowledge by the analyzer. As a result, the quantitative techniques are well-matched for large and medium-sized projects (Smith et al 2006). Analyses of quantitative are repeatedly built on mathematical possibility theories, which can be composite and challenging to manage by hand. Consequently, most accessible techniques apply computer based software to manage the calculations. Radu, (2009), in conclusion asserts that the Monte Carlo simulation, sensitivity analysis and decision tree are the utmost used quantitative analysis techniques.

2.8.1 Risk Treatment

The treatment process purpose: is to choose risks that should be cured and what precedence they should have. The assessment targets to relate the results providing by the risk analysis with the recognized risk taking criteria, in the present context (Smith et al 2006). If the identified risks cannot be acknowledged, it has to be treated in one way or another (ISO 31000:2009). Treating the process take in methods which amend

risks until it can be known or measured. In general, risks can be altered in two approaches where the first cuts the risk's probability of occurrence and the second decreases its consequence on the project. There are four basic types of risk responses for a company to treat a risk, according to Smith et al (2006). They claim that the basic methods are to sidestep or lessen a risk, to handover a risk to another party or to hold a risk. The treatment decisions can be used independently but should preferably be applied in combination with other treatment techniques to attain the best probable outcome. When decision makers are choosing the treatment option, there should be a balance to the cost and effort for the risk treatment action against the profits it provides (ISO31000:2009).

2.8.2 Checking and Review

The finishing stage in the risk management process is the checking and review. It is essential to climax that this phase is not the polish of the risk management process, somewhat an end of an accomplished cycle. The phase is required to be one of the best significant phases in the whole risk management process (Tah and Carr, 2000). After achieved risk treatment activities, there should be a quantity of outstanding risks which could not be preserved as the reputable plan. The residual risks should be documented and transferred to the next phase in the risk management process, the monitoring and review (ISO 31000:2009). The stage should be executed as a routine in the risk management process with established checklists to guide the work. The process will assess the activities treatment to guarantee that it has turned out effective and cost efficient. Project decision makers should evaluate if the treatment activities have turned out particularly effective for a certain risk type or if the chosen method should be changed for future projects. The position of the risk should be accepted and

reassigned to the risk register for additional analysis and evaluation (Tah and Carr, 2000).

2.8.3 Risk Communication

It is essential to have a decent communication with external and internal shareholders all over the whole risk management process. The organization hence should form a risk communication plan, which must be established during a project's contextual phase. There should be a communication plan to simplify how risk related information should be reassigned between involved parties and from one segment to another. The plan should make clear, a corporate risk language that diminishes the misinterpretations in the process. Furthermore, the plan is necessary to warrant effective implementation of the risk management process in an organization. Owing to the changes in risk perception, the communication plan should climax the subject and guarantee that all relevant views are suitably considered when the risk standards are defined (ISO 31000:2009).

2.8.4 Risk Management Standard and Tools

ISO 31000 is a typical for practicing risk management and is circulated by the International Organization for Standardization, which are the world's prime developer and publisher of international standards. The broad version was done in 2009 and is accepted by twenty five countries as the official standard of managing risk. The benchmark's purpose is to craft a common opinion of risk definition and risk management practices. It is advanced to be appropriate for all industries and all types of risks. In contrary to other standards, ISO 31000 is not aimed to be an object for certification (Leitch, 2010). Purdy (2010) says that ISO 31000 has four objectives.

First of all it should build a collective used risk terminology and then it should form performance criteria, which companies have to adopt. The third objective is to produce a structure on how risk management should be performed in practice from the identification process to the treatment process. In conclusion, it should run strategies on how the risk management process should be effected in an organization.

The standard is relatively new and it has been criticized since it was issued. Leitch, (2010) references four arguments why ISO 31000 is a dissatisfaction. He cups that the standard is indistinct; it indications to unsound decisions; there are snags of conforming to the standard and it does not cover mathematically issues as probability and data handling. There are both positive arguments and negative arguments to accept a new standard. Moatazed-Keivani et al (1999) illustrate this statement and claim that an acceptance can make higher costs, more establishment and can be time consuming. Nevertheless, they deliberate that the implementation's advantages evidently outweigh the downsides.

2.9 CONSTRUCTION AND RISK MANAGEMENT PRACTICES

Most often than not contractors have been portrayed to be poor at managing risk (Baloi and Price, 2003; Ahmed et al 2002). Baloi and Price (2003) averred that a lot of contractors are unexperienced with risk factors associated with modeling risk and do not have the experience and knowledge to manage them successfully. This results in engagements, deprived quality, late completion, poor cost performance and business. Most contractors have traditionally used high mark-ups to cover risk but as profit margins become lesser this approach is no longer active. Contractors rarely use these techniques and tools in practice.

Most construction contractors based risk calculation and management on expectations, rules of thumb, experience and intuitive judgment which cannot be described fully by inflexible or normative models. Separate knowledge and experience, yet, need to be accumulated and designed to ease the analysis and retrieval by others. According to Ahmed et al (2002), the construction industry has a poor status in handling risks, and many projects fail to meet deadlines and cost targets. Risk analysis is mostly ignored or done subjectively by simply adding a contingency. As an outcome several projects failing to meet schedule time limit and cost targets with attendant loss to both contractors and owners. Show that Contractors are also minimizing risk by declining work perceived as too risky, subcontracting large portions of their work to others, and apportioning risk in wage structures. In essence, they are passing on risk to others.

Extant literature shows that very few studies have been conducted on how risk is managed by Ghanaian construction firms. Laryea and Hughes (2008) investigate the way that contractors bidding price is established in Ghana, and contain allowances for risk in their prices. A study done by seven contractors to find out how their prices are put together, and how in sharing of their risk influences price. Maximum recognized their bidding price by building up prices for plant (9%), overhead (15%), profit (10%), labour (14%) and material (45%). The core elements of price appeared to be the noticeable direct costs; project time delivery; competition payment level regime; and clearness of tender documents. Risk allowances of 5 to7.5% were included in the profit margin of some bill item prices. This was founded mainly on the direct judgment of the quantity surveyors who calculated the price, based on their intuition and experience.

The study found out that no formal and analytical risk models were used. The study also showed that none of the contractors specified any knowledge of published risk models. The contractors' risk allowances appeared to be guided by concerns about opposition and winning the job quite than the true cost of risk. Their findings show that it cannot be settled that Ghanaian contractors practice formal risk management; though it is clear that they take justification of risks when pricing their work.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This stage stresses on the methodology used for the study. The methodology is the procedure used to gather information and data for the determination of making business assessments. In other words, the methodology involves an orderly source of information tied with tools of analysis for making complete decision involving tiniest risk to an organization in the well-lit of growing competition and increasing size. It involves the research design, data collection, population and sample, as well as the instruments used. The procedure for data collection and data analysis has been discussed.

The chapter presents data collection instruments, methods, and procedures. It stipulates comprehensive clarifications to each of the methods engaged and how the methods adopted were used to address the aim and objectives. It investigates also the methodologies implemented in order to carry to accept the appropriate matters as regards the criteria for measuring risk formalization in construction industry.

3.2 RESEARCH STRATEGY, DESIGN AND PROCESS

Research method packages with how the research objectives are examined. Naoum (1998), states the three core approaches as quantitative, qualitative, and triangulation while the choice to follow any specific strategy rest on the purpose of the study, the sort and accessibility of information for the research (Naoum and Coles, 1997).

The drive of the method and research design was to offer way in the planning and enactment of the study in a way that is best to realize the projected aim. The design of the research dealt also with the outline for data collection and analysis; the organization that monitors the execution of the technique for collection and analysis of data, which offers the connection among empirical data to its ends, in a consistent sequence to the early research question of the study (Bryman, 2004, 1992); and comprises untried survey, case study, and action research (Baiden, 2006). The methodology is therefore a scheme for steering the study (Burns & Grove, 1999). These approaches defined in eye by what means the study is to be showed. According to Burns & Grove (1999), methodology consist of design, sample, and set, methodological constraint and data collection and analysis techniques in a study.

On the other hand research dialogs method, data collection instruments, and measures. It delivers clarifications full to each of the methods engaged and in what manner the methods accepted were used to address the objectives, research questions and aim. This research recognized the quantitative strategy and included questionnaire survey which was preceded by a detailed literature review. A questionnaire survey was carefully chosen since it is essential for generalization on the findings across the construction industry. It increases also the consistency of observations and mends duplications because of the vital uniform measurement and sampling procedures (Oppenheim, 1996). This study approved the positivist philosophy utilizing the quantitative approach in data collection and analysis.

3.3 INSTRUMENTATION

The researcher hand delivered the questionnaires to respondents personally to construction industries in the classifications of D1K1 and D2K2 in the region of

Ashanti and Greater Accra. Some of the questionnaires were retrieved on the spot while others were turned in by the respondents which lasted for two to four weeks. In all 241 questionnaires were administered and 145 were retrieved representing a response rate of 60.17%.

3.4 DATA COLLECTION

Data collection involved a desk survey (literature review) and a field survey. The literature review aided to set the step for the developing the field survey instruments by means of questionnaires, and interview (Fadhley, 1991). While the literature review placed the study inside its theoretical perspective, the field survey, which consisted of survey questionnaires were used in the collection of empirical data.

3.5 SAMPLING TECHNIQUES

The sampling criterion was based on the research problem, purpose, design and practical implications of the research topic. The Ashanti and Greater Accra regions were selected and construction industries with D1K1 and D2K2 classifications were selected. Non-probability sampling technique with emphasis on purposive sampling was used to obtain sample from the population of contractors.

Purposive sampling is characterized by the use of judgment and a deliberate effort to obtain or select representative samples (respondents) by including typical areas or groups in the sample (Kerlinger, 1986; Rea and Parker, 1997; Struwig et al., 2001). Krathwohl (1998), states that purposive sampling is where samples are assembled by intentionally seeking individuals or situations likely to yield new instances or greater understanding of a dimension or concept of interest by selecting information rich cases for in-depth study. Pasha (1979) also indicated that the technique of purposive

sampling is an appropriate method under conditions in which it is appropriate for the researcher to select a sample on the basis of their knowledge of the population, its elements, and the nature of the research aim. This method of sampling was selected because the survey was constituted to obtain opinions, perspectives and experience of the respondents.

3.6 DETERMINATION OF SAMPLE SIZE

Yamane (1967:886) runs a Basic formula to calculate sample sizes. As shown below:

$$n = \frac{N}{(1+N)*e^2}$$

Where 'n' is the sample size, 'e,' for precision level which is ±5% and 'N', the population size.

Records from the Ministry of Water Resources, Works and Housing which keeps records of the number of contractors show that there were six hundred and four (604) D1K1, D2K2 contractors in Greater and Ashanti regions of Ghana making the population size.

Therefore the sample size: $n = \frac{604}{(1+604)*0.05^2} = 240.6375 \approx 241.$

Finally, the sample size formulas provide the number of responses that need to be obtained.

In all a total of two hundred and forty one questionnaires (241) were sent out to contractors of class D1K1 and D2K2 in the Ashanti and Greater Accra regions of Ghana.

3.7 QUESTIONNAIRE DESIGN

The literature review and the in-depth exploratory interview guided the design of the questionnaires to ensure that only the relevant questions in the context of the research were asked (Oppenheim, 1996). The format of the questionnaires were guided by considerations of appeal to respondents, ease of reading and supplying the required data so that the research participants‘ time were not wasted during the data collection. The questionnaires were designed to include scaled-response questions.

The type of questions and the way in which questions were articulated and presented influenced the quality of the responses and response rate. It was therefore, important to ensure that the right questions were asked, well understood and asked in the right way (Wahab, 1996). The first set of questions were asked to explore the detail data about the respondents, which included information such as contact detail, company's classification and type of projects, as well as number of projects undertaken, years of experience in construction industry and professional background. The next set of questions which were mainly closed-ended type were asked to inquire about risk formalization. The questionnaire was sectionalized as risk management procedure and processes, risk management policies and processes, risk analysis, risk reporting and communication, risk treatment, monitoring and review of the risk management process and the structure and administration of risk management; the next section dealt with main risk management techniques work; and finally, dealt with contractors performance on project time and cost. The five point likert scale was used to derive opinion of contractors on the issues enumerated above.

3.8 DATA PREPARATION AND STATISTICAL TOOL FOR ANALYSIS

The raw data was grouped and treated into a system fit for analysis (data sorting). They were then entered into data sets by the Microsoft Excel and at that moment introduced to Statistical Package for Social Sciences (SPSS), version 16.0 for the analysis to begin. Descriptive statistical tools were mainly used to analyze the data. Basic frequency with percentage was used to analyze the detail information about the company. Total expected scores were generated from the first section of the data which comprised of the risk formalization for each company. Then percentage mean score was run to measure the weight of each sub-section and the overall section.

Section two was analyzed using Relative Importance Index (RII), to rank the variables that were highly weighted (very often) in relation to the other techniques. Fowler and Floyd (1995), defines ranking as a comparison among given options, within pairs of options, by cardinality of importance (first, second, third) or that score items one at a time using a common scale, and it also determines the importance of that factor. The Importance Index (I.I) of determination of importance of factors was adopted because, Enshassi et al (2007) asserted that to analyze data on ordinal scale (e.g. Likert scale 1-5), the application of Importance Index is also suitable.

The last section was analyzed by correlating the total mean score of risk formalization with the mean score of contractors' performance on time and cost to see whether there is significant correlation between the two variables.

The selection of the analytical tool was contingent on a thorough review of available analytical and statistical tools.

3.9 CHAPTER SUMMARY

This retro has talked over research methods and given reasons for the choices selected to attain the research aim and objectives. The chapter defined also the research design and methodology, as well as the research strategy, and accepted research design for this study. The methods and techniques which were used in the data collection and analyses were also offered. The part specified the research process and enclosed matters such as the questionnaire survey scope, data sources, sample size determination and sampling, questionnaires development, questionnaires content, questionnaires distribution, and data analytical tools.

CHAPTER FOUR

RESULTS, ANALYSIS AND DISCUSSION

4.1 INTRODUCTION

This chapter presents the results of the study, analysis and discussion of the results. It is also divided into sub-headings representing questions asked on the field during the survey and the data collected and used for the analysis.

4.2 RESULTS, ANALYSIS AND DISCUSSION

A total of two hundred and forty one (241) questionnaires were sent to contractors in Ashanti and Greater Accra Regions of respondents of which one hundred and forty five (145) were received representing a response rate of 60.17%.

Aibinu et al. (2006), in assessing construction delays and their causative factors in Nigeria, made reference to assertion by Moser and Kalton, (1971) that "the result of a survey could be considered as bias and of little value if the return rate is lower than 30-40%". This assertion indicates that the response rate of 60.17% was adequate for the analysis.

Table 4.1: Detail of Company/Contractor

	Variables	Frequency	Percent
Company's classification	D1K1	69	47.59
	D2 K2	76	52.41
	Total	145	100.0
Types of projects undertaken by the company	Housing	43	32.1
	Commercial	18	13.4
	Roads/Civil Works	5	3.7
	All	45	33.6
	Housing and Commercial	17	12.7
	Housing and Roads/Civil Works	3	2.2
	Commercial and Roads/Civil Works	3	2.2
	Total	134	100
Position/role in company	Managers	48	35
	Engineers	21	15
	Directors	13	10
	Quantity Surveyors	24	18
	Supervisors	8	6
	Officers	3	2
	Architects	5	4
	Foremen	9	7
	Others	5	4
	Total	136	100
Years of experience in construction field	Less than 5 years	19	13.4
	5-9 years	49	34.5
	10-14 years	52	36.6
	Over 14 years	22	15.5

	Total	142	100
Professional background	Architect	10	7
	Quantity Surveyor	34	23.8
	Project Manager	42	29.4
	Construction Manager	35	24.5
	Foreman	12	8.4
	Others	10	7
	Total	143	100
Number of projects undertaken in the past three years			
	Valid	128	
	Missing	17	
	Mean	11.3	
	Std. Deviation	25.6	
	Minimum	1	
	Maximum	200	

It is important to assess the contractors with respect to their company's classification, type of projects undertaken, position, and years of experience in construction field, professional background and number of projects undertaken in the past three years. These detail information of contractors was aimed to ascertain the validity of information provided for this research work. This helped in ensuring that data was gathered from the appropriate respondents. From Table 4.1 above, it has been demonstrated that approximately 52% and 48% of the company's classification were D2K2 and D1K1 respectively. The main types of projects undertaken by the company were housing representing 32.1% and commercial representing 13.4%, housing, commercial and road/civil works representing 33.6%.

Respondents role in the company were categorised as Managers, Engineers, Directors, and Supervisors. Manager's position/role in the company was observed to be consisted of commercial managers, construction managers, contract managers, development managers, project managers and general managers representing 35%. Engineers represent 15% comprising of civil engineers, project engineers, site engineers, geodetic engineers and structural engineers. Directors represent 10% of the respondents consisting of C.E.O, managing directors and technical directors. The other category was "Supervisors representing 6% consisting of site supervisor and technical supervisor. Quantity surveyors represents 18 percent, and other positions were officers (2%), Architects (4 %), and Foreman (7 %). Others denoted positions which respondents occupying represent less than 1%, which were assistant human resource manager, contractor, impact assessment personnel, marketing and planner.

Years of working experience in construction field was fairly distributed among the categories; less than 5 years representing 13%, 5-9 years representing 35%, 10-14 years representing 37% and over 14 years represents 16%. Respondents have enough years of working experience.

The mean number of project respondents that have undertaken in the past three years was 11 with a standard deviation of 25.6. The high standard deviation showed that the data deviated from the mean by ±25.6. This showed that the mean was not representative. The extreme values were 1 and 200 for minimum and maximum respectively.

In perusing this result, it has been realized that the company's classification, types of projects undertaken in the past three years, positions, years of experience in the construction field and professional background were representatives enough to obtain

information in this research. This goes to explain that the information gathered reflect the measure of risk management formalisation.

Table 4.2 Contractor Performance on Project Time

Project		Under Schedule	On Schedule	Time Overrun	Total
1	Frequency	23	93	29	145
	Percent	16	64	20	100
2	Frequency	21	89	35	145
	Percent	15	61	24	100
3	Frequency	19	85	41	145
	Percent	13	59	28	100
4	Frequency	18	82	45	145
	Percent	12	57	31	100
5	Frequency	15	87	43	145
	Percent	10	60	30	100

Table 4.2 indicates that, for Project 1 out of 145 contractors, 23 contractors forming 16% managed to work before the scheduled time, 93 contractors forming 64% finished on schedule and 29 contractors forming 20% exceeded the time. Project 2' had 21 contractors forming 15% completed the project before the scheduled time, 89 contractors forming 61% completed on schedule and 35 contractors forming 24% exceeded the time schedule. For Project 3 19 contractors forming 13 % completed the project before time scheduled, 85 contractors forming 59% completed on schedule and the remaining 41 contractors forming 28% exceeded the time schedule. Project 4', had 18 contractors forming 12% completed under time schedule, 82 contractors forming 57% completed the project on schedule and the remaining 45 contractors forming 31% went beyond the time schedule. For Project 5, 15 contractors forming 10% completed the project before scheduled time, 87 contractors forming 60% completed the project on schedule and the remaining 43 contractors forming 30% exceeded the time schedule.

Table 4.3 Contractor Performance on Project Cost

Project		Under Budget	On Budget	Cost Overrun	Total
1	Frequency	15	89	40	144
	Percent	10.3	61.4	27.6	99.3
2	Frequency	15	81	48	144
	Percent	10.3	55.9	33.1	99.3
3	Frequency	8	90	46	144
	Percent	5.6	62.5	31.9	100.0
4	Frequency	9	90	44	143
	Percent	6.3	62.9	30.8	100.0
5	Frequency	19	73	52	144
	Percent	13.2	50.7	36.1	100.0

According to Table 4.3, Project 1 had 15 contractors, forming 10.3% working under the allotted budget, 89 contractors, forming 61.4% working on or within the budget and 40 contractors forming 27.6% working over the budget that is exceeding the allotted cost. Project 2 had 15 contractors forming 10.3% working with less than the cost or specified budget, 81 contractors forming 55.9% working on the budget and 48 contractors forming 33.1% exceeding the assigned budget for the project. Project 3', had 8 contractors forming 5.6% using less than the budget, 90 contractors forming 62.5% working on the budget and the remaining 46 contractors forming 31.9% exceeding the assigned cost of executing the project. Project 4 had 9 contractors forming 6.3% using less than the specified cost of the project, 90 contractors using exactly the cost assigned or working with the budget and 44 contractors forming 30.8% exceeding the budget. Project 5 had 19 contractors forming 13.2% using less than the budget, 73 contractors forming 50.7% using the budget or working within the budget and the remaining 52 contractors forming 36.1% exceeding the specified budget for the project.

Table 4.4 Risk Management Formalisation

Factors for measuring risk management formalisation	N Valid	Percentage Mean Score	Std. Deviation	N Variables
Risk Management Procedures And Processes In Your Firm	145	63.0	14.3	13
Risk Management Policies And Processes	145	60.8	20.0	3
Risk Analysis	145	55.9	23.6	7
Risk Reporting And Communication	145	58.2	23.0	5
Risk Treatment	144	61.1	17.6	5
Monitoring And Review Of The Risk Management Process	145	60.9	25.7	2
The Structure And Administration Of Risk Management	145	59.1	22.6	36
Extent of risk formalisation amongst Ghanaian contractors	**145**	**59.4**	**19.3**	**71**

The Table 4.4 shows the statistics of risk management formalisation. In all, there were 71 questions grouped into seven key areas for respondents to answer. They ranked each on a scale from 1-5. The total expected score for each respondent was given by $\sum_{i=1}^{n} x_i$, where x denotes ranking value for each question and n denotes the number of questions responded. The scores were converted to percentage mean score for standardisation. Total scores for each group were used to measure the extent of risk formalisation in each group. Total mean score for the seven key areas were weighted to measure the extent of risk formalisation in general.

It was observed from the results that risk management procedure and processes had the highest percentage mean score, then risk treatment, monitoring and review of the risk management, risk management policies and processes, the structure and administration of risk management, risk reporting and communication and lastly risk analysis respectively.

Generally, the extent of risk formalisation was weighted to be 59.4%, which was above 50% but less than 60%. This indicated that there was not much formalisation of risk management procedures among Ghanaian contractors even though the value of the extent was above 50%. The result was in support of the claim made by Baloi and Price (2003) that, many contractors are unfamiliar with risk factors associated with modeling risk and do not have the experience and knowledge to manage them effectively.

Table 4.5 Impact of Risk Management Formalisation on Contractor Cost/Time Performance –Correlations

Variables		Extent of risk formalisation amongst Ghanaian contractors	Contractor Performance On Project Time	Contractor Performance On Project Cost
Extent of risk formalisation amongst Ghanaian contractors	Pearson Correlation	1	0.023	0.029
	Sig. (2-tailed)		0.782	0.733
	N	145	145	145
Contractor Performance On Project Time	Pearson Correlation	0.023	1	.693**
	Sig. (2-tailed)	0.782		0.000
	N	145	145	145
Contractor Performance On Project Cost	Pearson Correlation	0.029	.693**	1
	Sig. (2-tailed)	0.733	0.000	
	N	145	145	145

The expected percentage mean score for the variables measuring the extent of risk management formalisation and contractors' performance on both project time and cost were used to run correlation analysis to measure impact of risk formalisation on contractor's performance on project time and cost.

The results from Table 4.5 show that the correlation coefficient between extent of risk formalisation among Ghanaian contractors and contractors' performance on project

time was 0.023. This means that there was weak positive correlation. There was not much significant correlation between risk formalisation and contractors performance on project time.

Similarly, there was not much significant correlation between the extent of risk formalisation among Ghanaian contractors and contractors' performance on project cost. There was weak positive relationship between risk formalisation and performance on cost. Companies that scored high risk management formalisation were completing project under schedule and those that scored low risk management formalisation complete project overrun, however, the relationship was not strong.

This can be concluded that, the impact of risk management formalisation on contractors' performance on both project time and cost were positive correlated but weak.

Considering one project at a time, Table A1 in the appendix showed that risk formalisation had a positive correlation with Project time 1, albeit very small (0.032). There was small negative correlation between risk formalisation and Project time 2, 3, 4 and Project time 5. This indicates that the impact of risk formalisation could be positive or negative on Project time but this impact was very small.

Table A2 in the appendix shows that, Risk Formalisation had a small negative correlation with project Cost 1 (-0.067), negative correlation with Project Cost 2 and negative correlation with Project Cost 3 (-0.-018 and -0.219 respectively). Risk Formalisation had small positive correlation with Project Cost 4 and Project Cost 5 that is 0.033 and 0.014 respectively. This implies that there was weak correlation between risk management formalisation and Project Cost.

4.3 YEARS OF EXPERIENCE IN CONSTRUCTION FIELD

Kruskal-Wallis test was run to investigate how the respondents' years of experience rankings on the extent of risk management formalisation, contractor's project performance on time and cost differ from each other. Four categories of respondents' years of working experience in the construction industry were used; less than 5 years, 5-9 years, 10-14 years and over 14 years. The results showed that there was no significant difference among their rankings. As shown in Table 4.6, the significant values for the extent of risk management formalisation was 0.311 > 0.05, performance on project time was 0.307 > 0.05 and performance on project cost was 0.330 > 0.05. None of them was significantly different from each other. This specifies respondents at all level of working experience in the construction industries ranked the variables the same statistically.

Table 4.6: Kruskal Wallis Test on years of experience in construction field.

	Extent of risk formalization	Performance on Project Time	Performance on Project Cost
Chi-Square	3.574	3.606	3.428
Df	3	3	3
Asymp. Sig.	0.311	0.307	0.33

a. Kruskal Wallis Test, b. Grouping Variable: Years of experience in construction field

Table 4.7: Kruskal Wallis Test on Contractor's professional background.

	Extent of risk formalisation	Performance on project time	Performance on project cost
Chi-Square	6.439	1.157	4.483
df	4	4	4
Asymp. Sig.	0.169	0.885	0.345

a. Kruskal Wallis Test, b. Grouping Variable: Contractor's professional background

4.4 CONTRACTOR'S PROFESSIONAL BACKGROUND

Rankings of Contractor's professional background were investigated using Kruskal-Wallis test as to whether categories of profession has significant difference on measuring the extent of risk management formalisation, contractor's project performance on time and cost. Professional background of respondents were categorised into five; Architect, Quantity Surveyor, Project Manager, Construction Manager and Foreman. The results showed that there was no significant difference among their rankings. As shown in Table 4.7, the significant values for the extent of risk management formalisation was 0.169 > 0.05, performance on project time was 0.885 > 0.05 and performance on project cost was 0.345 > 0.05. There was no significant difference in the rankings of professions on measuring the extent of risk management formalisation, performance on project time and performance on project cost.

Respondents were asked to indicate the extent to which their firm uses the above techniques. In identifying the main risk techniques used by Ghanaian contractors, relative importance index was used to rank the techniques that were highly weighted (used all the time) in relation to the other techniques. Fowler and Floyd (1995), defines ranking as a comparison among given options, within pairs of options, by cardinality of importance (first, second, third) or that score items one at a time using a common scale, and it also determines the importance of that factor. The Importance Index (I.I) of determination of importance of factors was adopted because, Enshassi et al., (2007) asserted that to analyse data on ordinal scale (e.g. Likert scale 1-5), the application of Importance Index is also suitable.

Brainstorming was ranked first with relative weight of 76%. This weight suggests that most of the contractors often use brainstorming techniques. The second and third techniques had almost the same weight (58%) but probability analysis was used above the decision tree analysis. As illustrated in Table 4.8 below. It was observed that with the exception of the first techniques used, the other techniques were not highly significantly used. They fall within sometimes and often used as a category of ranking in the questionnaires that were administered.

Table 4.8 The Main Risk Management Techniques Used by Ghanaian Contractors

Type of Techniques	Valid	Missing	Mean	Sum	RII	Ranking
Brainstorming	143	2	3.8	544	76	1
Probability analysis	143	2	2.9	417	58	2
Decision tree analysis	143	2	2.9	412	58	3
Breakeven analysis	143	2	2.9	410	57	4
Scenario analysis	143	2	2.9	410	57	5
Sensitivity analysis	143	2	2.7	392	55	6
Root cause analysis	141	4	2.7	381	54	7
Simulation analysis	143	2	2.7	384	54	8
Syndetic	141	4	2.6	362	51	9
Failure mode analysis	140	5	2.6	358	51	10
Portfolio theory analysis	142	3	2.5	356	50	11
Pareto diagrams	141	4	2.4	335	48	12
Fuzzy set theory	142	3	2.1	304	43	13

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.0 INTRODUCTION

The aim of the study was to explore the effect of the implementing formal risk management procedures on the performance of Ghanaian contractors. Chapter one of the research outlined the introduction of the study. Chapter two entailed of relevant literature within the limits of risk formalisation with chapter three outlining the methodology of the research. Chapter four discussed the research findings within the limits of the methodology. Chapter five enclosed conclusion drawn from the research and the recommendations made.

5.1 REVIEW OF RESEARCH OBJECTIVES

Four objectives were clearly outlined in this study. They were; to evaluate the extent of risk formalisation amongst Ghanaian contractors, to examine the impact of risk management formalisation on contractor time performance, to examine the impact of risk management formalisation on contractor cost performance and to identify the main risk management techniques used by Ghanaian contractors.

OBJECTIVE 1: To evaluate the extent of risk formalisation amongst Ghanaian contractors.

From the results, specifically from Table 4.4, the extent of risk formalisation was weighted to be 59.4% which was above 50%. This indicated that there is an average level of formalisation of risk management procedures among Ghanaian contractors. The level of risk management formalisation among Ghanaian contractors was observed not to be strong.

OBJECTIVE 2: To examine the impact of risk management formalisation on contractor time performance.

Results from Table 4.5 showed that risk formalisation had weak positive correlation with performance on project time with correlation coefficient of 0.023. Formalising risk had positive impact on project completion time. Respondents with all level of working experience in the construction industry had similar ranking, hence, results not biased. Risk management formalisation had positive correlation with project time 1, albeit very small (0.032). Also, there was weak negative correlation between risk management formalisation and project time 2, project time 3, project time 4 and project time 5. Thus, risk formalisation had an effect on the individual Project times but this impact was very small according to findings.

OBJECTIVE 3: To examine the impact of risk management formalisation on contractor cost performance.

It was found risk management formalisation had weak positive correlation with performance on cost. Formalising risk reduces cost of project and none formalisation of risk increases performance on cost. It was observed that there was weak negative correlation with project cost 1 (-0.067), negative correlation with project cost 2 and negative correlation with project cost 3 (-0.018 and -0.219 respectively). Risk formalisation had small positive correlation with project cost 4 and 5, thus, 0.033 and 0.014 respectively. This implies that there was a little or no significant correlation between risk Formalisation and Project Cost.

OBJECTIVE 4: To identify the main risk management techniques used by Ghanaian contractors

It was observed from the result in table 4.8, that, the main risk management technique used by Ghanaian contractors was brainstorming. This was significant with relative importance index of 76%. This weight suggested that most of the contractors very often used brainstorming techniques to measure risk management. The other risk management techniques used by Ghanaian contractors had index below 60% but above 50% which showed that they were often used. The second and third techniques had weights of 58%. Probability analysis was used above the decision tree analysis. The least used technique was the Fuzzy set theory with index of 43%.

5.2 RECOMMENDATIONS

Based on the findings of this research work on "exploring the effect of implementing formal risk management procedures on the performance of Ghanaian contractors", the following recommendations are made;

- Increase education on risk management to increase the uptake of risk management by Ghanaian contractors.
- There should be increased documentation of risk management procedures.
- Ghanaian contractors should be encouraged to set up departments responsible for risk management.
- Formal Risk Management Formalization should be implemented at the inception stage of every construction project and should form part of the criteria for the selection of a contractor bidding for any projects.

5.3 FURTHER STUDY

In conclusion, further study could be done to explore the linkages between risk formalisation and performance in countries where there is a greater use of formal risk management procedures.

REFERENCES

Adjei, A.B., (2006), Message from the Chief Executive. Public Procurement Board, June 2006.

Ahmed, S., & Mahmoud, I., (2010) Public procurement and corruption in Bangladesh confronting the challenges and opportunities, Journal of public administration and policy research Vol. 2(6) pp. 103-111

Anvuur, A., and Kumaraswamy, M., & Male, S., (2006), Taking forward public procurement reforms in Ghana, CIB W107, Construction in Developing Economies International Symposium; Construction in Developing Economies: New issues and Challenges January 18th – 20th, Santiago, Chile.

Aryeetey, E., Baah-Nuakoh, A., Duggleby, T., Hettige H., & Steel W. F. (2002), failing to compete: Technology Development and Systems in Africa, Cheltenham, UK and Northampton, MA, USA: Edward Elgar.

Azeem, V., (2007) Impact of the Public Procurement Act, 2003 (Act 663) in Ghana Integrity Initiative's Perspective. Paper Presented at a Special Forum on Improving Efficiency and transparency in Public Procurement through Information Dissemination.

Baiden, B.K., (2006). Framework for the Integration of the Project Delivery Team. Unpublished Doctoral Thesis submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy at Loughborough University, Loughborough United Kingdom.

Bajaj, C., Schikore, Visualisation of scalar topology for structural enhancement. IEEE visual. (1998), pp.51-58.

Baker, S., Ponniah, D. & Smith, S. (1999). Survey of Risk Management in major UK Companies. Journal of Professional Issues in Engineering and Practice 125(3), 94.

Baloi, D., & Price, A. D., (2003). Modelling global risk factors affecting construction cost.

Bryman, A., (2004). Social research methods, 2nd edn. Oxford: Oxford University Press.

Burns, N. & Grove, S.K., (1999). Understanding Nursing Research. (2nd edition), Philadelphia: W.B. Saunders Company.

Chapman, & Ward, S., (2003). Project Risk Management: processes, techniques and insights (second edition), Chichester; Wiley.

Coggburn, J. D., (2003). Exploring Differences in the American States Procurement Practices. Journal of Public Procurement, 3 (1): 3-28.

Dikmen, L., Birgonul, M., Anac, C., Tah, J., & Aouad, G., (2008). Learning from risks: A tool for post-project risk assessment. Automation in Construction, 18(1), 42-50.

District Chief Executives with respect to the implementation of the Public Procurement Law, Decentralization Agenda, and 3e March 2007, pp. 1-3

Edmonds and Mills (1984). Edmonds, Deformations of maps to branched coverings in dimension two….of the 1981 Shinghai-Hefei; Symposium on Differential Geometry and Differential Equations (Science Press, Beijing, 1984), pp.…Banach Centre Publications, vol.

Edwards, P.J., Bowen, P.A., Hardcastle, C., & Stewart, P.J., (2009). Identifying and communicating project stakeholder risks. Building a sustainable future: Proceedings of the 2009 construction research congress, Seattle, Washington; April 5-7, 2009.

Enshassi, A., Sherif M., Ziad, A. M., & Peter, E.M., (2007), "Factors Affecting Labour Productivity in Building Projects in the Gaza Strip", Journal of Civil Engineering and Management, Vol. XIII, No. 4.

Evenett, S. & Hoekman, B., (2005). International cooperation and the reform of public procurement policies.

Eyiah, A. & Cook, P., (2003). Financing small and medium-scale contractors in developing countries: A Ghana case study. Construction Management and Economics, 21(4), pp. 357-367.

Fadhley, S.A., (1991). A Study of Project Finance Banking with Special reference to the Determinants of Investment Strategy. Unpublished Doctoral Theses, submitted to the Loughborough University.

Fidan, G., Dikmen, I., Murat, T. A., & Birgonul, M. T., (2011). Ontology for Relating Risk and Vulnerability to Cost Overrun in International Projects. Journal of Computing in Civil Engineering, 25 (4), 302-315.

Fischer, K., Leidel, K., Riemann, A., & Alfen Hans Wilhelm. (2011). an integrated risk management system (IRMS) for PPP projects. Journal of Financial Management of Property and Construction, Vol. 15 (3), 260 – 282.

Flanagan et al. (2007). Risk Management and Construction. Oxford: Blackwell Scientific Publication.

Forgor, E. S., (2007) proposed amendments to make procurement flexible: the practical experiences.

Fowler, J. & Floyd J., (1995), "Improving Survey Questions: Design and Evaluation", Sage Publications Vol. 38, Thousand Oaks, CA.

Ghana Investment Promotion Centre (GIPC), 2006. Gross domestic product (GDP) at 2006 prices by Economic Activity. www.gipcghana.com/invest-in ghana/doing

Ghana Statistical Service, (2012). Statistical for development & progress, Gross Domestic Product (GDP) at Current market prices by Economic Activity. www.statsghana.gov.gh/docfiles/gdp/provisional 2012.pdf.

Jaafari, A., (2001). Management of Risks uncertainties and opportunities on projects: Time for a fundamental Shift. International Journal of Project Management, 19(2), 89-101.

Kerlinger, F., (1986). Foundations of behavioural research, Orlando, FL: Harcourt Brace and Company.

Kheni, K., (2007). Managing the Projects: The channel tunnel rail link. American Intercontinental University- London.

Kpodo, S., (2011) General risk management principles: The quantity surveyor Issue 1, June 2011.

Krathwohl, D. R., (1998). Methods of educational & social science research: An integrated approach (2nd Ed.). White Plains, NY: Addison Wesley Longman, Inc.

Laryea, S. & Hughes, W., (2011).Risk and Price in the bidding process of contractors Journal of Construction Engineering and Management.137 (4), 248-258.

Leitch, C., Hill, F., Harrison, R., (2010). Women's Entrepreneurship and Growth Influences: An International Perspective. London: Edward Elgar Publishing.

Lyons, T. & Skitmore, M., (2004). Project Risk Management in the Queensland Engineering Construction Industry: a Survey International Journal.

Morrison, K., & Potts, J., (2008) "Towards behavioral innovation economics-Heuristics and biases in choice under novelty: Discussion Papers Series 379.

Naoum, S.G. & Coles, D., (1997). Dissertation Guide: Instructions for Preparation, Control and Presentation of the Dissertation, School of Construction, South Bank University, UK.

Naoum, S.G., (1998).Dissertation research and writing for construction students, London: Elsevier Butterworth Publications.

Oppenheim, A.N., (1996). Questionnaire Design, Interviewing and Attitude Measurement, New York: Basic Books.

Performance International Journal of Project Management, 21, 261-269.

PMI (2004) A guide to the Project Management Body of Knowledge (PMBOK Guide), 3rd edn, Project Management Institute, Newtown Square, PA.

Purdy, N., Laschinger, H., Finegan, J., Kerr, M., & Olivera, F.,(2010). Linking workplace factors to workplace outcomes.

Radu, C.G., (2009). Journal of Environmental Management, Ed, Elsevier vol… Vulnerability and Risk Mapping.

Rea, L. M. & Parker, R. A., (1997). Designing and Conducting Survey Research: A Comprehensive Guide. San Francisco: Jossey–Bass. Reading, MA: Addison-Wesley.

Rezakhani, P., (2012) "Classifying key risk factors in construction projects", Kyungpook National University, Korea.

Sambasivan, M., & Soon, Y.W., (2007) 'Causes and effects of delays in Malaysian construction industry', International Journal of Project Management, **25** (5), 517-526

Simu, K., (2006) Risk Management in Small Construction Projects: Licentiate dissertation, Department of Civil & Environmental Engineering, Lulea: LTU.

Struwig, M., & Struwig, F.W., Stead, G.B., (2001). Planning, reporting and design in research, South Africa: Pearson

Wahab, I.A., (1996). Financing the Growth of Small Manufacturing Firms. .A Doctoral Thesis submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy of Loughborough University, UK.

Wells, G.N., & Sluys, L.J., (2007). International Journal for Numerical Methods in engineering volume 50, Issue 12 pp. 2667-2682.

Winch, G.M., (2010). Managing Construction Projects: An information Processing Approach (2nd edn.) Oxford, Wiley- Blackwell. 522pp.

Yamane, T., (1967) statistics' an introductory analysis, 2nd Ed., New York' Harper and Row.

Zou, P.W.X., Zhang, G., Wang, J., (2006) Identifying key risks in construction projects: life cycle and stakeholder perspective. Sydney: Faculty of Built Environment, University of New South Wales.

APPENDIX 1

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF BUILDING TECHNOLOGY

QUESTIONNAIRE

RISK MANAGEMENT FORMALISATION AND CONTRACTOR PERFORMANCE

The researcher is a post-graduate student at the Kwame Nkrumah University of Science and Technology studying for a Master of Science degree in Construction Management. The researcher is conducting a research into risk management formalization in the construction industry.

Kindly answer the questions in this questionnaire as accurately as you possibly can. Your response to this research will be confidential and will be used exclusively for academic purposes. The questionnaire is divided into three main sections.

SECTION A: BACKGROUND INFORMATION

Please tick as applicable

1. Name of Organization (Optional)……..

2. How long have you been working in this institution
   Less than 5 yrs. ( ) 5 -9 yrs. ( ) 10 – 14 yrs. ( )
   14 yrs. and above ( )

3. Gender:
   Male ( ) Female ( )

4. Age Group:

18–30 yrs. ( ) 31-40 yrs. ( ) 41-50yrs ( ) 51-60yrs ( )

5. What is your level of education?

   Postgraduate ( ) First Degree ( ) HND/ Diploma ( )

   Technician (CTC I, CTC II, CTC III) ( )
   Others please specify……

6. How long has your organization been
   Less than 5 yrs. ( ) 5 -9 yrs. ( ) 10 – 14 yrs. ( )

   14 yrs. and above ( )

7. Position Held:
   Project/Contract Manager ( ) Civil/Materials Engineer ( ) Quantity Surveyor ( ) Managing Director ( )

   Others please specify ……

RISK MANAGEMENT PROCEDURES

On a scale of 1 to 5, where 1 "strongly disagree", 2 is "disagree",3 is "not sure", 4 is "I agree" and 5 is "strongly agree", please answer these questions about Risk Management procedures and processes in your firm.

Item	Risk Management Procedures and Processes	RATING				
		1	2	3	4	5
8	There is a dedicated department responsible for risk management in our company					
9	There exists comprehensive and clear-cut policies covering all aspects of risks associated with our business and operations					
10	There are some procedures covering the management of					

	risk in our company. These are not documented and not everyone knows / follows these.					
11	No regular procedures on risk management exist. Decisions relating to the management of risk are made in an ad-hoc manner.					
12	Risk Management procedures are fully documented					
13	Everyone in the company is fully aware of all risk management procedures					
14	Risk Management procedures are fully implemented by all staff					
15	Our company has fully written-up procedures on all risks and Risk Management					
16	There is a stated policy in place for managing risk					
17	The Risk Management policy was designed by a specialist who is also responsible for the execution of our Risk Management systems					
18	The Risk management policy sets out the approach to and appetite for risk and approach to risk management.					
19	Risk management policy sets out responsibilities for risk management					
20	There are some Risk Management procedures even if not directly developed or followed by everyone in the company.					

NB: If you have ticked option 4 - "I agree" or 5, "strongly agree" for any of the questions from 8 to 20, please proceed to Qu. 21 in section B on the next page. If however you chose only options 1 to 3 for Qu. 8 to 20, please proceed to Q.

Section B

On a scale of 1-5, where;

1 means "Not documented as part of formal risk management processes in our firm", 2 means "Not documented, though some employees may sometimes do it on ad-hoc basis", 3 means "Partly documented as part of formal risk management system in our firm", 4 means "Fully documented and many employees in our firm are aware of this", 5 means "Fully documented as part of our risk management processes; all employees know about it and follow at all times", indicate the level of formalization of these risk management procedures

NO	QUESTION	RATING				
RISK MANAGEMENT POLICIES AND PROCESSES		1	2	3	4	5
21	Risk management is a central part of company strategic management					
22	Risks are addressed carefully with the goal of achieving sustained benefit within each activity and across the portfolio of all activities.					
23	Clearly laid-out plans and procedures for managing risks					
RISK ANALYSIS						
24	Risk identification is approached in a methodical way to warrant that all significant happenings have been identified and all the risks flowing from these activities well-defined.					
25	All related instability related to various activities are recognized and categorised.					
26	Risk identification is carried out using an in-house approach with well communicated, consistent and co-ordinated processes and tools.					
27	Identified risks are presented in a structured format using a					

	table to ensure a full risk identification, description and assessment process.					
28	Key risks that need to be analysed in more detail are prioritised by considering the consequence and probability of a set of risks.					
29	Risk management is incorporated at the conceptual stage of projects as well as throughout the life of a specific project.					
30	Use the results of risk analysis process to produce a risk profile					
	RISK REPORTING AND COMMUNICATION					
31	Individuals in the company should understand their accountability for individual risks					
32	Individuals in the company should report systematically and promptly to senior management any perceived new risks or failures of existing control measures					
33	Individuals in the company should report to stakeholders on a regular basis setting out risk management policies and the effectiveness in achieving objectives.					
34	Preparations for the formal reporting of risk management must be clearly itemised and available to stakeholders.					
35	Any major lacks uncovered by the system, or in the system itself, should be informed together with the stages taken to deal with them.					
		1	2	3	4	5

RISK TREATMENT						
36	The loss to be anticipated if no action is taken should be projected and equating the results, management agrees whether or not to implement the risk control measures.					
37	Occasionally where the cost of reducing a risk is totally uneven to the effect of the risk, some litheness should be tolerable					
38	There should always be a dedicated business continuity plan for anticipated risk which is tested on a regular basis and updated at least every year to reflect changes in the business					
39	Business continuity plans should be actively tested through simulations					
40	Business continuity plans should be communicated regularly to employees					
MONITORING AND REVIEW OF THE RISK MANAGEMENT PROCESS						
41	Risk management systems should be observed regularly to ensure that risks are effectively identified and assessed and that appropriate controls and responses are in place.					
42	Regular audits of risk management policies and standards should be carried out for compliance with regulatory standards					
43	Risk checking and reporting tools should be uniform across the organization.					
44	Issue tracking, monitoring and reporting should be regularly performed using GRC (Governance, Risk Management and					

	Compliance) software.					
47	Chief executive and decision-making management should be strongly dedicated to the risk management process.					
48	The Board has responsibility for creating the environment and the structures for risk management to operate effectively.					
49	The nature and extent of downside risks acceptable for the company to bear within its particular business must be established and communicated					
50	The likelihood of such downside risks becoming a reality must be calculated					
51	How unacceptable risks should be managed should be clearly explained					
52	The company aims to improve its ability to minimise the probability and impact on the business					
53	The costs and benefits of the risk and control activity undertaken should be determined					
54	The effectiveness of the risk management process should be assessed					
55	The risk implications of board decisions must be explored					
56	There should be two-way open communications about risk with external stakeholders.					
57	Communication must be time and transparent and provide relevant information that conveys the decisions and values of the organization.					

58	The board or management committee plays a leading role in defining risk management objectives.					
59	A common risk framework has to be adopted and implemented across the organization.					
60	There is a formal method for defining adequate risk brinks within the business.					

On a scale of 1-5, where;
1 means "Not documented as part of formal risk management processes in our firm",
2 means "Not documented, though some employees may sometimes do it on ad-hoc basis",
3 means "Partly documented as part of formal risk management system in our firm",
4 means "Fully documented and many employees in our firm are aware of this",
5 means "Fully documented as part of our risk management processes; all employees know about it and follow at all times", indicate the level of formalization of these risk management procedures

THE STRUCTURE AND ADMINISTRATION OF RISK MANAGEMENT		1	2	3	4	5
61	Leadership should put in place an effective risk management program.					
62	Forecasting and risk reporting cycles should be coordinated so that current risk information is incorporated into business planning.					
63	Completion of risk-related training should be incorporated into individual development					
64	Integrated technology enables the organization to manage risk and eliminates or prevents redundancy and lack of coverage.					

65	Overlap and duplication of risk activities should be identified and addressed.					
66	Lines of business should establish key risk indicators (KRIs) that predict and model risk assessment.					
67	Self-assessment and other reporting tools should be uniform across the business.					
68	Controls should be enhanced to improve effectiveness, reduce costs and support increased business performance.					
69	Main risk metrics should be established at the commercial level.					
70	Risk dashboards are automated and include governance, risk and compliance indicators.					
71	Business units have primary responsibility for managing risk on a day-to-day basis					
72	Business unit management is accountable for promoting risk awareness within their procedures					
73	Risk management is a regular management-meeting item to allow thought of exposures and to reprioritise work in the well-lit of real risk analysis					
74	Business unit management should ensure that risk management is incorporated at the conceptual stage of projects as well as throughout a project					
75	There should be a risk management officer/ Department responsible for setting policy and strategy for risk management, a champ of risk management at strategic and					

	operational level to build risk alert values in the company and launch internal risk policy structures.					
76	There should be an Internal Audit team responsible for directing the internal audit work on the vital risks providing active care and participation in the risk management process.					
77	The level of risk expertise in organisation at the maximum levels should be frequently reviewed					
78	The capitals required to implement our firm's risk management policy should be visibly established at each level of management and within each business unit.					
79	Those involved in risk management have a duty to have their parts clearly well-defined.					
80	Risk management is embedded within the company through the strategy and budget processes					

Using a scale of 1 to 5, please specify the extent to which your firm uses these techniques. Where; 1=Never, 2=Sometimes, 3=Often, 4=Very often, 5=All the time

	TECHNIQUES	RATING				
		1	2	3	4	5
81	Brainstorming					
82	Synetics					
83	Probability analysis					
84	Decision tree analysis					
85	Sensitivity analysis					
86	Simulation analysis					
87	Portfolio theory analysis					
88	Breakeven analysis					
89	Scenario analysis					
90	Failure mode analysis					
91	Pareto diagrams					
92	Root cause analysis					
93	Fuzzy set theory					

SECTION C

CONTRACTOR PERFORMANCE ON PROJECT TIME AND COST

Please use the table below to provide some details about your firm's time performance on your last five completed projects.

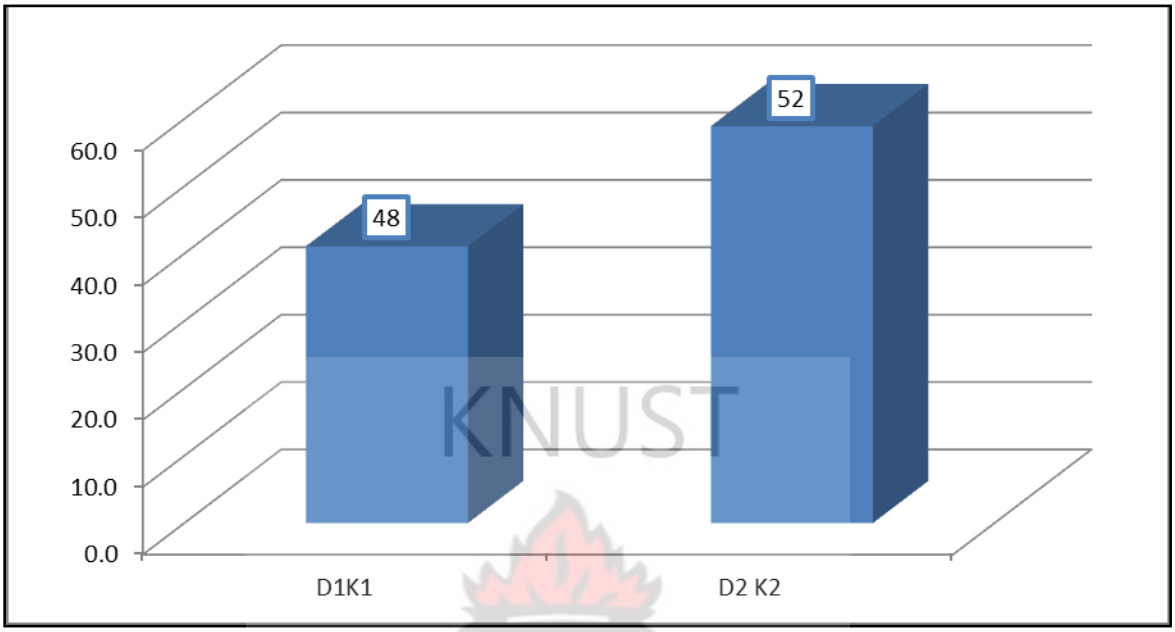
Note: the variance = $\frac{\text{proposed time – final time}}{\text{Proposed time}}$ x 100

PROJECT	UNDER SCHEDULE	ON SCHEDULE	TIME OVERRUN
1			
2			
3			
4			
5			
PROJECT	UNDER BUDGET	ON BUDGET	COST OVERRUN
1			
2			
3			
4			
5			

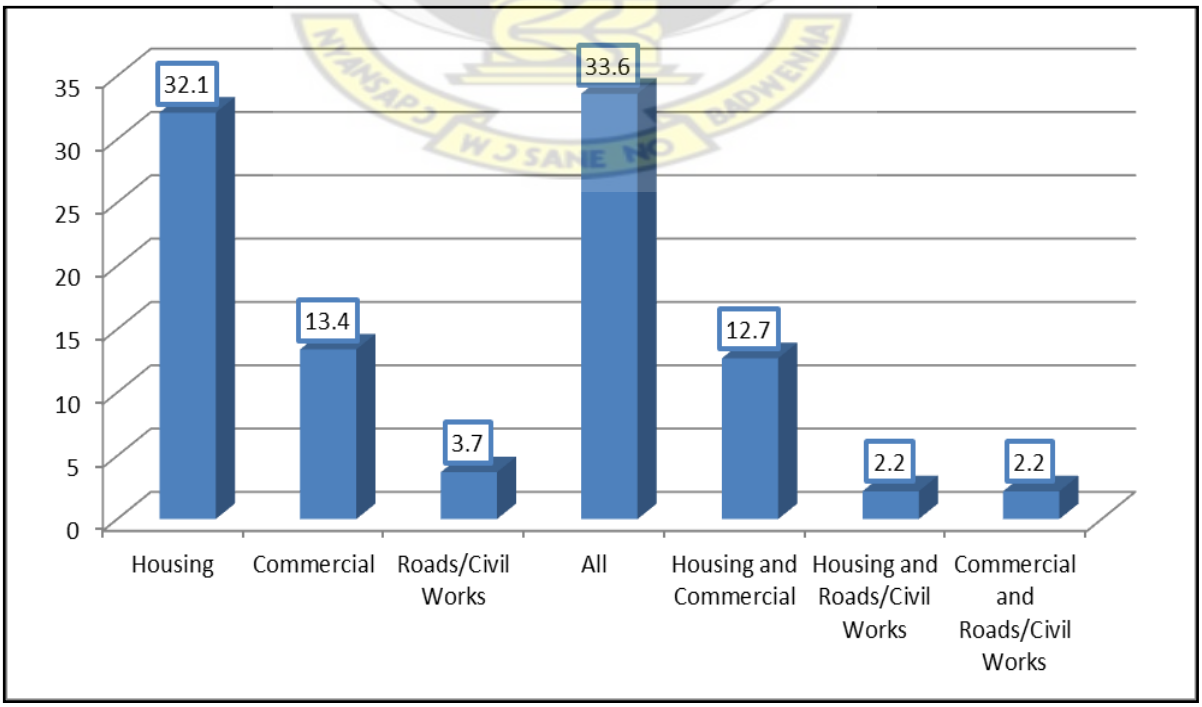
Thank you for your time!!!!!!

APPENDIX 2

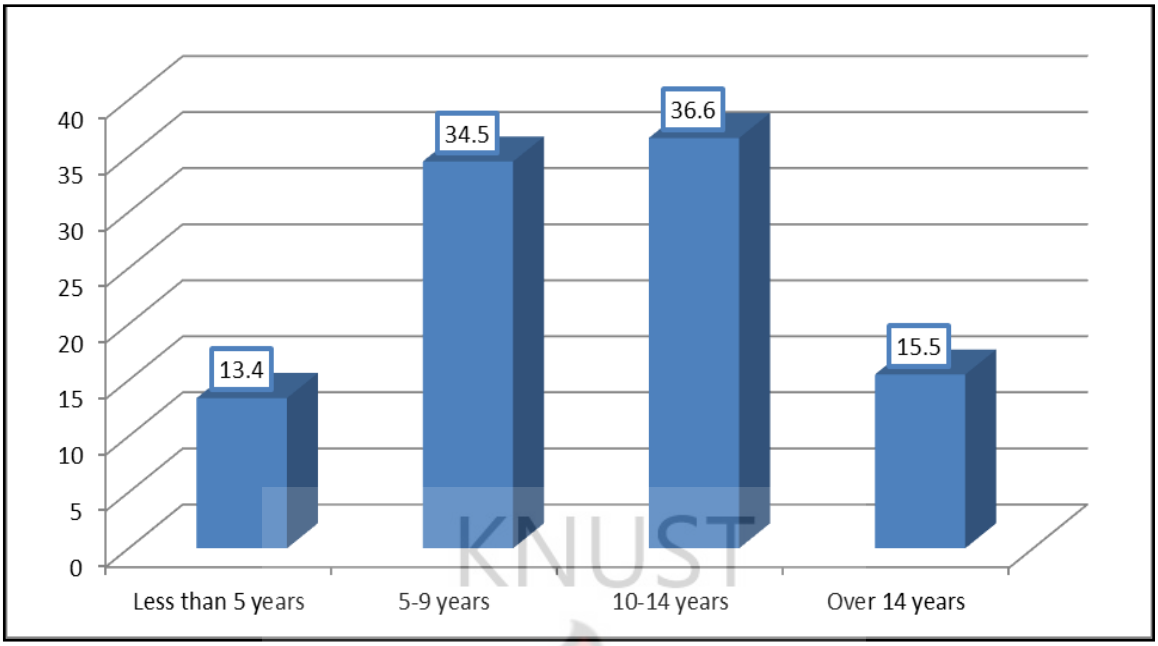
Figures A1: Company's classification



Figures A2: Types of projects undertaken by the company



Figures A3: Years of experience in construction field



Figures A4: Professional background

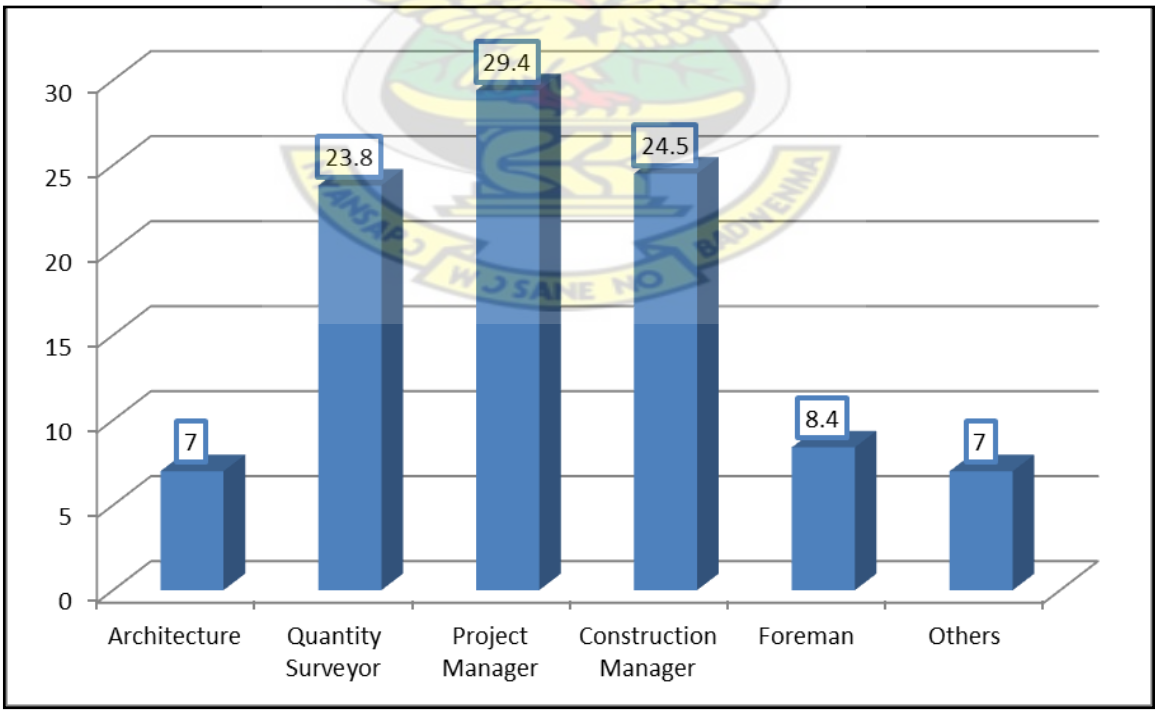


Table A1: Risk formalisation and project time performance-Correlations							
		Risk formalisation	Project time 1	Project time 2	Project time 3	Project time 4	Project time 5
Risk formalisation	Pearson Correlation	1	0.032	-0.029	-0.03	-0.004	-0.022
	Sig. (2-tailed)		0.705	0.725	0.716	0.965	0.79
	N	145	145	145	145	145	145
Project time 1	Pearson Correlation	0.032	1	.685**	.334**	.217**	.208*
	Sig. (2-tailed)	0.705		0.000	0.000	0.009	0.012
	N	145	145	145	145	145	145
Project time 2	Pearson Correlation	-0.029	.685**	1	.465**	.256**	.248**
	Sig. (2-tailed)	0.725	0.000		0.000	0.002	0.003
	N	145	145	145	145	145	145
Project time 3	Pearson Correlation	-0.03	.334**	.465**	1	.382**	.417**
	Sig. (2-tailed)	0.716	0.000	0.000		0.000	0.000
	N	145	145	145	145	145	145
Project time 4	Pearson Correlation	-0.004	.217**	.256**	.382**	1	.485**
	Sig. (2-tailed)	0.965	0.009	0.002	0.000		0.000
	N	145	145	145	145	145	145
Project time 5	Pearson Correlation	-0.022	.208*	.248**	.417**	.485**	1
	Sig. (2-tailed)	0.79	0.012	0.003	0.000	0.000	
	N	145	145	145	145	145	145

Table A2: Risk formalisation and project cost performance-Correlations							
		Risk formalisation	Project cost 1	Project cost 2	Project cost 3	Project cost 4	Project cost 5
Risk formalisation	Pearson Correlation	1	-0.067	-0.018	-.219**	0.033	0.014
	Sig. (2-tailed)		0.427	0.833	0.008	0.697	0.865
	N	145	144	144	144	143	144
Project cost 1	Pearson Correlation	-0.067	1	.552**	.326**	.194*	.375**
	Sig. (2-tailed)	0.427		0.000	0.000	0.02	0.000
	N	144	144	144	144	143	144
Project cost 2	Pearson Correlation	-0.018	.552**	1	.472**	.206*	.227**
	Sig. (2-tailed)	0.833	0.000		0.000	0.014	0.006
	N	144	144	144	144	143	144
Project cost 3	Pearson Correlation	-.219**	.326**	.472**	1	.317**	.308**
	Sig. (2-tailed)	0.008	0.000	0.000		0.000	0.000
	N	144	144	144	144	143	144
Project cost 4	Pearson Correlation	0.033	.194*	.206*	.317**	1	.514**
	Sig. (2-tailed)	0.697	0.020	0.014	0.000		0.000
	N	143	143	143	143	143	143
Project cost 5	Pearson Correlation	0.014	.375**	.227**	.308**	.514**	1
	Sig. (2-tailed)	0.865	0.000	0.006	0.000	0.000	
	N	144	144	144	144	143	144

Table A3: MEANS OF RISK MANAGEMENT PRACTICES AND PROCESSES

RISK MANAGEMENT PROCEDURE AND PROCESSES IN FIRM	N-Valid	Mean
There are some risk management procedures even if not directly developed or followed by everyone in the company	144	3.4
Risk management policy sets out responsibilities for risk management	144	3.4
There is a dedicated department responsible for risk management in our company	145	3.3
There exists a comprehensive and clear-cut policy covering all aspects of risks associated with our business and operations	145	3.3
There is a stated policy in place for managing risk	145	3.3
There are some procedures covering the management of risk in our company and there are not documented and not everyone knows/follows these	145	3.2
Risk management procedures are fully documented	144	3.2
The risk management policy sets out the approach to and appetite for risk and approach to risk management	144	3.2
The risk management policy was designed by a specialist who is also responsible for the execution of our risk management systems	144	3.1
Our company has fully written-up procedures on all risks and risk management	145	3
No regular procedures on risk management exist. Decisions relating to the management of risk are made in an ad-hoc manner	145	2.9
Risk management procedures are fully implemented by all staff	145	2.9
Everyone in the company is fully aware of all risk management procedures	145	2.9
OVERALL MEAN		3.2
RISK MANAGEMENT POLICIES AND PROCESSES	N-Valid	Mean
Risk management is a central part of company strategic management	143	3.06
Risks are addressed methodically with the goal of achieving sustained benefit within each activity and across the portfolio of all activities	143	3.07
Clearly laid-out guidelines and measures for managing risks	143	3.12
RISK ANALYSIS		
Risk identification is approached in a logical way to ensure that all major activities have been recognized and all the risks flowing from these events defined	136	2.94
All related instability related to various activities are identified and categorized	134	2.97
Risk identification is agreed out using an in-house approach with well linked, consistent and matched processes and tools	134	2.91
Identified risks are displayed in a structured format using a table to ensure comprehensive risk identification, description and assessment process	134	2.88
Key risks that need to be investigated in more detail are line up by considering the significance and chance of a set of risks	133	3.09
Risk management is incorporated at the conceptual stage of projects as well as throughout life of a specific project	134	3.31
Use the results of risk analysis process to produce a risk profile	133	3.04

RISK REPORTING AND COMMUNICATION		
Entities in the company should gain their responsibility for diverse risks	134	3.25
Persons in the company should report thoroughly and on time to senior management any alleged new risks or letdowns of existing control measures	132	3.28
Individuals in the company should report to stakeholders on regular basis setting out risk management policies and the effectiveness in achieving objectives	134	2.96
Preparations for the formal reporting of risk management should be plainly stated and available to stakeholders	134	3.14
Any significant deficiencies uncovered by the system. Or in the system itself, should be reported together with the steps taken to deal with them	134	3.14
RISK TREATMENT		
The loss to be expected if no act is taken should be estimated and by relating the results, management chooses whether or not to device the risk control methods	142	3.06
Occasionally where the cost of reducing a risk is totally disproportionate to the effect of the risk, some flexibility should be allowed	143	2.97
There should always be dedicated business continuity plan for anticipated risk which is tested on a regular basis and updated at least every year to reflect changes in the business	143	3.2
Business continuity plans should be actively tested through simulations	143	3.14
Business continuity plans should be communicated regularly to employees	143	3.13
MONITORING AND REVIEW OF THE RISK MANAGEMENT PROCESS		
Risk management systems should be monitored regularly to ensure that risks are effectively identified and assessed and that appropriate controls and responses are in place	134	3.4
Regular audits of risk management policies and standards should be carried out for compliance with regulatory standards	133	3.21
Risk monitoring and reporting tools should be standardized across the organization	134	3.22
Issue tracking, monitoring and reporting should be regularly performed using GRC (Governance, Risk Management and Compliance) software	134	2.96
Chief executive and executive management should be strongly committed to the risk management process	134	3.42
The board has responsibility for creating the environment and the structures for risk management to operate effectively	134	3.33
The nature and extent of downside risks acceptable for the company to bear within its particular business must be established and communicated	134	3.25
The probability of such disadvantage risks becoming a certainty must be considered	134	3.11
How improper risks should be accomplished and should be clearly clarified	134	3.11
The company goals to improve its capacity to abate the likelihood and effect on the business	134	3.29
The costs and benefits of the risk and control activity undertaken should be determined	134	3.36
The success of the risk management process should be evaluated	134	3.27
The risk consequences of board decisions must be discovered	134	3.26
There should be two-way open communications near risk with external stakeholders	134	3.27
Communication must be time and clear and provide applicable information that	134	3.28

carries the decisions and values of the organization		
The board or management committee plays a leading role in defining risk management objectives	134	3.46
A shared risk framework has to be approved and applied across the organization	134	3.27
There is a formal method for outlining usual risk thresholds within the organization	134	3.02
THE STRUCTURE AND ADMINISTRATION OF RISK MANAGEMENT		
Leadership should set in place an active risk management program	134	3.34
Planning and risk reporting cycles should be harmonized so that existing risk information is incorporated into business planning	134	3.27
Accomplishment of risk-related training should be incorporated into distinct development	134	3.21
Integrated technology permits the body to manage risk and eradicates or avoids sloth and lack of coverage	134	3.1
Join and repetition of risk activities should be recognized and give a talk	134	3.06
Lines of business should establish key risk indicators (KRIs) that predict and model risk assessment	134	3.16
Self-assessment and other reporting tools should be standardized across the business	134	3.18
Controls should be improved to advance effectiveness, lessen costs and support enlarged business performance	134	3.27
Key risk metrics should be established at the business level	134	3.07
Risk dashboards are automated and include governance, risk and compliance indicators	134	2.86
Business units have principal duty for handling risk on a day-to-day basis	134	3.06
Business unit management is responsible for helping risk awareness in their actions	134	3.09
Risk management is a steady management-meeting item to allow care of contacts and to reprioritize work in the well-lit of current risk analysis	134	3.11
Business unit management should certify that risk management is fused at the conceptual period of projects as well as all over a project	134	3.22
There should be a risk management officer/Department responsible for setting plan and approach for risk management, champion of risk management at strategic and operational level, build risk aware culture in the company, establish internal risk policy and structures, design and review processes for risk management, etc.	134	3.25
There should be an Internal Audit team in charge for focusing the internal audit work on the important risks, providing guarantee on risk management, providing dynamic support and taking part in the risk management process, etc.	134	3.16
The level of risk expertise in organization at the highest levels should be regularly reviewed	134	3.16
The resources necessary to device our company's risk management policy should be clearly proven at each level of management and within each business unit	134	3.17
Those involved in risk management should have their roles in organizing risk management policy/strategy openly defined	134	3.31
Risk management is surrounded within the company over the strategy and budget process	133	3.26