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RISK ASSESSMENT AT THE DESIGN PHASE OF CONSTRUCTION PROJECTS IN GHANA

BY

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DECLARATION

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

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ABSTRACT

The construction industry, perhaps more than most is plagued by different kinds of risks resulting in poor performance in terms of costs, time and quality. Extensive evidence in literature suggests that risk assessment is a recognized practice that maximizes the opportunities and minimizes the consequence of these risks. The ability to asses risk at the design phase which proffers momentous amount of risks in the construction process has been established to be an important and central element in preventing unwanted consequences. While a good deal of research has been conducted on risk assessment globally, Ghana as a developing country has not focused on risk assessment particularly at the design phase. It is against this backdrop that this study was conducted to explore the approaches employed by consultants for risk assessment at the design phase of projects. The study was situated in the positivist paradigm which enabled the researcher to make an objective analysis. This stance facilitated the researcher to use the quantitative research strategy and also questionnaire survey as the main data collection instrument for soliciting information from consultants in Ghana. It came to light that majority of consultants have an average knowledge of risk management. Based on the findings it was recommended that consultants undergo advanced training in risk assessment. Again, it was suggested that consultancy firms develop a set of laid down procedures for consultants to use in risk assessment in order that the use of intuition employed by majority is lessened. The challenges observed in risk assessment and the remedial steps suggested to curtail the detrimental effects of risks would be of wide importance to many developing economies.

Keywords: Construction industry, Construction project, Risk management, Risk assessment, Construction project, Design phase.

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To all the above, I express my deep appreciation and God Bless you all.

LIST OF ABBREVIATIONS

BSI	British Standard Institute
FTA	Federal Transit Administration
DV	Design Variables
NSW	New South Whale
IEC	International electrochemical commission
PBL	(Plan-ochbygglag) – The Swedish Planning and Building Act
SPSS	Statistical Package for Social Sciences

DEDICATION

This work is dedicated to my beloved parents; Mr. and Mrs. A. Awuni.

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CHAPTER ONE

GENERAL INTRODUCTION

1.1 BACKGROUND

Globally, public infrastructure services needs are fast outpacing the resources for providing them (Anvuur *et al.*, 2006), the construction industry which proffers these needs is directly linked to the economy with the government being the biggest client (Agyakwa-Baah, 2007, Tuuli *et al.*, 2007). Again, the importance of the industry cannot be overemphasized as it is evidenced by its average revenue flows, which generally represent some 25% of the budget revenue and 6% of Gross Domestic (GDP) in Ghana (Agyakwa-Baah *et al.*, 2010). These socio-economic realities have underscored the need for more innovative ways to achieve value for money in construction projects in Ghana (Anvuur *et al.*, 2006). Any improvement in the construction industry will therefore have a direct and substantial impact on the overall economic situation of the country and result in budgetary savings and efficiency in government expenditures.

A haunting specter of inefficiencies attracting criticisms in outcomes such as time, cost overruns and poor quality (Latham, 1994, Egan, 1998, Ericsson, 2002, Chan *et al.*, 2003) has however bedeviled the construction industry. The industry perhaps more than most, is plagued by different kinds of risks (e.g., environmental, physical, political, social and economic risks) (Flanagan *et al.*, 1993), which are not often dealt with adequately resulting in poor performance (Thompson *et al.*, 1992). However, according to Agyakwa-Baah (2007) most consultants (Architects, Engineers and Quantity Surveyor) do not predict risks and even if risks are predicted, they are dealt with in a completely arbitrary way by adding 10% contingency onto the

estimated cost of a project. This phenomenon is very worrying considering the influence that risk has on project objectives i.e., cost, time and quality (Tadayon *et al.*, 2012).

In response to this type of situation, Andi *et al.* (2003) and Faridi *et al.* (2006) therefore intimated that risk assessment should form a major element in the design phase of construction projects. According to Uher *et al.* (1999) it is at the design phase, i.e. Programming and feasibility, Schematic, Design development; and Contract documentation that the greatest degree of uncertainty about the future is encountered. The construction industry in Ghana in particular has been slow to realise the potential benefits of risk assessment (Flanagan *et al.*, 1993) at the design phase of construction. The limited use of risk assessment is however very surprising considering the presence of risk and uncertainty at this phase. Recently, Tadayon *et al.* (2012) opined that intensive research and development have focused on project risk management, however while a good deal of research has been conducted on risk management globally, Ghana as a developing country has not focused on risk assessment at the design phase.

It is against this backdrop that this study is conducted to explore the approaches employed by consultants for risk assessment at the design phase of projects in Ghana. Substantial evidence in literature suggests that construction problems relating to Ghana are similar to the situations in many African and some Asian countries (Aniekwu *et al.*, 1988, Kumaraswamy, 1994, Rwelamila *et al.*, 1999). The challenges observed and the remedial steps to be suggested will therefore be of wider importance to many developing economies.

1.2 STATEMENT OF THE PROBLEM

According to Anvuur *et al.* (2006) successive reviews have revealed substantial inefficiencies and concluded that value for money was not being achieved in both government- and donor-financed construction. Williams (1999) added that, the industry is characterized by late delivery, exceeded budget and quality problems. This depicts the Ghanaian situation of construction industry, which is characterized by cost and time overruns and quality problems. Recent study by Tadayon *et al.* (2012) shows that construction risk is an event that influence project objectives, i.e., cost, time and quality. According to Bu-Qammaz (2007) the construction industry inherent enormous amount of risks; as it is portrayed with a unique characteristic in which most of its products are exceptional in respect of form, size, purpose and complexity.

The experience and competence of the architects and engineers handling the design of the project, as well as their quality control in the development of working drawings, directly affect the construction effort and, consequently, the risk associated with the plans and specifications (Mubarak, 2010). Again larger public projects are prone to intentional underestimation due to political pressure resulting in the risk of project not reaching its completion. Also failure on the part of structural engineers in conducting extensive geotechnical survey has resulted in unforeseen ground conditions leading to the risk of buildings experiencing differential settlements and at the end resulting in their possible eventual collapse. These unexpected occurrences could have been mitigated and the number of successive projects increased if more consultants had included risk assessment as an integral part of their construction projects (Smith *et.al*, 2006).

According to Project Management Institute (2000) risk assessment is a recognized practice that helps clients deliver projects on schedule, at the right quality and within cost. It is however lamentable that many consultants in Ghana have not yet realized that there is a need to include risk assessment as a key process at the design phase of the construction project. Risk assessment if even performed has traditionally been that of an intuitive feeling (Al-Bahar *et al.*, 1990). Andi *et al.* (2003) and Faridi *et al.* (2006) intimated that risk assessment should form a major element in the design phase of construction projects. The design phase is very important for many aspects of project performance, such as life cycle costs, project costs and schedule (Andi *et al.*, 2003, Faridi *et al.*, 2006). Risk assessment at the design phase therefore has to be further developed in order that potential problem areas that may adversely affect the desired construction outcomes are reduced (NSW Government Project Guidelines, 2006). The research aims at exploring the approaches employed by consultants in risk assessment at the design phase of projects in Ghana.

1.3 AIM AND OBJECTIVES

To overall aim of the research is to explore the approaches employed by consultants in risk assessment at the design phase of projects in Ghana.

To achieve this aim, the following three specific objectives were set for the study:

1. To examine the extent of knowledge of consultants in risk assessment at the design phase of construction projects;
2. To identify the risk assessment tools and techniques employed by consultants in Ghana at the design phase; and

3. To examine the influence of consultants in risk assessment at the design phase of construction projects.

1.4 SCOPE OF THE STUDY

Geographically the study was carried out exclusively in Ghana. The study was narrowed to consultants (Architects, Quantity Surveyors and Engineers) in Ghana. Consultants were selected because they are the main actors involved at the design phase of construction projects. Contextually, the study examined the extent of knowledge of consultants in risk assessment at the design phase of construction projects; identified the risk assessment tools and techniques employed by consultants and examined the influence of consultant in risk assessment at the design phase of construction projects.

1.5 RESEARCH METHODOLOGY

Achieving the objectives of this research required conforming to logical and scientific processes and empirical investigations from the viewpoint of consultants. Information for this study was gathered as follows: Firstly, use of books, technical journals and professional magazines and secondly, through questionnaires to consultants. Responses to the questionnaire were collected, collated and analyzed. The analysis included ranking the different methods used to identify risk at the design phase of construction projects.

1.5.1 The Research Design

Research design is not just a work plan but it is a tool that enables the researcher to ensure that the evidence obtained answer the objectives under investigation in a research, as unambiguously as possible (De Vaus, 2001). The data was analyzed using quantitative analysis. Quantitative method, however, uses standardized instruments, so that the varying perspectives and experiences of people can fit a limited number of predetermined response categories, to which numbers, relative importance index etc are assigned and measured statistically.Fellows *et al.* (2008) described several types of research, e.g. instrumental, descriptive, exploratory, explanatory and interpretive. The research presented in this thesis is a descriptive type. Descriptive research aims at identifying and recording a phenomenon, process or system and may be conducted using surveys (Fellows *et al.*, 2008).

1.5.2 Data Sources

The approach for collecting data in this study was the primary data collection technique.

1.5.3 Field Survey: Primary Data Source

The field survey is involved with the collection of empirical data. A single source approach of data gathering was adopted for the purpose of this research (using questionnaires).

1.5.4 Population, Sampling Techniques and Sample Size

The population for this study comprised consultants (Architects, Engineers and Quantity Surveyors in Ghana) within selected consultancy firms in Ghana. The main reason for using this

category of people was that their activities directly or indirectly have a bearing on construction projects. The simple random technique was used to select consultancy firms within the three professional bodies that are the Ghana Institute of Architects, Ghana Institution of Engineers and the Ghana Institution of Surveyors (Quantity Surveying Division). The simple random technique was used taking into consideration the list of consultancy firms in good standing within the three professional bodies. This was to prevent bias and afford each consultancy firm an equal chance of been selected.

Again, the simple random sampling was used in selecting individuals within the various institutions for answering the questionnaire. The sample size was determined using the Kish (1965) statistical formula.

1.5.5 Design Variables

Variables (DVs) utilized included extent of knowledge of risk assessment; importance of risk assessment at the design phase of the construction projects; the types of risks frequently assessed at the design phase; risk assessment tools and techniques employed by consultants; and the level of influence consultants have in risk assessment. This made it possible to make inferences about the dependent variable. The source of independent variables was from literature and through consultation with consultants.

1.6 JUSTIFICATION OF THE STUDY

The construction industry in Ghana still suffers from poor project performances due to risk. The increasing complex and dynamic nature of projects coupled with new construction methods

(Latham, 1994) has made, risk assessment has become increasingly important at the design phase of the construction projects. A survey by Laufer *et al.* (1992) of 40 U.S. construction managers and owners indicated that for design objectives only 35% of the projects considered had low uncertainty and the remaining 65% had medium to very high uncertainty at the beginning of construction. A risk has a cause and also a consequence and if triggered, can lead to failure in achieving the construction objectives. The overall goal of risk assessment is to maximize the opportunities and minimize the consequences of a risk event. Being able to assess risks through the design phase in the construction process is an important and central element in preventing unwanted consequences. It is against this backdrop that this study is conducted, the challenges observed and the remedial steps to be suggested will be of wider importance to many developing economies.

1.7 OUTLINE OF THE THESIS

This thesis consists of five chapters. Chapter one is an introduction to the research and includes six sections. Chapter two contains review of literature on the concepts and other issues that are regarded as relevant to the research topic. The Research methodology for the study is captured in chapter three. Chapter four presents an analysis of the data while chapter five presents a summary of the findings, recommendations and the conclusion of the study. Figure 1.1 illustrates the outline of the thesis.

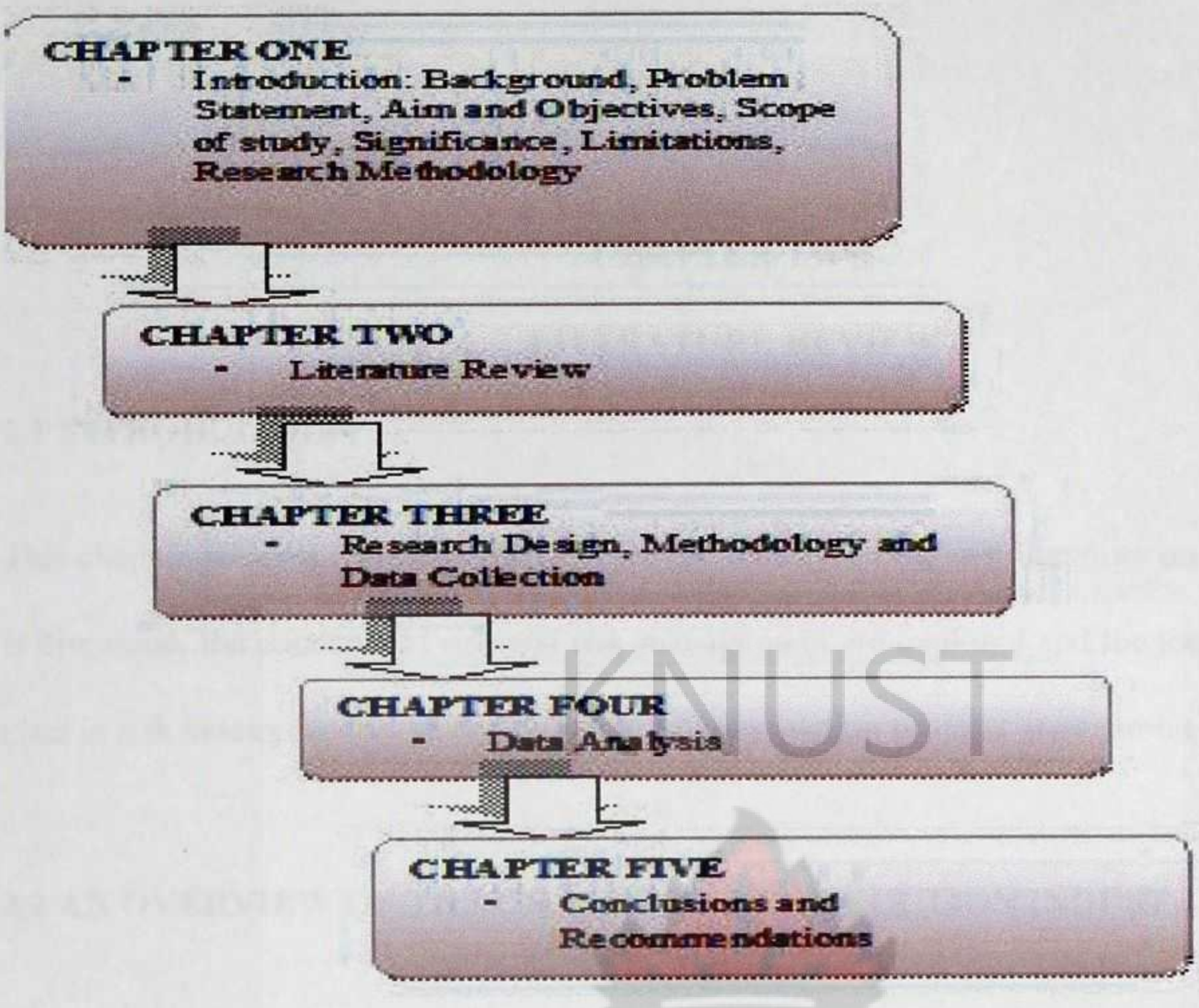

Figure 1.1: Outline of thesis. Source: Author's construct

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents a literature review for the research. Relevant literature on risk management is discussed, the concepts of risk and risk management are explored and the tools and techniques used in risk assessment at the design phase of construction projects are examined.

2.2 AN OVERVIEW OF THE GHANAIAN CONSTRUCTION INDUSTRY

The construction industry is a key sector of the economy of every country (Hillebrandt, 2000). Ofori (2012) noted that, the industry is important because of the outputs and outcomes of its activities, whilst contributing to national socio-economic development by providing the buildings which are used in the production of all goods in the economy. Moreover, the physical infrastructure, built through construction activity, is the nation's economic backbone as it forms the arteries for the facilitation of productive activity by enabling goods and services to be distributed within and outside the country.

Lopes (2012) also observed that in every country, the industry constitutes a large part of the economy. This observation is in tandem with the situation in Ghana as the World Bank (2003) noted that, an approximate annual value of public project for works and consultant services has been given as US$600 million (World Bank 2003) representing about 10% of the country's GDP. Again the industry boosts of an average revenue flow representing about 25% of the budget and 6% of the Gross Domestic Product (Chileshe *et al.*, 2011). These observations

pointed out emphasize the significance of the industry to the country as its activities have an economic and social effect (Anvuur *et al.*, 2006). Just like other industries, different players are usually involved in the industry in Ghana.

The main players in the industry are clients, consultant and contractors (Smith *et al.*, 2006). From the clients perspective there are two main groups of construction clients: public and private (Osipova, 2008). Agyakwa-Baah (2007) and Tuuli *et al.* (2007) noted that government is the biggest client in Ghana. A contractor is an organisation that provides a service for the client, i.e. executes the construction works. According to Ayirebi-Dansoh (2005) construction firms in Ghana are categorized into four financial classes (1 through 4) according to the size of individual projects they can bid from the government. The classification by the Ministry of Works and Housing in Ghana has however been observed to be too general and obsolete and the registration criteria, lists of contractors and monetary thresholds are not regularly updated (Eyiah *et al.*, 2003, World Bank 1996). From the perspective of consultants, generally they belong to one or more of the three main professional institutions in Ghana i.e. the Ghana Institute of Architects, Ghana Institution of Engineers and the Ghana Institution of Surveyors.

It has conversely been observed by several authors (Anvuur *et al.*, 2006, Chileshe *et al.*, 2011,Tuuli *et al.*, 2007) that the industry perhaps more than most, is plagued by different kinds of risks (e.g., environmental, physical, political, social and economic risks)(Flanagan *et al.*, 1993) resulting in poor performance (Thompson *et al.*, 1992). Tadayon *et al.* (2012) therefore recommended that the industry should be awakened by this occurrence in order that remedial steps are taken to curtail the situation before it reaches crescendo.

2.3 RISK IN CONSTRUCTION PROJECTS

Risk is a multi-facet concept. Research literature offers different definitions of project risk (Baloi *et al*., 2003, Barber 2005, Chapman *et al*., 2002; Flanagan *et al.,* 1993; IEC, 2001; Jaafari 2001; PMI, 2008; Smith *et al.,* 2006). As this research discusses risks in the project context, the research has adopted a more general and broad definition of risk as presented by "A Guide to the Project Management Body of Knowledge 2008'', there risk is defined as an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives (A Guide to the Project Management Body of Knowledge, 2008).

In addition to the different definitions of risk Smith *et al*. (2006) added that there are various ways for categorizing risk for different purposes. For example, some categorize risks in construction projects broadly into; known risks, 'known unknowns' and 'unknown unknowns'. Known risks include minor variations in productivity and swings in material costs. These occur frequently and are an inevitable feature of all construction projects. 'Known unknowns' are the risk events whose occurrence is predictable or foreseeable. Either their probability of occurrence or their likely effect is known. 'Unknown unknowns' are those events whose probabilities of occurrence and effect are not foreseeable by even the most experienced staff. Others classify risk in more detailed categories of technology risk, financial risk, contractual risk, political risk, environmental risk, social risk, economic and force majeure risk (Songer *et al*., 1997, Deviprasadh, 2007 and Osipova, 2008). According to Chapman *et al*. (2002) technology risks are the risk factors associated with the technologies involved in the execution methods and operational technology of the project. Financial risk involves issues or concerns associated with

the financing of the project (Deviprasadh, 2007). Barber (2005) added that contractual risk involves issues or concerns associated with the contractual and project approaches-systems-processes used for both project execution and operation, whilst political risk involves issues or concerns associated with the local, regional, and national political and regulatory situation confronting the project. Environmental risk involves issues or concerns associated with the environmental problems (Deviprasadh, 2007). Smith *et al.* (2006) added that social risk involves issues or concerns associated with the social and cultural impacts of the project to the community and region within which it is to be located whilst economic risk involves issues or concerns associated with the macroeconomic impact of the project to the community and region within which it is to be located (Osipova, 2008). Force majeure risks can also be termed an Act of God, it refers to an event which is beyond a parties' power to control. A war, breakdown of machinery, a strike or fire caused by lightning are examples of force majeure. They consist of such things as fires, earthquakes, tornadoes, hurricanes, riots, and civil commotion. Some other conditions, such as strikes, work slowdowns, and labour shortages, which are normally called "acts of man," are often included (Mubarak, 2010).

2.4 CONCEPT OF RISK MANAGEMENT IN PROJECTS

Risk management is a formal and orderly process of systematically identifying, analysing, and responding to risks to obtain the optimum degree of risk elimination, mitigation and/or control (Wang *et al.*, 2004). A systematic approach to risk management in construction industry consists of three main stages: a) risk identification; b) assessment; and c) risk response (Osipova, 2008). The risk management process begins with the initial identification of the relevant and potential

risks associated with the construction project. This according to Osipova (2008) is of considerable importance since the process of risk assessment and response management may only be performed on identified potential risks.

According to Paulson (2007) risk assessment is what we as private persons do every day, e.g. when we decide to take the car instead of the train for a certain trip or when we choose to cross the street outside instead of inside the pedestrian crossing. During risk assessment, identified risks are evaluated and ranked. Risk assessment is the intermediate process between risk identification and management. It incorporates uncertainty in a quantitative and qualitative manner to evaluate the potential impact of risk (Deviprasadh, 2007). There is considerable literature in the area of risk management presented by several authors which is discussed in the following section.

2.5 DISCUSSION OF RELEVANT LITERATURE

Uher *et al.* (1999) examined various structural and cultural factors concerned with the implementation of risk management in the conceptual phase of a project life cycle, they found out that the most frequently used approach for risk assessment is the qualitative approach, which uses word form or descriptive scales to describe the magnitude of potential consequences and the likelihood that those consequences will occur. Again Bajaj *et al.* (1997) identified, investigated and evaluated the process of risk identification. They found that the most frequently used method of risk identification is the top-down approach technique, where the project is analysed from an overall point of view. Baker *et al.* (1999) believed personal and corporate experience,

engineering judgement, and brainstorming are effective ways for identifying new risks and for qualitative use.

Carter (2002) has undertaken a significant study of the problems involved in the adoption of risk assessment by industrial corporations. In a study of four major oil companies, he found that this was a difficult, time consuming and expensive operation, and that the experience of these companies ranged from `success' to 'complete failure'. According to Wang *et al.* (2004) a significant step was taken by the New South Wales (NSW) Government in late 1993 when it required agencies under its control to apply risk assessment in planning new projects and major capital asset activities valued in excess of $5M. The guidelines for undertaking this are set out in a publication entitled Risk Management Guidelines. This document makes the point that risk assessment should begin at the design stage of a project and continue throughout its life.

Discussions of management issues involved in the implementation of risk assessment procedures in organisations can be found in Hull (1990) and Hertz *et al.* (1995). The former makes the point that while technical competence is important, the success or failure of risk evaluation `is determined by a whole battery of organisational and behavioural forces' such as organisation readiness to adopt risk assessment, committed support of top and middle level management for acceptance of risk evaluation and for educational needs, availability of good input data and a team approach to performing risk analysis.

Again, Hertz *et al.* (1995) have written a widely quoted book dealing with the application of risk analysis to corporate activity. One of the many things discussed there concerns the importance of management attitudes to the value of risk assessment vis a vis matters such as the high cost of managerial time input, `gut 'feeling, and overall `know-how'.

To summarise this section, several of those authors have pointed out that most of the encumbrance to the application of risk assessment tools and techniques can be pointed to a knowledge gap in the area; further a late survey by Tah (2001) indicated that a significant problem in construction projects has been that the knowledge of risk assessment tends to be poor, hence there is a need to explore this knowledge gap in order that proposal can be made to improve on risk assessment in projects.

2.6 THE CASE OF CONSULTANTS KNOWLEDGE OF RISK ASSESSMENT IN CONSTRUCTION PROJECTS

The importance of knowledge in risk assessment cannot be overstated as its implementation has a great impact on achieving project objectives (NSW Government Project Guidelines, 2006). On the contrary; several authors have reported a distressing trend pointing out a knowledge gap in the area of risk assessment. In a recent survey by Osipova (2008) it was observed inter alia that most consultants have what might be described as a fair understanding or knowledge of risk management. Again, the knowledge of and skill in risk assessment were rated by respondents in a late study carried out by Uher *et al.* (1999) and it was noted to be average. Hertz (1995) found out that the main obstacles to applying risk assessment were inadequate knowledge of and lack

of understanding of its potential benefits (Hertz *et al.*, 1995). The Ghanaian construction industry is no exception.

As a result of these gaps pointed out by the authors, project participants do not have an understanding of the risks that threaten a project and consequently are unable to implement effective early warning measures and mitigating strategies to adequately deal with them (Tah, 2001). Several authors (Osipova, 2008, Uher *et al.* 1999) have emphasized on the need to create more emphasis on education and training of industry professionals in risk assessment as a panacea to the knowledge gap. It is believed that the development of knowledge in risk assessment will lead to a greater degree of consistency for the assessment of construction risks and a greater understanding of their consequences for projects (NSW Government Project Guidelines, 2006).

Faridi *et al.*, (2006) underscored the need for knowledge at the design phase of projects in a recent study intimating among other things that risk assessment at the design phase is very important for many aspects of project performance, such as life cycle costs, project costs and schedule (Andi *et al.*, 2003).

2.7 THE DESIGN PHASE OF PROJECTS IN PERSPECTIVE

According to Smith *et al.* (2006), a project is divided into a number of separate phases. Different authors suggest different numbers of phases (Chapman *et al.*, 2002, Flanagan *et al.*, 1993, PMI 2000, Smith *et al.* 2006, Osipova, 2008). The study adopted Osipova (2008) model which comprises three phases - design, tender/contract award and production.

Flanagan *et al.* (1993) noted that the design phase of projects inherent momentous risks which according to PMI (2000) threatens project objectives. Several authors have prescribed several stages at the design phase (Neighbour, 2006, Construction Project Management Handbook, 2006, Jacksons 2010) the study however adopted Jacksons (2010) model as it entails all the elements of the models presented in literature which includes programming and feasibility, schematic design, design development and tender document.

According to Jackson (2010) programming is typically done prior to the design process and engages the owners and end users to clarify needs, goals, and objectives for the facility. Some of the information that comes out of the programming phase is the overall building size, the number of rooms and their adjacencies, how the spaces will be used and what the requirements are for their function. Often the project budget is also discussed during programming, and it is the designer's responsibility to try to carry out the design with this budget in mind. That's where the feasibility comes in.

In explaining the schematic or conceptual design phase, Neighbour (2006) noted that it is the first step of the creative process. These drawings consist of rough sketches identifying general spaces and adjacencies, shapes, circulation patterns, orientation, and perhaps massing. The design team starts to consider such things as materials, sizes, colours, textures, and other aesthetic factors. At this point, the design is far enough along for the design team to outline preliminary specifications and estimates (Jackson, 2010).

The design development phase is where much of the detail work gets done. A great deal of research and investigation takes place regarding the use of materials, equipment, and systems that will go into the facility. The specifications become more developed at this phase, and more accurate pricing can now take place. It is during the design development process that value engineering and constructability reviews are typically performed (Jackson, 2010).

The final detailed drawings (along with the final specifications) are called the tender documents. These drawings may also be referred to as working drawings because they are the plans that the builder will actually use for construction. These are the documents that are used to solicit bids and pricing from the contractor. The quality of these documents will impact the quality of the pricing (Jackson, 2010). The design phase of project ends with the preparation of the tender documents. The tender/contract award phase of a project then progresses with the process of inviting contractors to tender for the project.

2.8 THE SOURCES OF RISKS AT THE DESIGN PHASE OF PROJECTS

There are many sources of risks at the design phase that can impact the contractor's ability to deliver the project on time, within budget, and within the quality specifications expected by the owner. The following sources of risks have been identified by several authors (Jackson, 2010, Boussabine *et al.*, 2004); inadequate project formulation, investigations and technical specifications, lack of proper financial appraisal of the project, difficulty in capturing and specifying the client/user life requirements, difficulty in estimating the time and resources required, difficulty in understanding and setting project objectives, responsibilities between

stakeholders ill defined, inexperienced design team, planning and environmental constraints, inadequate site information and analysis, allocated resources are inadequate, incomplete design scope, compliance with standards and codes of practice, late completion of design, design is too complex and novel, environmental and planning conditions imposed on design, contract documents are inadequately developed, escalation of tendering costs etc. (Boussabine *et al.*, 2004, Jackson, 2010). The approaches, tools and techniques for curtailing the detrimental effects of these sources of risks are presented in the following section.

2.9 RISK ASSESSMENT APPROACHES ADOPTED BY CONSULTANTS IN CONSTRUCTION PROJECTS

According to Smith *et al.* (2006) there are two basic types of approach to the management of risk in projects, and these are the informal approach and the formal approach. Osipova (2008) noted that the informal approach to the management of risk is one that views the risks in a subjective manner and due to the nature of this approach, many organisations implement these methods but do not realise that they are operating any kind of risk management procedure. The formal approach often consists of a set of procedures laid down by an organization for use in the risk management process. These procedures are structured and provide guidelines to be followed, so that they can be used by any member of the organization. Also, (Akintoye *et al.*, 1997) added that many consultants implement risk assessment processes but do not realise that they are operating any kind of risk management procedure. One of the most widely used techniques is the informal approach to the management of risk which involves the provision of contingency funds

(Akintoye *et al.*, 1997). A contingency fund is not financially representative of all the identified risks in a project because it is unlikely that all of the possible risks would be realized.

Risk identification is the first step of the risk assessment process. There are a number of tools and techniques that consultants use for identifying the project risks (IEC, 2001). These are brainstorming, expert opinion, structured interviews, questionnaires, checklists, historical data, previous experience, testing and modelling, evaluation of other projects (Uher *et al.*, 1999). Empirical studies of risk management practice (Akintoye *et al.* 1997, Lyons *et al.* 2004, Uher *et al.* 1999) show that checklists and brainstorming are the most usable techniques in risk identification. They also highlight that risk identification often relies on individual judgments of the project participants. In this context, it is interesting to mention a recent study by Maytorena *et al.* (2007) that suggests that the role of experience in risk identification is less significant than is commonly assumed.

Both qualitative and quantitative techniques are used by consultants for assessing project risks. Personal and corporate experience and engineering judgement are the most successful qualitative techniques, while quantitative techniques include break-even analysis, expected monetary value and scenario analysis (Osipova, 2008). Several authors report rather opposite results on the usage of quantitative techniques. The studies of risk management practice in the UK construction industry show that the practitioners rely mostly on professional judgment, intuition and experience (Akintoye *et al.*, 1997, Wood *et al.*, 2003). A questionnaire survey conducted by Tang *et al.* (2003) shows that qualitative analysis is the most commonly used technique in the Chinese construction industry, while the use of quantitative methods is very low. The results of the study conducted by Simu (2006) show that the Swedish contractors mostly use professional

experience and gut-feeling in risk assessment. Kähkönen (2007) argues that the quantitative methods used in risk management have advantages in comparison with the qualitative methods but their use is limited due to difficulties that practitioners face.

2.10 ROLE OF THE DESIGN CONSULTANT IN RISK ASSESSMENT

It has been traditional for different parties to be responsible for different phases in the life cycle of the project (Smith *et al*, 2006). These are clients or owners, contractors, sub-contractors, manufacturers and suppliers, consultants, local authorities, funding organisations etc. In this research the main group of actors in focus is the Consultant. Key among the role of the consultant in risk assessment as presented by various authors (PBL 1987, FTA, 2007, Jackson, 2010, Smith *et al*., 2006, Neighbour, 2006) includes; establish design criteria and assess and address project risks, perform conceptual design and preliminary engineering in support of the environmental clearance documents, perform technical studies, develop engineering criteria, and conduct VE and risk assessment; and produce final design drawings and specifications for the construction bid package. Many Consultants perform risk assessment because somebody else, for example their client has told them to do so, it is therefore important for the consultant to recognize risk assessment at the design phase as a major role to carry out.

2.11 THEORETICAL FRAMEWORK FOR RISK ASSESSMENT

Several frameworks can be found in literature, the Standard Australia/Standards New Zealand (1999) framework involve four steps, establish context, identify risks, analyze risks and evaluate risks,. British Standard Project Management framework, (2000) also consists of four steps which

include context, risk identification, risk analysis and risk evaluation and the Canadian Standards Association framework (1997) consists of initiation, preliminary analysis, risk estimation and risk evaluation. Below is a theoretical framework encapsulating the various steps in risk assessment from various authors (Standard Australia/Standards New Zealand, 1999,British Standard Project, 2000, Canadian Standards Association framework, 1997).

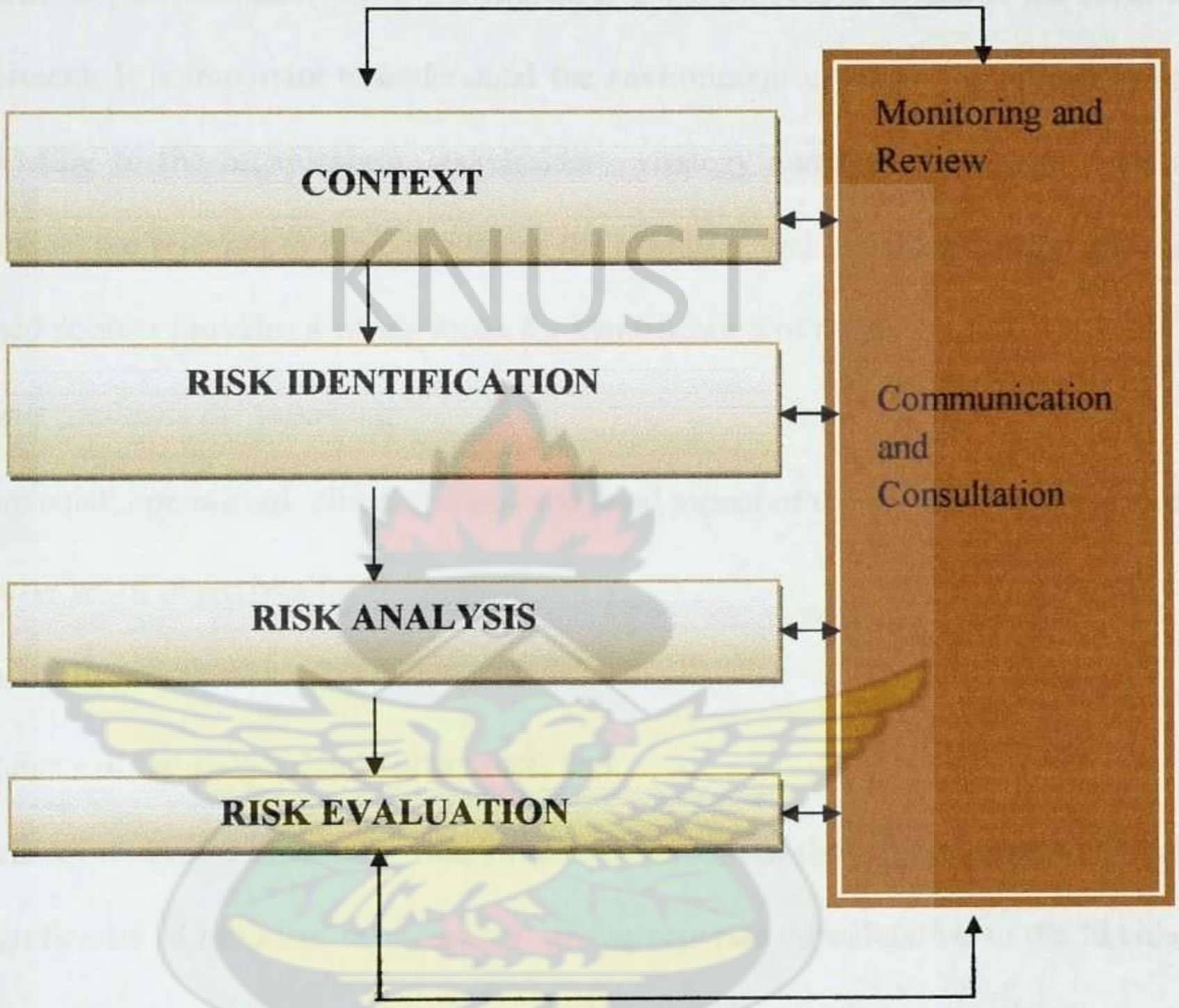

Figure 1.1: Theoretical framework for risk assessment. Source: Standard Australia/Standards New Zealand, 1999, British Standard Project Management framework, 2000, Canadian Standards Association Framework, 1997.

2.11.1 Context

To be able to recognise a risk it is necessary to know what is at risk. According to the Standard Australia/Standards New Zealand(1999), the first step in the process is to define the context of the risk assessment. It is important to understand the environment in which the project is being undertaken relating to the organization, stakeholders, strategy and timeframe, and determine what key elements are relevant to project. Stating the objective and benefits of project within a clearly designed context provides a strong focus for identification of risks.

Context analysis produces the following:

- The financial, operational, client, cultural and legal aspect of the organizations functions;
- A concise set of objectives for the project;
- A note of the stakeholders objectives;
- A summary of the stakeholders' objectives; and
- A small set of success criteria by which the achievement of the projects objectives and so the significance of risks can be measured, giving separate consideration to the likelihood or frequency of an outcome and its impact (Canadian Standards Association framework, 1997).

2.11.2 Risk identification

This step seeks to identify the risks to be managed. Comprehensive identification using a well-structured systematic process is critical, because if a potential risk is not identified at this phase it is excluded from further analysis. The tools and techniques used to identify risks include checklists, judgments based on experience and records, flow charts, brainstorming, systems

analysis, scenario analysis and systems engineering techniques (Standard Australia/Standards New Zealand, 1999).

2.11.3 Risk analysis

The objectives of analysis are to separate the minor acceptable risks from the major risks, and to provide data to assist in the evaluation and treatment of risks (BSI, 2000). Risk analysis involves consideration of the sources of risk, their consequences and the likelihood that those consequences may occur. Factors which affect consequences and likelihood may be identified. Risk is analysed by combining estimates of consequences and likelihood in the context of existing control measures.

2.11.4 Risk Evaluation

Risk evaluation involves comparing the level of risk found during the analysis process with previously established risk criteria (Canadian Standards Association framework, 1997). Risk analysis and the criteria against which risks are compared in risk evaluation should be considered on the same basis. Thus qualitative evaluation involves comparison of a qualitative level of risk against qualitative criteria, and quantitative evaluation involves comparison of numerical level of risk against criteria which may be expressed as a specific number, such as fatality, frequency or monetary value. The output of a risk evaluation is a prioritized list of risks for further action. The objectives of the organization and the extent of opportunity which could result from taking the risk should be considered.

2.11.5 Monitoring and review

It is necessary to monitor risks. Risks and the effectiveness of control measures need to be monitored to ensure changing circumstances do not alter risk priorities. Few risks remain static. Factors which may affect the likelihood and consequences of an outcome may change, as may the factors which affect the suitability or cost of the various treatment options. It is therefore necessary to regularly repeat the risk assessment cycle (Uher*et al.* 1999)

2.11.6 Communication and consultation

According to Akintoye *et al.* (1997) communication and consultation are an important consideration at each step of the risk assessment process. It is important to develop a communication plan for both internal and external stakeholders at the earliest phase of the process. This plan should address issues relating to both the risk itself and the process to manage it. Communication and consultation involve a two way dialogue between stakeholders with efforts focused on consultation rather than a one way flow of information from the decision maker to other stakeholders (Lyons *et al*, 2004).

Effective internal and external communication is important to ensure that those responsible for implementing risk management, and those with a vested interest understand the basis on which decisions are made and why particular actions are required. Perceptions of risk can vary due to difference in assumptions and concepts and the needs, issues and concerns of stakeholders as they relate to the risk or the issues under discussion. Stakeholders are likely to make judgments of the acceptability of a risk based on their perception of risk. Since stakeholders can have a

significant impact on the decisions made, it is important that their perceptions of risk, as well as their perceptions of benefits, be identified and documented and the underlying reasons for them understood and addressed (Lyons *et al.*, 2004).

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

This chapter examines the research methodology adopted in this thesis. It first outlines the philosophy that underpins the approach taken for the study, discussing the researcher's positivist stance to research and the consequent choice of a quantitative approach. The next section discusses the approach to data collection and then the data collection instrument. The chapter then provides an overview of the research population and sampling technique and the unit of analysis. The chapter concludes with a section on the survey coverage and response rate validity.

3.2 PHILOSOPHICAL UNDERPINNING OF THE RESEARCH

It has been noted that some writers use the terms 'methodology' and 'method' interchangeably (Hussey *et al.* 1997). They consider that methodology refers to the overall approach taken, as well as to the theoretical basis from which the researcher comes, and that method is the various means by which data is collected and analysed (Hussey *et al.*, 1997). Similarly, Mason (2002) separates "the concept of methodological strategy" from the method, while noting that a particular method will be a part of the strategy. In line with these writers, the approach taken here is to include all facets of the research process under the overall heading of methodology. Therefore, the research design, the approach taken, the particular data collection methods chosen and the means of analysis, are all considered to be part of this thesis's methodology, and are set out in the following sections.

However, underpinning the methodology, by necessity, is a philosophical stance in relation to the purpose of research in general (Marsh *et al.*, 2002). Therefore, research philosophy is a belief about the way in which data about a phenomenon should be gathered, analyzed and used; it consists of the following components: ontology, epistemology, and methodology (Galliers, 1991). A researcher's stance on ontology and epistemology will underlie the entire research process and govern the particular theoretical perspective (for example positivism or interpretivism) (Marsh *et al.*, 2002). The theoretical perspective will be implicit in the objectives of the research and dictate the researcher's choice of methodology. Finally this methodology or plan of action will in turn inform the choice of research methods employed (for example, questionnaires or interviews). To Marsh e*t al.* (2002) these stances a researcher takes are pivotal to his research, as "they shape the approach to theory and the methods" utilized.

3.2.1 Ontology and Epistemology

Ontology, relates to the nature of reality, that is, what things, if any, have existence or whether reality is "the product of one's mind" (Burrell *et al.*, 1979). The researcher's view of reality is the corner stone to all other assumptions, that is, what is assumed here predicates the researcher's other assumptions (Hay, 2002). Two basic distinctions can be made here: firstly, there is no real world but the world is socially and discursively constructed and hence dependent from a particular time or culture-hence the expression antifoundationalism. Secondly, there is a real (without quotation marks) world that is independent from our knowledge and upon these foundations life is built – hence the expression foundationalism, which is in tandem with this research (Marsh *et al.*, 2002).

Epistemology then concerns the study of the nature of knowledge, that is, "How is it possible, if it is, for us to gain knowledge of the world?" (Hughes *et al.*, 1997). It is concerned with "the nature, validity, and limits of inquiry" (Rosenau, 1992). Ones epistemological position reflects the "view of what we can know about the world and how we can know it. Again there are two major distinctions to be made here: Firstly, it is possible to acquire knowledge about the world unmediated and with no interferences. This implies that objectivity is possible, because everyone observes things in the same way. Foundationalists would take this point of view. Secondly, observation is never objective but always "affected by the social constructions of 'reality'' (Marsh *et al.*, 2002). Anti-foundationalists would employ this point of view. For them there is no real world to observe, as everything or action obtains meaning only by actors and not by sheer existence.

To summarize, there are two completely opposite positions with regard to ontology and epistemology that have absolutely nothing in common, the research is situated on a foundationalist ontological believe and an according objective epistemology. These are reflected in the positivism research paradigm (Bryman *et al.*, 2007, Hughes *et al.*, 1997, Travers, 2001).

3.2.2 Positivism and Interpretivism

Interpretivists believe that it is not possible to make objective statement about the real world because there is no such thing as a real world but it is only socially and discursively constructed (Bryman *et al.*, 2007). Researchers would observe aspects of the social world and seek to discover patterns that could be used to explain wider principles (Babbie, 2005). The ontological

position here is clearly anti-foundationalist. Because the world is only socially constructed so are social phenomena, which positivists claim to be able to examine by sheer observation. Suiting the claims of not possible objectivity, interpretivists usually employ qualitative research methods. Unlike positivists they look to understand social behaviour rather than explain it and focus on its meaning.

The opposite position is taken by positivist; positivism adopts foundationalist ontology and an according objective epistemology (Bryman *et al.*, 2007). This is a traditional viewpoint and the positivist believes that it is possible to observe everything that happens and understand it as such without any mediation, thereby denying any appearance/reality dichotomy. According to Travers (2001) a central tenet of positivism is that researchers can take a 'scientific' perspective when observing social behaviour, with an objective analysis possible. The philosophical assumptions underlying this research come from the positivist tradition.

3.2.3 Discussion and Rationalization for Choice of Approach

The research was situated in the positivist paradigm recognising the following parameters:

- The research is designed to produce quantitative data: this would fit well with the survey approach which is explained in section 3.5;
- Data is objective: the gathering process would be objective due to the distance between the researcher and the respondent;
- Samples are large: The researcher tends to use a large sample; and
- Independence: In this study, the observer is independent and is not part of what is observed.

Research based on a positivist philosophy tends to be based on deductive theorising, where a number of propositions are generated for testing, with empirical verification then sought (Babbie, 2005).

3.3 DEDUCTIVE AND INDUCTIVE REASONING OF SCIENTIFIC INQUIRY

It is important also to classify the research approach in terms of whether it is inductive or deductive. The choice between the deductive or inductive reasoning of scientific enquiry has been discussed by a number of authors (Cavaye, 1996, Hussey *et al.*, 1997, Perry, 2001). A researcher should explain clearly which approach is being followed in his or her research project. According to Saunders *et al.* (2003) the inductive approach which is known as building a theory, involves the researcher collecting data in an attempt to develop a theory. Hussey *et al.* (1997) added that inductive research is a study in which theory is, "developed from the observation of empirical reality; thus general inferences are induced from particular instances, which is the reverse of the deductive method since it involves moving from individual observation to statements of general patterns or laws,".

The deductive approach known as testing a theory is when the researcher develops a theory or hypotheses and designs a research strategy to test the formulated theory. In explaining deductive research, Perry (2001) added it is a study in which a conceptual and theoretical structure is developed which is then tested by empirical observation; thus particular instances are deducted from general influences. Deductive research is a study in which theory is tested by empirical observation. The deductive method is referred to as moving from the general to the particular and

it often requires considerable data (Hussey *et al.*, 1997). This study is shaped using the deductive research design as it tends to use considerable data which would in turn favour the use of quantitative methods to analyse (Travers, 2001).

3.4 RESEARCH STRATEGY

Research strategy can be taken to mean the way in which the research objectives are questioned (Bouma *et al.*, 1995). According to Bouma *et al.* (1995) there are two types of research strategies, namely, 'quantitative research' and 'qualitative research'. Deciding on which type of research to follow, depends on the purpose of the study and the type and availability of the information which is required.

3.4.1 Qualitative and quantitative research strategy

Denzin *et al.* (1998) intimated that qualitative research emphasises the process of discovering how the social meaning is constructed and stresses the relationship between the investigator and the topic studied. Berg (2001) added that qualitative research refers to the meanings, concepts, definitions, characteristics, metaphors, symbols and descriptions of things. Creswell(1994) noted that quantitative research is an inquiry into a social or human problem, based on testing a hypothesis or a theory composed of variables, measured with numbers, and analysed with statistical procedures, in order to determine whether the hypothesis or the theory hold true (Creswell, 1994). Bouma *et al.* (1995) indicated that quantitative data is, therefore, not abstract, they are hard and reliable; they are measurements of tangible, countable, sensate features of the world (Bouma *et al.*, 1995), it uses structured tools to generate numerical data and uses statistics

to interpret, organize and represent the collected data (Burns *et al.*, 2001). Mack *et al.* (2005) noted that qualitative and quantitative research approaches differ basically in some major areas, including: their analytical objectives; types of questions posed; types of data collection methods used; types of data produced; degree of flexibility in study design (Mack *et al.*, 2005).

In this study, the research strategy was quantitative as the main data collection techniques used in this research was questionnaires. This method allowed the researcher to ask all respondent the same question with predetermined responses, which allowed objective data to be collected throughout the study therefore being in tandem with the positivist tradition with survey as the main data collection approach.

3.5 APPROACH TO DATA COLLECTION

According to Naoum (2007) there are two approaches to data collection namely, fieldwork (primary data collection) and desk study (secondary data collection). The primary data collection technique was used for the study.

3.5.1 Field Survey: Primary Data Source

The field survey is involved with the collection of empirical data. Fieldwork can be associated with three practical approaches; the survey approach, the case study approach and the problem-solving approach (action research) (Naoum, 2007). A survey is used to collect original data for describing a population too large to observe directly (Mouton 2001). A survey obtains information from a sample of people by means of self-report, that is, the people respond to a

series of questions posed by the investigator (Polit *et al.*, 1993). The researcher used surveys because according to Robson (2002), surveys are used for relatively large number of respondents within a limited time frame. Robson (2002) added that there are two types of surveys available: the descriptive survey and the analytical survey (Robson, 2002).

3.5.2 Descriptive survey

Burns *et al.* (2001) in explaining descriptive survey intimated that it is a study that observes and describes the presence, frequency or absence of characteristics of a phenomenon as it naturally occurs, in order to gain additional information. The primary purpose of a descriptive survey research is to describe the situation, preferences, practices, opinions, concerns or interests of the phenomenon of interests of the phenomenon of interests (Polit *et al.*, 2006). Naoum (2007) added that the descriptive survey aims to answer such questions as: How many? Who? What is happening? Where? and When? It deals with counting the number of respondents with certain opinions/attitudes towards a specific object. The counting can be later analysed to compare or illustrate reality and trends. Descriptive studies provide valuable base line information. The method is also flexible and can be used to collect information from a large group of respondents (Mouton, 2001).

The descriptive survey was selected because it provides an accurate portrayal or account of the characteristics, for example behaviour, opinions, abilities, and knowledge of a particular individual, situation or group (Naoum, 2007). This design was chosen to meet the objectives of the study, namely to examine the extent of knowledge of consultants in risk assessment, to

identify the risk assessment tools and techniques employed by consultants in Ghana at the design phase and examine the role of the consultant in risk assessment at the design phase.

3.6 DATA COLLECTION INSTRUMENT

3.6.1 Questionnaire

A questionnaire is a printed self-report form designed to elicit information that can be obtained through written responses of the subjects. The information obtained through a questionnaire is similar to that obtained by an interview, but the questions tend to have less depth (Burn *et al.*, 1993). Questionnaires were developed because of the following: They offered possibility of anonymity because subjects' names were not required on the completed questionnaires. There was less opportunity for bias as they were presented in a consistent manner. Most of the items in the questionnaires were closed, which made it easier to compare the responses to each item. They required less time and energy to administer.

3.6.2 Content of Questionnaires

Generally, the questionnaire was designed to collect data from architects, engineers and quantity surveyors. These questions were grouped in categories to collect data on knowledge in risk assessment, risk assessment tools and techniques employed by consultants and the role of consultants in risk assessment at the design phase. Section A, solicited personal and general information from the participants using objective test. Section B, solicited information on respondent's knowledge in risk assessment. Information on importance of risk assessment at the design phase was scaled from 1-4 with the statement **unimportant, not so important, fairly**

important and very important. Information on how frequent respondents had assessed the different types of risks identified was scaled from 1-4 with the statements **not frequent, fairly frequent, frequent and very frequent.** The questions in section B were intended to test the respondent's knowledge in risk assessment at the design phase.

In section C the risk assessment tools and techniques employed by consultants were explored. Information on how frequent consultants used the various tools identified for risk identification was scaled from 1-4 with the statements **not frequent, fairly frequent, frequent and very frequent**. Section C was intended to identify the approach used to assess project risk, methods used to identify risk and how frequents consultants used the qualitative or quantitative approach to assess risks.

In section D, the role of consultants in risk assessment at the design phase was explored. The level of influence that consultants have on risk assessment at the design phase was scaled from 1-4 with the statements **very small, fairly small, fairly large and very small**. The importance of the roles of the consultant at the design phase of project was scaled from 1-4 with the statements **unimportant, not so important, fairly important and very important**. The level of influence that consultants have in assessing the risks identified was scaled from 1-4 with the statements **very small, fairly small, fairly large and very small**.

3.6.3 Questionnaire Administration

The research questions were developed by the researcher and were reviewed by some experts in academia and in construction project practice. Subsequently, a pilot test of the questionnaire and

interview was conducted for six (6) participants made up of two architects, two engineers and two quantity surveyors in order to identify and eliminate potential ambiguity in the questionnaire. Few questions were reviewed as a result of non-response from the respondents of the pilot study. This was done to improve the reliability and validity of the questionnaire. The questionnaires were self-administered on one-to-one basis and also through the internet to the respondents willing to fill or provide answers to the questionnaire. To improve the response rate, a number of follow-up procedures and strategies were considered, such as sending reminder surveys or notices to non-respondents.

To overcome that, a range of measures to improve the response rate based on established principles of reciprocity, social proof, and legitimacy and authority as recommended by Bednar *et al.*, (2006) were incorporated within the survey. These included measures such as having a shorter questionnaire (six pages) and, most importantly, reciprocity through promising respondents a summary report of the results of the study. The primary data collected was reviewed by the researcher to ensure maximum accuracy, legibility, completeness, consistency and to reduce ambiguity.

3.7 SCOPE OF THE STUDY

Geographically, the study was carried out exclusively in Ghana. Consultants who by their profession are actors at the design phase of construction projects were drawn from the three main professional associations in Ghana made up of the Ghana Institute of Architects, Ghana Institution of Engineers and the Ghana Institution of Surveyors (Quantity Surveying Division) practicing in Ghana for the study. Consultants are selected because they are the main actors

involved at the design phase of construction projects. Contextually, the knowledge of consultants in risk assessment at the design phase of construction projects is examined. The risk assessment tools and techniques employed by consultants are identified, and finally the influence of consultants in risk assessment is examined.

3.8 RESEARCH POPULATION AND SAMPLING TECHNIQUE

3.8.1 Research population

A research population can be defined as the totality of a well-defined collection of individuals or objects that have a common, binding characteristics or traits (Polit *et al.*, 2006). Burns *et al.*, 2001 added that a population is defined as all elements (individuals, objects and events) that meet the sample criteria for inclusion in a study. The research covers a population of one hundred and eighty six (186) consultants made up of architects, engineers and quantity surveyors within selected consultancy firms in Ghana. The main reason for using this category of people is that their activities directly or indirectly have a bearing on risk assessment at the design phase of projects. The criteria for inclusion or exclusion of the consultants are stated below.

3.8.1.1 Inclusion criteria

Inclusion criteria are the characteristics that the respondents must have in order to be included in the study (Burns *et al.*, 2001). The respondents included in this study were consultants drawn from consultancy firms within the three main professional associations involved in construction projects.

3.8.1.2 Exclusion criteria

Exclusion criteria are the characteristic that the respondents lack in order not to be included in the study (Burns *et al.*, 2001). In this study the respondents not willing to participate in the study and consultants who were not randomly selected were excluded.

3.9 SAMPLING

Sampling is a process of selecting a portion of the population to represent the total population and the findings from the sample represents the rest of the group (Burns *et al.*, 2001). The advantage of selecting a sample is that it is less costly and time saving than collecting information from a large group of respondents. The selected sample should therefore, have similar characteristics to the population under study to allow generalizability of the results to represent the population (Burns *et al.*, 2001, Polit *et al.*, 2006). In this study probability sampling is used.

3.9.1 Probability sampling

They involve random selection procedures to ensure that each unit of the sample is chosen on the basis of chance. All units of the study population should have an equal or at least a known chance of being included in the sample (Burns *et al.*, 2001). The probability sampling technique was used because it prevents subjectivity, bias, and allows the results to be generalized to the target population.

3.9.3 Sample size

Burns *et al.* (2001) stated that there are no hard or fast rules about the sample size but a sample should have at least 30 respondents. According to Ploit *et al.* (2006), quantitative research designs require large samples to increase representatives and reduce sampling error. The sample size for the various consultancy firms was determined using the Kish (1965) statistical formula as stated below:

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

Where:

n = Sample Size $n^1 = \frac{S2}{V2}$

N = Population Size

S = Maximum standard deviation in the population element

(Total error = 0.1 at a confidence level of 95%)

V = Standard error of sampling distribution = 0.05

P = The proportion of the population elements that belong to the defined class=0.5

$S^2 = P(1-P) = 0.5(1-0.5) = 0.25$

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

3.9.4 Sample size for Architectural Consultants

$$n^1 = \frac{0.25}{0.05^2} = 100$$

N = 114 (Ghana Institution of Architects, as at December 2012)

n = 100/ (1+ (100/114)) = 53.27 = 54

One Architect from each firm was sent the questionnaire since they play a part in the procurement processes. This gives a total of fifty-six (56) questionnaires to these Architectural Practicing Consultants.

3.9.5 Sample size for Quantity Surveying Consultants

N = 51 (Ghana Institution of Surveyors (Quantity Surveying Division), as at December 2012)

n = 100/ (1+ (100/51)) = 33.77= 34

One Quantity Surveyor from each firm was sent the questionnaire since they play a part in the procurement processes. This gives a total of forty (34) questionnaires to these Quantity Surveying Practicing Consultants.

3.9.6 Sample size for Civil Works Consultants

N = 35 (Ghana Institution of Engineers, as at December 2009)

n = 100/ (1+ (100/35)) = 25.93=26

The Engineer was sent the questionnaire since they play a part in the procurement. This gives a total of twenty-six (26) questionnaires to these Civil Works Consultants.

Table 3.1: Sample size for each of the selected firms

Item	Firms	Unit of analysis	Consultants	Number of sample frame
A	Architectural Practicing Firms	Architects	114	54
B	Quantity Surveying Firms	Quantity Surveyors	51	34
C	Civil Works Consultants	Civil engineers	35	26
	Total		**186**	**114**

Source: Researcher's Fieldwork April, 2013

Using the above formula, a sample size of 114 people was considered appropriate and representative enough for the study. The study involved architectural consultants, quantity surveying and civil engineering consultants.

3.10 UNIT OF ANALYSIS AND STUDY VARIABLES

The unit of analysis is that unit about which information is collected and that provide the basis for analysis. The unit of analysis according to Kumekpor (2002) is the actual empirical units, objects, occurrences, which must be observed or measured in order to study a particular phenomenon. Therefore, the unit of analysis must be appropriate to the problem being investigated and focuses on the essentials of the objectives of the study. For the purpose of this study, the units of analysis are consultants (Architects, Quantity Surveyors and Engineers). The study variables that were considered for the study are knowledge of consultants in risk assessment, risk assessment tools and techniques employed by consultants and the role of the

consultant in risk assessment at the design phase of the projects. These variables were considered with reference to the study objectives and the research questions.

3.11 ANALYSIS OF THE DATA

The data was analyzed using SPSS software computer program. Descriptive and inferential statistics, such as frequency tables, percentages and cross tabulations were used in the data analysis and summaries. Simple tests of associations were undertaken by using Chi square and Cramer's V statistics to compare relationships between variables. Again, relative importance index was also used to analyze some of the data by computing to deduce their rankings.

3.11.1 Chi Square test (X^2)

The Chi square test (X^2) examines the relationship between two variables in quantitative research. The test compares the actual frequencies with the expected outcomes or how closely they match or differ from expected distribution and whether two variables are independent or not. In this study, some of the questions were 'yes' or 'no' and discrete hence the use of this test and frequency tables in interpretation of data (Burns *et al.*, 2001). A Chi square test was done on a number of variables including testing for example the relationship between the years of experience of consultants and engagement in project.

3.11.2 Cramer's V statistics

The Cramer's V statistic shows the extent of association or relationship between two variables (Rea *et al.*, 1992). The Cramer's V statistics was used to test the level of association between

various variables for example between years of experience of consultants and engagement in project. Below is a convention for describing the magnitude of association (Rea *et al.*, 1992).

Table 3.2: Magnitude of association between two variables

Value of Cramer's V	Description
.00 and under .10	Negligible association
.10 and under .20	Weak association
.20 and under .40	Moderate association
.40 and under .60	Relatively strong association
.60 and under .80	Strong association
.80 to 1.00	Very strong association

Source: Rea *et al.*, (1992)

3.11.3 Relative importance index (RII)

The relative importance index was used to analyze some of the data by computing to deduce their rankings as below. Data was also analyzed by ranking for example the degree of importance of risk assessment at the design phase of projects. The ratings of the degree of importance of risk assessment by respondents were placed against a four-point scale and were combined and converted to deduce the Relative importance indices as follows:

$$RII = \left\{ \frac{4n4 + 3n3 + 2n2 + 1n1 \times 100}{4(n1 + n2 + n3 + n4)} \right\}$$

Where RII = Relative Important Index

n1= Number of respondent who answered "Unimportant"

n2= Number of respondent who answered "Not so important"

n3= Number of respondent who answered "Fairly important"

n4= Number of respondent who answered "Very important"

The factor with the highest relative importance index was then ranked as 1, and then followed by two as the next higher rank and so on.

3.12 SUMMARY

The purpose of this chapter was to describe the research methodology of this study, explain the sample selection, describe the procedure used in designing the data collection instrument and provide an explanation of the statistical procedures used to analyze the data.

CHAPTER FOUR

DATA ANALYSIS, DISCUSSIONS AND PRESENTATION

4.1 INTRODUCTION

The focus of this chapter is on the analysis of data gathered from the field with the aid of questionnaires. A questionnaire was issued to sampled respondents representing some randomly selected firms of the various professional bodies.

4.2 SURVEY COVERAGE AND RESPONSE RATE VALIDITY

A total of 114 questionnaires were sent out. Although 67 were returned, 7 were rejected because they were not completely filled out; thus, only 60 were included in the analysis for a response rate of 53%. Akintoye *et al.*, (1997) argued that this is well above the norm of 20–30% for questionnaires for use in the construction industry. The response rate was therefore deemed adequate for the purposes of data analysis.

Table 4.1: Years of experience*Engagement in any construction project. Cross tabulation

			Q4. Have you been engaged in any construction project? (G)		
			Yes	No	Total
Q1. Please indicate your years of experience in project?	0 - 5yrs	Count	14	4	18
		% within G	25.0%	100.0%	30.0%
	6 - 10yrs	Count	27	0	27
		% within G	48.2%	.0%	45.0%
	11 - 15yrs	Count	7	0	7
		% within G	12.5%	.0%	11.7%
	15 yrs and above	Count	8	0	8
		% within G	14.3%	.0%	13.3%
Total		Count	56	4	60
		% within G	100.0%	100.0%	100.0%

Source: Field survey, April 2013

Of the total population of 60 respondents, majority of the respondents 56 had been engaged in construction projects. Out of the 56 respondents, 25 % had 0-5 years' experience whilst 75% had over five (5) years experience. This means that the results represent the point of view of consultants who have a lot of experience in Construction projects.

Table 4.2: Chi-Square Test for relationship between years of experience*engagement in any construction project

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.000[a]	3	.0019
Cramer's V	.408		.0019
N of Valid Cases	60		

Source: Field survey, April 2013

The author used cross tabulation method to see if there is a relationship between years of experience and engagement in project at 3 degrees of freedom. Considering Table 4.2 above, the null hypothesis is that there is no relationship between years of experience and engagement in construction project. While the alternate hypothesis is that there is a relationship. The criterion of acceptability of the test results is the significance probability p-value. Test values with significance of ≤ 0.05 provide evidence against the null hypothesis while those with significance > 0.05 provide enough evidence in favour of the null hypothesis. Results of the cross tabulation Table 4.2 indicates p-value (0.019) which is ≤ 0.05; this therefore provides evidence against the null hypothesis. The implication of this is that, the null hypothesis is rejected, on the basis of the sample; years of experience of respondents and engagement in project are related. The Cramer's V statistics show the extent to which years of experience of respondents is related to engagement in construction projects. It was found out that the Cramer's V with effect size 0.019 falls between 0.00 and 0.10 (Refer table 3.2); this shows that there is a negligible association between years of experience and engagement in construction project. This means that even though there is a relationship between years of experience and engagement in project, the level of relationship is insignificant.

Table 4.3: Years of experience*Participation in the design phase of projects. Cross tabulation

		Q5. Have you participated in the design phase of project before? (H)		
		Yes	No	Total
Q1. Please indicate your years of experience in project? 0 - 5yrs	Count	14	4	18
	% within H	25.0%	100.0%	30.0%
6 - 10yrs	Count	27	0	27
	% within H	48.2%	.0%	45.0%
11 - 15yrs	Count	7	0	7
	% within H	12.5%	.0%	11.7%
15 yrs and above	Count	8	0	8
	% within H	14.3%	.0%	13.3%
Total	Count	56	4	60
	% within H	100.0%	100.0%	100.0%

Source: Field survey, April 2013

Analysis of Table 4.3 indicated that out of the 60 respondents, only 4 indicated that they had not participated in the design phase before. Again, the 4 respondents were in the years of experience bracket of 0-5 years. All the respondents who indicated that they had over 5 years work experience indicated that they had been engaged at the design phase of project. This goes to show that the higher the number of years of respondents, the higher the likelihood that they ever participate in the design phase of project of works.

Table 4.4: Chi-Square Tests for years of experience and participation in the design phase

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.000[a]	3	.0019
Cramer's V	.408		.0019
N of Valid Cases	60		

Source: Field survey, April 2013

Cross tabulation was used to see if there is a relationship between years of experience and participation at the design phase of project at 3 degrees of freedom. Considering Table 4.4 above, the null hypothesis is that there is no relationship between years of experience and participation in the design phase of project. While the alternate hypothesis is that there is a relationship. Results of the cross tabulation Table 4.4 however indicates p-value (0.019); this therefore provides evidence against the null hypothesis. The implication of this is that, the null hypothesis is rejected, on the basis of the sample; years of experience of respondents and participation in the design phase of project are related. In the same vein, it was found out that the Cramer's V with effect size 0.019 falls between 0.00 and under 0.10; this shows that there is a negligible association between years of experience and participation in the design phase of project. It can be deduced from the analysis of Table 4.3 that even though years of experience of consultants can translate into higher levels of engagement of consultant at the design phase of construction project, the degree of their relation is small.

Table 4.5: How frequent consultants carry out risk assessment at the design phase* Studies in risk management or/ and project management courses. Cross tabulation

			Q2. Did you study risk management or/and project management courses? (A)		
			Yes	No	Total
Q15. Evaluate how frequent the Consultant carries out risk assessment at the design phase	Not Frequent	Count	12	4	16
		% within A	22.2%	66.7%	26.7%
	Fairly Frequent	Count	18	0	18
		% within A	33.3%	.0%	30.0%
	Frequent	Count	14	2	16
		% within A	25.9%	33.3%	26.7%
	Very Frequent	Count	10	0	10
		% within A	18.5%	.0%	16.7%
Total		Count	54	6	60
		% within A	100.0%	100.0%	100.0%

Source: Field survey, April 2013

From the analysis of Table 4.5, it can be seen that out of the 60 respondents, 54 indicated that they had studied risk assessment or/and project management course before whilst 4 indicated otherwise. 56% of respondents who had studied risk management before indicated that they do not frequently and fairly frequently undertake risk assessments at the design phase of project (Refer Table 4.5). This is not encouraging considering that majority of the respondents 54 out of

60 of the population indicated that they had studied risk assessment or/and project management courses before.

Table 4.6: Chi-Square Test for how frequent consultants carry out risk assessment at the design phase*Studies in risk management or/ and project management courses

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.222[a]	3	.065
Cramer's V	.347		.065
N of Valid Cases	60		

Source: Field survey, April 2013

The author again used cross tabulation method to see if there is a relationship between how frequent consultants carry out risk assessment at the design phase and whether consultants had studied risk assessment before at 3 degrees of freedom. Considering Table 4.6 above, the null hypothesis is that there is no relationship between how frequent consultants carry out risk assessment at the design phase and whether consultants had studied risk assessment before. While the alternate hypothesis is that there is a relationship. Results of the cross tabulation Table 4.6 however indicate p-value is > 0.05; this therefore provides evidence in favour of the null hypothesis. The implication of this is that how frequent consultants carry out risk assessment at the design phase and whether consultants had studied risk assessment before are not related. The observation that there is no relationship between how frequent consultants carry out risk assessment at the design phase and whether consultants had studied risk assessment before also lends credence to the fact that even though majority of respondents

indicated that they had studied risk management before, many respondents (30) either do not frequently or fairly frequently carry out risk assessment (Refer Table 4.6).

Table 4.7: Studies in risk management or/and project management courses* evaluation of knowledge in risk management. Cross tabulation

			Q3. How do you evaluate your knowledge of risk management (A)			Total
			Low	Average	High	
Q2. Did you study risk management or/and project management courses?	Yes	Count	2	43	9	54
		% within A	50.0%	91.5%	100.0%	90.0%
	No	Count	2	4	-	6
		% within A	50.0%	8.5%	.-	10.0%
Total		Count	4	47	9	60
		% within A	100.0%	100.0%	100.0%	100.0%

Source: Field survey, April 2013

Data from the survey showed that majority of the respondents 43 who had studied risk assessment or/and project management course had an average knowledge of risk assessment whilst only 9 had a high knowledge (Refer Table 4.7). This is not encouraging considering the fact that majority of the respondents 54 out of 60 had studied risk management or/and project management courses.

Table 4.8: Chi-Square Tests for studies in risk management or/and project management courses* knowledge of risk management

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.227[a]	2	.016
Cramer's V	.370		.016
N of Valid Cases	60		

Source: Field survey, April 2013

The author used cross tabulation method to see if there is a relationship between whether respondents had studied risk assessment or/and project management course and how respondents evaluate their knowledge in risk assessment at 2 degrees of freedom. Considering Table 4.8 above, the null hypothesis is that there is no relationship between whether respondents had studied risk assessment or/and project management course and how respondents evaluate their knowledge in risk assessment. Whilst the alternate hypothesis is that there is a relationship. Results of the cross tabulation Table 4.8 indicates p-value (0.016); this therefore provides evidence against the null hypothesis. The implication of this is that, the null hypothesis is rejected, therefore there is a relationship between whether respondents had studied risk assessment or/and project management course and how respondents evaluate their knowledge in risk assessment are related. In the same vein, it was found out that the Cramer's V with effect size 0.016 falls between 0.00 and under 0.10; this shows that there is a negligible association between whether respondents had studied risk assessment or/and project management course and how respondents evaluate their knowledge in risk assessment. This

also implies that even though there is a relationship, the degree of the relationship is small and therefore gives credibility to the observation that even though most respondents 70% had over 5 years' experience and 90% had studied risk assessment or/and project management course before, only 9 out of 60 respondents had a high knowledge in risk assessment.

Table 4.9: Risk assessment for a project* importance of risk assessment at the design phase of project. Cross tabulation

			Q6. Access the importance of risk assessment at the design phase of the project? (D)			
			Not so important	Fairly important	Very important	Total
Q7. Have you carried out any risk assessment for project before? If no turn to que 13	Yes	Count	3	9	28	40
		% within D	100.0%	60.0%	66.7%	66.7%
	No	Count	0	6	14	20
		% within D	.0%	40.0%	33.3%	33.3%
Total		Count	3	15	42	60
		% within D	100.0%	100.0%	100.0%	100.0%

Source: Field survey, April 2013

Despite majority of respondents 42 representing 70% indicated that risk assessment at the design phase of project was very important, it was worrying to find out from the analysis of Table 4.9 that though all projects are subject to risk and risk management is a recognized practice that helps clients deliver projects on schedule and within time, 33.3% of respondents do not undertake any risk assessment in project of works. This according to Tadayon *et al.* (2012) is a major cause of cost overruns, project delays and poor quality of projects.

Table 4.10:Chi-Square test for risk assessment for a project* importance of risk assessment at the design phase.

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.800[a]	2	.407
Cramer's V	.173		.407
N of Valid Cases	60		

Source: Field survey, April 2013

The null hypothesis here is that there is no relationship between whether respondents had carried out risk assessment for project before and how respondents access the level of importance of risk assessment at the design phase. While the alternate hypothesis is that there is a relationship The author used cross tabulation method to see if there is a relationship between whether respondents had carried out risk assessment for project before and how respondents access the level of importance of risk assessment at the design phase at 2 degrees of freedom. Results of the cross tabulation, Table 4.10 indicates p-value (0.407); this therefore provides evidence against the null hypothesis. The implication of this is that, the null hypothesis is rejected, on the basis of the sample; there is a relationship between whether respondents had carried out risk assessment for project before and how respondents access the level of importance of risk assessment at the design phase. It was found out that the Cramer's V with effect size 0.407 falls between 0.40 and under 0.60 (Refer Table 3.2 Level of magnitude of association); this shows that there is a relatively strong association between how consultants assess the importance of risk assessment and whether consultants carry out risk

assessment. This shows that majority of respondents who evaluate risk assessment important at the design phase mostly carry out risk assessment. This can be observed from the Table 4.9 which indicates that for the majority of the respondents 28 out of 40 respondents who indicated that risk assessment at the design phase is very important, majority 66.7% had carried out risk assessment before.

Table 4. 11: Phase of the project where risk assessment processes were performed * Importance of risk assessment at the design phase of projects. Cross tabulation

			Q6. Access the importance of risk assessment at the design phase of the project?			
			Not so important	Fairly important	Very important	Total
Q8c. If yes to que 7, in what phase of the project were the risk assessment processes performed?(E)	Design	Count	-	-	14	14
		% within E	-	-	100.0%	100.0%
	Tendering/Contract Award	Count	-	6	8	14
		% within E	-	42.9%	57.1%	100.0%
	Production	Count	-	-	4	4
		% within E	-	-	100.0%	100.0%
	Design and Production	Count	-	-	2	2
		% within E	-	-	100.0%	100.0%
	Tendering/Contract and Production	Count	3	3	-	6
		% within E	50.0%	50.0%	-	100.0%
	NA	Count	-	6	14	20
		% within E	-	30.0%	70.0%	100.0%
Total		Count	3	15	42	60
		% within E	5.0%	25.0%	70.0%	100.0%

Source: Field survey, April 2013

Risk assessment is conducted at various phases of project. The study sought to find out from respondents the phase or phases of project in which they had conducted risk assessment before. Table 4.11 shows the various phases in project where respondents had carried out risk assessment before. From the analysis of the results, it can be seen that the phase where majority

of respondents (20 representing 33%), undertake risk assessment is the tendering/contract award phases. This may be as a result of the fact that during tendering/contract award phase, evaluation of tenders submitted by the tenderers is a major activity. Even though majority of the respondents 70% indicated that risk assessment was important at the design phase, it was worrying to find out that only 14 representing 23% of the respondents undertake risk assessment only at the design phase and 2 at both the design and production phase.

Table 4. 12: Risks frequently assessed in project

	SCALE					
	Not Frequent	Fairly	frequent	Very frequent		
	FREQUENCY					
RISK					**RII**	**Rank**
Financial Risk	2	4	18	16	80.0	1st
Contractual risk	2	10	12	16	76.3	2nd
Economic Risk	8	12	20	-	57.5	3rd
Environmental Risk	11	11	14	4	56.9	4th
Political Risk	14	12	6	8	55.0	5th
Technology Risk	14	16	8	-	46.1	6th
Social Risk	20	12	8	-	42.5	7th
Force Majeure Risk	25	7	6	2	40.6	8th

Source: Field survey, April 2013

Consultants were asked to evaluate how frequent they carry out the different kind of risks that can be found in projects. From the analysis of Table 4.12, it can be observed that majority of respondents frequently assess financial risks which is ranked 1st and contractual risks which is also ranked 2nd. The others follow suit from the highest ranked to the lowest ranked as follows,

economic risk 3rd, environmental risk 4th, political risk 5th, technology risk 6th, social risk 7th and force majeure risk 8th. The increase in the number of projects with huge cost overruns and contractual disputes which was also observed by Chan *et al.* (2003) has been a major reason for consultants concentrating on assessing them.

Table 4.13: Type of approach used to assess risks

Type of approach	Frequency	Percent (%)
Formal Approach	9	15
Informal Approach	29	48
Both	2	4

Source: Field survey, April 2013

The approach consultants use to assess project risks vary from organization to organization. Data gathered from the field indicates that, majority of consultants 48% use the informal approach to analyze risk whilst 15% use the formal approach (Refer to Figure 4.13). This finding supports Smith *et al.* (2006), as it was noted that many organizations implement the informal approach of risk assessment.

Table 4.14: Method frequently used to identify risk

	SCALE					
	Not Frequent	Fairly	Frequent	Very frequent		
Method for identifying risk	**FREQUENCY**				**RII**	**RANK**
Previous Experience	-	4	15	21	85.6	1st
Historical Data	-	4	23	11	79.6	2nd
Expert Opinion	-	6	30	2	72.4	3rd
Brainstorming	4	6	20	8	71.1	4th
Evaluation of Project	11	7	14	8	61.9	5th
Checklist	12	20	4	2	47.4	6th
Structured interview	19	13	4	2	42.8	7th
Questionnaire	23	9	6	-	38.8	8th

Source: Field survey, April 2013

Regarding the method used to identify risk, data from the field showed that consultants use varied methods with previous experience been the most frequently used method followed by historical data, expert opinion, brainstorming, evaluation of projects, checklist, structured interview and questionnaires in descending order (Refer Table 4.14).This observation is in tandem with a late study by Baker *et al.* (1999), which was noted that personal experience, historical data and brainstorming to be effective ways for identifying new risks.

Table 4.15: Method used to analyze risk

Frequency of Method used for analyzing risk	SCALE					
	Not Frequent	Fairly frequent	frequent	Very frequent		
	FREQUENCY				RII	RANK
Qualitative Method	8	4	20	8	67.5	1st
Quantitative Method	16	6	12	2	50.0	2nd

Source: Field survey, April 2013

In analyzing risk, consultants resort to using qualitative or the quantitative method to analyze risk. Analysis of data gathered and analyzed (Refer Table 4.15) showed that, the qualitative method of risk analysis was ranked 1st indicating that, the qualitative method of risk analysis is the method frequently used by most consultants in Ghana to analyze risk. This result is similar to a questionnaire survey conducted by Tang *et al.* (2003) in China, which showed that qualitative analysis is the most commonly used technique in the Chinese construction industry, while the use of quantitative methods is very low.

Table 4.16: Level of influence consultants have on risk assessment

Level of influence	Frequency	Percent (%)
Very Small	2	3
Fairly small	10	17
Fairly large	22	37
Very Large	26	43

Source: Field survey, April 2013

Majority of the respondents 43% assess the level of influence that consultants have on risk assessment at the design phase as very large whilst 3% as very small. This indicates that the role of the consultant in risk assessment at the design phase of the project of work is very significant.

Table 4.17: Level of influence consultants have in assessing the following risks

RISK	SCALE					
	Very Small	Fairly small	Fairly large	Very Large		
	FREQUENCY				RII	RANK
Contractual risk	-	6	24	30	85.0	1st
Financial risk	2	8	26	24	80.0	2nd
Economic risk	4	15	27	14	71.3	3rd
Environmental risk	4	18	22	16	70.8	4th
Technology risk	9	16	21	10	64.3	5th
Social risk	6	24	22	6	62.1	6th
Political risk	19	14	15	10	56.9	7th
Force Majeure risk	20	18	14	8	54.2	8th

Source: Field survey, April 2013

In ranking the level of influence consultants have in assessing the risks identified, it came to light that contractual risk was ranked 1st. This indicates that consultants have a very significant influence when assessing contractual risks followed by financial 2nd risk, economic risk 3rd, environmental risk 4th, technology risk 5th, social risk 6th, political risks 7th and force majeure risks 8th (Refer Table 4.17).

4.3 SUMMARY

This chapter has been a presentation of the analysis of the relevant data collected from the field. Relevant data to the study was analyzed and discussed. This was done taking into consideration the objectives of the study. A Chi-square test was undertaken to establish the relationship between various variables including inter alia the relationship between years of experience and engagement in any construction project, years of experience and participation in the design phase, how frequent consultants carry out risk assessment at the design phase and whether consultants had studied risk management or/and project management courses before and also whether consultants had carried out risk assessment for project before and how consultants assess the importance of risk assessment at the design phase of project. An additional test was carried out using the Cramer's V statistic to establish the level of relationship that variables which were recognized to have a relationship had.

Further some issues concerning risks frequently assessed in a project, type of approach used to assess risks, method frequently used to identify risk, level of influence consultants have on risk assessment and level of influence consultants have in assessing project risk were discussed. These issues discussed served as basis for drawing findings and making relevant recommendations. The next chapter focuses mainly on presenting the findings and recommendations of the study. It also gives a general conclusion to the study.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter presents the summary of the study, conclusions that have been arrived at and recommendations.

5.2 SUMMARY OF FINDINGS

In the sections below, the objectives are presented and discussed. The content of each objective forms titles of the sections. The discussion is based on the respondents' opinions and the researcher's reflections. The research work was undertaken purposely not only to fulfill the academic pursuit but also to present recommendations for risk assessment at the design phase of projects in Ghana. After a series of intensive review and analysis of materials relating to risk assessment, the following findings were made.

5.2.1Extent of Knowledge of Consultants in Risk Assessment at the Design Phase of Project in Ghana;

- It was revealed that majority of consultants who have a high level of experience have a high participation at the design phase of projects; however the magnitude of relationship was low. This shows that even though a high number of years of experience of consultants can result in a high participation of consultants in construction projects, the level of their relationship is small.

- With regard to the design phase of projects, it was also revealed that with a high number of years of experience of consultants comes a higher participation at the design phase, the level of their relationship is also small.
- Again, it came to light that even though majority of consultants have a large experience and are educated in risk assessment in project, most of the respondents have what might be described as an average understanding or knowledge of risk assessment. It would have been expected that majority of consultants rate themselves as having a high understanding of risk assessment due to their years of experience and level of participation in projects, although this was not the situation.
- In spite of a high participation of consultants at the design phase of project and a high assessment of the importance of risk assessment, just a few consultants had undertaken risk assessment at the design phase before.
- Further, it was also revealed that even though all projects are subject to risks and risk management is a recognized practice that helps clients deliver projects on schedule and within time (Project Management Institute, 2001), regrettably many consultants 33.3% in Ghana do not undertake any risk assessment in project resulting in major cost overruns, project delays and quality problems (Tadayon *et al.*, 2012).
- It came to light that majority of consultants undertake risk assessment at the tendering/contract award phase, conversely it was worrying to note that out of the few consultants who undertake risk assessment in project, less than 50% of them had undertaken risk assessment at the design phase whilst more than 50% do not undertake risk assessment at the design phase of project.

- In response to the question of what types of risks the respondents dealt with in project, the following risks were mentioned (listed in the decreasing order of importance): Financial risk, Contractual risk, Social risk, Force majeure risk, Political risks, Economic risks and Technology risk. This indicates that the risks connected to Technology and Economic are not frequently assessed.

5.2.2Risk Assessment Tools and Techniques Employed By Consultants in Ghana at the Design Phase of Project;

- The questionnaires revealed that majority of the consultants use the informal approach of assessing risks. This supports smith *et al.*(2006), survey that many organizations implement the informal approach of risk management.
- Previous experience, historical data, expert opinion and brainstorming are the tools and techniques frequently used by majority of the respondents to identify risk.
- Again, in response to the method used to identify risk, it was revealed from the analysis that previous experience is the most frequently used method by consultants, followed by historical data, expert opinion, brainstorming, evaluation of projects, checklist, structured interview and questionnaires in descending order This observation is in tandem with a late study by Baker *et al.* (1999), which was noted that personal experience, historical data and brainstorming to be effective ways for identifying new risks.
- On the issue of the approach that respondents use to analyze risk, the study revealed that the qualitative method of analysis which uses descriptive scales to describe the magnitude of consequence and likelihood was frequently used.

5.2.3 Influence of Consultants in Risk Assessment at the Design Phase of Construction Projects

- The study revealed that most consultant evaluate the influence that they have on risk assessment as very large. This indicates that the role of the consultant in risk assessment at the design phase of a project is very significant. This adds credence to the research by Mubarak (2010) that the experience and competence of the consultants in handling the design of the project is of great importance (Mubarak, 2010).
- In ranking the level of influence consultants have in assessing projects, it came to light that contractual risk was ranked 1st. This indicates that consultants have a very significant influence when assessing contractual risks followed by financial risk, economic risk, environmental risk, technology risk, social risk, political risks and force majeure risks in descending order of magnitude.

5.3 CONCLUSION

Considering the effects that risk assessment has on project goals in the form of quality, time and cost, it should be an open conscious process. The aim of the paper was to explore the approaches employed by consultants for risk assessment at the design phase of projects. To achieve this aim, three specific objectives were set for the study; to examine the extent of knowledge of consultants in risk assessment at the design phase; to identify the risk assessment tools and techniques employed by consultants in Ghana; and to examine the influence of the consultant in risk assessment. Based on the literature review presented in the study and the findings of the survey results, it can be concluded that all the research objectives have been achieved as follows;

the study revealed that the extent of knowledge of consultants in risk assessment at the design phase is average. On the issue of the risk assessment tools and techniques employed by consultants in Ghana at the design phase for assessing risk, it came to light that the approach consultants use in is either the formal approach or the informal approach, for identifying risk consultants use previous experience, historical data, expert opinion, brainstorming, evaluation of projects, checklist, structured interviews and questionnaires in descending order. Finally the study revealed that consultants have a significant influence in risk assessment at the design phase.

To conclude the interest in risk assessment is growing, with an increasingly and rapidly changing nature of projects, the onus falls on consultants to manage risk while maintaining control and improving performance. The recommendations proffered in this research would assist consultants in Ghana in assessing risk at the design phase of projects.

5.4 RECOMMENDATIONS

The findings of this research are expected to contribute to a more effective risk assessment process and therefore, benefit construction projects actors. To achieve this objective, this study proposes a set of recommendations to the consultants:

- As many respondents identified the lack of theoretical knowledge, it would be reasonable to suggest advanced training in risk assessment for consultants. The training is expected to increase knowledge of the subject and understanding of the importance of risk

assessment for safeguarding project objectives. This recommendation is directed to the consultancy firms because they are responsible for staff development.

- One way to analyze risk is to develop and use a checklist. Using a checklist, a project agency can identify any possible difficulties in the project process. Checklist contains a list of the risks which commonly occur on projects of a similar type. Below is a checklist presented to aid consultants in assessing risks.

Table 5.1: Checklist of Risks

PHASE	RISKS
Programming and Feasibility	• Unrealistic budget • Inadequate project formulation, investigations and technical specifications; • Lack of proper financial appraisal of the project ; • Difficulty in capturing and specifying the client/user life requirements; • Difficulty in estimating the time and resources required ; • Difficulty in understanding and setting project objectives; • Responsibilities between stakeholders ill defined • Responsibilities of project staff not clearly defined • Expectations and objectives unclear • Legal complexities
Schematic Design and Design Development	• Inexperienced design team; • Planning and environmental constraints; • Inadequate site information and analysis; • Allocated resources are inadequate ; • Incomplete design scope ; • Compliance with standards and codes of practice; • Design is too complex and novel; • Environmental and planning conditions imposed on design; • Unrealistic time / cost expectations
Contract Document	• Contract documents are inadequately developed Escalation of tendering costs. • Delays in obtaining approvals • Incorrect market approach selected • Lack of interest in response to tender

Source: Author's construct

- Consultancy firms should develop a set of laid down procedures for consultants to use in risk assessment at the design phase of project in order that the use of intuition employed by majority of consultants in risk assessment is lessened.

5.5 RECOMMENDATIONS FOR FURTHER RESEARCH

The findings of this research provide several directions for further work. For example, the study revealed a low participation of consultants in risk assessment at the design phase of projects in Ghana. In further research, participation of consultants in risk assessment should be explored. Another important finding is a knowledge gap in risk assessment at the design phase. Thus, a deeper study of the knowledge gap in risk assessment would be of particular interest.

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APPENDICES

APPENDIX 1: QUESTIONNAIERE

Dear Sir/Madam

QUESTIONNAIRE SURVEY- RISK ASSESSMENT AT THE DESIGN PHASE OF CONSTRUCTION PROJECTS IN GHANA

I am currently undertaking research into the risk assessment at the design phase of construction projects in Ghana. The study is based on a case study of consultants, so your participation is important.

As part of the research, I am conducting a questionnaire survey to seek input from consultants in Ghana. I would be grateful if you could kindly devote about twenty (20) minutes to complete the enclosed questionnaire and return it as soon as possible. Your response will be treated as STRICTLY CONFIDENTIAL. The information will be used for academic purposes only, as one part to a university research project. Only a consolidated summary of the results may be published, i.e. no names of participating individuals will be referred to and only the aggregate groups will be reported. A summary of the findings will be made available to you upon request.

Should you have any questions, please feel free to contact me by phone on 0269507681/0208042893 or by email at maumeloneusa@yahoo.com

Thank you very much for your participation in the survey.

Yours sincerely,

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QUESTIONNAIRE

RISK ASSESSMENT AT THE DESIGN PHASE OF CONSTRUCTION PROJECTS IN GHANA

Please provide the correct information by ticking (√) in the appropriate box and fill in the blank spaces where necessary.

Section A: Personal Data

1. Please indicate your years of experience in construction projects?0-5yrs ☐

6-10yrs ☐ 11-15yrs ☐ 15yrs and above ☐

Section B: Knowledge in Risk Assessment

2. Did you study risk management or/and project management courses? Yes ☐ No ☐

3. How do you evaluate your knowledge of risk assessment? Low ☐ Average ☐ High ☐

4. Have you been engaged in any construction project before? Yes ☐ No ☐

5. Have you participated in the design phase of a project?

(The design phase of a project includes programming and feasibility, Schematic, Design development and Contract documentation. The final detailed drawings along with the final specifications and Bills of Quantities are called the contract documents).

Yes ☐ No ☐

6. Assess the importance of risk assessment at the design phase of a project?

Assessment criteria	**Please tick (√) as appropriate**
Unimportant	
Not so important	
Fairly important	
Very important	

7. Have you carried out any risk assessment for a project before?Yes ☐ No ☐

If No, kindly turn to question eighteen (13).

8. If yes to question 7, in what phases of the project were the risk assessment processes performed?

(Tick off one or more alternatives that are suitable)

Design ☐ Tendering/Contract award ☐ Production ☐

9. If yes to question 7, how frequent have you assessed the following risks in a project?

Risks	**Not Frequent**	**Fairly frequent**	**Frequent**	**Very frequent**
Technology risk				
Financial risk				
Contractual risk				
Political risk				
Environmental risk				
Social risk				
Economic risk				
Force Majeure risk				
Other:				

Section C: Risk Assessment Tools and Techniques employed by Consultants

10. If yes to question 7, what type of approach did you use to assess project risks?

*(The **formal approach** often consists of a set of procedures laid down by an organization for use in the risk assessment process. The **informal approach** for the assessment of risk involve discussions with experts, relevant experience etc)*

Formal Approach ☐

Informal Approach ☐

11. If yes to question 7, what method/methods do you frequently use to identify risk?

	Not Frequent	**Fairly frequent**	**Frequent**	**Very frequent**
Brainstorming	☐	☐	☐	☐
Expert Opinion	☐	☐	☐	☐
Structured Interview	☐	☐	☐	☐
Questionnaire	☐	☐	☐	☐
Checklist	☐	☐	☐	☐
Historical Data	☐	☐	☐	☐
Previous Experience	☐	☐	☐	☐
Evaluation of Projects	☐	☐	☐	☐

Other.....

12. If yes to question 7, how frequent do you use the following method to analyze risks?

*(**Qualitative analysis** uses word form or descriptive scales to describe the magnitude of consequence and likelihood of risks. **Quantitative analysis** uses statistical and probabilistic approaches to describe the magnitude of consequence and likelihood of risks)*

Method	**Not frequent**	**Fairly frequent**	**Frequent**	**Very Frequent**
Qualitative				
Quantitative				

Section D: Role of Consultants in Risk Assessment at the Design phase

13. Evaluate the level of influence that consultants have on risk assessment at the design phase?

Evaluation criteria	**Please tick (√) as appropriate**
Very small	
Fairly small	
Fairly large	
Very large	

14. Assess the importance of the following roles of the consultant at the design phase of a project?

(Scale: 1 =Unimportant 2=Not so important 3=Fairly important 4=Very important)

Roles	**1**	**2**	**3**	**4**
Assess procurement risks at the design stage				
Establish design criteria				
Perform conceptual design and preliminary engineering in support of the environmental clearance documents				
Perform technical studies and develop engineering criteria				
Produce final design drawings, specifications and bills of quantities for the construction bid package				
Others:				

15. Evaluate how frequent the consultant carries out risk assessment at the design phase?

Evaluation criteria	**Please tick (√) as appropriate**
Not frequent	
Fairly frequent	
Frequent	
Very frequent	

16. Assess the level of influence that consultants have in assessing the following risks?

Risks	**Very Small**	**Fairly small**	**Fairly large**	**Very large**
Technology risk				
Financial risk				
Contractual risk				
Political risk				
Environmental risk				
Social risk				
Economic risk				
Force Majeure risk				
Others:				

Other Comments:

Thank You for Your Participation