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INVESTIGATION OF PROJECT RISK MANAGEMENT PRACTICES IN THE CONSTRUCTION INDUSTRY IN GHANA.

FRANK BENTUM MENSAH

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(200029456)

A Thesis in the Department OF CONSTRUCTION AND WOOD TECHNOLOGY EDUCATION, FACULTY OF TECHNICAL EDUCATION, Submitted to the School of Graduate Studies, University of Education, Winneba, in Partial Fulfillment of the Requirements for the Award of Master of Philosophy (Construction Management) degree.

NOVEMBER, 2021

DECLARATION

Student's Declaration

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

SIGNATURE……..

DATE……..

Supervisor's Declaration

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of thesis/dissertation/project as laid down by the University of Education, Winneba.

NAME OF SUPERVISOR: ENGR. MICHAEL K. TSORGALI

SIGNATURE ……

DATE…….

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DEDICATION

To my Nuclear family: Mrs. Genevieve Bentum Mensah, Nana, Paa Peter, Agabus Ekow, Maame Araba Oforiwa, Naomi and Antoinette.

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ABSTRACT

The construction industry is one of the most dynamic, risky, and challenging businesses. The number of risks present invariably goes beyond those found in other industries. The research was conducted with the aim of developing an effective risk management guide for building construction projects in the Central and Greater Accra regions of Ghana. Purposive sampling technique was used to select ninety (90) participants that were made up of clients, contractors and consultants of on-going projects for the study. Three instruments (Observation, Questionnaire and Interview) were used to illicit information from the participants. Twenty-five risks were identified and categorized into ten main categories. For each of these risks, relevant mitigation strategies were also proposed. Findings of the research revealed that Economic, Financial and political risks have the greatest influence on construction projects in the Central and the Greater Accra Regions of Ghana. Moreover, there is a serious lack of risk management knowledge and expertise among all the three key categories of actors. The conclusion drawn from the evaluation of risk management strategies was that due to high volatility of the economic situation of the country, reactive risk management is practiced more than proactive risk management. Moreover, employment of contingency theory for managing situations has been stated to be unique for each particular situation and therefore the situation should be defined in order to refer to a more specific concept. The study recommended among other things that utilization of contingency plan needs to be made more explicit in the theory. A thorough feasibility studies should be undertaken before any project is done.

Key words: Client, Contractor, Consultant, Construction Risk, Contingency theory.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter presents the introduction of the study. It involved the background to the study, Statement of the Problem, Purpose of the study, objectives of the study, research questions, significance of the study, Scope, limitation and organization of the study.

1.2 Background to the Study

Every human endeavour in life involves risk. Risk by nature may be a cause for concern as it is uncertain and unpredictable, but one needs to step up to the challenge for life to be interesting. There may be success or failure, even though the degree of failure is proportional and cannot be defined as a precise terminology (Dey and Ogunlana, 2004).

According to Mark and *et al* (004), risk is described as a potential for complications and problems with respect to the completion of a project and the achievement of a project goal. In addition, the impact or consequences of risk are unexpected, (Chia, 2006) Construction project risk can also be described as an uncertain event or condition that, if it occurs, has a negative effect on at least one project objective, such as time, cost, or quality (Jomaah, *et al* 2010). Risks are therefore threats to project delivery. Failure to adequately deal with risks has been shown to cause cost and time overruns in construction projects (Andi, 2006).

According to Loosemore *et al* (2006), trying to eliminate all risks in construction projects is impossible. However, they opined that, it is well accepted that

a risk can be effectively managed to mitigate its' adverse impacts on project objectives, even if it is inevitable in all project undertakings. Sources of risks includes inherent uncertainties such as pandemic (COVID 19) and issues relative to company's fluctuating profit margin, competitive bidding process, weather change, job-site productivity, the political situations, inflation, contractual rights, and market competition (Karimi *et al*., 2011). It is important for the construction companies to face these risks by assessing their effects on the project objectives. Risk management helps in deciding which of the project is riskier, planning for the potential sources of risk in each project, and managing each source during construction (Zayed *et al* 2008).

1.3 Statement of the Problem

Economic growth and socio-economic development are particularly important for developing countries; and the construction industry plays a central role in driving both of these. However, construction projects have been identified as one of the most dynamic, risky and complex endeavours (Kangari, 1995; Mills, 2001). A large number of construction projects in developing countries suffer from many setbacks in terms of completion of the project at stipulated time, cost overruns and quality problems. These setbacks are often responsible for turning profitable projects into loosing ventures (Sweis, Sweis, Abu Hammad and Shboul, 2008). An example of the poor performance of construction projects can be found in Central and Greater Accra Regions of Ghana.

Ofori (2011), pointed out that cost and time overruns have become a cankerworm within the Ghanaian construction industry today as well as lack of good quality work of its end product, which do not provide many of the clients' value for money. Construction projects in Ghana are known for overshooting their initial cost budget, which invariably means it is out of initial time schedule (Ofori,2011).

The researcher visited a lot of project site to have first-hand information in the Central and Greater Accra Regions of Ghana. Some of the areas visited includes Komenda, Elimina, Cape Coast Kasoa (all in the central Region), Weija,Kokrobite and Pokuase (All in greater Accra Region) Some of the risks that affect construction projects in the Central and the Greater regions of Ghana were; land litigation, land guards' activities, uncoordinated activities that lead to project not living up expectation, political interferences, inadequate source of funding, cultural and traditional beliefs such as pacification of gods and relocation of deities, an environmental consequences, Community interference, late completion of work and the final projects cost exceeding the project budget.

The effects of the risks discussed above has led to long delay in executing the project and the viability of the project cannot be sustained. the purpose of constructing these projects has not been achieved. Unfortunately, many stakeholders in the construction industry fail to recognize, understand, and mitigate construction project risks, which then frequently lead to an unsuccessful project. (ofori,11)

As a result, risk and uncertainty can potentially have damaging consequences for all construction projects. The ineffective handling of risks can be damaging not only to the contractor, but also to the project as a whole. Risk can affect productivity, performance, quality, and the budget of a project. Risk sometimes cannot be eliminated, but it can be minimized, transferred or retained (Smith, Merna, and Jobling, 2006)

Understanding these risks could help stakeholders to avoid, or mitigate the level of risk on the projects as proper feasibility studies will be done before any project will takes off. To address this challenge, risk management has become an important part of the decision-making process in construction industry - as it determines the success or failure of construction projects (Abujnah and Eaton, 2010). Good decisions are made

against a predetermined set of objectives based on knowledge, data, and information; whereas decisions that are made without a logical assessment of project-specific criteria may lead to difficulties in project delivery (Abujnah and Eaton, 2010).

1.4 Purpose of the Study

The purpose of this study is to develop an effective practice risk management guide for building construction projects in the Central and Greater Accra regions of Ghana.

1.5 Objectives of the Study

The study was guided by the following objectives:

i. Explore project risk in the construction industry in the Central and the Greater Accra regions of Ghana.
ii. Determine the causes and the effect of these risks on projects in the Central and Greater Accra regions of Ghana.
iii. Examine the risk management practices being used to control the identified risks.
iv. Assess the practical implementation of risk management practices using contingency theory.

1.6. Research Questions

1. What are the some of the construction project risks that affect projects in the in the central and the Greater Accra regions of Ghana?
2. What are the causes and effect of these risks that affect clients in the construction industry in the central and greater Accra regions Ghana?
3. What are the risk management techniques and practices that are used to control the identified risks?

4. How is the knowledge about construction risks utilized in managing risks in line with contingency theory?

1.7. Significance of the Study

The following are the significance of the study:

The outcome of the study will add to the knowledge already existing in every aspect of the construction industry to manage the construction projects according to the situation and mitigate the risks as much as possible in the Central and Greater Accra regions of Ghana

Moreover, it will provide directions in research development, training, and strategies that will respond to the needs of the construction industry in general.

The outcome of this research will help the contractors, clients and other stakeholders to understand how the risk management practices of construction firms lead to the execution of projects in the Central and the Greater Accra Regions of Ghana.

1.8. Scope of the study

The study involved issues of importance in relation to risks in the construction industry. Among the issues contained in the study were: awareness of risk in the construction project, the effect of these risks on projects, management practices to mitigate the effect of risk on the project. The issue of contingency theory was also discussed. The study was done in the Central and Greater Accra regions of Ghana.

1.9. Limitation of the study

Although the results of the research were very successful, there were certain difficulties that were encountered. Locating some of the contractors and clients were

very difficult. For the public sector construction projects, clients were governmental establishments and therefore it was quite difficult to access the top-level managers in these organizations. Some of the projects has changed hands and it was difficult to get certain vital information.

1.10 Organization of the Study

The research report was organized in five chapters.

The chapter one was about introduction which consists of the background of the study, statement of the problem, purpose of the study, objectives of the study research questions, significance of the study, limitation and delimitation (scope) of the study.

Chapter two: Literature Review – reviewed the literature on project and project management; Highlights the construction projects as the designated context of this thesis; clarifies the concept of risk (the focus of this thesis) in general and in the context of construction Projects; defines the risk management process and refers to its sub-processes; underlines the Factors influencing the risk management process; reviews related studies and papers undertaken by other researchers and discusses their findings; evaluates various theories about management and risk management and argues for justification of choosing contingency theory as the theoretical framework of this thesis; examined the contingency theory in context of construction risk management; and finally presents the research questions which are answered through undertaking this thesis

Chapter three: Methodology – discussed the preferred research methodology undertaken for answering the questions of the thesis; defines the adopted research approach; also the rationale for the choice of research designs was discussed followed by a critical evaluation of the survey design; distinguish the research strategies and

data collection methods to justify the chosen data collection methods for this thesis; explains the sample size for the questionnaires and interviews; identifies the data analysis methods that was used; and finally refers to material facts and ethical considerations of the thesis

Chapter four: – Presented the result and the discussions on the data that was collected from some of the construction sites, clients, contractors and consultant in the Central and Greater Accra regions of Ghana.

Chapter five: Summary of the findings, Conclusion and Recommendations – summarizes findings of the thesis, gave conclusion and recommendations. The research also provided suggestions for further research in this study.

Key words:

Client: is a legal person who signs the construction contract and assigns the contract activities to contractors based on the contract's documents. Legal representatives and substitutes of client are tantamount to client.

Contractor: is a legal or real person who is the other side signing the construction contract and has accepted the responsibility for execution of contract activities based on the contacts documents. Legal representatives and substitutes of contractor are tantamount to contractor. The contractors used for the thesis were executing projects for the clients mentioned.

Consultant: is a legal or real person who is introduced to contractor from clients' side for supervising the execution of the work within the authorities appointed to them in the contract's documents.

Private sector clients: private companies, NGOs as well as individuals

Public sector clients: Public sector clients used in the research work were Municipal Assembly, Roads and Highways, Ministry for works and housing, Ministry for Trade and Industry, Educational as well as Health institutions.

Construction Risk: Potential event whose occurrence results in uncertainty as to the final cost, duration and/or the quality of the project as well as social and environmental consequences.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter review relevant literature in the concept of risks in general and types of risks construction project some part of Ghana encounter as a context of this thesis. It also discusses the awareness and management practices taken to mitigate the effect of risks in a construction project.

Related studies undertaken by other researchers are reviewed and their findings are discussed. Finally, contingency theory is examined in the context of construction projects risk management.

2.2. Overview of Risk management in Construction Projects

Mark et al (2004), described risk as a potential for complications and problems with respect to the completion of a project and the achievement of a project goal. Risk is generally uncertainty circumstances or events which can produce a positive or negative impact on a project, if it occurs. Jaffari (2001), considered risk as loss/gain and magnitude. In other words, risk is the exposure to gain or loss, or the probability of its occurrences multiplied by their respective magnitude. Jaffari (2001), further explained that a certain event is 100% if their probabilities of occurrences are achieved and conversely an uncertain event is when the probability of occurrence is zero. There are wide variations in between the two stated extremes opined by Jaffari. A simpler definition by the Project Management Institute (1996), described risk as separate and unconnected occurrences that positively or negatively affects a project. Kartam (2001), asserted that risk may be defined as the probability of occurrence of some unpredictable, uncertain and even undesirable events that may change the profitability on a given investments prospects (Kartam, 2001). Any situation or thing that can cause harm may be defined as hazard and the likelihood that a recipient of harm could be influenced by hazard as the extent of exposure. Exposure is taken to imply notions of frequency and probability while hazard relates to damage, injury, loss of performance and finance. Risk is the triple characteristic of any project decision in the situation of uncertainty. The existence of a number of possibilities that has unknown occurrence is termed as uncertainty (Yoe, 2000). Yoe (2000), further affirms that not all uncertainties

are risks but some risks are uncertain. Risks and uncertainties however share similar characteristics in services, production and exchange.

Planning, monitoring, implementation, adjustment, behaviour and explain choices are the fundamental variables that are influenced by risks and uncertainties according to Okema (2001). The nature of the risk and its application are the basis to define risk with a common element of subjectivity. The specification of correctly predicting the exact period during a project in the construction industry where certainty exists or assured is very uncommon (Flanagan and Norman, 1993). Some researchers based their definitions on the outcomes and probability of a project outcome been realised. For instance, According to Kartam and Kartam (2001), risk is the probability of occurrence of uncertain, unpredictable and even undesirable events that would change the prospects for the profitability on a given investment. Managing risk is to minimise, control and share risk and not merely passing them off unto another party (Kartam and Kartam, 2001). The Royal Society (1992) as cited in Edward and Bowen (1999) defines risk as the probability that an adverse event occurs during a stated period of time. Chapman (1997) defines risk as exposure to the possibility of economic and financial loss or gain, physical damage or injury, or delay as a consequence of the uncertainty associated with pursuing a particular course of action. Project in controlled environment Consequently Elinwa, and Joshua, (2001 defines construction risk as a potential event, either internal or external to a project that, if it occurs, may cause the project to fail to meet one or more of its objectives. Odeyinka *et al* (2006), define construction risk as a variable in the process of construction whose occurrence results in uncertainty as to the final cost, duration and/or the quality of the project Risk may exist when a decision is expressed in terms of range of possible outcomes and when known probabilities of the outcomes are attached, while as uncertainty is when there is

one possible outcome of a course of action. There is unknown outcome of the probability of each outcome and in some occasions, there are no reference to the chance of bad consequences on risk. Thus, good consequences should be relevant in the definition of risk (Education and Learning Wales, 2001).

Greene (2001), viewed risk as the probability an adverse event that occurs during a stipulated time period, or results from a particular challenge. Greene (2001) also opined that there is the likelihood that statistical theory obeys all the formal laws affecting probab ilities of expertise, and cultural values to which the hazard relates (Greene, 2001).

Clients have different risks to the contractor, and each stakeholder in the project faces a different set of risks. Sometimes these risks are the same for a number of stakeholders – so for instance, if the project is slipping against the construction schedule this could negatively impact both the client, subcontractors and the contractor. One would consider that if the contractor loses money on the project this should not be a risk for the client. Yet, if the contractor loses so much money that they become bankrupt before the project is finished then this could have a major impact for the client, who would almost certainly have to engage another contractor, at additional costs, to complete the project, which would also certainly result in a delay to the project. In addition, when contractors lose money their subcontractors, employees and suppliers are also at risk. Unfortunately, many clients fail to recognize, understand, and mitigate a construction risk, which then frequently leads to an unsuccessful project.

2.2.1. Construction Projects

A construction project is defined as a physical structure that is initiated by the designers' drawings and gets transformed into finished product through a set of

methods and processes (Levy, 2000). Executing a construction project is defined as a process of putting up an infrastructure. Extensive planning is key for a project to be executed successfully. Before the construction execution phase begins, the design together with the budgeted cost and timelines will have to be completed and approved. (Clough, 1979). According to Levy, (2000) for construction projects to be successful and achieve the set objective, the following key criteria must be met: Complete Project within the estimated time, Actual cost in executing the project is not more than the budgeted cost of project, The project should be claims/disputes free during and beyond the project lifecycle, good working rapport between Contractors and other stakeholders and the output of work meets the desired quality.

2.2.2 Construction Project Risks

Construction risks are uncertainties that affect construction project. Depending on the nature of risk, Researchers through the identification process have found and classified into different types. Such classification includes Contractual/legal, Construction, Political, Management, Physical, Environmental, Design, Financial, Natural hazards, Safety and Delay risk (Mustafa, 1991).

Among all the papers being studied for this thesis, only findings of those in which a specific country had been chosen as the case study of the research are reviewed here. Research conducted by Mills (2001), in Sydney, Adams (2008) in United Kingdom, Dey (2009) in India, Grace (2010) in United States, Alhassan (2016) in Ghana and Ghoddousi and Hosseini (2012), are mostly focusing on the categorization of risk. Therefore, for the purposes of this literature the pertinent research in which important risks and also risk management strategies have been proposed are provided below.

Odimabo (2016), have conducted research in Nigeria about downside risks in construction projects. The findings demonstrate lack of project management and project risk management maturity in Spain, and political issues have been marked as the main obstacles preventing a higher maturity level.

In a paper by Tang *et al.* (2007), they have compared criticality of the risks and have evaluated the methods and risk responses used by project parties in Chinese construction industry. They ranked the five most important risks as, poor quality of work, premature failure of the facility, safety, inadequate or incorrect design, and financial risk. They believe that the existing risk management systems are not sufficient for managing risks and the key barrier to proper risk management is lack of joint management mechanism. Their research suggested a need to introduce an information management scheme and the partnering principles to risk management process, encouraging the open communication among participants in order to manage the project risks jointly and collaboratively.

In research carried out by Hassanein and Afify (2007), they aimed at investigating contractors‟ perceptions of construction risks and their attitude toward risk identification and management based on a case study of power station projects in Egypt. The results show a lack of consistency in contractors‟ risk identification behaviour and also point out previous experience with the same owner as a factor having significant effect on the contractor's risk identification effort.

Liu et al. (2007), have studied key issues and challenges of risk management and insurance in Chinese construction industry. According to the results of their research, managers‟ knowledge and understanding about risk management is very little in Chinese construction projects. Great percentage of the respondents who had participated in this research believe that risk management skills are essential for project

management activities but have not developed in China as much as project management. Unsupportive culture was identified as the biggest barrier in development of risk management in China's construction industry, followed by other factors such as attitude and perception of the contractors.

Perera et al. (2009), research on construction projects in Sri Lanka has ranked scope change and tentative drawings as the two most influential risks in construction projects. Authors have concluded that one best way for responding to risk does not exist and various risk handling strategies should be employed for dealing with the risks.

Zou et al. (2006), in their paper have identified and analysed the risks associated with the development of construction projects from the perspectives of stakeholders and project life cycle in Australia. The results indicate that many risks occur at more than one phase and it was also concluded that construction phase is the most risky phase, followed by the feasibility phase.

Pourrostam and Ismail (2011), have conducted research focusing on identification of the main causes and consequences of delay in construction projects of Ghana. The result of research identified 10 predominant causes of delay as poor site management and supervision, delay in progress payment by clients, change orders by client during construction, ineffective planning and scheduling of project by contractor, financial difficulties by contractor, slowness in decision making process by client, delays in producing design documents, delay in reviewing and approving design documents by clients, poor contract management by consultant and problems with subcontractors. The research also found 6 negative effects of delay as time and cost overrun, disputes, arbitration, total abandonment and litigation.

Santoso, *et al* (2003), classified risk factors in high rise building construction in Jakarta-Indonesia into nine main groups as follows: physical; personal; technical;

safety-accident; construction design causes; political and regulation; financial; contractual; and environmental regulation causes. Personal and technical categories are further broken down into several sub-categories. 'Personal' includes: technician and labour; subcontractor; staff and foreman; engineer; consultant; and client. 'Technical' comprises: material; equipment; technique; construction process; construction site; and ground conditions. Long, Ogunlana, Quang and Lam (2004), in their study identified the problems in large construction projects in Vietnam. They classified risks into seven major groups. These are; Financier, Owner, Contractor, Consultant, project attributes, Coordination and Environment. Faridi and EI-Sayegh (2006) classified risk factors causing delay in the UAE construction industry into eight groups: contractor; consultant/designer; owner; financial; planning and scheduling; contractual relationship; government regulations; and unforeseen conditions. Lo *et al* (2006), classified causes of delay in Hong Kong construction industry into seven categories: client, engineer, contractor, human behaviour, project and resource related as well as external factors. Al-Kharashi and Skitmore (2008) in their study of identifying the critical problems of delays in the Saudi Arabian public construction sector classified risks into six major areas. These are; labour, contract/relationship, consultant, client and materials-related causes. El-Razek, *et al* (2008), in their study of determining the main causes of risk in the Egyptian construction industry, classified risk as contractor, consultant and owners related. According to Zou,*et al* (2007), there are many methods to classify the risks associated with construction projects and the rationale for choosing a method must serve the purpose of the research. However, Fang *et al* (2004) reported that because of the differences in social and economic systems, as well as the differences in historical and cultural backgrounds, contractors are likely to encounter different risks in different countries. Several researchers have identified critical risk

factors in different construction industries in developing countries. In this research, extensive literature review was carried out to identify significant risk factors affecting performance in the construction sector in some developing countries.

2.3.1 Financial Risk Factors that affect Construction Project in Central and Greater Accra Regions of Ghana.

Financial failure and delay in payments in construction projects poses a major risk. Berko (2007), stated that, about 70% of infrastructure projects done in Ghana are not funded by the Government of Ghana but from foreign organizations and countries. Contractors are always complaining of delay in payment because of the unwinding bureaucratic system in governmental departments and agencies. Moreover, when these foreign organizations and companies delay in the release of the required funds, the progress of the projects are slowed down (Berko, 2007).

For instance, Komenda Sugar factory is affected by financial risk the project has come to a standstill since 2016. Komenda College of Education new administration block which was started in 2011 is still not completed. (Source field data, 2021).

2.3 2. Economic Risk Factors that Affect Construction Project in the Central and Greater Accra Regions of Ghana

Poor financial markets, inflation and price hiking are among of the variables associated with economic risk drivers which has a direct consequence on projects‟ overrunning (Agyakwa-Baah, 2007; Denini, 2009). Currency instability may result in cost overruns mainly because of inflation. Edwards and Bowen (1998), identified economic risks in Ghana as exchange rates, material supply, labour supply, fiscal policies and inflation. Frimpong et al. (2003) added that, the rise in inflation should also

be considered in risk studies. Komenda sugar factory also has economic risk factors that include the viability of the project. Projects that are also facing economic risk are the Atonkwa E-Block Educational Complex, Road's rehabilitations (Source field data, 2021).

2.3.3. Government influence on construction Projects in Central and Greater Accra Region.

In developing countries like Ghana, most of the construction projects are politically motivated and viewed by many as additions to satisfy public demand. Many roads are left at the mercy of politicians and according to Agyakwa-Baah (2009), it is the ultimate goal of government to lead and fast-track infrastructure project the society and moreover, the performance of the government is assessed in the developing countries by developmental projects. This creates unnecessary pressure on government to start something which will be terminated because it is not accommodated in the government's budget. For instance, a 10 km Road rehabilitation that was started in 2016 electioneering year at Atonkwa in the KEEA Municipality has pass through three different contractors' hands yet they could not execute the project. It was argued by De la Cruz et al. (2006), that, winning political scores leads to unplanned infrastructure development which lacks the necessary funding and required coordination of such projects.

2.3.4. Environmental Risk Factors that Affect Construction Project.

These risks associated with the natural environment has to do with the weather and this factor is hardly experience in Ghana such as harsh weather condition like typhoon or tornados but the two seasonal changes are witness in Ghana such as the wet

and dry seasons. De la Cruz et al. (2006). The New sugar factory at Komenda is at the mercy of the weather as Komenda is a coastal town. The sea breeze is affecting the equipment and moreover the rainfall pattern is not the best. This has affected a few sugar cane that were nursed. The central coastline sea defense project has paved way for the tidal wave to affect the other communities that are not part of the project.

2.3.5. Technical Risk Factors

Moreover, technical incompetence of designers has resulted to inaccurate design details or the inexperience of working on complex projects and risk prone projects. In addition, Oladapo (2007) identified that, variations are very profound in construction projects and its effect is inevitable on project objectives such as time and cost. To provide a simple understanding of variations, Baxendale and Schofield (1986) said the addition or subtractions made to the scope of the project amount to variation.

Inadequate and faulty Plants and equipment have been suggested to be an influential problem in construction firms, although local contractors mostly use labours for their works (Berko, 2007). Moreover, materials shortage, defective materials unavailability of the required skills and the abysmal performance of labour as well as the lack of technical expertise to operate plant and equipment have also been identified as risk most local contractors are experiencing internally as well as stealing of materials by workers (Berko, 2007; Agyakwa-Baah, 2009).

Table 2.1 Summary of Risk Factors affecting some ongoing Project in Central and Greater Accra regions of Ghana

Project	Risk factor	Year started	Year of completion	Expected duration of Contact.
New Komenda sugar factory	Economic, Financial, Environmental, Political, Social, land issues	2016	not completed	12 months

Central Coastal line sea defense project	Environmental, Economical	2020	not completed	12 months
10 km road from Komenda junction to Komenda college of Education	Political, financial and Technical	2016	not completed	6 months
4 Storey-building administration blocks at Komenda college of Education	Financial	2011	not completed	12 months
Private Estate developers at Kasoa	Land litigation and land guards' activities	2018	not completed	unknown
Construction of new cement factory at weija junction-Accra	Environmental hazard	2020	not completed	12 months
E-block school project at Atonkwa -KEEA Municipality	Political, Economic, Financial Environmental and Social	2016	not completed	12 months

Source: field data (2021)

2.4.0. Constructional Project Risk Management Practices

Prince (2009), refers risk management as "the systematic application of procedures to the tasks of identifying and assessing risks, and then planning and implementing risk responses."

- Risk management except from assisting to get the project completed on time and within budget, has got more benefits for any project such as:
- Allowing the decision-making process to be less subjective and more systematic.
- Making the significance of risks apparent, minimizing losses and maximizing opportunities.
- Improving the project's understanding by identifying risks and thinking about response actions.
- Impacting management by imposing an awareness regarding project's possible outcomes.
- Improving communication.

According to Loosemore et al. (2006), Project risk management is all about people making decisions for improving project performance and achieving project objectives the most difficult part in the risk management process is not finding techniques for identifying and managing risks, but accepting that life is uncertain and it cannot be ignored so it is better to grasp it.

By nature, risk management in construction industry allows for a lot of scope for many environmental and socio-political problems dating from pre contracts, contract up to post-contract stage leading to completion time problem, cost overruns and poor quality work. There exist a huge gap of uncertainty between the limit of 0% and 100% (Jaafari, 2001).

Uncertainty makes it difficult to have an exact outlook of future possibilities. To manage uncertainty effectively, the variability and ambiguity nature of uncertainty needs to be differentiated. A situation of usage where a measurable factor takes a unit of set of possible values describes its variability nature. Ambiguity situation is considered when there is no complete knowledge in relation to the situation being reviewed. (Hillson and Murray-Webster, 2007).

Some situations although uncertain are not regarded as risk. If the uncertainty does not affect the set objectives, it would not be considered as risk. There cannot be risk without it being defined in relation to certain objectives (Jaafari, 2001). Hilson and Murray Webster (2007a) intimated that there is a distinction between risk and uncertainty; risk is defined in relation to specific objectives and takes into consideration the consequences while uncertainty does not take that into account.

Uher (2003), has defined risk management as “a systematic way of looking at areas of risk and consciously determining how each should be treated. It is a management tool that aims at identifying sources of risk and uncertainty, determining

their impact, and developing appropriate management responses." Due to the nature of the risk management process, contingency plan can be considered as an essential element of this process. Contingency plan as defined by Gray and Larson (2008) is "a plan that covers possible identified project risks that may materialize over the life of the project".

Division of risk management process is as follows: risk classification, risk identification, risk analysis and risk response, with further division of risk response into avoidance, reduction, retention, and transfer (Berkeley et al., 1991; Flanagan and Norman, 1993).

2.4 .1. Risk Identification of construction projects

Events that affect the achievement of objectives and negatively cause problem, according to Moavenzadeh and Rossow (1999) are risks. Identification of potential threats follows the first step of risk planning, discovering and outlining those elements that affect the objectives of an organization. In addition to identifying the sources of risks and it is when the source of risk is identified that the consequences of that source are known. Investigation the consequences of sources or the problem it causes is very important under this very risk management process.

Identification of risk reveals two types of risks (controllable and uncontrollable). Controllable are voluntarily undertaken and its outcome is part of the direct control of a project while those risks which do not influence a project is termed as uncontrollable risks as observed by Chege & Rwelamila (2000). The identification the constituents of risks determines which risks are likely to affect the project and documenting the characteristics of each. Risk identification should be performed on a regular basis throughout the project, it is not a one-time event according to (PMI, 1996).

A thesis conducted in 1995 by Isaac defined the main constituents of risk identification as a method used to serve as a guide on what those risks should look like when written down to generate risks (Isaac, 1995). In every project there are internally and externally generally risks and it is the objective of risk identification to address these two elements. The elements or things that can be influenced by the project team, be it cost estimation and staff assignments, are internal risks. However, there are some things beyond the influence and control of the project team, typical example is the actions of government. In every project context, risk identification is not only concerned with positive outcomes or opportunities but also the negative outcomes or threats (PMI, 1996). This is a critical stage as a broader and clearer view is taken by the project team to ascertain the risks that are likely to impede the project in meeting its cost target without any constraint. The significance and criticality of this project risk management is affirmed in a study by Enshassi and Mayer (2001) which adds to literature that there should be proper recognition to the existence of one or more potential risks which may result in disaster or forgoing an event or opportunity for gain resulting from proper corrective action; failure to do so will lead delays or cost overruns.

Identifying risk can be compared to mapping the world which is centred on the location of the map maker. (Nescher 2018) Wherever one stand to mark the world from a map, may be entirely reveal the whole world to you and some places familiar to you may not be obvious to other project teams and vice versa. (Nescher 2018) Every project when viewed from the top has complex layers of planning, multiple interactions of vertical and horizontal as well as sequential problems and it is the ability of the management team to influence the outcome of a project by what they see, though outcome of projects are limited. (Nescher 2018) There should be greater concentration on what could happen rather than attempting to focus on what should happen (Flanagan

and Norman, 1993). Going further, Flanagan and Norman (1993) again observed the first equipment of risk identification is focusing on the effects of the risks and its sources. There can be a catalogue of extensive risk devised; however, they could be incomplete and inadequate leading to decision failing simply because most decision makers do not consider the full spectrum of the potentially events or things that may harmfully affect a project. One way of catering for this is by proper identification and categorization of risks so as to minimize the risks embodied in projects (Enshassi and Mayer, 2001).

2.4.2 Risk Analysis of construction projects

Risk management process is a crucial field of project management process in the construction industry. It is the process of risk management where the effects and causes of events which might cause havoc are identified and dealt with. A defined and accurate estimation of risk events is the aim behind such analysis and to some extent makes the decision making of the process to be specific and definite (Estate Management Manual, 2002). The significance of analyzing risk is not far-fetched as it analyze the various outcomes of any decision and captures all feasible options. Clients more often are interested in the likely price of a building project, but however, projects mostly and consistently experience cost overrun, too most often the more important questions of 'what if' are not asked by clients (Flanagan and Norman, 1993).

Assessing the identified risks is the main principle of risk analysis. Risk analysis are done by assessing values on the effect risk have on time and cost. The economic processes or parameters of their respective effects could be analysed and three generalized kinds of risk treatment can be applied: that is, transfer, avoiding or reducing and accepting or retaining risk (Education and Learning Wales, 2002). Flanagan and

Norman (1993), opined that the likely situations if a project is terminated or does not follow the initial plan, the use of risk analysis comes into play. There will be clearer vision of the risks when active minds are applied to the best available data in a systematic and structured way rather than the achievement it would have gained by intuition alone. There is recognition of uncertainty that surrounds the best estimate in risk analysis approach by generating a probability distribution based upon an expertise judgment. This therefore improves the effects of uncertainties and offers a better understanding of projects. Risk analysis is not a standalone activity; rather they are components of all decisions continually made to respond to project dynamics as stated by (Jaafari, 2001).

Evaluation of risks and interacting of risks are also critical to risk and it assesses the potential results on the project (PMI, 1996). Although, it is complicated in nature but it is not limited a number of sequences or factors including: Threats and opportunities can interact in an unexpected way, for example, scheduling delays may force adopting new strategies which reduces the duration of the overall project. According to a study conducted by Bender and Ayyub (2001), the use of mathematical techniques protect project managers control cost but some over rely on these techniques creating false impression of reliability and precision. These techniques are used throughout the whole life span of the project and most importantly the experience of construction experts throughout the construction project.

Risk analysis also indicates what could happen in the event that the project does not travel along the planned route (Flanagan & Norman, 1993).

2.4.3 Risk response to construction projects

The Project Management Institute (1996) highlighted three ways of risk responding in projects: avoiding is eliminating a specific threat by removing the cause. Most at times specific risk can be eliminated as not all risks can be eliminated by project management teams; mitigation is the introduction of new technology or buying insurance, for example, to reduce the expected monetary value by reducing its probability of occurrences; accepting as the name implies is accepting whatever the consequences of the risks might be. Dealing with a lower profit of some activity is passive while developing a contingency plan executable when risks occur is active PMI (1996).

There had been suggestions as to how to respond to residual risks by reducing uncertainties by obtaining additional relevant information leading to a re-evaluation of risk impacts. Another school of thought is the elimination of the risk factor through complete or partial re design. There were suggestions of transferring the risk to other sub-contractors and insuring the occurrences of the risks factors. Abu Rizk (2003) added to the assertion above that a further abortion of these project when the risks are intolerable and no favourable mechanisms could be taken to mitigate the damages.

Four identifiable and discreet appropriate methods of treating construction related risks are avoiding, reduction, transfer and risk retention as buttressed by the findings of similar studies (Akintoyne and MacLeod, 1997; Ahmed et al., 2001; Enshassi and Mayer 2001; Education and Learning Whales, 2001).

2.4.4. Avoiding risk of construction project

Risk avoidance at times is called risk elimination is not a generalized risk response practice in construction industry as the avoidance of placing a bid or the reluctance in project funding, for example, terminate the life of the project even during

the earlier days of the project. (Ahmed et al., 2001) In a bid to totally eliminate risks in construction industries, the above cited examples are impracticable and lead to delays and cost overruns. (Ahmed et al., 2001) A rather constructive approach/condition could be adopted in order to avoid risk. A contractor may tender for a contract with a higher bid, or place conditions on the particular bid, or signing a pre-contract or negotiating a favourable pre-contract condition, for not bidding on contracts that harbour higher risks as observed by Flanagan and Norman (1993) in their conducted research.

2.4 .5. Transferring risk of construction projects

As the name denotes; this risk response practice employs the transfer of risk from one management team to another or from one project to the other. The introduction of insurance premiums in construction projects are beneficial, however, it does not discharge all the identified risks of the project but covers a portion of risks (Tummala and Burchett, 1999). Moreover, Tummala and Burchett (1999), further indicated that the transfer of risk essentially can be done in two ways: transferring the risk from the responsible entity for by hiring sub-contractor on the hazardous projects; and retention of the property or activity but transferring the financial risk through surety and insurances packages.

2.4.6. Retaining risk for construction project

This risk response practice involves an internal management mechanism channeled at reducing controlling risk (Zhi, 1995). Akintoyne and MacLeod (1997), suggested that, it is conducive when avoiding the risk been handled by a particular company is impossible, there might be a small or insignificant financial loss and the probability of its occurrences are insignificant, making it uneconomical to transfer.

Akintoyne and MacLeod (1997), explained that the foreseeable or unforeseeable risks are financed and controlled by the contractor or company and there are two methods devised to retain risk in construction projects. A passive retention method occurs when the contractor performing the work borne all the risks which may occur through ignorance, negligence, or absence of decision. Passive retention method is non-insured.

Akintoyne and MacLeod (1997), further indicated that a self-insurance is a deliberate management mechanism devised to handle risks upon making a thorough analysis of the likely losses to be encountered and finding alternative strategies. Agyakwa-Baah (2007), identified that risks are mostly handled by construction companies by adding a contingency of 10% to the cost of the project cost to address any risk. Moreover, the importance of the industry is seen in its contribution to GDP and the percentage allocated to construction works in the national budget of Ghana (Agyakwa-Baah et al., 2010).

2.5.0. Measures to mitigate the effects of risks in construction projects.

Nescher (2018) suggested the following measures to be adopted to mitigate the effect of certain risks that affect clients.

2.5.1 Controlling Cost Overruns

- Ensuring that the budget is accurate. Budgets should continually be assessed and updated through the life of the project to take account of all the known information and changes. Check that the budget includes all of the costs and that these costs are an accurate assessment. Where necessary include suitable contingencies and allowances for unknown costs.
- Having the correct scope of work for contractors to price.

- Minimising changes and variations during both the design phase and during construction.
- Carrying out proper research of the project site conditions, including doing ground investigations before construction begins. Nescher (2018)

2.5.2. Controlling time Overruns

- The construction schedule isn't realistic. Ensure that the schedule is realistic by employing experienced project managers.
- The project schedule doesn't take account of the client's operations, project restrictions and the normal expected weather events.
- There are changes and variations during the project. Reduce and eliminate changes by ensuring that the project scope is properly prepared and complete and that the contractor has all the information when they price the project.
- Progress isn't monitored during the course of the project. Slippage is not addressed and rectified.
- Contractors are selected on the basis of their price alone and not on their experience and their available resources for the project.
- The project is managed poorly resulting in delays with granting access and issuing information to the contractor.

  Adapted: Nescher (2018)

2.5.3. Minimize the effect of weather

- Designing the project so that work that could be impacted by poor weather is assembled and built under cover, or off site. Even redesigning the project to eliminate activities which could be impacted by the weather, for example using

different foundation methods could eliminate the requirement to excavate in the rainy season.

- Planning the start of the project so it doesn't begin in the worst weather.
- Allowing adequate time in the construction schedule for the normal expected weather. (Nescher 2018)

2.5. 4. Overcoming Resource Constraints

- Projects can be rescheduled to start when the level of construction falls, which could even make the resources, and consequently the project cheaper.
- The project could be designed to make use of modules which could even be constructed in areas where resources are more available. Alternative materials could be used which are more readily available, or which aren't so labor intensive to install.
- The duration of the construction work could be extended to account for the shortage of resources. (Nescher 2018).

2.5.5. Selecting competent contractor

Clients often focus on choosing a contractor based purely on their price. However, the cheapest contractor might not end up providing the cheapest project. It is important to select a contractor that has the required experience and skills to deliver the project safely, to the required quality and on time. Clients should check the contractor's previous projects and clients. They need to review the contractor's planning for the project and check that their project resources will be adequate. (Nescher 2018).

2.5.6. Avoid completed project that cannot meet expectation.

- Selecting a design team that has the required expertise, experience and resources to design and to deliver the right project.
- Clients not only focussing on the price of the project, but ensuring that the project will deliver what's required.
- Clients not being persuaded by their personal agendas, but rather what is in the best interests of the project.
- Clients having reasonable expectations for what they can afford.
- Choosing experienced project managers to manage the design and construction process. (Nescher 2018).

2.5.7. Poor public perception of a project.

- Inadequate communication with all stakeholders about the project.
- Ignoring good environmental and design principles.
- Favoring some project stakeholders while ignoring the concerns of others.
- Not managing the construction process properly, which results in excessive noise (particularly after hours), dust, and damage to the surrounding property, litter, environmental damage, traffic congestions and parking problems.(Nescher 2018)

Good safety practices must be enforced uniformly from the start of the project. The safety records of contractors should be checked before they are selected

2.5.8. Avoid excessively costly projects

- Thoroughly adjudicating contractors' prices to ensure they have priced the complete scope of work.
- By appointing contractors using a legally enforceable contract document that has no conflicting clauses or loopholes.
- By checking all variation claims and invoices carefully, ensuring that items haven't been previously paid, and that the contractor is entitled to be paid the item.
- Considering alternative solutions, methods and projects that could deliver the desired end result cheaper or better. This means thoroughly researching and evaluating the project.
- Ensuring that project systems are robust to eliminate contractor collusion, checking that one contractor isn't unfairly favored over others in the bidding or pricing process and that there are always sound financial checks and balances through the life of the project. (Nescher 2018)

2.5.9. Avoid contractors becoming bankrupt on project

- Paying their contractors fairly and on time (in terms of the contract) and not withholding money without due reason.
- Speedily resolving, agreeing and paying variation claims.
- Thoroughly checking the contractor's financial affairs before awarding them the contract.
- Carefully evaluating contractor's and supplier's prices to check that they haven't made a mistake and underpriced the work. A bargain price might turn out very expensive if the contractor becomes bankrupt part way through the project because their price was too cheap and did not cover their costs.

- Always being aware when the contractor is running into financial difficulties (possibly they have another project which is in trouble) and taking steps to limit their risks. (Nescher 2018)

2.6.1 Contingency Theory (Fieldler, 1964).

Fred Fieldler, postulated the contingency theory in year 1964 by utilizing universal principles of past experiences and applying them in present projects. Contingency theory states that there is no appropriate method of managing an institution and therefore management method which works in some circumstances may not work in others (Fieldler, 1964).

Every project is unique and therefore should be managed according to its specific characteristics and environment in the particular period of time. The focus of this thesis is managing risk in the construction projects and asserting that due to one-off nature of the projects there is no one best way to manage them. Therefore, choosing contingency theory can be considered as an appropriate theoretical framework for this thesis because the main concept of this theory is in common with the focus of this thesis; the theory rejects the idea that there is one best way for managing.

The fact that management situations are not similar clarifies the reason why specific management practices work in some cases but not in others. Much in management and organizational life is situational and these realities of organizational life are what contingency theory has been grown from (Longenecker and Pringle, 1978). Discussing contingency theory within the context of organizational studies, Kast and Rosenzweig (1973) have pointed out that the theory represents a middle ground between:

1) Existence of universal principles for management and organizations

2) Uniqueness of each organization and therefore analyzing each situation separately

This suits the objective of this research where the theory recognizes the complexity involved in managing risk of construction projects but uses patterns of relationship of risks in order to facilitate risk management. Although the contingency approach refuses the existence of „one best way for managing risk, it proposes that there is „one most appropriate" approach for each specific situation (Contingencies). The word „contingency" indicates how the environment (external source of risk) relates with the system, and determines the activities and construction of an organizational system (Longenecker and Pringle, 1978). Therefore, „one best way" to manage all the construction projects cannot be defined and for this thesis, the most appropriate way in risk management depends on the nature of the environment (Ghana) in which the projects are taking place.

Improvement in organizational effectiveness is what contingency theory aims at in order to respond to uncertainty in performance. Contingency is mainly generated for removing or decreasing the negative outcomes of unforeseen events. The novelty of contingency theory, as recognized by Steiner (1979), is adaption of a new way to be identified for specific structures and activities which are the most appropriate for the current requirement of the organization. This illustrates that it is no longer suitable to utilize all-purpose theories or one-size-fit-all integrative frameworks in management and studies. So, contingency theory is used in this thesis in order to describe an approach in managing risk of construction projects that best suits the Ghana's current situation.

The aim of the contingency theory has been identified as two-fold by Ritchie and Marshall (1993):

a) Determining the probability of existence of relationships between specific elements in the environment of organizations

b) Identification of various organizations‟ responses to these elements in order to provide guidelines for other organizations with similar environmental influences (these influences should not be necessarily identical)

This thesis would extract and focus on the interaction between various risks influencing the project; that along with the specific influences of environment on risks and general responses to them; forms the foundation of the risk management process.

Contingency theory has been criticized by authors like Galbraith (1973) and Schoonhoven (1981) on the ground that it has problems such as lack of clarity in its theoretical statement. As a consequence of this problem, theoretical statements also fail to provide any clues about the specific form of the interaction intended. These criticisms are argued in Discussion chapter more fully when the theory is getting evaluated - including the researcher's considered view of the criticisms that other authors have made about the contingency theory. Although some objections may have been pointed out about contingency theory, it was found to be the most appropriate theory for this study as it is risk-based (the focus of the thesis), which gives it the power to take into account the environmental circumstances that can be considered as a significant source of risk for construction projects (Noor and Tichacek, 2009).

2.6.2.. Contingency Theory in Context of Construction Risk Management

As discussed earlier, contingency theory recognizes that there are a range of contextual variables (risks), each influencing the project that the theory is going to be applied to. Examples of these variables are external environment, technology, organizational structure and size, cost, culture, people involved, supply chain, strategy.

This thesis investigates the influences of these risks and the interaction between them on construction projects. Any of these risks may have an influence on a project and hence contingency theory can be suitable to be used for covering these influences depending on the situation in the central and the greater Accra regions of Ghana.

Adaptation in contingency theory mostly happens through organizational learning which can be defined as any modification of an organization's knowledge occurring as a result of its prior experience (successful or unsuccessful). Madsen and Desai (2010), believe that "organizational knowledge is not static; it is created, refined, altered, and discarded as organization members experience reality and attempt to update their individual and shared understandings of it to reflect the lessons they draw from their experience". This thesis also makes use of past experience of people involved in construction projects as a key tool for managing the risks.

Panthi et al. (2009), have pointed out that construction projects are complex and unique, and because it is difficult to evaluate the level of risks in construction projects, it is therefore also hard to apply risk management activities appropriately. One of the unavoidable outcomes of a construction project is variation that may lead to adverse impacts on time, cost and quality. Hence, utilizing contingency theory in projects is useful for mitigating these variations that arise later, through organizational learning which uses past experiences and applies them to current situations where possible. These guidelines can be communicated vertically within an organization and horizontally between organizations.

As discussed above, contingency theory is predominantly created for elimination/mitigation of adverse impacts of unforeseen events and therefore contingency cost can be considered as a significant element of contingency theory for confronting these events. Therefore, in this thesis, different categories of risk are

evaluated with a particular attention on cost and contingency cost. Cost is very influential in construction projects because except from the factors which may impact the cost of any project in its lifetime; the construction projects mostly have a bidding phase dealing with competitive estimation of an appropriate cost for implementing the project and this is what contingency theory is capable of, as it is risk-based and flexible.

Liu and Low (2009), have considered flexibility as a key solution for the modern businesses and their associated disorders (risks) and therefore have emphasized on the ability of contingency theory for presenting an explanation depending on the conditions and facts of each specific case. As Figueiredo and Kitson (2009), have presented "contingency is a cost element of an estimate to cover the probability of unforeseeable events to occur and that if they occur, they will likely result in additional costs within the defined project scope." Some costs in the projects cannot be readily determined or they are significant in the aggregate but too small to be estimated individually; so in order to account for these costs it is useful to include contingency in any cost estimate such as cost estimation for construction projects (Humphreys and Wellman, 1996). It should be noted that contingency is different from allowances in the projects. The events which are expected to occur and are within the scope of the project drive the allowances and as a result the allowances are not risk-based or dependent (Noor and Tichacek, 2009).

Contingency, as an estimated value of the risks which are not covered by contract terms or insurance but may be encountered during the project's implementation, can be determined through various approaches. A fixed value of 5-10% of total costs has been suggested by many text books to be added to project cost as the contingency cost. Smith and Bohn (1999) have also reported the same fixed percentage (5-10%) of the contract value for the contingency cost. This is also in

agreement with assertion of many other authors about accuracy level of the contingency estimation for the construction projects being remained at around 10% level for the past four decades (McCaffer, 1976; Flanagan and Norman, 1983; Morrison, 1984; and Yeo (1990) have considered this fixed percentage of the estimated budget as contingency to be 10-15%.

However, given the complicated nature of construction projects; the common traditional practice of allocation of a fixed percentage (ranging from 5% to 15%) of the estimated budget or the contract value as the contingency may not be appropriate. From the researcher's professional experience, complexity of the projects and inherent uncertainty in the project execution and involved parties" performance make it very difficult to forecast the exact budget of the construction projects precisely. As a result of this, it is required to include contingency as a funding source in projects" budget in order to provide the flexibility for the managers to address these deviations. So, how is it ever possible to estimate a fixed percentage of the project budget as the contingency when the budget itself is not precisely estimated.

Moreover, there are other factors that contingency allocation is dependent on such as the attitude of involved people towards risk (risk averse, risk neutral, risk taking), the expected return, how well the scope of the project is defined at the time of cost estimation, the level of risks on a project, organization's state in relation to available work, the type of contract chosen for the project, the economic situation of the country in which the project is taking place (Ranasinghe, 1994).

Therefore, contingency estimation should be considered as one part of the risk management process (Figueiredo and Kitson, 2009) and the contingency cost should be large enough to cover the impacts of risks but not to exceed the needs of the project. Allocating contingency is largely based on the estimator's perception of the project

risks and therefore a matter of judgment. Contingency may be derived through statistical analysis of past projects, by applying experience or through a projection based on assessed probability of what may occur. Risk assessment can provide the data which can be used for determining the degree of contingency to be assigned to each risk associated with a new project but because it is hard to estimate the monetary impact of these risks in a deterministic manner, a range is given to them (Minassian and Jergeas, 2009). This is the reason why the same fixed range (5-15%) cannot be allocated to all construction projects as the range for each project is dependent on various factors specific to that project as mentioned above. Even though each of these techniques may be used for any type of contingency prediction and estimation; the most common approach is still using previous experience that is the main characteristic of contingency theory through organizational learning (Gunhan and Arditi, 2007).

Since the contingency theory is risk-based, it can be sufficient to manage the realization of risks and as a result has been chosen as the theoretical framework of this thesis which is focusing on the risks associated with construction projects. As discussed above, the theory is the fit between organizations and contextual variables with the environment being considered as one of the important variables for any organization and subsequently the project which the organization is implementing.

Gunderman and Applegate (2005), recommended that, firms should develop their capacity by striking a balance between the opportunities that confront them and the possible negative consequences of risk and the ability to undertake such exercise places the firm in a higher pedestal to arrive at an acceptable conclusion.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, a description of data collection procedure adopted for this research is described. This chapter also provides the information about research design, target population, sampling technique and sample size. It also discusses in detailed methodology and tools. Two approaches were used in achieving the aim and objectives of this study. First of all vital information relating to the thesis topic was gathered through the literature review and the second, was through questionnaires, interviews and observations. Data collecting procedure has also been discussed.

3.2. Descriptive Research Design.

The researcher used descriptive Survey design. It involves the collection of information from a sample of individuals and organisations through their responses to questions and observation. When we want to describe individuals, groups, activities, events, or situations, descriptive research is appropriate. Geertz (1973) described descriptive research design as "thick descriptions" of social life (those that provide details, meanings, and context), typically from the perspective of the people living it. Researchers may turn to rigorous observation or related methods of interview in order to document how things are experienced, with respect to the phenomenon under investigation in this context it is the risks clients in the construction industry face. It can also be explained as a statement of affairs as they are at present with the researcher having no control over variable. Moreover, "descriptive studies may be characterized as simply the attempt to determine, describe or identify what is, while analytical

research attempts to establish why it is that way or how it came to be" (Geertz, 1973) Descriptive research is "aimed at casting light on current issues or problems through a process of data collection that enables them to describe the situation more completely than was possible without employing this method. In its essence, descriptive studies are used to describe various aspects of the phenomenon. In its popular format, descriptive research is used to describe characteristics and/or behaviour of sample population.

Descriptive research design strategy mainly gives emphasis to qualitative methods but it can also cover quantitative data. Therefore, empirical data which is focus of Descriptive research study can be quantitative (objective), qualitative (subjective) or combination of both.

3.3. Population

The population for the study was the contractors (D1K1), Consultants, Public and Private Clients in the Construction Industry in the Greater Accra and Central Regions of Ghana who were undertaking on-going project.

3.4 Sampling Techniques and Sample Size

Wood and Haber (1997), describe sampling as the process of selecting representative units of a population for the study in a research investigation. Scientists derive knowledge from samples; many problems in scientific research cannot resolve without employing sampling procedures (Wood & Haber, 1997).

Sampling serves to provide practical ways of ensuring that data collection and processing aspects of research are done whilst making sure that the sample is a true reflection of the population (Fellows & Liu, 1997).

. Purposive sampling was used. The researcher main target of the population were experience contractors who have been in the industry for not less than 3 years and who are executing ongoing projects. The clients and the consultant for these projects were also targeted. District and Municipal Assemblies were contacted to provides location of construction projects and their contractors in areas such as Accra, Cape Coast, Komenda, Elmina Kasoa. The reason why the researcher selected these areas was as result of proximity. Projects such as factories, office accommodation, roads, bridges, sea defense and residential facilities. In all ninety (90) sample size was used consisting of 30 each of the three stakeholders (clients, contractors and consultant) were obtained for the study (Table 3.1).

Table 3.1: Respondents Profile

Profession	Frequency	Percentages (%)
Clients (public)	15	16.7
Clients (private)	15	16.7
Contractors	30	33.3
Consultants	30	33.3
Total	90	100

3.5. Data collection Techniques.

The instruments used for the research were observation, Questionnaire and Interview

3.5.1 Observation

The researcher visited some on-going projects sites to familiarize himself with the operations and situations at the site. The researcher visited completed projects, stalled as well as on-going ones. Issues that were observed were; various stages of the

projects, the state and conditions of the projects, the duration of the project, risks that have occurred. Places visited include Komenda, Elmina, and Cape Coast all in the Central region. The researcher also visited Weija, Kasoa, Accra central.

Projects visited at Komenda includes; Sea defense project, Administrative Block, Auditorium as well as Four storey-bulding classroom block. The researcher also visited Komenda township road projects and Komenda sugar factory projects.

The researcher also visited Elmina landing beach project and the construction of bridge over the Benya lagoon. At cape coast the researcher visited university of cape coast and observe office complex being built.

A visit was also made to Weija and Kasoa to observe residential facilities being built by Estate developers and individuals.

3.5.2. Questionnaires

The researcher designed and developed questionnaires for contractors, consultants, clients, the main respondents.

Among the issues dwelled on involved:

1. The organization profile (contractor or consultant): this information dealt with the demographics with respect to the firm's financial class, years of experience in the construction, professional background of respondents, kind of projects they undertake, the duration and the cost.
2. Identified risk factors and their severity that affect construction projects: The second section dealt with the awareness of risk in general and risk that affect particular project.
3. Management of risk on a project: the section dealt with the measures that can be taken to manage construction project risk and other useful suggestions.

3.5.3 Interviews

The researcher designed and developed interview guide for clients.

Among the issues dwelled on involved:

- The nature or type of projects being executed.
- construction project risks being encounter
- risk management strategies
- implementation of contingency plans
- suggesting for mitigation strategies for the risks which they believed were more critical.

3.5.4. Validity of the Research

Questionnaire was reviewed by researcher's supervisor. The supervisor looked through whether the questions agreed with the scope of the items and the extent to which these items reflect the concept of the research problem and also if the instrument used is valid statistically and that the questionnaire was designed well enough to provide relations and tests between variables. The supervisor made the necessary corrections and suggestions that were relevant to the study.

3.5.6. Ethical considerations

Ethical principles were applied in this thesis in order to prevent ethical issues, because people were involved in questionnaires and interviews and the researcher's behaviour with them was important. Participants were assured that their information is kept confidential, they have the right to withdraw at any time and everything is with their consent, there is no deception and they were informed about every single step.

3.5.7. Data analysis

When the completed questionnaires had been collected by e-mail, the data was entered in the Statistical Package for Social Science (SPSS 16.0). All questions and sub-questions were converted into variables. Each answer alternative was coded using value labels. In total, 122 variables were entered and used for the analysis. Fellows and Liu (2003) differentiate three main forms of content analysis – qualitative, quantitative and structural. Despite a set of quantitative data, in all a sample of 90 responses was enough for a deep statistical analysis. Thus, simple SPSS tools such as descriptive statistics and custom tables were used. With their help frequencies, means, distributions and rankings were obtained. In order to illustrate statistical data, graphs were constructed in Microsoft Excel. The analysis of questionnaire data formed a basis for the interviews.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter represents the results and discussion of the data collected for the study. The results were analysed to establish the current levels of risk awareness, risk identification and methods used to deal with risks that affect the construction projects in the Central and the greater Accra regions of Ghana.

The results and discussions were done based on the data obtained from observation, questionnaire and interview. Frequency tables and figures were created, where appropriate, in support of the descriptive analysis to clarify their status.

4.2 Demographic variables and respondents' profiles

Table 4.1 shows the return rate of participate in the study. Thirty (30) contractors and 30 consultants were given questionnaires to respond, whereas 30 clients were interviewed. From Table 4.1, twenty-eight (28) out 30 clients that made up of 93.33% allow themselves to be interview. Twenty-six representing 86.66% contractors and 25 representing 83% Consultants out of 30 each returned the questionnaires filled. It is noticeable that, the gap among the three (3) responses in the study was not generally wide.

Table 4.1 Details of **Respondents Rate**

Job Title	No. Sent.	No. Received	Response Rate (%)
Clients	30	28	93.33%
Contractors	30	26	86.66%
Consultants	30	25	83.33%
Total	**90**	**79**	**87.77%**

4.3. Result of Observation.

The result of observation were obtained from sites visited at Komenda, Elmina, Cape Coast, Kasoa in the Central Region, and Weija and Pokuase in the greater Accra Region.

4.3.1 Observation at Komenda.

Figure 4.1 shows an uncompleted administration block at Komenda College of Education in the Central Region of Ghana. The construction of the block started in 2011. The project was to be completed in twelve (12) months. At the time of the visit (March, 2021), about 80% of the project has been completed researcher observed that There were few workers (6) on site. The progression of the work was very slow. upon enquiries, the researcher found out that the main challenge has been lack of funds. The project is a Ghana Education Service Trust Fund (GETFUND) sponsored project. According to the contractor, the delay in honoring the certificates by the Clients has caused the long delay in the completion of the project.

Figure 4.1 Uncompleted admiration block started in 2011.
Source (researcher's field data)

The Komenda Sugar Factory, was built at a cost of $35 million from an Indian EXIM Bank facility, it was inaugurated by then President John Mahama in May 2016, when the researcher visited the factory site, it was observed that the factory has not been completed to produce sugar. There were no raw materials (sugar cane) available. they were a few workers (8) who are there to maintain the facilities. The researcher's observation agrees with the parliamentary report (2017) that there many challenges, including the unreliable supply of sugarcane for continuous processing after the preliminary test run, hampered the operations of the company. Figure 4.2 shows the factory with weeds grown around it.

Figure 4.2 Komenda sugar factory established in 2016.
Source (researcher's field data)

Road rehabilitation and construction have become challenge for both contractors and clients. A 8.5km road construction from Komenda Junction to Komenda College of education which was started in 2016 was abandoned six (6) months later. The researcher found out that the road construction projects has passed through the hands of four different contractors yet it has not been completed. A source at the Municipal assembly gave the reason of legal, political and financial reasons as the cause of the projects. Figure 4.3 shows the nature of the road the some of the equipment left to rot.

Figure 4.3. An abandoned 8.5km road rehabilitation project from Komenda junction to Komenda College of Education started in 2016. Source (field data)

Another facility the researcher visited to observed was an abandoned Auditorium Hall for Komenda College of Education (Figure 4,4) in the cause of the research it was found out that the original contractor has outsource the project to another person who is founding it difficult to raise funds for the project.

Figure 4.4. Stalled auditorium project started in 2015 at Komenda College of Education. Source (researcher's field data)

4.3.2 Observation at Atonkwa/Cape Coast.

A visit to Atonkwa one of the communities around Cape Coast municipality discovered that a church auditorium which was started in 2019 has been abandoned due to persistent flood occurring in the area. It can be seen from figure 4.5 the structure of the abandoned building and flooded area.

Figure 4.5 A 2500 capacity church auditorium abandoned at Atonkwa since 2019.

4.3.3 Observation at Elmina.

Figure 4.5 shows a Central coastal line sea defense construction project started in 2019. The project is stretched from Elmina Komenda, and the rest of the coastal towns along the Central and Western region of Ghana. When the researcher visited the project site at Elmina it was observed that the project was on going but sand wining activities by the inhabitant has affected the work and the work is at a slow pace. Some of the inhabitants' buildings have blocked the road that led to some part of the construction site making it difficult for the heavy-duty trucks to have access to the site. Moreover, the tidal wave has affected other stretch of the beach that was not included in the project. Some part of the beach is considered as sacrilege and the people are not allowing the construction to go on there.

Figure 4.6 Sea defense project at Elmina-Komenda. Source (field data)

4.3 .4 Observation at Kasoa

Land litigation is one of the major causes of demolition of properties in Ghana. Figure 4.7. show a private property destroyed as a result of dispute over a piece of land at Kasoa in the central Region of Ghana. The researchers observed that during his visit three people were claiming ownership of the same piece of land as a result each party

has employed the services of land guards to demolish the uncompleted building on site. Similar incidence happened at Weija in the Greater Accra region

Figure 4.7. Private property demolished as due to land ligation at Kasoa-Central Region. Source (researcher's field data)

4.4.5 Observation at Weija

Another construction project visited is a six-classroom block started in 2016 situated at Weija in the Greater Accra region. Figure 4.8 shows the stalled project since 2017.for lack of funds. The contractor has promised on so many occasions to come to the site but he has failed to do so.

Figure 4.8. Classroom projects stalled since 2016.

4.4.5 Observation at Pokuase

The researcher visited the Pokuase interchange in march 2020. Figure 4.9 shows the state of the project.it was disclosed by the consultant that due to the COVID 19 pandemic, the project completion date will cannot be met. This because all the expatriates have for their countries and also it is difficult to get the imported materials.

Figure 4.9. Pokuase interchange. Source field data (April, 2020)

4.4. Results and Discussions of Questionnaires.

The result of questionnaires were obtained from Contractors and Consultants. Among the issues discussed involved:

- Contractors and Consultant response rate.
- Number of Project executed by Contractors and Consultant
- Contractors and Consultant level of experience
- Categories of project executed by Contractors and Consultant

- Duration. of construction project executed by Contractors and Consultant
- Contractors and Consultant responses on construction project risks and its severity that affect construction project.
- Contractors and Consultant views on strategies to mitigate construction project risk.

4.4.1 Results and Discussion of questionnaires from Contractors

The result in table 4.2 shows the breakdown of participant's organizational background information. Most of the contractors were represented by the personnel to respond to the questionnaires.

The results show that out of the total of number of 26 participants, 9 representing 34.6% management staff made up the largest proportion of the total responses; 2 Directors who participated made up the smallest proportion. 8 respondents were Senior Management staff, making up 30.8% of the total, and the remaining 7 representing 26.9% was made up of Site Engineers. The various groups gave a fair idea about the topic under discussion.

Table 4.2 Contractors' response rate.

Respondents	Frequency	Percentage (%)
Management staff	9	34.6
Directors	2	7.7
Senior management staff	8	30.8
Site engineers	7	26.9
Total	**26**	**100**

Table 4.3 also gives information regarding the number of projects executed by the firms in the last five years. The results indicate that the participating contractors

who had executed 21 or more projects made up the largest proportion of total responses at 34.6%. Seven (7) respondents had executed projects between 11-15 representing 26.9%. Six representing 23.1% had executed projects between 16-20. made up 29.3%. The remaining 15.4 % was made up of four (4) contractors with ten or less executed projects.

Table 4.3 Project executed by contractors

Range	Frequency	Percentage (%)
10 or less	4	15.4
11-15	7	26.9
16-20	6	23.1
21 or more	9	34.6

Figure 4.10 gives the number of years of experience of Contractors in construction. The figure shows that majority of the construction organisation numbering fifteen (15) that made up 57.7% of the total have practiced or executed projects for more than ten years. 23.1% of the construction organisation representing six respondents have between 6 to 10 years' experience in construction. Few of the organisation numbering five and at 19.2% have more than three years but less than five years.

Significant, much of the information used for this study is obtained from very experienced Contractors in terms of projects executed and from respondents (senior managers) who are at the decision-making positions and thus will have better information regarding risk and its management in the firm and can be considered as expert judgments on behalf of the firm and thus credible for the purposes of the study carried out. Interestingly it came out that contractors who have been on the job for long

time have also executed more projects. There is a correlation between number of years in the industry and the number of projects executed.

Figure 4.10 Contractors' level of experience

Categories of project executed by contractors is represented in table 4.4 which shows a kind of project contractors executed for their respective clients. Out of 183 projects, building took 125 representing 68.3%, whereas the rest (58) were represented by 31.5%.

Moreover, 143 projects which make up of 78.1% of the 183 projects were initiated by the government and only 40 (21.9%) were initiated by the private clients. This Cleary show that contractors mostly rely on the state institutions for project contract.

Table 4.4: Categories of project executed by contractors.

Project types	Frequency	Clients(public)	Clients (private)
Buildings	125	93	32
Roads	25	25	-
Bridges	5	5	-

Others	28	20	8
Total	**183**	**143**	**40**

The researcher wanted to know the duration for the project undertaken by the contractors. Figure 4.11 show that 68 representing 36% of the 183-project studied was given a duration of 18 months to complete. Fifty-one (51) representing 27% were design to take 6 months to complete. Fifty representing 26% and the least 21 representing 12% were design to take 12 and 24 months to complete respectively. This shows that most of the projects taken by contractors are short- and medium-term project that takes less than 15 months to complete.

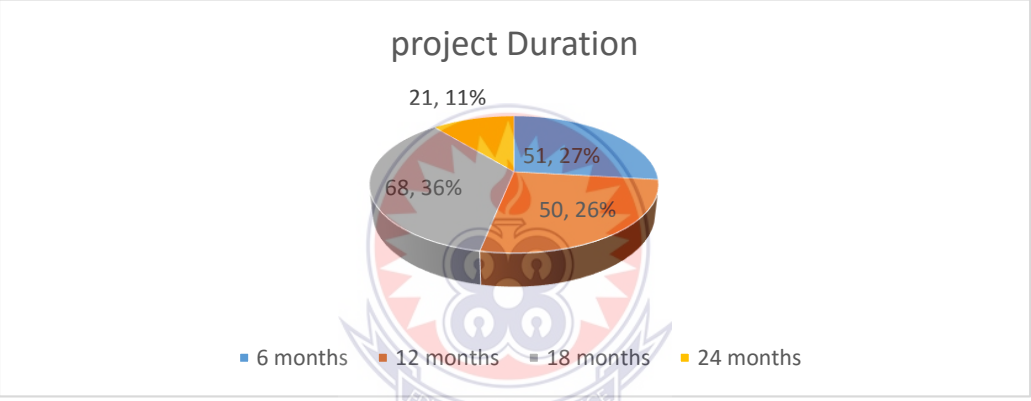

Figure 4.11 Project Duration

4.3.2. Contractors' views on Risks that affect construction project.

This section of the questionnaire includes 10 main risks listed for the contractors, asking them to rank their severity from low to high (1-3). Table 4.5 shows the level of severity for the construction project risks in central and Greater Accra regions of Ghana. As it is seen, the first four risks in terms of severity are the final project cost exceeding the project budget, late completion of project, shortage of resources and late payment. Referring to the risk categorization presented earlier, it can be determined that all these three risks are sub-categories of Economic and Financial category. This indicates the great significance of influences of economic and financial

risks on the construction projects in central and greater Accra regions. This is also followed by political or government influence on construction projects. Environmental and poor safety conditions ranked lowest.

Table 4.5. Risk Severity allocation by contractors. 1=Low, 2=Medium, 3=High

S/N	Risk category	Frequency	Yes	No	3	2	1
R1	The final project cost exceeding the project budget	26	-	-	26	-	-
R2	Late completion of project	26	-	-	26	-	-
R3	Shortage of resources	26	-	-	26	-	-
R4	Late payment	26	-	-	26	-	-
R5	Political/Government influence	26	-	-	19	7	-
R6	Force Majeure	26	8	18	13	4	13
R7	Technical	26	14	12	10	4	10
R8	Contractors' performance below expectations	26	6	18	4	4	18
R9	Poor safety conditions	26	10	16	8	9	8
R10	Environmental conditions	26	10	16	5	10	10

Table 4.6 shows the mean responses of the respondents that made it easier for allocation of the risk categories in to High, Medium and low severity.

Each risk in the questionnaire had a scale of 1-3 to for its severity. While analyzing, numbers in this scale have been grouped together in order to make the understanding of the results easier: as low, medium and high severity. Conforming Table 4.6 with figure 4.7, it can be realized that the first 5 risks in figure 4. has been fallen in the "High severity" group, followed by the next three risks in the "medium" group, and the last two risks in the "low severity" group.

Table 4.6 Mean distribution of contactors responses.

Categories of risk	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
The final project cost exceeding the project budget	26	2.00	.000	.058	1.48	1.72
Late completion of project	26	2.00	.000	.024	1.89	1.99
Shortage of resources	26	2.00	.000	.058	1.50	1.74
Late payment	26	2.00	.000	.033	1.66	1.79
Political/Government influence	26	1.73	.452	.026	1.32	1.65
Force Majeure	26	1.50	.510	.024	1.74	1.99
Technical	26	1,73	.452	.037	1.42	1.64
Contractors' performance below expectations	26	1.71	.460	.025	1.51	1.70
Poor safety conditions	26	1.31	.471	.058	1.49	1.74
Environmental conditions	26	1-19	.402	.033	1.56	1.79

Table 4.7. Contractors' allocation of 10 construction project risks to three groups of high, medium and low severity

Low	Medium	High
Poor safety conditions	Force Majeure	The final project cost
Environmental conditions	Technical	exceeding the project budget.
	Contractors' performance below average	Late completion of project.
		Shortage of resources
		Political /Government
		Late payment

4.3.3. Contractors' views on strategies to mitigate construction projects' risks.

For each of the 10 broad risks discussed above, there were one or more mitigation strategies proposed by the researcher in the questionnaire and the participants were asked to rate the effectiveness of these strategies.

The scale related to six of the mitigation strategies were presented as follows for analysis:

1: Not effective at all
2: Slightly effective
3: Somehow effective — Not Effective
4: Effective
5: Very effective — Effective

- **Mitigation Strategy 1 (MA): Control cost overrun.**

The contractors' responses on MA were shown in table 4.8

MA1: Ensuring that the budget is accurate. Budgets should continually be assessed and updated through the life of the project to take account of all the known information and changes. Check that the budget includes all of the costs and that these costs are an

accurate assessment. Where necessary include suitable contingencies and allowances for unknown costs.

MA2: Minimizing changes and variations during both the design phase and during construction.

From the contractors' point of view, they see MA1 & MA2 as the effective way the clients can adopt to minimize the cost overrun. .

Table 4.8 (MA) Controlling cost Overruns

Exceeded Budget	**MAI**	**MA2**	**MA3**
Not effective	-	-	26
Effective	26	26	26
Total	**26**	**26**	**26**

- **Mitigation Strategy 2 (MB): Minimize project that often finish late.**

  The contractors' responses on MB were:

MB1: Ensure that the schedule is realistic by employing experienced project managers.

MB2: Reduce and eliminate changes by ensuring that the project scope is properly prepared and complete and that the contractor has all the information when they price the project.

MB3: Experience contractors should be selected and their available resources for the project. Majority were of the opinion that MB1, MB2 and MB3 were effective for making sure that delay in completion of a projects are minimize as shown in the table 4.9.

Table 4.9: (MB) Controlling time Overruns

Late finish	**MBI**	**MB2**	**MB3**

Not effective	6	11	-
Effective	20	19	26
Total	**26**	**26**	**26**

- **Mitigation Strategy 3 (MC): late payment of projects cost.**

  The contractors' responses on MC give their views in indicated in table 4.10 are as follows:

MC1: Paying their contractors fairly and on time (in terms of the contract) and not withholding money without due reason.

MC2: Thoroughly checking the contractor's financial affairs before awarding them the contract.

MC3: Always being aware when the contractor is running into financial difficulties (possibly they have another project which is in trouble and taking steps to limit their risks. Majority were of the opinion that MC1, MC2 and MC3 were effective for making sure that delay in completion of a projects are minimize.

Table 4.10: (MC) late payment of projects cost.

Contractor bankrupt	**MCI**	**MC2**	**MC3**
Not effective	-	7	-
Effective	26	19	26
Total	**26**	**26**	**26**

- **Mitigation Strategy 4 (MD) : Minimize shortage of Resources**

Contractors' response on MD which has been indicated in table 4.11 are discussed as follows: Majority were of the opinion that MD1, MD2 and MD3 were effective for making sure that shortage of resources to the projects are minimize

MD1: Projects can be rescheduled to start when the level of construction falls, which could even make the resources, and consequently the project cheaper.

(MD2) The project could be designed to make use of modules which could even be constructed in areas where resources are more available. Alternative materials could be used which are more readily available, or which aren't so labor intensive to install.

(MD3): The duration of the construction work could be extended to account.

Table 4.11: (MD) Overcoming of Resources Constraints

Shortage of resources.	**MDI**	**MD2**	**MD3**
Not effective	10	11	-
Effective	16	19	26
Total	**26**	**26**	**26**

- **Mitigation Strategy 5 (ME): Political/Government influence**

Contractors' responses on political and government influence of project.

ME1: experience contractors should be given the contract rather than party affiliations.

ME2: Contract awarding should be decentralized

ME3: Political projects should be avoided especially election year.

It is obvious that ME1 and ME2 attracted the most effective among the 3 strategies as indicated in table 4.12

Table 4.12: (ME) Political/Government influence

Political/Government	MEI	ME2	ME3
Not effective		11	13
Effective	26	19	13
Total	**26**	**26**	**26**

- **Mitigation Strategy 6. (MF): Contractors' Performance below expectation**

(MF) contractor's performance below expectation can be mitigated by:

MF1: checking the background of contractors before awarding contract.

MF2. Avoiding nepotism and favoritism

MF3. Checking the history of project executed by the contractor.

With the exception of MF3 which has divergent view MF1 and MF2 attracted the majority view as indicated in Table 13 that that nepotism and, favouritsm should be avoided. Also, the background of the contractor should be thoroughly checked before awarding any contract.

Table 4.13: (MF): Contractors' Performance below expectation

Contractor's poor performance	MFI	MF2	MF3
Not effective		11	13
Effective	26	19	13
Total	**26**	**26**	**26**

4.4.2 Results and Discussions of Questionnaire from Consultant.

The number of years the consultants have been were also analysed. It was used to indicate the number of years of experience of consultants in the construction industry and number of construction projects they have supervised.

The figure as it is shown in the table 4.14, shows that majority of the consultants (16) that made up 62% of the total have practiced or executed projects between 6-15 years.

There is a correlation between number of years in the industry and the number of projects executed. The more a consultant stay in the job the more he or she supervised projects that give him experience.

Table 4.14. Consultant level of experience and projects supervised.

Level of experience	Frequency	Percentage (%)	No. of Project Supervised
1-5 years	7	28	21
6-10 years	8	32	50
11-15 years	8	32	72
16 or more years	2	8	88
Total	**25**	**100**	**221**

4.4.3. Consultants' views on Risks that affect construction project

This section of the questionnaire for the consultant is like the similar one given to the contractor which includes 10 main risks listed for the contactors, asking them to rank their severity from low to high (1-3). Table 4.15 shows the level of severity for the construction project risks in central and Greater Accra regions of Ghana. As it is seen, the first four risks in terms of severity are the final project cost exceeding the project budget, late completion of project, shortage of resources and late payment. Referring to the risk categorization presented earlier, it can be determined that all these three risks are sub-categories of Economic and Financial category. This indicates the great

significance of influences of economic and financial risks on the construction projects in central and greater Accra regions as perceived by the consultant. This is also followed by political or government influence on construction projects. environmental and poor safety conditions ranked lowest.

Table 4.15: Risk Severity allocation by consultants. 1=Low, 2=Medium, 3=High

SN	Risk category	Frequency	Yes	No	3	2	1
R1	The final project cost exceeding the project budget	25	-	-	25	-	-
R2	Late completion of project	25	-	-	25	-	-
R3	Shortage of resources	25	-	-	25	-	-
R4	Late payment	25	-	-	25	-	-
R5	Political/Government influence	25	-	-	15	10	-
R6	Force Majeure	25	13	12	13		
R7	Technical	25	15	10	10	5	10
R8	Contractors' performance below expectations	25	14	11	10	5	10
R9	Poor safety conditions	25	11	14	8	9	8
R10	Environmental conditions	25	12	13	5	8	7

4.4.4. Consultants' views on strategies to mitigate construction projects' risks.

For each of the 10 broad risks discussed above, there were one or more mitigation strategies proposed by the researcher in the questionnaire and the participants were asked to rate the effectiveness of these strategies.

The scale related to six of the mitigation strategies were presented as follows for analysis: the views expressed by the consultants were as similar to the contractors.

4.4.5. Results and Discussions of interview from clients.

The results of interview were obtained from the clients who were represented by clerk of works and other senior personnel. Among the issues discussed involved:

- The nature of construction projects executed and their sizes.
- Risk that has been affecting the project
- the impart or effect of the risks on the execution of the project?
- Organizational processes have for managing/mitigating risks
- Development of the contingency plans
- The learning process of what has happened during the project

Issue 1: The nature and size of projects clients executes.

The types of projects clients had initiated before in the time of interview sessions comprised projects from majority of the types: roads, factory housing complex, shopping mall, administrative blocks, sports facility, bridge, school, students' accommodation, warehouse and sea defense. In all 120 projects were counted. Majority (75) of the projects were from the governments and buildings are dominated as shown in figure 4.12.

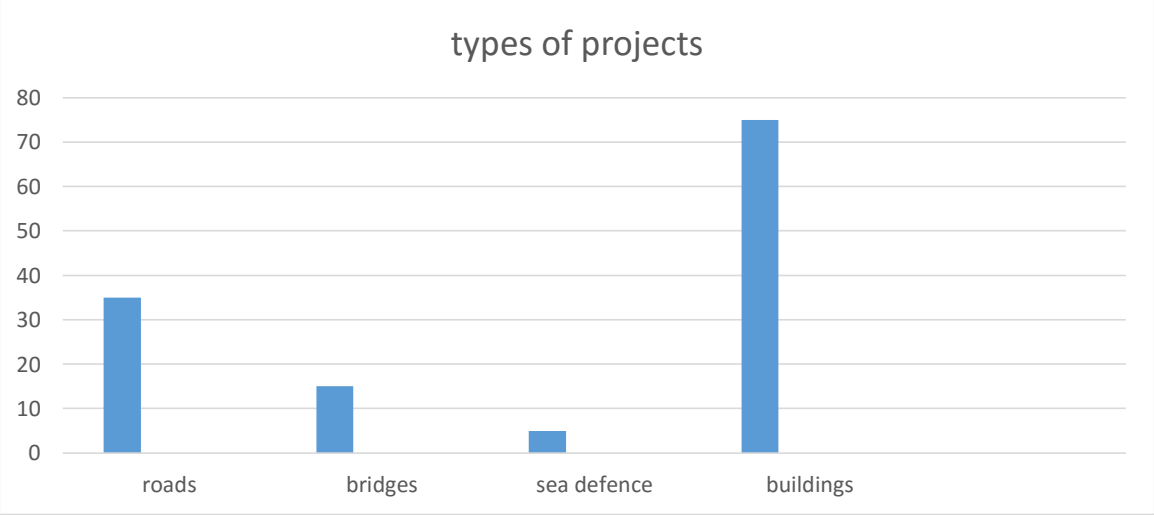

Figure 4.12 Projects initiated by various clients

Issue 2: Clients view on risk that affect construction projects

The responses provided by interviewees to this statement were grouped using the 10 main categories of risks. These were Late completion of project., Shortage of resources, Political /Government, A major contractor or supplier becoming bankrupt, the final project cost exceeding the project budget, Force Majeure, Contractors' performance below expectation, A project that does not perform as required, Poor safety, Poor public perception of the project.

The results shows that majority of the respondents (28) representing 100% consider th**e** final project cost exceeding the project budget, Major contractor or supplier becoming bankrupt, Shortage of resources and Contractors' performance below expectation are major risk in the construction industry.

Issue 3: Clients view on the effect of the risks on the execution of the project.

The issue of the effect of the risk on the construction project the clients were executing. Their views are as follows:

The final project cost exceeding the project budget: Not only could this make the project unviable in the long term, but it could even lead to the client becoming bankrupt.

Late completion of project: We cannot earn revenue from the project, or they incur additional costs to use other facilities in the interim. Delayed projects also inevitably incur additional supervision and management costs.

Issue 4: clients view on development of contingency plans to manage risk.

The response clients gave out show that majority of the 24 of the clients representing 86% stated that their organization does not have any processes for managing the risks and they think of a solution whenever risks arises. However, 15 indicated that they

planned to manage the risks at the start of project by trying to measure the time and cost precisely and they review the plans during the project for application of any changes. Moreover, they control other parties' progress in order to finish the project on its defined time.

Issue 5: The responsibility for evaluation of the effectiveness of the contingency plans

On the above issue twenty-six (26) clients (86%) indicated that nobody is assigned a specific role for evaluating the effectiveness of the contingency plans managing the risks. They again declared that they do not have any mechanism for reviewing the plans. They were of the opinion that, construction projects are so different from each other in Ghana and it is not possible to apply the experiences on any new project.

- **Comparative analysis of mean distribution among the clients, contractors and clients**

After looking at the mean of construction risks from the viewpoint of all the respondents, analysis was continued to investigate existence of any difference between viewpoints of three individual groups of clients, contractors, and consultants. Therefore, mean of responses for each of these groups were measured and then ANOVA test was utilized in order to find out whether or not the means of these groups are equal. The results are shown in tables 4.16 and 4.17.

Table 4.16. Descriptive

Total Risk category

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Contractor	26	1.60	.297	.058	1.48	1.72
Clients	28	1.94	.129	.024	1.89	1.99
Consultant	25	1.62	.292	.058	1.50	1.74
Total	79	1.73	.292	.033	1.66	1.79

As the p value shown in table 4.17 is .004, it can be concluded that there is a statistically significant difference between at least two of the three groups of clients, contractors, and consultants. The result of the test demonstrated in table 4.17 ascertains that client is the group which has slightly different opinions compared to the two other groups of contractors and consultants.

Table 4.17. ANOVA TEST

Total Risk category

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.942	2	.971	15.716	.004
Within Groups	4.696	76	.062		
Total	6.639	78			

4.5 Discussion

The focus of the risks result was related to the client who is the main sponsor, imitator and the beneficially of the project. It can be ascertained that among the severity risks are: the final project cost exceeding the project budget, late completion of project,

shortage of resources, contractor becoming bankrupt were agreed by the all the three groups as the risks that have the highest severity. These categories of risks can be classified under financial and economic risks as well as external risk. It confirms that the priority of the risks both in the list added by the participants' and the list of 10 ones evaluated by them goes to the Economic and Financial risks. This is confirmed by Ahmed *et al.* (2001) which says that majority of risk that affect the construction industry are economic and financial risk.

From clients, the first three risks in terms of severity are late completion of projects, contractors' performance below expectation, over increase of cost of a project.

It can be deduced that the frequency of Economic and Financial risks is still the same for the consultants comparing to the clients and contractors but Political and Governmental risks have got lower criticality for them.

Clients and contractors are two sides of the contract, one is paying for the project and the other is expending that money for the execution of the project. They have different responsibilities and subsequently seeking different benefits from the project such as importance of social position for the clients or importance of financial benefits for the contractors. Therefore, this may result in stating personal opinions based on their benefits and values (for the contractors and clients) whereas these opinions may be more impartial for the consultants due to their position in the contract and also during the execution of the project. Consultant is neither responsible for paying the budget of the project nor expending the majority of that budget and is appointed as an intermediate between the client and the contractor. Hence, opinion of the consultants can be considered to be less influenced by the personal benefits and more based on the risks influencing the project in general and this can be assumed as a reason for the sameness of their opinions to the overall ones.

Focusing on the dissimilarity of the clients‟ opinions compared to the rest; still two out of three risks fall in Economic and Financial category but the responses are slightly different from others. Although the client has the greatest responsibility for economic aspects and budget allocation of the project, costs overrun. According to the discussion provided. This revelation agreed with Ofori (2007) which says that client are of the opinion that economic as well as financial are considered a major risk in the construction industry.

4. 6: Steps for Risk Management Proposed by the Researcher

Before the starting of the project clients should do the following:

Stake holders in the specific projects identified

Responsibilities allocated to them

Potential risks to the project identified

Each stakeholder assigned responsibility to design a framework for managing the risk anticipated

The design framework analysed by all the stake holders

Periodic report from each stakeholder on any risk identified.

Solutions applied.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter present the summary of findings, Conclusion as well as the Recommendations.

5.2. Summary of the Findings of the Study.

1. The objective one of the study was to explore project risk in the construction industry in the Central and the Greater Accra regions of Ghana.

The study found out that there are various risk factors that are affecting the construction project in the Central and the Greater Accra regions of Ghana. Notable among them are:

1. Economic/Financial risk factor: This risk factor is affecting New Komenda sugar factory, Komenda College of Education Administration Block, Central coastline Sea defense project, Road rehabilitation from Komenda Junction to Komenda College of Education, Weija Junction cement factory project.
2. Political/Governmental Risk Factors has affected, the New Komenda sugar factory, central sea defense coastline and Road rehabilitation from Komenda Junction to Komenda college of education as a result of change of Government and political influence.
3. Environmental Risk factor has also affected the New Komenda Sugar factory project, Atonkwa E-Block project and weija cement factory project.
4. Social/Cultural risk factors, this risk factor has affected the Central coastline sea defence construction project.
5. Technical risk factor: This risk factor has affected the New Komenda sugar factory project, Atonkwa E-block construction project and Komenda junction to Komenda College of Education Road Rehabilitation.

2. **The objective two of the study was to determine the causes and the effect of the risks identified on some projects in the Central and Greater Accra regions of Ghana.**

The various risk identified were caused by the following:

- The Komenda College of Education New Administration Block, the Central coastline sea defense project and the road Rehabilitation have had numerous changes and variations. as a result it has caused cost overrun on the projects stated.
- Delay in honouring certificates for payment has also caused time overrun on the Komenda College New Administration Block, the auditorium and the road rehabilitation. As such the duration for the completion of the project has elapsed.
- The rapid Cedi depreciation against the major currencies has affected the cost of importing items for some of the project like the central coastline sea defense project, the road rehabilitation and other construction project visited
- Feasibility studies were not properly done for the new Komenda sugar factory as such the project has become standstill and is causing a lot of financial lost to the state.

Politics/Government risk factor:

- The bureaucratic processing of approving permit and other documents., change of Government, Project executed for political expediency and traditional authorities influence are some of the causes of delays that has affected project like the New Komenda sugar factory, the central coastline sea defense project and the road rehabilitation.

Environmental Risk factor was caused by unreliable rainfall pattern and it has affected the cultivation of sugar cane for the sugar factory and low water holding capacity of the soil has also affected the growth of the nursery seed for the factory farms.

Social/Cultural risk factor: Traditional and cultural practices of some of the communities along the coast has affected the construction of the Sea defense because they believed that some places are sacrilegious for that matter no human or machine should go there.

3. **The third objective was to examine the risk management practices being used to control the identified risks.**

The study found out that the strategy adopted by the stake holders was to address the situation as it occurs. No laydown strategy was put in place to manage risk

4. **Assess the practical implementation of risk management practices using contingency theory.**

Issues such as cost overrun are taken care by contingency cost, time overruns are taken care as the situation demands. There are regular site meetings to assess any prevailing issues and decisions taken.

5.4 Conclusion

The following conclusion can be drawn from the study;

Risks are being managed every day in the industry, but not in such a structured way as the literature describes. Construction risk management has not received adequate application within the construction sector in Central and the Greater Accra regions of Ghana.

Adhoc measures are taken base on peculiarity of the risks and the uniqueness of the project. Finance and economic risks as well as political and Government

interferences are considered as severe risks that affects construction projects significantly.

Utilizing contingency theory for managing risk of construction projects in these two regions of Ghana depends on economic and political conditions of the country more than other variables.

5.4. Recommendations.

The following recommendations are made to address the findings;

- Tenders should be awarded to accurate estimated cost and not necessarily to the lowest bidder. This could take the edge of high competition in bids and reduce risks' consequences by providing more profit margin for contractors.
- Exchange rate fluctuation should be considered as a risk factor by owners and donors and they should offer a compensation mechanism if there was any damage due to this risk.
- Clients should check the financial background of contractors before awarding contract to them.
- The design process is the most important phase in the construction process. Design products should be at the highest level of quality, because of that it should have more focus by clients.
- Payments of work done must be done as soon as the clients are satisfied.
- There three major stakeholders (clients, contractors and consultant) should always deliberate on the risks associated with the project and those who will be affected and suggest remedies before the project commenced.
- A thorough feasibility studies should be undertaken before any project is done.
- Beneficiary communities should be consulted when taking any project.

- The role of the consultant for managing risk in construction project in the Central and the greater Accra regions of Ghana should be well defined.
- Utilization of contingency plan needs to be made more explicit in the theory.

5.5 Suggestion for future Study

Managing risk of construction projects is a complicated area as it deals with two complex concepts: project, and risk. Although investigations have been done before on this area by various researchers and this thesis also aimed at studying it more; there are still rooms available for further research. Some suggestions are provided below for future research to focus on:

- Investigation on risk management of private construction projects in Ghana
- Comparison between private and public construction projects in Ghana and their risk management
- Assessing the socio-economic impact of managing risk in the construction project

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APPENDIX A

UNIVERSITY OF EDUCATION-KUMASI CAMPUS

DEPARTMENT OF WOOD AND CONSTRUCTION TECHNOLOGY

Dear Sir/Madam,

QUESTIONNAIRE SURVEY: CLIENTS' MANAGEMENT RISKS IN THE CONSTRUCTION INDUSTRY IN GHANA

I am currently undertaking a study aim at assessing clients' risks and how they are mitigated in the construction industry in Ghana.

This study is solely for academic purposes and your responses will be treated as STRICTLY CONFIDENTIAL. Participating Contractors and consultant will be provided with the findings of the study upon request.

I would like to thank you for accepting to assist and cooperate towards this study.

Yours Sincerely,

Frank Bentum Mensah

SECTION A

GENERAL INFORMATION

Please circle your answer

1. Which of the following category of personnel best describes you?

   a. Contractor b. Consultant

2. How many years of experience do you have in the construction industry?

   a. 0-5 years b. 6-10 years c. More than 10 years

3. How many construction projects have you been involved in?

   a. 1-5 b. 6-10 c. More than 10

4. What type of projects has your organization been engaged in?

   a. Building School b. Office and Administration Building

   c. Hospital d. Hotel and Business Center Building

   e. Civil Engineering Project f. Others, please specify …….

5. What main types of contracts are you engaged in?

a. Traditional contracts b. Design – Build – Operate

c. Others please specify:……

6. What is the average project duration?

a. Less than 12 month b. 12 month to 18 month

c. 18 month to 24 month d. 24 month to 30 month

e. 30 month to 36 month f. Others please specify…

7. What is the actual duration you used to complete the project?

a. the same duration proposed b. more than 6 months. c. more than 8 months

d. more than 1 year.

8. Has some of the project could not be completed?

If yes give reasons……

9. Are there regular assessment of risk in the execution of projects?

a. Yes b. No

10. If yes specify briefly how it is carried out……..

……..

And if NO why ……

……..

SECTION B Risk that affects clients and its severity. 1=Low, 2=Medium 3=High

S/N	Risk	Yes	No	1	2	3
1	The final project cost exceeding the project budget					
2	The project is completed late					
3	Shortage of resources					
4	Poor public perception of the project					

5	The project is completed late Incurring excessive or unnecessary costs for the project					
6	Adverse weather conditions					
7	A major contractor or supplier becoming bankrupt					
8	The project does not perform as it is required					
9	Poor safety					
10	Incurring excessive and unnecessary cost for the project					
11	Political(change of Government)					
12	Legal(land litigation)					
13	Environmental(Access to site)					
14	Social (Inhabitant attitude)					
15	Construction					

16. List ways you used to mitigate these risks mentioned.

1. ……
2. ……
3. ……
4. ……
5. ……
6. ……
7. ……
8. ……

17. Please feel free to give any additional information that may be necessary

Thank you

APPENDIX B

INTERVIEW GUIDE FOR PRIVATE AND PUBLIC CLIENTS

UNIVERSITY OF EDUCATION-KUMASI CAMPUS

DEPARTMENT OF WOOD AND CONSTRUCTION TECHNOLOGY

Dear Sir/Madam,

CLIENTS' RISKS MANAGEMENT IN THE CONSTRUCTION INDUSTRY IN GHANA

I am currently undertaking a study aim at assessing clients' risks and how they are mitigated in the construction industry in Ghana.

This study is solely for academic purposes and your responses will be treated as STRICTLY CONFIDENTIAL. Participating Contractors and consultant will be provided with the findings of the study upon request.

I would like to thank you for accepting to assist and cooperate towards this study.

Yours Sincerely,

Frank Bentum Mensah

1. What is the nature of the projects you are doing/have done and their sizes?

   ……

2. Did you anticipated some risk before you embark on the project?

   ……..……

3. If yes what are types of risks you anticipated?

   …….

   ……

   ……

   ……

4. What processes did you put in place for managing/mitigating the anticipated risks?

……

……

……

5. How do you develop the contingency plans?

……

……

……

6. What mechanisms are there for keeping the contingency plans on the review? And who is responsible for evaluation of the effectiveness of the contingency plans?

……

……

……

7 What are the actual risk(s) you faced during the execution of the project?

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……

……

8. What was the impart of the risks on the execution of the project?

……

……

……

9. At the end of the project, is there any learning process of what has happened during the project?

   How?.....

   .....

10. How is your relationship with contractor/consultant/? Do they also mitigate the risks or all the existing risks was shifted under your responsibilities?

    ……

    ……

    ……

11. What is your opinion about effective mitigation strategies for them?

……

……

Please arrange the following risks in other of severity that affect your projects. by using 1-8 in the space provided.

12. The final project cost exceeding the project budget

    The project is completed late

    Shortage of resources

    Contractors that don't perform

    A project that doesn't perform as required

    Poor public perception of the project

    Incurring excessive or unnecessary costs for the project

    A major contractor or supplier becoming bankrupt

    Change of Government

    Access to site difficult

    Land litigation

Inhabitant attitudes

1……....
2……
3……
4……
5……
6……
7……
8……
9……
10……
11……
12……..

13. In your way you mitigate these risks?

1……
2……
3……
4……
5……
6……
7……
8……

14. Please feel free to provide me with your opinion about any existing issue in construction

Industry in Ghana which was not mentioned in this interview.

……

……

Thank you.

APPENDIX C

Statistics

Category			The final project cost exceeding the project budget	Late completion of project	Shortage of resources	Force Majeure
Contractor	N	Valid	26	26	26	26
		Missing	0	0	0	0
	Mean		2.00	1.77	1.77	1.50
	Std. Deviation		.000	.430	.430	.510
Clients	N	Valid	28	28	28	28
		Missing	0	0	0	0
	Mean		2.00	2.00	2.00	2.00
	Std. Deviation		.000	.000	.000	.000
Consultant	N	Valid	25	25	25	25
		Missing	0	0	0	0
	Mean		2.00	1.80	1.80	1.52
	Std. Deviation		.000	.408	.408	.510

Statistics

Category			Political	Contractors' performance below expectation	A project that does not perform as required	A major contractor or supplier becoming bankrupt
Contractor	N	Valid	26	26	26	26
		Missing	0	0	0	0
	Mean		1.73	1.38	1.38	2.00
	Std. Deviation		.452	.496	.496	.000
Clients	N	Valid	28	28	28	28
		Missing	0	0	0	0
	Mean		1.89	1.71	1.93	2.00
	Std. Deviation		.315	.460	.262	.000
Consultant	N	Valid	25	25	25	25
		Missing	0	0	0	0
	Mean		1.76	1.40	1.40	2.00
	Std. Deviation		.436	.500	.500	.000

Statistics

Category			Poor safety	Environmental factors
Contractor	N	Valid	26	26
		Missing	0	0
	Mean		1.31	1.19
	Std. Deviation		.471	.402
Clients	N	Valid	28	28
		Missing	0	0
	Mean		1.89	1.96
	Std. Deviation		.315	.189
Consultant	N	Valid	25	25
		Missing	0	0
	Mean		1.32	1.20
	Std. Deviation		.476	.408

Frequency Table

The final project cost exceeding the project budget

Category			Frequency	Percent	Valid Percent	Cumulative Percent
Contractor	Valid	Yes	26	100.0	100.0	100.0
Clients	Valid	Yes	28	100.0	100.0	100.0
Consultant	Valid	Yes	25	100.0	100.0	100.0

Late completion of project

Category			Frequency	Percent	Valid Percent	Cumulative Percent
Contractor	Valid	No	6	23.1	23.1	23.1
		Yes	20	76.9	76.9	100.0
		Total	26	100.0	100.0	
Clients	Valid	Yes	28	100.0	100.0	100.0
Consultant	Valid	No	5	20.0	20.0	20.0
		Yes	20	80.0	80.0	100.0
		Total	25	100.0	100.0	

Shortage of resources

Category			Frequency	Percent	Valid Percent	Cumulative Percent
Contractor	Valid	No	6	23.1	23.1	23.1
		Yes	20	76.9	76.9	100.0
		Total	26	100.0	100.0	
Clients	Valid	Yes	28	100.0	100.0	100.0
Consultant	Valid	No	5	20.0	20.0	20.0
		Yes	20	80.0	80.0	100.0
		Total	25	100.0	100.0	

Force Majeure

Category			Frequency	Percent	Valid Percent	Cumulative Percent
Contractor	Valid	No	13	50.0	50.0	50.0
		Yes	13	50.0	50.0	100.0
		Total	26	100.0	100.0	
Clients	Valid	Yes	28	100.0	100.0	100.0
Consultant	Valid	No	12	48.0	48.0	48.0
		Yes	13	52.0	52.0	100.0
		Total	25	100.0	100.0	

Political

Category			Frequency	Percent	Valid Percent	Cumulative Percent
Contractor	Valid	No	7	26.9	26.9	26.9
		Yes	19	73.1	73.1	100.0
		Total	26	100.0	100.0	
Clients	Valid	No	3	10.7	10.7	10.7
		Yes	25	89.3	89.3	100.0
		Total	28	100.0	100.0	
Consultant	Valid	No	6	24.0	24.0	24.0
		Yes	19	76.0	76.0	100.0
		Total	25	100.0	100.0	

Contractors' performance below expectation

Category			Frequency	Percent	Valid Percent	Cumulative Percent
Contractor	Valid	No	16	61.5	61.5	61.5
		Yes	10	38.5	38.5	100.0
		Total	26	100.0	100.0	
Clients	Valid	No	8	28.6	28.6	28.6
		Yes	20	71.4	71.4	100.0
		Total	28	100.0	100.0	
Consultant	Valid	No	15	60.0	60.0	60.0
		Yes	10	40.0	40.0	100.0
		Total	25	100.0	100.0	

A project that does not perform as required

Category			Frequency	Percent	Valid Percent	Cumulative Percent
Contractor	Valid	No	16	61.5	61.5	61.5
		Yes	10	38.5	38.5	100.0
		Total	26	100.0	100.0	
Clients	Valid	No	2	7.1	7.1	7.1
		Yes	26	92.9	92.9	100.0
		Total	28	100.0	100.0	
Consultant	Valid	No	15	60.0	60.0	60.0
		Yes	10	40.0	40.0	100.0
		Total	25	100.0	100.0	

A major contractor or supplier becoming bankrupt

Category			Frequency	Percent	Valid Percent	Cumulative Percent
Contractor	Valid	Yes	26	100.0	100.0	100.0
Clients	Valid	Yes	28	100.0	100.0	100.0
Consultant	Valid	Yes	25	100.0	100.0	100.0

Poor safety

Category			Frequency	Percent	Valid Percent	Cumulative Percent
Contractor	Valid	No	18	69.2	69.2	69.2
		Yes	8	30.8	30.8	100.0
		Total	26	100.0	100.0	
Clients	Valid	No	3	10.7	10.7	10.7
		Yes	25	89.3	89.3	100.0
		Total	28	100.0	100.0	
Consultant	Valid	No	17	68.0	68.0	68.0
		Yes	8	32.0	32.0	100.0
		Total	25	100.0	100.0	

Environmental factors

Category			Frequency	Percent	Valid Percent	Cumulative Percent
Contractor	Valid	No	21	80.8	80.8	80.8
		Yes	5	19.2	19.2	100.0
		Total	26	100.0	100.0	
Clients	Valid	No	1	3.6	3.6	3.6
		Yes	27	96.4	96.4	100.0
		Total	28	100.0	100.0	
Consultant	Valid	No	20	80.0	80.0	80.0
		Yes	5	20.0	20.0	100.0
		Total	25	100.0	100.0	

Descriptive

Total Risk category

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Contractor	26	1.60	.297	.058	1.48	1.72
Clients	28	1.94	.129	.024	1.89	1.99
Consultant	25	1.62	.292	.058	1.50	1.74
Total	79	1.73	.292	.033	1.66	1.79

Descriptive

Total Risk category

	Minimum	Maximum
Contractor	1	2
Clients	2	2
Consultant	1	2
Total	1	2

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Total Risk category	Based on Mean	13.872	2	76	.000
	Based on Median	14.307	2	76	.000
	Based on Median and with adjusted df	14.307	2	73.330	.000
	Based on trimmed mean	14.895	2	76	.000

ANOVA

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.942	2	.971	15.716	.004
Within Groups	4.696	76	.062		
Total	6.639	78			

Robust Tests of Equality of Means

Total Risk category

	Statistic[a]	df1	df2	Sig.
Welch	23.038	2	41.394	.004
Brown-Forsythe	15.165	2	57.454	.004

a. Asymptotically F distributed.

Post Hoc tests

Multiple Comparisons

Dependent Variable: Total Risk category

	(I) Category	(J) Category	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound
Dunnett T3	Contractor	Clients	-.335*	.063	.000	-.49
		Consultant	-.016	.082	.996	-.22
	Clients	Contractor	.335*	.063	.000	.18
		Consultant	.319*	.063	.000	.16
	Consultant	Contractor	.016	.082	.996	-.19
		Clients	-.319*	.063	.000	-.48

Multiple Comparisons

Dependent Variable: Total Risk category

	(I) Category	(J) Category	95% Confidence Interval Upper Bound
Dunnett T3	Contractor	Clients	-.18
		Consultant	.19
	Clients	Contractor	.49
		Consultant	.48
	Consultant	Contractor	.22
		Clients	-.16

*. The mean difference is significant at the 0.05 level.

Homogeneous Subsets

Total Risk category

			Subset for alpha = 0.05	
	Category	N	1	2
Tukey B[a,b]	Contractor	26	1.60	
	Consultant	25	1.62	
	Clients	28		1.94

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 26.275.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.