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THE USE OF INSURANCE AS A MAJOR TOOL IN RISK MANAGEMENT IN THE GHANAIAN CONSTRUCTION INDUSTRYT

by

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ABSTRACT

Construction works are hazardous by nature and accidents are frequent and often severe. The annual toll of deaths, bodily injuries and property damage in construction world is very high. Not only this but construction works involve large amount of investment especially in public projects. All of this increases the risk of construction business and makes handling of financial matters more critical. Insurance and Surety are some of the methods utilized by the contractors and client as risk controlling mechanisms. There is a growing body of interests in construction insurance, supporting interactions between the construction industry and the insurance industry. The main aim of the research was to conduct an investigation into how insurance is used as a risk transfer tool in the Ghanaian construction industry. The existing literature on construction insurance was reviewed in the light of this analysis to identify key gaps in knowledge and help to focus further the research priorities. The research methodology comprised a questionnaire survey supplemented with interviews among Clients, Consultants, Insurance Companies and Contractors (mainly D1 and D2). To provide a convincing explanation on this interaction, one need to improve the theoretical and analytic frameworks in four key areas: the nature of construction risks, risk transfer and insurance mechanism, insurable risks, and perspectives on risks from concerned parties.The research revealed that Insurance companies only provide insurance covers to projects but do not normally visit project site or educate other participants especially contractors as to the control or minimizing the occurrence of risk. It was recommended that right from the briefing stage till handover to users, the client should involve the various contract groups in discussing risk management process as well as drafting of insurance policies before and during construction.

DEDICATION

To my father and mother, the late Alhaji Yakubu Abubakari and Hajia Memunatu Adam

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I wish to express my heartfelt appreciation to the Almighty God for his numerous blessing and guidance on me through another challenging moment in life.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

No construction project is risk free. Every construction project, large or small, involves risks with varying impact. The construction industry is subject to more risk and uncertainty than many other industries (Flanagan and Norman, 1993). The process of taking a project from initial investment appraisal to completion, and into use, is complex. It requires a multitude of people with different skills and interests and the co-ordination of a wide range of disparate, yet interrelated activities. Such complexity moreover, is compounded by many external, uncontrollable factors. Risk may hinder the successful completion of a project by causing time and budget over-run, and/or quality default.

Construction insurance is used as a collective term to describe various types of policies to protect construction works, erection and operation of machinery. Traditionally, it is assumed to be only limited to the construction stage. However, the project is a whole life process, which includes a feasibility study, a call for tender and evaluation of tenders, an award of contract, construction and erection phases, and a take-over and maintenance period. Many researchers (Hickson, 1987, Levine, 1991, Palmer, 1996, Advanced Study Group No, 1999, Bunni, 2003) discussed all possible insurance policies during the whole project process to build an overall picture of construction insurance.

With the development of construction management and civil engineering, construction insurance products and services have become increasingly specialized since the first Contractors' All Risks policy was issued in 1929 to cover the construction of Lambeth 19 Bridge over the Thames in London (Harry, School of Business, Shenandoah University, Winchester, VA 22601, United States). A special insurance building policy was created in Germany in 1934 and started to spread slowly (Wassmer, 1998). Latent defects insurance was introduced as Decennial Insurance by French insurers during the 1980s.

Insurance, which are generally required in connection with a construction project, can be divided into two basic categories: property insurance and liability insurance. Recently, it has been extended to cover business interruption during construction process, which is generally termed as Delay in Start-up (DSU) or Advance Loss of Profit (ALOP). Although it would seem ideal to obtain one insurance policy covering a construction contract, this is not possible because the range of contract risks is vast and insurers specialize in underwriting certain risks (Levine, 1991). Project insurance, sometimes called wrap-up, is an all-embracing insurance for construction projects. Unlike conventional construction insurance coverage where each contractor provides his or her own insurance coverage, project insurance allows the client or contractor of the construction project to purchase an insurance policy covering most parties participating in a given project. It can best represent and protect client's interests, avoid an insurance gap and possibly save on project costs. In the long term, particularly for large projects, more specific project insurances can cover all parties with comprehensive non-duplicating, gap-free cover (Edwards, 1996). However, it has some limitations. For example, size is an important prerequisite and dominant

factor in determining a project's suitability for project insurance. So a project must be sufficiently large, or at least contain significant labour costs, to make project insurance financially viable. Otherwise, the additional administrative cost generally makes it less worthwhile to use project insurance.

DEFINITIONS

Risk and Risk Management

The Oxford Advanced Learner's Dictionary (1995 ed.) defines risk as the "chance of failure or the possibility of meeting danger or of suffering harm or loss". In construction projects, a risk may be defined as the likelihood of a detrimental event occurring to the project. Since the objectives of construction projects are usually stated as targets established for function, cost, time and quality, the most important risk in construction is failure to meet these targets.

Within the scope of management and decision theory, research in construction and project risk management began in 1960's (Guilin, 2004). Risk management is defined as a set of methods and activities designed to reduce the disturbances occurring during project delivery (Skorupka, 2003). It can also be defined as the structured set of processes aimed at identifying, analyzing and responding to project risks. It includes maximizing the results of positive events and minimizing the consequences of negative events (PMBOK Guide, 2000). According to Gray (2000), risk management is a proactive approach rather than reactive. It is preventive process designed to ensure that surprises are reduced and negative consequences associated with the undesirable events are minimized. Successful management of project risk gives the project

manager better control over the future and can significantly improve chances of reaching project objectives on time, within budget and meeting required technical (functional) performance.

RISK TRANSFER AND INSURANCE

Risk transfer is a risk management technique of passing the responsibility of risks to another party. Risks can be transfer either through contracting or by insurance which changes an uncertain exposure to certain cost. Transferring risk does not necessarily reduce the effect the risk would have or the likelihood of its occurance but only passes the responsibility to another party.

From the legal viewpoint, insurance allocates the risks to which the project is exposed, between the parties. Dickson (1983) highlighted insurance as a risk transfer mechanism that the insured transfer from a state of uncertainty to a state of certainty at the certain cost of the insurance premium. It is a cost-smoothing mechanism, in which contractors exchange a regular known annual premium for an unknown potential loss.

Insurable risks are defined by FIDIC (1986) and CII (1993) together as follows:

- An insurable risk must be measurable in quantitative terms and in such a way that the theories of probability and the law of inertia of large numbers may be used;
- A large number of homogeneous and relatively independent exposure units;
- Potential losses that is accidental and unintentional;
- Losses that is determinable and measurable;
- Reliable estimates of claim frequency and severity are available;

• The risk charge or premium is economically feasible; and

• The insured must have an insurable interest in the object of the insurance contract.

1.2 STATEMENT OF THE PROBLEM

The provision of insurance is generally considered important and indeed in the event of a major loss, the insurance may be the only viable means of repaying financiers or ensuring that the Project is back on track. However paradoxically, rarely does insurance receive the attention it deserves, either within the overall context of the deal or in the detail of the interrelationship between the drafting of the construction and franchise agreements and the insurance wording (Palmer, et al, 1996). Also practitioners sometimes do not have a clear understanding of risk allocation and the strategy of risk management through insurance. This can results in claim difficulties which can consequently affect the project in diverse ways, such as increase in project cost, completion time of the project as well as quality.

It is important to understand the extent of the insurance contract before contractual terms are finalised to avoid circumstances where risks have been assumed based on the wrong assumptions of a party's ability to obtain particular insurance at a commercially acceptable price (or at all). This is of particular concern in the current climate where insurance premiums are higher; policies contain many limitations and exclusions.

1.3 AIM OF STUDY

The main aim of the research was to conduct an investigation into how insurance is used as a risk transfer tool in the Ghanaian construction industry and examine the interaction between construction players and insurance companies with respect to risk management.

1.4 OBJECTIVES

The objectives of the study include:

i. To identify major risks factors in the Ghanaian construction industry;
ii. To identify the most insurable risks typically involved in the construction industry;
iii. To identify the types of insurance commonly used in the Ghanaian construction industry; and
iv. To recommend management strategies to insurance companies, construction firms as well as client in the use of insurance as a tool for risk transfer;

1.5 JUSTIFICATION OF THE RESEARCH

Construction insurance is a practice of exchanging a contingent claim for a fixed payment to protect the interests of parties involved in a construction project. Construction insurance is a major method of managing risks in the construction industry. Its primary function is to transfer certain risks from clients, contractors, subcontractors and other parties involved in the construction project to insurers to provide contingent funding in time of difficulty. Construction insurance plays an increasingly important role in guaranteeing the success of projects, with insurers

sharing losses resulting from natural disasters and other contingencies. Insurance is, of course, only one means of managing risks associated with projects. It needs to be put into context and understood that not every risk can be insured against, insured against adequately or insured for a price that is acceptable. As stated in the statement of problem, construction insurance does not receive the attention it deserves as a result of lack of proper risks management practices in the construction industry. The research sought to identify insurable risks and the types of insurance typically involved in the Ghanaian construction industry.

The study is expected to contribute in raising the awareness of the insurable risks and policies which project participants are exposed to, in the contracts they enter into. It will also provide a tool for decision-making in contract formation especially in insurance policies.

1.6 RESEARCH METHODOLOGY

The study was carried out using a three phase approach. The first was to review the relevant literature on the subject of risk management and insurance, in particular looking at insurance as means of risks transfer from literature of previous researchers.

In the second phase, a pilot study which took the form of structured questionnaire was conducted with selected insurance companies, contractors, client and selected experts (professionals) in the Ghanaian construction industry. Structured interviews and questionnaires survey were adopted as a method for data collection. The questionnaires were in three main parts as follows:

(a) Background information – collecting the personal data of respondents, their experience in the construction industry.

(b) General perception of Risk management and insurance – gathering the respondents' familiarity with the concept of risk management and insurance practices in the Ghanaian construction industry. This part of the questionnaire explored the respondents' level of knowledge of risk response especially risks transfer through insurance.

The final phase of the research was used to analyse the data collected using descriptive and inferential statistical methods.

1.7 SCOPE OF THE RESEARCH

The research focused on insurance as a risk management tool for the building construction industry in Ghana. It was limited to insurance companies, contractors within D1 K1 and D2 K2 classification of Ministry of Water Resources, Works and Housing, client and experts (professionals) in the Ghanaian building construction industry.

1.8 ORGANISATION OF THE RESEARCH

The research was organised in Six (6) chapters. Chapter one provided the introduction and background to the problem. This was followed by a review of literature on risk management and construction insurance in the second and third chapters respectively. The fourth chapter highlighted the research methodology and data collection method. Analysis of the research results was discussed in chapter five whiles' conclusions and recommendations were captured in chapter six.

CHAPTER TWO

REVIEW OF RISK MANAGEMENT

2.1 RISK AND UNCERTAINTY

Although risk is widely studied, it still lacks a clear and shared concept definition: risk is often only perceived as an unwanted, unfavourable consequence. Such a definition embodies two misleading concepts: first, among professionals there is an established consensus that risk needs to be viewed as having both negative and positive consequences. Second, risk is not only related to events, i.e. single points of action, but risk also relates to future project conditions. Conditions may turn out to be favourable or unfavourable. The point is that future project conditions are hard to predict in the early stages of the project life-cycle. In addition, conditions can change during the project life-cycle and the risk is that the conditions are different, and potentially more severe than was first estimated. Risks analyzed only as certain events are further criticised for not taking the degree of impact into consideration. Risks are seldom on-off-types; meaning that risks do not either happen or "not-happen", the impact of the risk varies greatly, depending on the conditions at the time of the possible occurrence (Artto and Kähkönen, 2000). Variability and the level of predictability (uncertainty) of the future scenarios determine the quality of risk analysis done today (Turner, 1999).

Therefore many researchers have suggested that the term risk should be replaced with a more neutral term that could embody a larger scope than risk traditionally denotes. The term uncertainty is suggested to replace risk because it can easily embody the

variability and ambiguity of risk (Ward and Chapman, 2003). Chapman and Ward (2003) explain that uncertainty is critical to all projects and that this uncertainty relates to more than just time and cost objectives of a project. An uncertainty includes for example problems like which parties ought to be involved, their motives and alignment of project objectives with corporate strategy. Managing these uncertainties efficiently is a best practice in project risk management. They continued that risks are caused by a lack of certainty and that uncertainty is especially prevalent in the early project phases. Since not all factors can be predicted at the onset of a project, yet decisions still have to be made, there is a risk that the outcome of these decisions is something other than what is expected.

Ward and Chapman (2003) further state that there is a need for a clearer focus on the upside effects, i.e. the opportunities. They believe that it is desirable to let go of the close connections to historical events, conditions and sets of circumstances and instead focus on the different sources of uncertainty that could lead to threats of failure or, equally, opportunities. Instead of closely connecting specific objectives of the risks and uncertainties involved, they suggest that uncertainty management is about anything that matters for the project success. Their opinion is that it is vital to understand where and why uncertainty is important in a given project context and not to focus solely on the threats and opportunities connected to given events, conditions or circumstances. They continue their line of argument with the suggestion that` uncertainty management´ should replace `traditional risk management´ to indicate that a wider perspective is being sought. It is also important to realise that the key issues help to understand where and why uncertainty plays an important role in a specific project and its context. Regardless of this development in the field, the term risk has

been preferred in this thesis because it is more established in both theory and practical use. According to the Project Management Institute, PMI (PMBOK, 2000), a definition of risk should consider both the positive and negative effects of a project objective. This is a broad view in terms of threats and opportunities and how they are connected to an event, a condition or a specific circumstance. This is the definition that works in theory but fails in practice. Despite the enlightened definition, opportunity is neglected when it comes to practical use. According to PMI, risk includes upside effects, the opportunities, but tradition focuses on the downside, i.e. the negative effects.

Risk and uncertainty could also be described in a more theoretical sense. They could be addressed as either aleatory or epistemic. An aleatory risk is a risk that could be regarded as random, estimated with probabilities and consequences to a set of possible known outcomes, but still, in the end, with a random outcome. To get a better understanding one can view this as something made in the right way, in the right system, but with the wrong outcome because the outcome is random and not predictable. An epistemic risk or uncertainty is more related to a lack of knowledge about matters having an influence on the outcome. These uncertainties are more about lacking the essential knowledge or using the wrong methods and tools to identify or assess risks and uncertainties. It could also be that there is a lack of information to identify or assess. An epistemic `uncertainty´ is thus an "unknown event from an unknown set of possible outcomes" (Hillson, 2004). This way of describing epistemic uncertainty leaves the door open for an interpretation that uncertainty is prior to risk in some sort of logical process. Hence, the concept of uncertainty could lead to opportunities as well as risks. This is illustrated in Figure 2.1

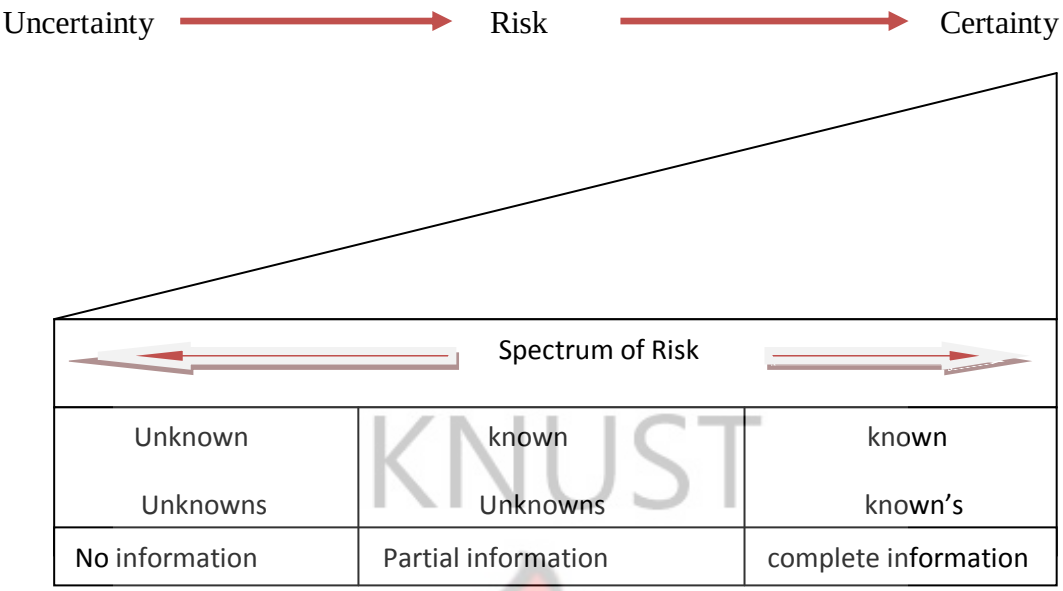


Figure 2.1: The Spectrum of Risk

(Source: Best Practice Guideline A5: Managing construction procurement risks)

This way of regarding risk is also found in the book 'Risk Management in Construction' (Flanagan & Norman, 1993) and in the philosophical view of decision theory (Hansson, 1994). Risk is somewhat calculable in their view, since it has to do with probabilities, whereas uncertainty has no previous history to relate any probabilities to. Uncertainty is rather an epistemic uncertainty, since it has to do with uncertainty of outcome and related to system performance (Aven, 2003).

2.1.1 Project Risk Categorisations

Project risks can be categorised in a number of ways according to the level of detail or a selected viewpoint (Peltonen, Kiiras, 1998). Some risk categorisations are merel risk lists, while some categorisations are formed based on the source of risk, by impact type or by project phase. Categorisations help to form risk lists that are useful when identifying construction risks.

One of the most typical risk categorisations is presented by Artto and Kähkönen (2000). According to them, risks are divided into pure risks (e.g. hazards and weather conditions), financial risks (e.g. cash flow or credit risk), business risks (almost anything that can happen in a project) and political risks, which refer to the certain political environment and risks that are caused mostly by extreme conditions, such as, among others, war. Risks in the project network can relate to any one of this list's categories. Project actors can cause hazards to one another because of inexperience, lateness of their products, delivery failure or unmade payments (bankruptcy) or new government laws either in favour or disfavour of the project.

Turner (1999) suggested that risks can be divided either according to their impact or by where the control lies. Thus these categories can be further divided into business risks, insurable risks, external risks and internal risks, for example bad weather is external risks since it cannot be controlled by a project manager and business risks are those risks that in generally have to be accepted in order to have an opportunity to take advantage of positive outcomes of a risk.

Miller and Lessard (2001) studied large engineering projects and categorised risks according to their source. Market, completion and institutional risks are divided into three categories. Market risk is mainly caused by the demand uncertainty, completion risks refer to technical risks during and after the completion of a project (for example, will the capacity of a factory be as designed and planned). Institutional risks are related to the political uncertainties in a specific situation. Miller and Lessard (2001) propose "a layering process" to systemically transfer, diversify and sell risks with financial instruments, real options and contract incentives.

Earlier in this chapter the definition for risk was discussed, it was clear that seeing risk only as an event-type phenomenon is not sufficient, but the ambiguity and unpredictability related to the future conditions must also be considered. Many sources describe the uncertainty resulting from ambiguity, variability and lack of data. In this study's perspective, risk and uncertainty are not that different that they should be separated as definitions. Ward and Chapman (2003) also identified five different categories of uncertainty as follow:

i. variability associated with estimates;
ii. uncertainty about the basis of estimates;
iii. uncertainty about design and logistics;
iv. uncertainty about objectives and priorities; and
v. uncertainty about fundamental relationships between project parties.

From their list of five uncertainty (risk) areas, the fifth is the most interesting in this study's point of view. Here Chapman and Ward have recognised that difficulty to identify responsibilities, capabilities and proper mechanisms for coordination and control is "a pervasive source of uncertainty". They add that these relationships may

or may not include formal contracts. These are the core issues of interest in this study; interaction between construction players and insurance companies with respect to risk management and what should be done to get these uncertainties (risks) managed.

2.1.2 Typical Construction Project Risks and Uncertainties

Construction projects are characterized as very complex, always unique projects, where risks rise from a number of different sources. These projects are characterized by a continuous decision making due to numerous sources of risk and uncertainty, many of which are not under the direct control of project participants (Baloi and Price, 2003). Construction projects have a bad reputation of failing to meet the deadlines and cost targets (Miller, 2001). That is why identifying risk factors or sources are extremely important, since it is not necessarily possible to identify single risks.

Odeh and Battaineh (2000) studied the most typical reasons for construction delays in Far-East construction projects. They found seven significant causes of delays: owner interference, inadequate contractor experience, financing and payments, labour productivity, slow decision making, improper planning and subcontractors.

The emphasis here is the experience and capability of project participants having the most effect on construction delay. These kinds of risks can be seen as network-related. Thus in order to have a successful project, it should be guaranteed by some means that all participants are experienced and trained to do the project.

Cohen and Palmer (2004) identified risk trends in construction projects. They found that typically, risks are determined at the very early phases of the project (feasibility

and planning) while the impacts are not experienced until the construction and production start-up phases. Their list of typical sources for risks in construction projects as follows:

i. Changes in project scope and requirements;
ii. Design errors and omissions;
iii. Inadequately defined roles and responsibilities;
iv. Insufficient skilled staff;
v. Force majeure; and
vi. New technology.

It is very clear that these lists or categorisations are based on the assumption that risk is something negative and threatens the project. This sense is more prevalent in construction risk categorisations than in general project risk categorisations in the frequent use of terms such as "lack of " ,"inefficiency", and "errors", among others.

2.2 RISK MANAGEMENT PROCESSES

Risk management is now widely accepted as a vital tool in the management of projects, although risk management has become firmly institutionalised across the industry sectors, it is only comparatively recently that this has extended to include the construction industry (Flanagan and Norman, 2003). The growth in the practice of risk management has been accompanied by a proliferation of standard and guidance information. There are British standards, guidance from professional bodies, public sector guidance, research published in academic journals and text books dedicated to the subject matter of risk management.

There are several definitions to risk management offered by the various professional institutions and standards bodies. According to BSI Guide 73 (2003), risk management is defined as coordinated activities to direct and control an organisation with regards to risk and generally includes risk assessment, risk treatment, risk acceptance and risk communication. The PMI's project Management book of knowledge (2000) describes risk management as the systematic process of identifying and analysing and responding to project risk. It includes maximising the probability and consequences of positive events and minimising the probability and consequences of events adverse to project objectives. It includes processes of risk management planning, risk identification, qualitative risk analysis, quantitative risk analysis, risk response planning and risk monitoring and control. BS6079 -1(2000) Guide to project management, does not offer an explicit definition of risk management as such, but states that the project manager should take positive steps to identify, assess and ultimately manage all risk inherent in the project, as an integral part of the project management process. The Australian / New Zealand standard AS/NZ 4360 (1999) defined risk management as a generic framework for establishing the context, identification, analysis, evaluation, treatment, monitoring and communication of risk (Best practices guideline, 2004).

There are several frameworks to improve the project risk management process, two difference frameworks are compared in figure 2.2 and 2.3.

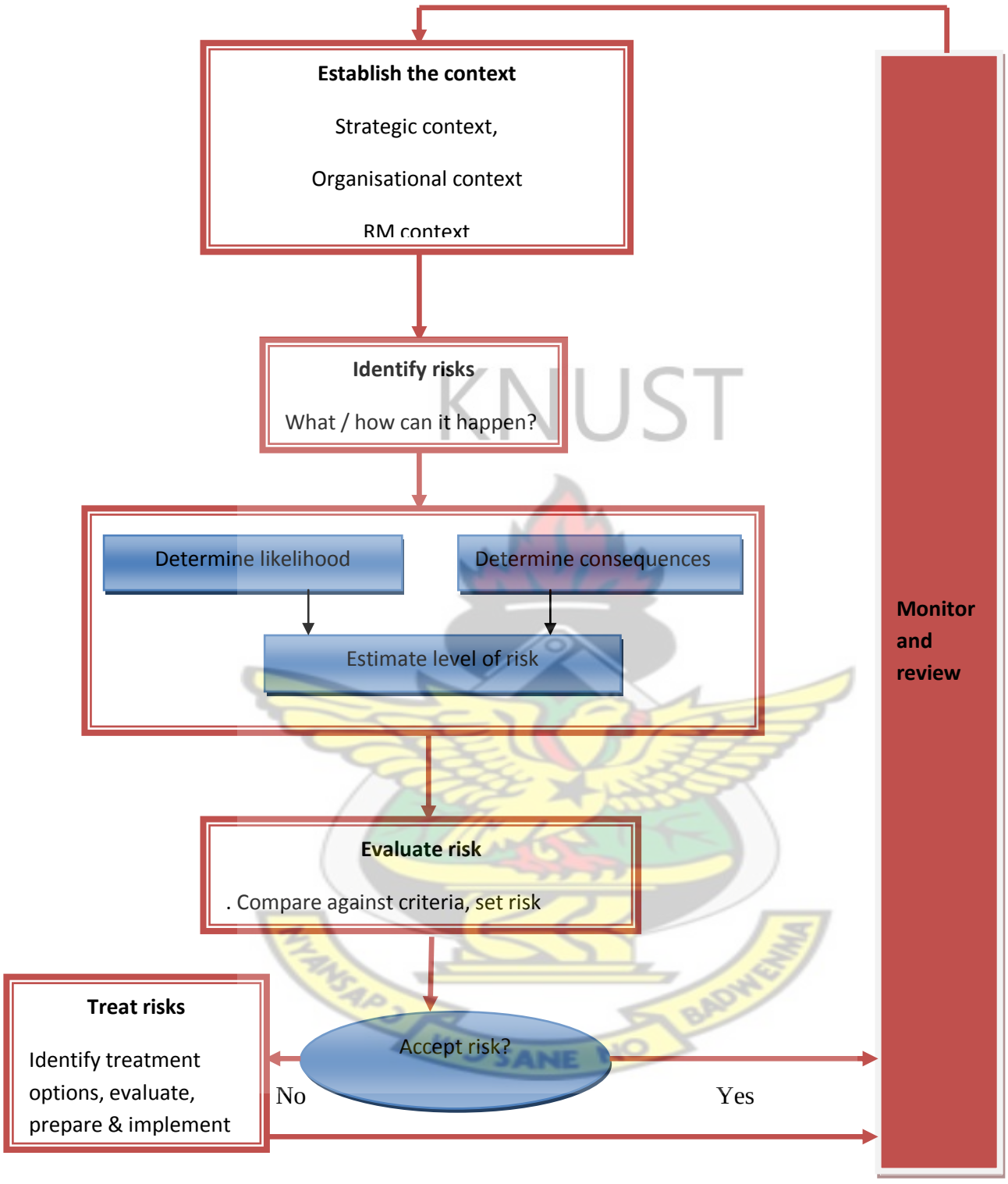


Figure 2.2: The process of establishing and implementing a risk management plan.

(Source: Best Practice Guideline A5: Managing construction procurement risks)

All of these processes basically have the same phases; only the level of detail in describing processes varies. Again, though, there are a number of key steps recognisable in all which are discussed, it is mainly a difference in terminology and emphasis which separates the various explanation of risk management rather than any matters of real substance. All of them are meant to be iterative processes where risk management phases are kept ongoing during the whole project life-cycle. Iterative rounds are important, for example Floricel and Miller's (2001) study showed that regardless of a thorough and careful identification phase, something unexpected occurred in every project they included in the study.

Risk management process should be implemented at the early project phases, when there is still a possibility for fundamental changes (Chapman, 1997). The project should be carefully analysed as to which kind of methods to use at which project phases and a process needs to be customised according to all project characteristics. This study will adopt the PMI PMBoK generic risk management process shown in figure 2.4. Next, all identified core processes are discussed each in turn.

THE RISK MANAGEMENT FRAMEWORK

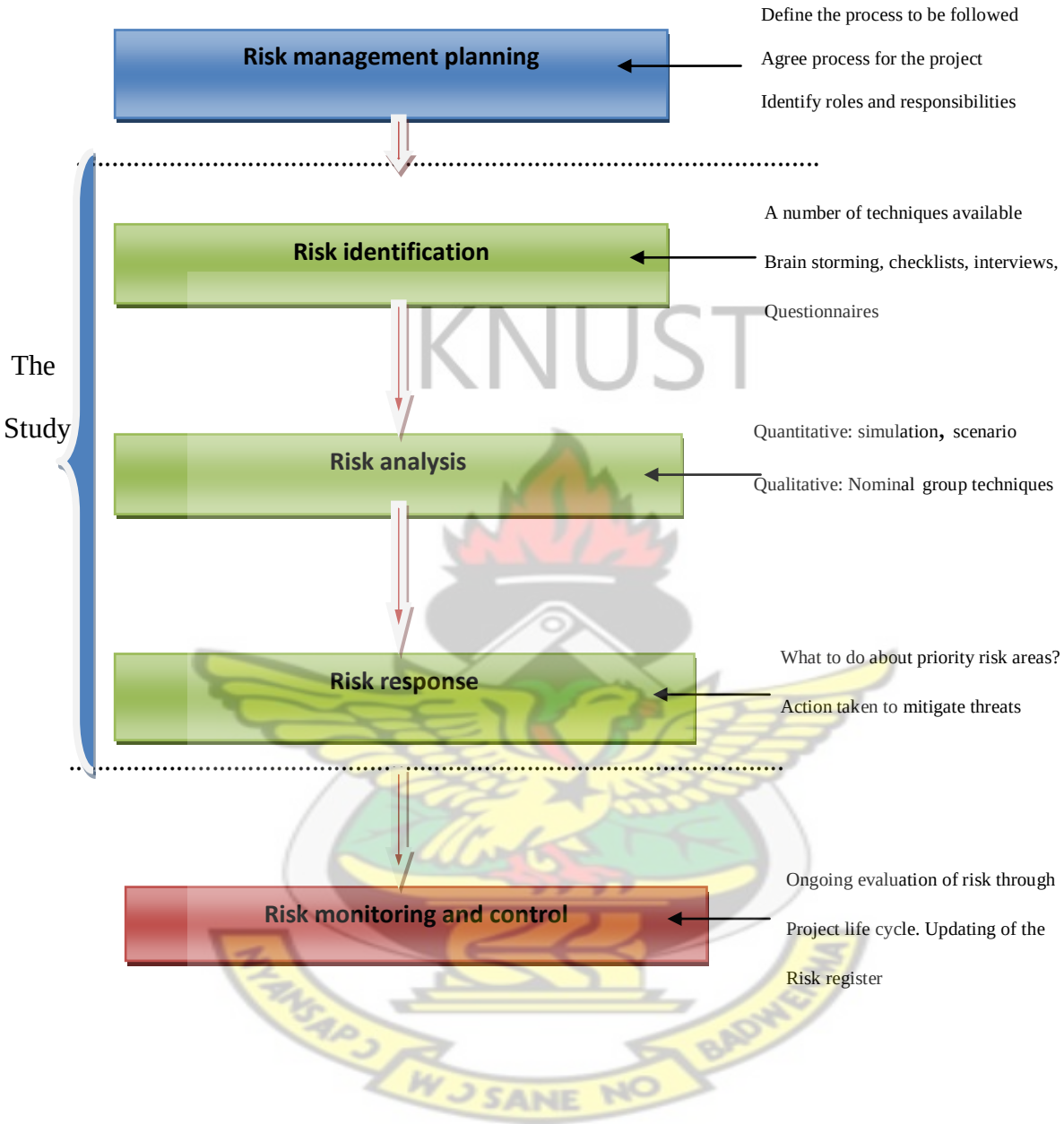


Figure 2.3: Risk Management Framework

(Source: PMI PMBoK, 2000)

2.2.1 Risk Management Planning

Prior to the identification of the key significant categories of risk, it is first important to establish the context within which those risks must be managed and to set out the scope for the rest of the risk management process. The context will include the organisation's external and internal environment and the purpose of the risk management activity which will also include consideration of the interface between the external and internal environments. Clearly the context will vary depending on which party (i.e. principal, contractor, financier, insurer, and end-user) is undertaking the risk management process (AS/NZS 4360:2004). For example, a contractor being asked to submit a tender for a particular project can only do so in the context of its corporate goals and objectives, its particular tolerance for risk, and the external environment in which it is operating. Oftentimes the internal context will be established and documented in tendering and corporate risk guidelines against which any proposed project will then be gauged.

The external environment may be more variable. In buoyant economic conditions, a contractor may take the view that he does not wish to procure contracts with a contract value of less than a certain figure and will only proceed to bid when he can achieve a particular margin. Given a scarcity of resources and the opportunities available in other areas of its business, he may also determine not to tender for projects that fall outside his direct area of expertise. Similarly, he may be in a position to insist upon strict compliance with his own internal guidelines in relation to the level of contractual and financial risk he is prepared to assume on the project before it is prepared to "walk away".

This context might be contrasted with that in which the contractor may find himself once boom conditions dissipate - work may be undertaken for a lower margin and at greater assumed risk in areas in which he has less expertise, in order to support an enlarged labour force and head office overheads.

In addition to identifying the points at which risk management is to apply in the project, it is necessary to identify roles and responsibilities on the participants involved, agreed the methods and approaches to be used and review as well as reporting frequency.

2.2.2 Risk Identification

Having established the context, the task of actual identification of risks needs to be undertaken. Chapman, (2001) points out that since the risk management process builds heavily on the primary identification phase, the success of later risk management phases is directly comparable to the quality of the first identification phase. Risk identification itself is often undertaken through a variety of methods which may include checklists, brainstorming, visits to site, corporate experience (or drawing upon consultants or subcontractors who have experience in the particular industry segment), analysis of prior projects, the use of organisational charts to review internal structures and flowcharts to review process issues and through research, interviews and surveys of parties likely to be impacted by the proposal.

Additionally, sources of risk or uncertainty and sources of known unknowns should be listed. Ward and Chapman (2003) emphasise using an uncertainty perspective in the project risk identification phase, since they consider such an approach to be the best way to determine all possible sources of opportunities (positive risks), not just threats.

These identification lists need to be followed and updated as our knowledge and understanding of the project environment increases.

Ultimately the aim is to generate a comprehensive list of sources of risks and events that might have an impact on the achievement of each of the objectives identified in the context. These events might prevent, degrade, delay or enhance the achievement of those objectives. There are also a multitude of risks which could emerge at any stage of a project and while these will require constant monitoring, management and treatment, at some juncture the process of risk identification needs to be finalised in order to progress through the balance of steps in the risk management process. Most commonly a relatively small percentage of key risks are likely to account for the majority of the time and cost implications of the entire risk.

The two most used risk identification techniques are discussed below:

Checklists

Generic checklists are a useful source of information when compiling a list of possible risks associated with a project. A checklist is a comprehensive list of risks that could affect any project. Although necessarily general in nature, checklist can be used as a prompts in determining what the potential risks are for the project under study. Published checklist in texts and journal papers can be consulted as a part of the risk identification process. Separate ones exist for client, contractor and consultant perspectives. Whiles checklist is undoubtedly a convenient and relatively simple approach to risk identification it is important not to be over reliant on them (Heriot-Watt University, value and risk management, D19CV9). There is a danger that they can

act as a straitjacket and actually inhibit detailed thought on specific project risks that may not be recorded on a generic checklist.

Brainstorming

This is one of the most powerful, and most widely used, techniques for risk identification. It is a creative technique extensively used in value management and much can be found written about it in value management literature. Essentially a brainstorming session is a short-term intensive group exercise, where a team of individuals will generate as many ideas as possible for risk events that may adversely affect the project. In a sense, this must be termed "negative brainstorming" as the team of individuals is trying to determine all the things that may go wrong with the project (Heriot-Watt University, value and risk management, D19CV9).

2.2.3 Risk Analysis

The next phase of the risk management process after risk identification is risk analysis. An understanding of the possible effects on project objectives is needed: since most projects have only a limited amount of resources to use for risk management, concentration on only the major risks is essential (Baccarini and Archer, 2001). There are two features that characterise risks:

- The probability (chance) by which they can happen; and
- Their ultimate impact on the project, if they do materialise.

An accurate assessment of these two aspects will enable an organisation or consortium to decide on a course of action.

The probability of a risk occurring and its impact on a project are used in tandem as decision aids. For example, if the chance of a risk happening is assessed to be high

and its potential impact is equally high, then such risk is accorded high priority. Risks can be assessed either using a quantitative or qualitative analysis. The most common ways are to estimate risk probability and impact in simple scales for example, from 1 to 5 or from high, medium or low probabilities, or it can be refined to any number of descriptions. Table 2.1 is an example of probability grading.

Table 2.1: Probability Grading (from Qualitative to Quantitative)

Assessed likelihood	**Equivalent Probability**
Loss is not possible	0%
Unlikely to occur	5 – 45%
As likely as not	45 – 55%
Likely	55 – 99%
Almost certain	95 – 99%
Certain to occur	100%

In a qualitative assessment, both probability and impact are assessed subjectively. In practice, qualitative analysis is often used first to obtain a general indication of the level of risk and to reveal the major risk issues. Later it may be necessary to undertake more specific or quantitative analysis on the major risk issues. Qualitative analysis uses words to describe the magnitude of potential consequences and the likelihood that those consequences will occur. In semi-quantitative analysis, the objective is to produce a more expanded ranking scale than is usually achieved in qualitative analysis with probability being assessed subjectively but impact assessed objectively. In quantitative analysis numerical values for both consequences and likelihood using data from a variety of sources is undertaken. The quality of the analysis depends on the accuracy and the completeness of the numerical values and the validity of the models used. Consequences may be determined by modelling the outcomes of an

event or set of events, or by extrapolation from experimental studies or past data. Figure 2.5 demonstrates risk grid (probability-impact matrix)

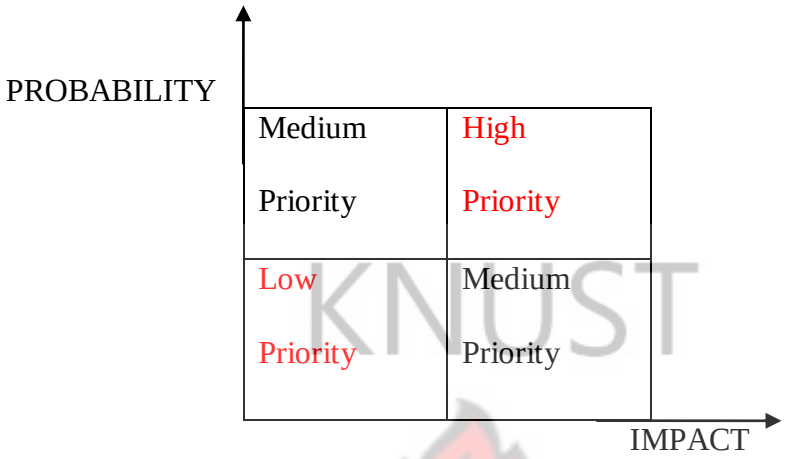


Figure 2.4: Risk Matrix
(Source: Best Practice Guideline A5: Managing construction procurement risks)

Risk identification and evaluation does not provide enough support for the later risk management processes: the large amount of risk data from these two phases should be structured to aid in the interpretation and comprehension (Hillson, 2003). Risks also need to be assessed in relation to other risks, since these relations may cause minor risks to become more relevant to the risk management process if they are significant sources for other risks. A lack of attention toward cause-and-effect-chains was also a concern of Aalto, Järvinen and Tuovinen (2003), when they initiated their research on risk continuums. Risk continuums are cause-and-effect-chains, where one event (risk) causes another to arise. They examined risks in four different levels of project business.

2.2.4 Risk Response

Risk response planning process is defined by PMBoK Guide:

"The process of developing options and determining actions to enhance opportunities and reduce threats to the project objectives."

Obviously it is not possible, affordable or appropriate to develop responses to all identified risks. The risk team will focus only on the high priority areas (Heriot-Watt University, value and risk management, D19CV9). Artto, Kujala and Martinsuo (2005), PMI PMBoK, 2000 and Turner, 1999 suggest that there are generally four response types to cope with risk as shown in Figure 2.5

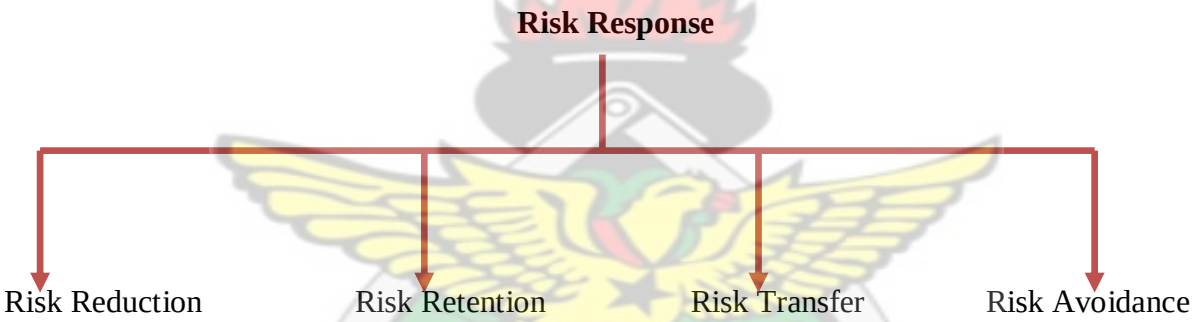


Figure 2.5: Risk Response
(Source: PMI PMBoK, 2000)

Often these mitigation strategies, particularly risk transference, are given effect contractually via the use of such means as contractual exclusions, limitations of liability, indemnity clauses, risk transference, guarantees, performance bonds and insertion of a risk premium.

Planning of how to carry risks needs to have clear, shared principles in order to have a consistent attitude towards the risks (Artto, Kujala and Martinsuo, 2005). The purpose of

the process is to ensure that actions that are planned and taken will have the expected effect on project risks, or if not, will effect whether new methods should be implemented. Risk response planning and the execution- phase needs an effective control process by its side to ensure that the risk management processes are iterative and ongoing, are not dismissed as project starts and it follows that decisions are implemented and have the expected results.

The above categorisation of risk response options helps formalize risk management planning. The Caltrans Project Risk Management Handbook suggests a subset of strategies from the categorisation. The Caltrans handbook states that the project development team must identify which strategy is best for each risk and then design specific actions to implement that strategy. The strategies and actions include the following:

Avoidance: The team changes the project plan to eliminate the risk or to protect the project objectives from its impact. The team might achieve this by changing scope, adding time, or adding resources (thus relaxing the so-called triple constraint).

Transference: The team transfers the financial impact of risk by contracting out some aspect of the work or by insurance. Transference reduces the risk only if the contractor is more capable of taking steps to reduce the risk and does so.

Reduction: The team seeks to reduce the probability or consequences of a risk event to an acceptable threshold. It accomplishes this via many different means that are specific to the project and the risk. Mitigation steps, although costly and time consuming, may still be preferable to going forward with the unmitigated risk.

Retention: The project manager and team decide to accept certain risks. They do not change the project plan to deal with a risk or identify any response strategy other than agreeing to address the risk if it occurs.

CHAPTER THREE

REVIEW OF CONSTRUCTION INSURANCE

3.1 CONSTRUCTION INSURANCE

Insurance is an important part of dealing with risk, and is a way of transferring risk to other agencies and spreading the financial cost of recovery over time.

From the legal viewpoint, insurance allocates the risks, to which the project is exposed, between the parties. Dickson (1983) highlighted insurance as a risk transfer mechanism that the insured transfer from a state of uncertainty to a state of certainty at a certain cost of the insurance premium. It is a cost-smoothing mechanism, in which contractors exchange a regular known annual premium for an unknown potential loss.

Insurable risks are defined by FIDIC (1986) and CII (1993) together as follows:

- An insurable risk must be measurable in quantitative terms and in such a way that the theories of probability and the law of inertia of large numbers may be used;
- A large number of homogeneous and relatively independent exposure units;
- Potential losses that are accidental and unintentional;
- Losses that are determinable and measurable;
- Reliable estimates of claim frequency and severity are available;
- The risk charge or premium is economically feasible; and
- The insured must have an insurable interest in the object of the insurance contract.

Therefore, whether insurance can be used as a solution depends on:

- The insurability of the risk;
- The adequate and tailored policy;
- The comparison of the insurance premium and the potential loss of risks;
- The trust and confidence of insurers about their solvency and claim service; and
- No other alternative risk transfer solutions available.

A typical construction project will consider insurance on:

- Material Damage;
- Third Party Liability;
- Materials in Transit;
- Damage to Constructional Plant;
- Non-negligent Indemnity; and
- Consequential Loss.

Insurance covers not usually included but obtainable:

- Employer's Liability/Workmen's Compensation;
- Motor;
- Professional Indemnity (for Architects, consulting engineers etc.);
- Inherent Defects; and
- Contract Performance Guarantee Bond.

Construction insurance encompasses all contract of indemnity within the activities of the construction industry where insurance is chosen as the medium through which liabilities are shifted. It involves not only many branches of insurance but many disciplines and professions (Bunni, 1986).

It is expected that all parties involved in construction insurance should act in unison to provide correct allocation of risks and responsibilities, which must be reflected in contractual agreements. These agreements must also encompass the allocation of liabilities and how they are to be dealt with, if they arise (Annual report for the 104th year of business, 1984).

3.2 ROLES OF INSURANCE IN CONSTRUCTION

3.2.1 Overview

As mentioned above, insurance is not the only means by which risks associated with construction and infrastructure projects may be addressed. However, it is one of the principal means by which parties to major projects treat risk.

According to Allens (2003), in considering whether or not insurance should be looked at as the answer to a particular identified risk, the following questions need to be considered:

(a) Is the risk insurable - can a policy be procured which specifically covers the risk?;

(b) Is the cover adequate - if a policy is procured, will it respond to the risk which you have identified and to the fullest extent of that risk?;

(c) Does the cost outweigh the risk - what is the cost of the policy?;

(d) What is the nature of the policy - how long will the policy operate to provide cover;

(e) Can the policy be tailored or negotiated?; and

(f) is the insurer here for the long haul – to what extent can the parties have confidence that the insurer is solvent and able to honour its contractual obligations if called upon?.

3.2.2 Policy of Risk

In negotiating a policy of insurance, you need to understand:

- What the risk is, against which you are seeking insurance protection;
- The policy itself, how the policy operates and what obligations you may have to the insurer under the policy, e.g. notifications, conduct, no assumption of additional risk, etc;
- What the limitations to the policy cover are and to what exclusions the policy is subject; and
- Whether the policy is effective to provide cover in respect of the particular risks which you have identified and in respect of which you have sought cover, i.e. do the policy clauses clearly and without limitation apply to the identified risk.

Policies of insurance should also be subject to periodic review against the totality of risks insured to ensure that there are no gaps in policy coverage through which the proverbial truck may be driven.

3.2.3 Procedural Risks

Having obtained policies of insurance which on their face provide protection, you should also be aware that until such time as the policy is tested, you cannot necessarily be certain that protection will be provided. At this time, further issues may arise which may result in a denial of insurance protection.

For example, there may be issues as to:

• The policy wording – does it apply to cover the event which has occurred?;

•Compliance – has appropriate notice been given, has there been non-compliance with the terms and conditions of the policy which acts to preclude cover?;

• Interpretive issues - as to the meaning and extent of cover provided by the policy, e.g. is the event in respect of which cover is sought one occurrence or multiple occurrences of arguments in respect of the World Trade Centre?; and

• Are there issues of waiver, subrogation, etc which might be argued against you?.

The claim for indemnity may trip up on any one of these issues and again leave you uninsured, alternatively involved in lengthy and expensive court proceedings which waste resources and divert management time, to determine whether or not insurance does apply.

3.2.4 Quantum Risk

Insurance policies will have a deductible excess, i.e. uninsured element. An assessment has to be made by weighing premium costs against the amount of uninsured risk which you will carry before insurance cover kicks in. Equally, it may be determined that policy cover of, say, $50 million, is adequate to protect against identified risks, whereas the consequence of catastrophic failure may see claims emerge well in excess of the insurance cover. Again, you are exposed in respect of that excess (Allens, 2003).

3.3 INSURABLE RISKS

Insurable risk means a risk, which can be covered by insurance. For a risk to be acceptable by an insurer it has to be a "pure risk" which means it has the downside of the effect only (opportunity for loss only); speculative risks are not covered by traditional insurance. Moreover, it has to be sudden and accidental, with statistics available for insurers to simulate past events and generate a creditable premium (Junying, 2006). As obvious and simple as it appears, insurability is the core of the insurance business as it can operate only within its limits. Insurance provides a method for individuals to equalize their amount of money available over diverse states of the world, i.e. it is a method of smoothing assets over time. The insured pays a premium; reducing his current wealth, in return to receive some monetary amount from the insurance company should a loss occur. The amount paid out by the insurer is not absolutely equal to the amount paid by the insured.

Various definitions of the concept of insurability exist in the literature. In his book on limits of the insurability of risks, Baruch Berliner (1982) discusses criteria by which insurance firms can determine whether they will in principle offer to cover a particular risk. Those criteria are mainly supply side criteria. Others (Holsboer, 1995) define insurability as the situation for which a policyholder can buy the coverage he reasonably needs. This definition focuses on demand side arguments. From an actuarial point of view, a risk will be considered as insurable if the Law of Large Numbers can be applied. This is the case when the maximum potential loss is not too large and when the risks are not too much positively correlated.

This study will consider risk as being insurable when the organization of risk transfer in the private market place can be organized so that a prospective policyholder could acquire the coverage he needs to combat the adverse financial consequences of damages resulting from an uncertain occurrence.

On the supply side, two conditions must be met before insurance providers are willing to offer coverage against an uncertain event. The first condition is the ability to identify and quantify, or estimate, the chances of the event occurring. The second condition is the ability to set premiums for each potential customer or class of customers. If those two conditions are both satisfied, a risk is considered to be insurable. Yet, insurers may still opt not to offer coverage against this risk, as it may be impossible to specify a rate for which there is sufficient demand and incoming revenue to cover loading factors and claims costs of the insurance and yield a net positive profit. An insurance market will take place if, given the economic environment, a mutually advantageous risk transfer can be exploited by the consumer and supplier of insurance (Insurance Economics, N° 46 / July, 2002).

To identify the risk, estimates must be made regarding the frequency at which specific events occur and the extent of losses likely to be incurred. Such estimates use historical data of previous events and scientific analyses of what is likely to occur. Depending on the frequency and severity of the potential loss, some risks are not insurable or are not worth being insured. Figure 3.1 illustrate the insurability element of the risks in construction contract. Insurance existence requires a framework for efficient operation.

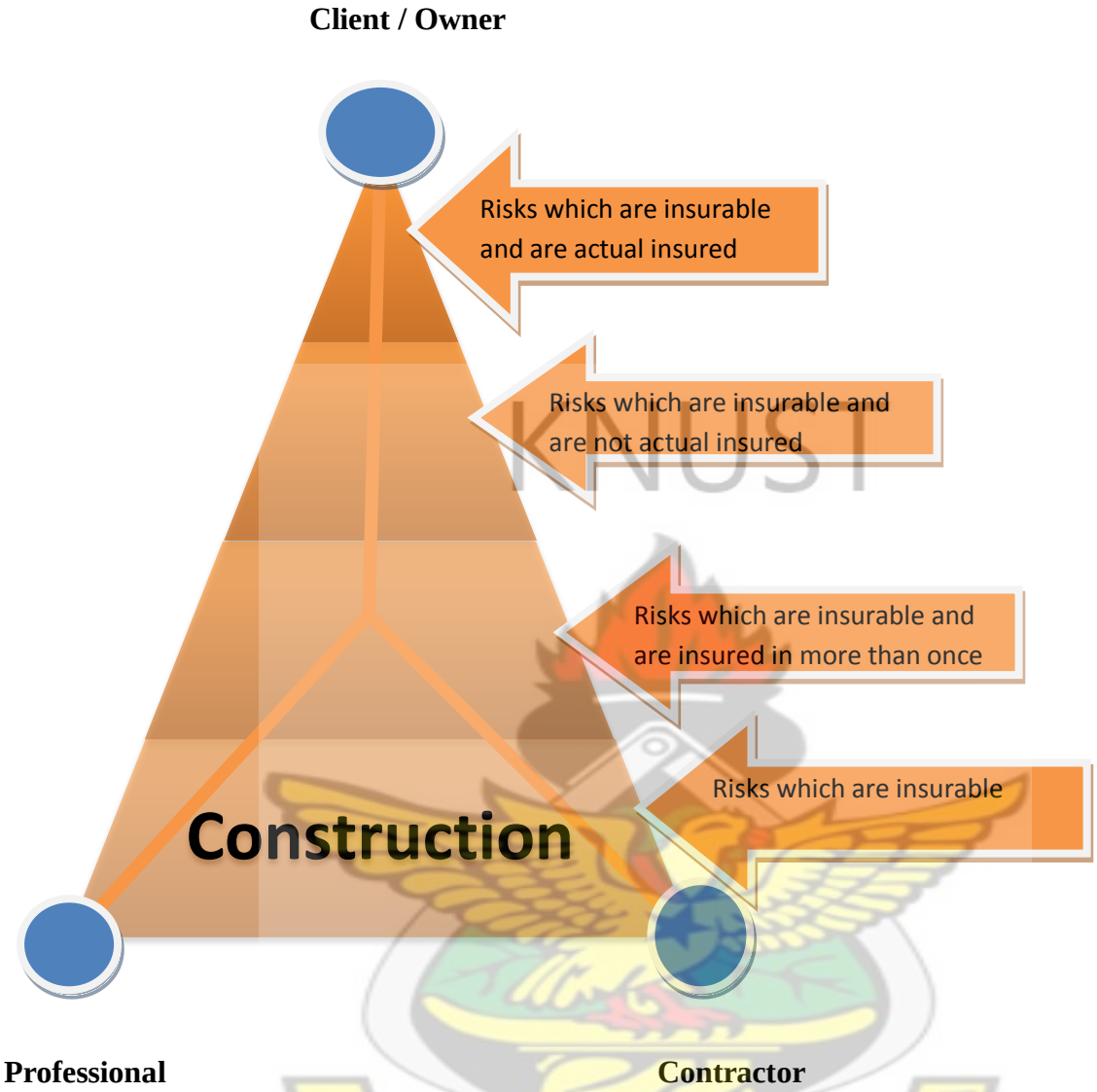


Figure 3.1: Classification of risks on the basis of insurability

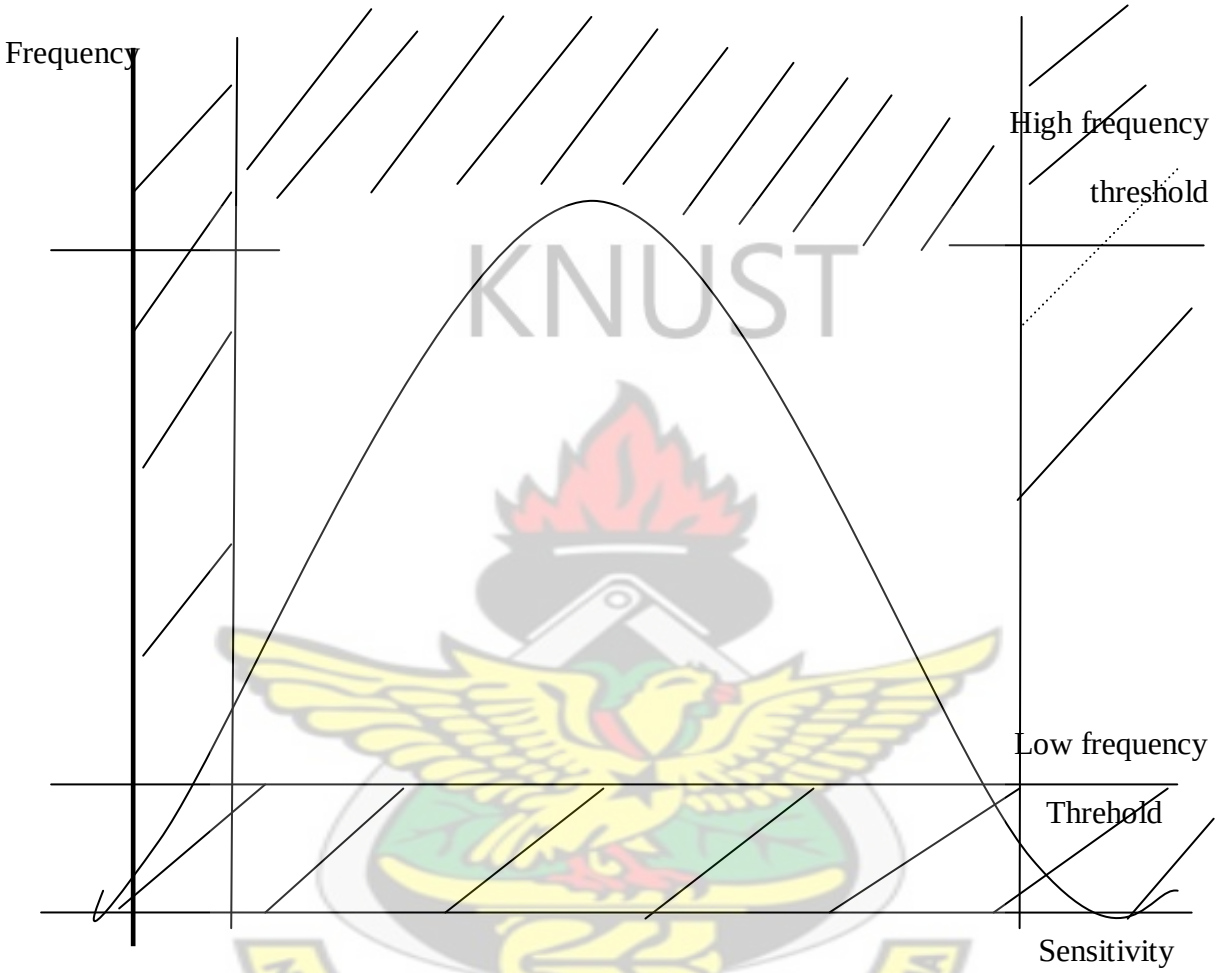
(Source: Risk Management in Construction (Flanagan & Norman, 1993))

3.3.1 Insurability Framework

As pointed out, insurance requires that the losses have some probabilistic character. The risk characteristics must exist. If it were certain or nearly certain that a person would suffer a particular loss in a particular period, the solution would not be insurance as the risky element, which is created by uncertainty, is absent. Examples are costs of repairs or simple maintenance, which like other regular occurrences do not qualify as uncertain events.

On the other hand, extremely low frequency events are scarcely insurable. As the probability of the occurrence of the events is very low, the historical data may be poor or even do not exist, and then risk assessment and risk modelling may be very problematic (insuring earthquakes in areas that are considered as being not at risk might be such a risk). Insurance also requires that the severity of the potential loss or the amount insured is not too small. For example, it is not economically efficient to insure an umbrella or tennis balls. The transfer costs created by the risk sharing mechanism are simply too high. Finally, the fourth situation concerns the occurrence of events with huge financial consequences. Insuring the risk that a large asteroid hits earth is scarcely manageable. We have to recognize that the world is not insurable. Only small parts are.

Once all those situations have been eliminated, it defines an insurance framework described in the severity/frequency space shown in figure 3.2.



The area within the curve and the low frequency boundary (A) in the framework, risks are principle insurable base on the definition of insurable risk.

Figure 3.2 Insurance framework
(Source: Insurance Economic N 46/ July, 2002)

3.3.2 Limitations to Insurance

Once risks have been identified, the insurer has to price the risk he offers coverage on. He needs to determine what premium he can charge to make a profit. There are a number of factors that play a role in determining what prices companies would like to charge. In particular, the limits to insurability in economics terms are dictated by the need to control the moral hazard and the adverse selection problem. Moral hazard is the phenomenon familiar to all insurers that the behaviour of an insured party changes simply because of the fact of having insurance. Moral hazard can occur either ex ante or ex post the occurrence of the loss.

Ex ante moral hazard relates to the fact that as the risk is fully insured the insured party has less incentive to prevent the occurrence of the risk (Shavell, 1979). Hence, due to this change in behaviour, the probability of accidents starts to rise so that the premium will be too low. If the moral hazard cannot be properly contained, a risk does indeed become uninsurable. At the extreme any insurance would be undesirable because the risk of accident will rise as a result of the availability of insurance. The fact that liability insurance was banned in many western European countries up until the nineteenth century and in the former Soviet Union until quite recently is a consequence of this problem (Faure, 1995). Techniques that allow insurers to fight against moral hazard are well known: partial insurance that keeps the insured exposed to risk so as to develop prevention activities is one of them; making the premium depend on preventive activities, to the extent that the insurer has the possibility to observe those activities. Ex post moral hazard is the increase in claims against the insurance policy beyond the services the claimant would purchase if not insured (Dionne, 1984). In the context of medical insurance, for instance, ex post moral

hazard include excessive visits to doctors, longer hospital stays, and more elaborate and expensive methods of treatment. It is obvious that too much ex-post moral hazard can make insurance contracts showing a deficit and then make the risk uninsurable. The problem here is to give the good incentives to the policyholder to report his actual loss.

The phenomenon of adverse selection entails that an insurer, because he has no proper information about the risk constituted by the individual insured party, is unable to make a proper differentiation in premiums. This will in turn mean that insurance is relatively too expensive for the good risks, leaving the insurer with the bad risks and hence creating uninsurability. The problem comes from the fact that information is not always equally distributed among the parties. From the insurer, the point is to get hold of that information by means of adapted techniques. Indeed, an appropriate remedy for adverse selection is adequate risk differentiation: defining the risk group as closely as possible and fixing the premium accordingly (Dionne, 2001).

Another element, also linked to information problem that limits insurability is the concept of ambiguity. As already pointed out, there are many instances in which the random variable describing the risk has no probability distribution. This is mainly due to the absence of historical data or to imperfect scientific knowledge. Owing to this lack of information, it may be very difficult to calculate or compute the insurance premium. The evaluation of the benefits of an insurance contract for the insured also becomes hardly possible. There is a large literature dealing with the subject of aversion to ambiguity from a demand side point of view (Gilboa, 1987). Regarding the supply side, ambiguity may lead to wrong estimation of the risk. Thus, the higher

the uncertainty regarding the probability of loss and its magnitude, the higher the premium charged will be. As shown by a series of empirical studies, actuaries and underwriters are so averse to ambiguity and risk that they tend to charge much higher premiums than if the risks were well specified (Kunreuther, 1995).

Finally, it is worth stressing that insurance is also constrained through regulatory and legal limitations. National insurance legislation determines and specifies what an insurance company can supply under its license. Hence simply because it is a new type of insurance, it can be outside the current definition of permitted insurance. Besides, certain types of insurance can be deemed to be against the public interest. For instance, it is unthinkable that homicide insurance would be allowed. To be legally enforceable, insurance contracts usually require that the insured suffers a financially quantifiable loss and he does not profit if the agreed event causing the loss occurs. Those points undeniably limit the supply of insurance.

3.3.3 Moving the Limits of Insurability

Once limits of insurability have been defined, the question on how to combat the problems created by these limits is at the upfront. As explained in figure 3.2, region (A) within the framework, risks are insurable (as shown in. If the risk is outside region (A) of the framework, it has to be considered as uninsurable. Four basic scenarios can be isolated from the framework in figure 3.2. They are stated below together with some ideas on how to extend those limits.

Scenario 1: risks located above the high severity threshold, i.e. to the right of the boundary line.

One of the main solutions involving only the private market to increase capacity for high-severity (and often low-frequency) events is to consider catastrophe bonds. Such bonds refer to securities issued by insurance firms or re-insurance firms, with the key feature that if a prescribed catastrophic event occurs, then the insurance firm can use the cash from the bond sale to pay its insured losses. The insurance firm is then relieved of its obligation to repay the principal on the bonds. At the moment a limited number of catastrophe bonds have been issued by insurance firms to hedge their hurricane and earthquake risk (Insurance Economics N° 46 / July 2002). Yet, the risk premium required so far by capital market investors plus the high complexity of the transfer have limited their usefulness. Another way to extend the amount of capacity available in the private sector is to draw in the government as insurer of last resort.

Scenario 2: risks located below the low severity threshold.

The idea to make those risks insurable is to reduce transfer costs. This can essentially be done through economic efficiency gain in offering insurance solution, i.e. economy of scale, increasing competition, reducing overhead costs, and so on.

Scenario 3: risks located above the high frequency threshold.

The obvious strategy is to reduce the frequency below the insurability threshold. Building dams in flood prone areas would be such a technique. A different strategy would be to provide coverage only under certain circumstances or in combination with other events (trigger events). An example would be the basic car insurance against damages to the vehicle. Either they have to be caused by a third party (trigger) or under certain circumstances (e.g. meteorological conditions). All other damages have to be borne by the owner.

Scenario 4: risks located below the low frequency threshold.

One of the ways to insure those events is to pool them with high-frequency events. For instance, as in the case of car insurance, insurance against hail is usually included in the contract even if the car is used only in areas where hail storms do not occur.

(Source: The Geneva Association Insurance Economics N° 46 / July 2002)

3.4 INSURANCE VS. RISK MANAGEMENT

Rendell and Yablonsky (2003) believed that insurance was often proved to be the most cost-effective or most convenient method to manage certain classes of risk, or risks above a certain level. Therefore the first concern is how to evaluate the use of insurance in managing construction risks.

Purchasing insurance from a commercial insurer is still the most widely used method and generally the most cost-effective way to handle low frequency, high severity losses for small to medium-sized public entities (Rendell and Yablonsky, 2003). Because of statutory and contractual requirements, insurance is a significant part of construction risk management (Edwards, 1996). However excessive reliance on insurance, including contractual requirements forcing the purchase of insurance, can lead to higher overall costs of risk in the construction industry (CII, 1993). Construction organizations, particularly contractors, often have no choice but to take up insurance. Insurance Task Force (1993) found that clients and contractors must realize that the costs associated with risk financing on projects had become a significant portion of total project cost, and that with proper management and co-operation these costs were controllable. If risk management by insurance cannot be

proved to be the most cost-effective of available commercial solutions, contractors would choose other risk financing solutions.

The insured's past loss experience can affect the premium. The insured retains some control over the cost in the sense that loss-prevention efforts can reduce the number of losses and consequently reduce the premium (Williams 1998). To maintain market share, insurers are increasingly taking into account the claims track record of individual construction-related organizations, in order to provide the best possible deal (Edwards, 1996). So construction insurance can help the insured to take a positive attitude to risk management.

However, the structure of organizations often creates obstacles to integrated risk management (Williams, 1998). Few companies have a full time risk manager and risk management system. On the other hand, the same type of boundaries often appear in the structure of courses offered by academic institutions, leading students to believe that the management of risk is a subtopic of accounting, finance, or human resources (Smith, 1999). Therefore, an integrated risk management strategy should be built from internal and external approaches. Both approaches include knowledge learning, experience sharing, professionals performing and risk management system establishing and implementing. The insurance premium should be based on contractors' safety records and risk management to encourage contractors to take proactive risk management program.

3.5 TYPES OF INSURANCE POLICIES

Below are issues which may arise in relation to the key classes of insurance commonly required in construction and infrastructure projects. They are by no means a definitive list of the types of insurance which may be required for a particular project.

3.5.1 Contract Works

Contract Works insurance is often provided as a combined material damage and legal liability policy. The first part of the policy usually insures against physical damage to:

I. the works under construction;

II. materials for the project stored on site and off-site;

III. temporary structures;

IV. hired plant and equipment; and

V. contractor's plant and equipment (although in some cases this is insured separately under Contractor's Constructional Plant insurance).

The second part of the policy insures against damage to property or personal injury to third parties arising from construction activities on and off the site.

Contract Works policies will usually contain exclusions for, amongst other things, faulty workmanship and design. They do not cover all risks associated with the building works and most importantly, where design is an issue, must be supported by professional indemnity cover. This type of insurance is usually taken out by the contractor but can be taken out on a principal controlled or project manager controlled basis and in such case should name the principal, project manager, contractors and subcontractors as insured under that policy.

A construction program is usually put to the insurers (such as developing an underground mine which will go down to a certain number of levels and construct a treatment plant which will take 18 months) and the contract works insurers agree to cover the principal and the contractors for that period. At the completion of the construction phase the insurer will then take over. Sometimes however there is a phased handover from the contract works policy to the ISR policy and this is because it is a cheaper option but it can get very complicated. What that means is the contract works policy will apply to various stages of the project and as each stage is completed that stage is taken out of the contract works policy and covered under the ISR policy. So for example you might find that you have a pipeline which has been built and is completed and the pipeline may be used to run off water while part of the mine is developed. Once the pipeline has been completed it can be taken out of the contract works policy and put into the ISR policy. However if it is being used for construction purposes it may be considered to still fall under the contract works policy but it may also fall under the ISR policy because it itself has been completed. You may end up with disputes between insurers, for example, the ISR insurer may say that the pipelines are not covered by the ISR policy because they are being used as part of the construction process but the contract works insurer may argue that the pipeline is not covered because it has been completed and is no longer itself under construction.

Similar complications can arise where the works involve extensions or refurbishment to existing structures. The interface between the works and the existing structure must be clearly defined to avoid a stand-off between insurers. Another means of minimising such insurance disputes is for the Contract Works and ISR policies to be placed with the same insurer. However, this can give rise to other issues (Allens, 2003).

3.5.2 Industrial Special Risk (or 'ISR')

This insurance is sometimes referred to as 'Property Damage and Business Interruption' insurance. Like Contract Works insurance, an ISR policy normally has two components. The first of these is property damage, under which cover is provided for the physical loss, destruction or damage to all tangible property belonging to the insured, or for which it has assumed responsibility to insure. If a loss occurs, the policy allows for reinstatement or replacement of the damaged property. The policy has, as most policies do, a number of exclusions and these usually include war, radiation, wear and tear, faulty materials or faulty workmanship, error in design, theft, fraudulent acts, erosion, earthquakes, flood, kidnapping and bombing.

The second part of the ISR policy is what is called a business interruption section under which cover is provided for consequential or pure economic losses resulting from an interruption to or interference with business following damage to an asset insured under the first part of the policy. For example, it would say something like:
If any building or other property used by the insured at the premises for the purposes of the business is lost, destroyed or damaged, and the business carried on by the insured in consequence thereof is interrupted or interfered with, the insurers will pay the amount of the loss suffered as a result of that interruption or interference. Of course as you would expect there is a formula set out as to how the insured's loss is calculated along with a number of exclusions. The policy will usually cover either the reduction in gross earnings or the loss of gross profit and in some policies the insured can elect which formula to adopt (Allens, 2003). Calculating the loss of profits claim under the business interruption section of an industrial special risks policy is very complicated and it is necessary to use both very experienced loss adjusters and some

accountancy firms recruit expertise in this area. It is not usually the sort of matter that an ordinary accountant would be able to do.

Furthermore, as referred to above, it is critical to manage the interface between the works and existing structures and the transition of particular items under construction from cover under the Contract Works policy to cover under the principal's ISR policy, to ensure there are no gaps in cover, having regard to the fact that a principal will usually elect for its ISR cover to commence only at the same time as commencement of commercial operations.

(Source: The Geneva Association Insurance Economics N° 46 / July 2002)

3.5.3 Professional Indemnity (PI)

As its name suggests, this insurance indemnifies an insured for amounts which the insured becomes legally liable to pay as a result of any actual or alleged negligent act, error or omission in the conduct of its business or profession. Costs and expenses incurred to investigate, defend or settle any claim are also included, sometimes in addition to the policy limit.

PI insurance is' claims made' insurance. This means that the policy only responds to claims first made against the organisation during the policy period, irrespective of when the act of negligence actually occurred. This is an important point of distinction to other policies, such as Public and Product Liability, where coverage is provided for occurrences when the policy is in force even if the claim is made after expiry of the policy.

It is common for a principal to require a contractor to have PI insurance where the contractor is to provide engineering, design, project management or other professional advisory services relied upon by the principal. A principal will also usually endeavour to ensure that the contractor maintains such insurance for a number of years after completion of the contractor's work.

Sometimes the principal will assume responsibility for PI insurance of its consultants subject to a nominated excess, and then require the contractors to maintain their own PI insurance for claims up to value of the excess under the principal procured policy. The rationale behind such an approach might be as follows:

- the particular project would give rise to PI issues for a number of consultants;
- the consultants are likely to pass on to the principal the cost of obtaining the PI insurance required by the principal and the principal would be at risk of a claim being made by another principal to which the consultant has provided services that would remove or reduce the coverage available for claims by the principal; and a principal controlled, project specific PI policy can be tailored to the particular circumstances of the project, would maximise the prospects of recovery by the principal and would avoid the need for the principal to review its consultants' PI insurance for several years after the completion of their work (Allens, 2003).

3.5.4 Public and Product Liability

This insurance is sometimes referred to as ‘Combined Liability' or ‘General Liability' insurance. Again, there are usually two components to this policy:

Public Liability: Legal liability to pay compensation to third parties arising in connection with the business activities of the insured. This part is limited to a

maximum amount for any one occurrence or event (or series of claims from the one incident), but generally unlimited in the number of events it will respond to in any one policy year.

Product Liability: Legal liability to pay compensation to third parties arising in connection with the insured's products. This section is limited to a maximum amount for any one term and for all claims in any one policy year. Most insurers now accept that insured have a products exposure, even if they do not manufacture or produce anything in a tangible sense (e.g. food and beverages supplied at the insured's cafeteria).

In large infrastructure projects, it is common for the principal to require a contractor to procure Public and Product Liability insurance immediately upon the commencement of the operational phase of the project. This insurance then takes over from any liability cover provided under the Contract Works insurance.

3.5.5 Workers' Compensation

All states and territories have statutory requirements for employers to effect workers' compensation insurance for the benefit of their employees. While there are variations from country to country, this insurance effectively covers all liabilities, whether arising under statute or at common law, in relation to the death of, or injury to, employees or persons deemed to be employees. It is common for a principal to require a contractor to maintain the necessary workers' compensation insurance in respect of all employees engaged in performing the contract.

The principal may also seek endorsements on the contractor's workers' compensation policy, in the case of a contract for a project with specific recognised hazards e.g. the construction of processing facilities for a mine, endorsements may be sought to extend cover to industrial diseases and to include employees working underground.

A principal will usually seek to be named and insured as a principal under the contractor's workers compensation policy. This is to cover claims by contractors' employees who assert that the principal is a deemed employer.

3.5.6 Compulsory Third Party Motor Vehicle

The Insurance law, PNDCL. 227, 1989 (National Insurance Commission, Ghana) made it compulsory to provide insurance cover for third party injury liability arising out of the use of a motor vehicle. Like the workers' compensation legislation, administration of the CTP scheme, premiums levied and the extent of cover provided vary from jurisdiction to jurisdiction. Principals often require the inclusion of a provision requiring the contractor to take out all necessary CTP insurance as required by statute in the relevant jurisdiction for vehicles used in connection with work under the contract (PNDCL. 227, 1989).

3.5.7 New Insurance Products

New insurance products evolve as the insurance market develops new approaches to address risk of potential importance for construction projects; one insurance product new to the market is transactional insurance (Allens, 2003).

Transactional insurance is directed at protecting parties from risk-related contingencies or disagreements which might otherwise block the completion of a business transaction. For example, transactional insurance may be used to replace

more traditional forms of risk treatment such as indemnities or representations and warranties in the project documentation, letters of credit, and a party accepting reduced financial benefit or retaining financial liability following a deal. Risks which may be addressed by transactional insurance include one party's withdrawal from the transaction, unfavourable regulatory changes and decisions, unfavourable tax treatment, environmental liabilities and loss associated with existing litigation.

Obviously, the precise terms of a policy within the above 'classes' of insurance will vary from insurer to insurer and be affected by the prevailing market conditions and the circumstances of the project to be insured (Allens, 2003).

3.6 SUMMARY

Risk management is a process in which decisions are made to either accept a known risk and/or to eliminate or mitigate it (Treceno, 2003). However, the question is which party should carry construction risks and at what cost? There are many parties involved in the construction industry, including clients, contractors, subcontractors, insurers, and suppliers. Chapman and Ward (1997) stressed that different parties involved in a project frequently have different perspectives on the risks according to their own background and benefits. Client bodies might be principally concerned with the risk of the project not being finished on time and exceeding the budget which has been allocated; contractors may be focused on making a profit out of their work on the project; and the workers might well be concerned about the health and safety of their day-to-day working environment and the risk of having accidents and suffering ill health (Anderson, 2000). In addition, some risks are peculiar to one party and some shared with other parties (Baartz and Longley, 2003). Therefore, there are so many conflicts and claims in the whole project life cycle. The different parties have

different knowledge and perceptions of risks, which interact with their various objectives and priorities. The risk is best placed with that party involved in the management of a project who is best able to manage the factor which gives rise to it (Flanagan and Norman, 1993). For example, a client deals with political risks; contractors can control safety risks; design consultants are responsible for design defects. Construction insurance can cover the interest of clients, financiers, contractors, subcontractors, architects, engineers and suppliers.

Clients

The clients of the industry ultimately pay the bill and it is important to understand their needs and expectations. From clients' perspective, the risk management process should start from briefing of project to the handover to users. Clients are the first party to conduct the risk management process and involve contractors during the construction stage or at an earlier stage according to the procurement method. For example, construction and design would involve contractors from the design stage. Clients want to achieve their desired objectives, i.e. cost, time and quality.

Edwards (1995) stated that a promoter (financier or client) is concerned that a reasonable rate of return is obtained for the risks undertaken and how likely changes in estimated costs, benefits and timing will affect that rate of return. A traditional view is that the more risk is transferred away from the client, the safer and more secure his budget will be (Boothroyd and Emmett, 1996). However, this should be balanced with the overall cost of risk transfer.

Contractors

Contractors have the major responsibility to deal with construction risks. They are responsible for successful risk management of the project (Treceno, 2003). A contractor's capability in risk management is one of the key factors to project performance (Wang and Chou, 2003). There has been a trend in construction contracts over the last few years to shift the risks to the contractor (Lynch, 2003), by using contract clauses (Wang and Chou, 2003). If there is no stipulation about the allocation of a certain risk event condition, the client and the contractor would normally have consensus that such risk should be taken by the contractor, particularly as such risks arise from unexpected disturbance by a third party, such as illegal waste disposal, threats by gangs, and requests for contributions to local community (Wang and Chou, 2003). The contract terms and conditions should clearly state the allocation of risks to the various parties. It is not sufficient to have vague conditions where it is unclear who is responsible and could lead to misunderstanding. Such misunderstanding could result in disputes with other parties or even project failure. The contractor needs to assess the risks to be retained or insured. If insurance policy is not issued accurately according to the risks, it might lead to the lack of indemnity cover by insurers when claims arise. Construction insurance policies must be specially designed to respond to the particular circumstances (Bunni, 2003). It means an insurance policy needs to be specially designed according to the nature of project, the types of procurement and construction contract. In this respect, contractors should be innovative and have the ability to negotiate with the insurers improved conditions of insurance, which are adapted to the changed needs as well as obtain best premium reduction through implementing proper loss control and risk management measures via their experienced expert team.

Insurers

While contractors are mainly responsible for successful risk management of a project, insurers can provide their expertise to assist the contractors' risk management in recognizing potential risks and reducing the probability of such risks. The willingness of insurer to write an insurance coverage reflects favourably on the insured's efforts at safety control, health and environment (Williams, 1998). Construction risks are usually very complex, hazardous and difficult to assess, price and control. It requires insurers to provide the highest quality service of insurance with the help of training, research and up-to-date engineering knowledge and information technology (Heidenhain, 2001).

Insurers can provide their expertise and knowledge based on past experience. They work on the basis of historical precedent, and take particular note of claims processed by them in the past (Anderson, 2000). There is a danger that management will become complacent and blind to hazards, particularly in cases where few losses have occurred in the past (Treceno, 2003). Insurers and the described risk management process, i.e. surveys, can assist the owner's risk management in recognising potential hazards and reducing the probability of such hazards (Treceno, 2003). The risk management system and nature of risks have a significant impact on the insurance premium. Insured's strong and deep interest in potential risk management development encourages insurers to offer substantial added value, which assists the insured to manage risks. Construction insurers' opportunity lies in having skilled staff available and adequate resources to be able to perform an expert service in insurance and risk management.

CHAPTER FOUR

RESEARCH METHODOLOGY AND DATA COLLECTION

4.1 INTRODUCTION

This section describes all the procedures that were undertaken to achieve the objectives set for this study. The procedures that were adopted including all the information relevant to the needed data, where those data were obtained and how they were obtained are discussed. The methods that were used to obtain the sample size as well as data collection are discussed.

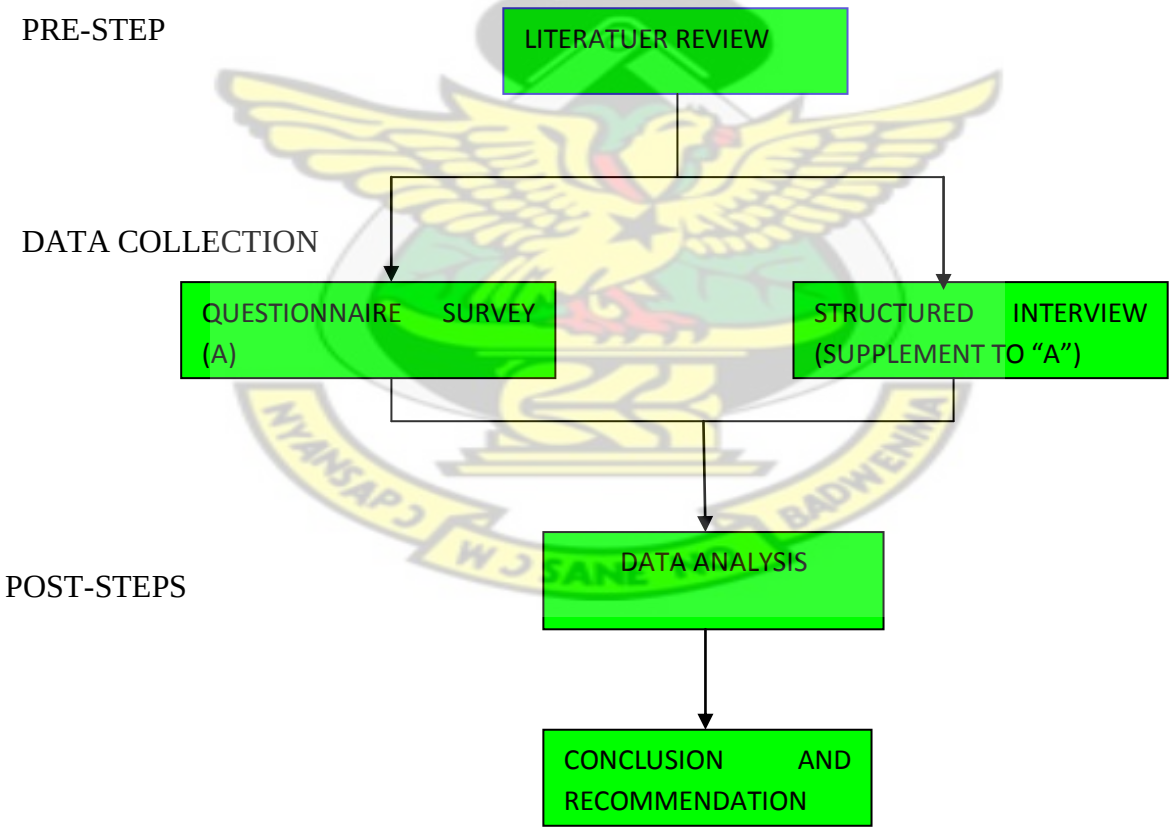


Figure 4.1: Flow Chart of Research Methodology

4.2 RESEARCH STRATEGIES / PROCEDURES

The procedure for the research took the form of literature review and survey using the questionnaire approach and supplemented with structured interviews as shown in figure (4.1).

The research was carried out using a three phase approach in order to achieve the aims and objectives of the research. The first was to undertake a literature search on previous publications on risk management especially insurance as a major risk transfer tool in the construction industry. The Literature review was carried out throughout the whole research project, this was to compile and discuss information on insurance as a major risk transfer tool in construction in order to have an in-depth study, and to establish current theory on the use of insurance in construction. Many literature sources were used as primary, secondary and references such as academics periodicals, research journals, government publications, dictionaries, past dissertations and Internet resources.

In the second phase, questionnaires were developed basically on the project objectives, the project objectives were translated into specific questions.

The questionnaires were in three main parts in order of sequence as follows:

(a) The first set of question was to categorise respondents to the main parameters in the industry. Thus classifying them under the role of client, consultants, contractor as well as insurers. The purpose was to determine the answers they give base on the role they play during the risk management and insurance.

(b) Background information – collecting the personal data of respondents, their experience in the construction industry.

(c) General perception of Risk management and insurance – collecting the respondents' familiarity with the concept of risk management and insurance practices in the Ghanaian construction industry. The set of questions under the section was to ask respondents on the following:

a. To identify major risks factors in the Ghanaian construction industry;
b. To identify insurable risks and the types of insurance policies mostly used in the construction industry; and
c. To identify the role of insurance as a means of managing risks;

Structured interviews were supplemented where necessary.

Finally, the results of the questionnaire were analysed using statistical techniques and the results used to form basis for recommendations as well as areas for further research. The following methods of analysis were used in analysing the data:

a. Relative Importance Index (RII)
b. Weighted Average

4.3 DATA COLLECTION

4.3.1 Primary Data

The source of the primary data will be in a form of questionnaire and structured interviews, designed together a large volume of data from construction clients/Consultants, D1 and D2 building contractors as well as insurance companies. The primary function of the survey is to collect information that can be analysed, and inference made to produce conclusion about major risk factors in construction, the use of insurance as a risk transfer tool in the construction industry, the interactions

between construction players and insurance companies with respect to risk management.

4.3.2 Secondary Data

Secondary data which involves information from published text such as academics periodicals, research journals, government publications, dictionaries, past dissertations and Internet resources were used to compliment the primary data.

4.3.3 Sampling

The questionnaires were sent to randomly selected contractors, clients/consultants and insurance companies in the Construction industry in Ghana.

Contractors

The study were limited to contractors in classes D1 and D2; that was due to the type and size of projects they have handled, which were normally involved with high risks as well as insurance covers.

From Ministry of Water Resources, Works and Housing, there are 96 class D1 and 446 class D2 contractors giving a total of 546 for D1 and D2 contractors. The sample size will be determined by using the formula (Kish, 1965).

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

Where n = sample size

$$n^1 = \frac{S2}{V2} \qquad S2 = (P)\,(1\text{-}P)$$

N = total population (population proportion) = 546

S = Maximum standard deviation in the population elements.

P = Proportion of the population elements that belong to the defined category

i.e. P = 0.5

V = Standard error of the sampling distribution i.e. V = 0.05

Solving for S2,

S2 = (0.5) (0.5) = 0.25

V2 = (0.05)2 = 0.0025

n1 = S2 / V2 =0.25 / 0.0025 = 100

Hence sample size n = $\frac{100}{1+ 100/546}$

n = 84.52

n =85

The Calculation of 95% confidence limit for the proportion of the population element that belongs to the defined category is as follow:

Calculation for 95% C.L for P:

Given the population proportion P = 0.5

$1-\alpha = 0.95, \quad \Rightarrow \alpha = 0.05$

$Z\ \alpha / _2 = 0.025$

Standard error, Se = 0.05

95% confidence limits:

$P \pm Z\ \alpha/_2.Se = 0.5 \pm 1.96\ (0.05)$

$= 0.5 \pm 0.098$

The 95% confidence interval is therefore (0.5-0.098) to (0.5+0.098)

= 0.402 to 0.598

= 0.40 to 0.60

This means that there was 95% probability that, the proportion of the population chosen for the study is between 40% and 60%, with a total error of 0.098 or 0.1.

Clearly there was a large sampling error indicating that, a large sample should be used.

45% response rate will be used

Response rate, 45% = 85/K, where K is the total number of questionnaires or the size of the sample.

K = 85/0.45

= 188.88 =189

The sample size for contractors was increased from 189 to 268 due to the general apathy in the industry towards the responds to questionnaires and to accommodate the anticipated shortfall in response.

Insurance groups

The main Insurance groups considered for the data collections are Insurance companies, Insurance brokers, and Insurance agent's and Reinsurance companies.

From National Insurance Commission (NIC), there are 56 Insurance companies, 64 Broking companies and 3 Reinsurance companies' giving a total of 123 Insurance groups. The sample size will be determined by using the formula (Kish, 1965).

Substituting N = 123, in the Kish formula, a sample size of 86 is obtained.

Clients

The following groups of clients were considered; public and private individuals or organizations. These will include Government Ministries, Departments and Agencies, Universities, Churches as well as non-governmental organizations with construction project management units. A total population of 65 is considered

Substituting N =65, in the Kish formula, a sample size of 48 is obtained.

CHAPTER FIVE

SURVEY RESULTS, ANALYSIS AND DISCUSSION

5.1 INTRODUCTION

A total of 592 questionnaires were sent to a selected sample of respondent in the construction industry, comprising the following: 48 of Clients, 190 of Consultants, 86 of Insurance Firms and 268 of contractors. A sample of the questionnaires can be seen Appendix 1. The questionnaires were sent to key stakeholder organizations in the construction industry. These include Clients, Consultants, Insurance Companies and Contractors.

5.2 ANALYSIS OF RESPONSE

A total of 592 questionnaires were sent to the four groups of respondents in the construction industry of which 491 were collected. The 491 questionnaires collected comprised 40 from clients, 149 from consultants, 74 from insurance firms and 228 from contractors. This gives a responds rate of 82.94%. Below is the breakdown of responses from the various sample groups.

5.2.1 The Clients

A total of 48 questionnaires were sent out to the various clients in the building construction industry of which 43 were returned. Three of these questionnaires were considered invalid and therefore rejected on grounds that they were not adequately completed. This puts the total number of valid questionnaires at 40, representing 83.33% of total number of questionnaires sent out.

5.2.2 The Consultants

Out of a total of 190 questionnaires sent out to the consultants; made up of 75 Architects, 65 Quantity Surveyors and 50 Civil Engineers, about 149 questionnaires were received and considered valid for analysis. Table 5.1 shows the survey response

Table 5.1: Consultant's Response to Survey

Groups	Issued	Returned	Percentage Returned (%)
Architectural	75	56	74.67
Quantity Surveying	65	52	80.00
Civil Engineering	50	41	82.00
Total	190	149	78.42

5.2.3 Insurance firms

A total of 86 questionnaires were sent out to the Insurance fraternity. Out of which 38 questionnaires sent to Brokers, 45 to Insurance Companies and 3 to Reinsurance Companies'. A total of 74 were completed and returned. Table 5.2 shows the survey response.

Table 5.2: Insurance firms Response to Survey

Insurance firms	Issued	Returned	Percentage Returned (%)
Insurance companies	45	38	84.44
Insurance Brokers	38	33	86.84
Reinsurance Companies	3	3	100.00
Total	86	74	86.05

5.2.4 The Contractors

Out of a total of 268 questionnaires sent out to (D1 and D2) contractors, 228 questionnaires, representing 85.07% were returned and found to be valid. Out of this number, 154 came from D2 contractors and 74 from D1 contractors. Details of the survey responses are shown in Table 5.3.

Table 5.3: Contractor's Response to Survey

Classes	Issued	Returned	Percentage Returned (%)
D1	85	74	87.06
D2	183	154	84.15
Total	268	228	85.07

An overall response rate of 82.94% was achieved. This is significant for the purpose of validating the research results. The respondents were generally slow in responding to the questionnaires but all were compiled within a reasonable time space. Table 5.4 shows the overall survey response levels;

Table 5.4: Overall survey responds levels

Group	Issued	Returned	Percentage Returned (%)
Clients	48	40	83.33
Consultants	190	149	78.42
Insurance Firms	86	74	86.05
Contractors	268	228	85.07
Total	592	491	82.94

5.3 RESULTS ANALYSIS AND DISCUSSION

In this section, an analysis of respondent understanding and views on construction risks, assessment and management have been considered and discussed. The responses of the various contract groups to the questionnaire (Appendix 1) were analyzed and discussed as shown below.

5.3.1 Respondents Job Title

Table 5.5: Job Title/Area of specialization of Respondents in the Construction Industry

NO.	Area of Specialization	CLIENTS		CONSULTANTS		INSUR. COMP.		CONTRACTORS		O.ALL % RESPONSE
		NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	
1	Project Manager	10	25.00	10	6.71	12	16.22	32	14.06	13.03
2	Structural Engineer	7	17.50	40	26.85	3	4.05	58	25.44	22.00
3	Architectural	12	30.00	52	34.90	10	13.51	64	28.07	28.11
4	Quantity Surveyor	9	22.50	38	25.50	4	5.41	54	23.68	21.38
5	Insurance specialist	0	0.00	4	2.68	45	60.81	4	1.75	10.79
6	Service Engineer	2	5.00	5	3.36	0	0.00	16	7.02	4.68
	Total	40	100.00	149	100.00	74	100.00	228	100.0	100.0

The purpose of question one was to know the capacity in which respondents have undertaken risk management and insurance. The questionnaire was to be completed by respondents who were involved in construction works, contract administration as well as construction insurance. To this end, categories of respondents targeted were Project Managers, Architects, Structural Engineers, Quantity Surveyors, Insurance specialist and Service Engineers.

The survey shows that 13.03 percent of the respondents were Project managers, 22.00% were structural engineers, and 28.11% were Architects and 21.38% by Quantity surveyors, 10.95% by insurance specialist and 4.68% by service engineers. The percentage distribution of the various professionals indicates that majority of the questionnaires were completed directly by experts involved in construction and insurance works. The survey also shows that it was well represented by all professionals in the construction insurance industry and these groups of respondents are expected to have some wealth of experience.

5.3.2 Experience of Respondents

Table 5.6: Respondents experience in the construction insurance industry

NO.	Experience	CLIENTS		CONSULTANTS		INSUR. COMP.		CONTRACTORS		O.ALL % RESPONSE
		NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	
1	5 years or less	8	20.00	32	21.48	16	21.62	48	21.05	21.18
2	From 6 to 10 years	14	35.00	68	45.64	35	47.30	84	36.84	40.94
3	10 years and above	18	45.00	49	32.88	23	31.08	96	42.11	37.88
4	Total	**40**	**100.00**	**149**	**100.00**	**74**	**100.00**	**228**	**100.00**	**100**

A total of 491 questionnaires were sent to the respondents. The data depicted that 21.18% of the respondents had 5 or less years working experience, 40.94% had 6 to 10 years of experience and 37.88% had more than 10 years experience. This is shown in Table 5.6. This implies that the respondents have quite a reasonable working experience in the construction industry, considering 41% of respondents with 6 to 10 years working experience and 38% having more than 10 years working experience.

5.3.3 Understanding of the concept of Risk Management practices

Table 5.7 The Level of understanding of concept of risk management

NO.	Understanding of Risk Management	CLIENTS		CONSULTANTS		INSUR. COMP.		CONTRACTOR		O.ALL % RESPONSE
		NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	
1	Understand deeply through reading and practice	12	30.00	104	69.80	28	37.84	88	38.60	47.25
2	Only read about it	19	47.50	16	10.74	34	45.94	31	13.60	20.37
3	Not read about it but understand from practice	9	22.50	29	19.46	12	16.22	109	47.80	32.38
4	No knowledge about it	0	0.00	0	0.00	0	0.00	0	0.00	0.00
	Total	**40**	**100.00**	**149**	**100.00**	**74**	**100.00**	**228**	**100.00**	**100**

This question was put forward to respondents to identify their level of understanding of the risk management concept. From the analysis of the results shown in Table 5.7, the following picture emerged:

(i) That whilst about 69.80% of consultants understand risk management through reading and practice, it was 30.00%, 37.84% and 38.60% in the case of clients, insurance companies and contractors respectively;

(ii) An overall rate of 32.38% of respondents understands risk management only through practice. This is 22.50% by clients, 19.46% by consultants, 16.22% by insurance companies and 47.80% by contractors. This shows that a high percentage of contractors understand risk management only through practice;

(iii) All the respondents have some knowledge of risk management; and

(iv) Only 20.37% overall percentage of response rate understand risk management only through reading.

5.3.4 Provision of Insurance Cover/Policy

Table 5.8: shows the various contract groups responses to the essence of providing insurance policies

NO	Why the provision of insurance cover	CLIENTS		CONSULTANTS		INSUR. COMP.		CONTRACTORS		O.ALL % RESPONSE
		NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	
1	To meet the demand of the client	12	12.50	43	9.64	28	15.91	120	19.93	15.38
2	To reduce the impact of any disaster during construction	30	31.25	132	29.60	49	27.84	158	26.25	27.95
3	To meet tender and contract requirement	23	23.96	125	28.03	38	21.59	178	29.57	27.58
4	To absorb/transfer risks from/to other agencies	31	32.29	146	32.74	61	34.66	146	24.25	29.09
	Total	96	100.00	446	100.00	176	100.00	602	100.00	100.00

The survey from table 5.9 shows the following;

(1) About 12.50% of clients sought for insurance cover with the aim of meeting the demand of the client. This was 9.64% in the case of consultants, 15.91% of insurance companies and 21.28% of contractors. On the average, about 15.83% of all respondents sought insurance cover to meet the demand of the client for the provision of insurance policy. This is the is the lowest among the factors stated;

(2) About 31.25% of clients, 29.60% of consultants, 27.84% of insurance companies and 26.64% of contractors considered "to reduce the impact of any disaster during construction" as a reason for the provision of insurance policy. This has an overall responds rate of 28.15%.

(3) “To meet tender and contract requirement” attracted an overall response rate of 27.8%. this

reason was cited by 23.96% of clients, 28.03% of consultants, 21.59% of insurance companies and 31.36% of contractors. This factor attracted a comparatively high response rate from contractors; and

(4) To absorb/transfer risks from/to other agencies resulted in 32.29% response from clients, 32.74% from consultants, 34.66 % from insurance companies and 24.25% from contractors. The overall response is 29.09%. This factor received the highest overall response rate from the various contract groups. Generally, the response rate for contractors on this factor is low as compare to other contract groups.

The above results also show that the highest percentage response rate of contractors on the essence of provision of insurance policies is 29.57% that is to meet tender and contract requirements. This clearly shows contractors understanding of the essence of provision of insurance policies in the construction industry.

The overall response by the contract groups in order of high response rate shows the following; (1) absorb/transfer risks from/to other agencies, (2) to reduce the impact of any disaster during or after construction, (3) to meet tender and contract requirement and meeting the demand of clients as reason for the provision of insurance cover.

5.3.5 Visit to Project Site During/After Construction

From table 5.9, the survey revealed that 100% of clients, 100% of consultants, 9.38% of insurance companies and 100% of contractors visit the project site. From the above analysis one can conclude that presently, insurance companies only provide insurance covers but do not visit the project sites. This therefore shows that no proper measures and controls are put in place by insurers to prevent or minimized the occurrence of risk. Table 5.9 shows the various contract groups responses to the following questions.

Table 5.9 Response of Various Contract Groups

NO.	Question	CLIENTS		CONSULTANTS		INSUR. COMP.		CONTRACTOR		O.ALL % RESPONSE
		NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	
1	Do you visit the project site during construction (yes respondents)	32	100.00	120	100.00	6	9.38	186	100.00	85.57
2	Do you visit the project site during construction (No respondents)	0	0.00	0	0.00	58	90.63	0	0.00	14.43
3	Are the premium charge reasonable relate to the potential loss insured (yes respondents)	14	43.75	48	40.00	62	96.88	22	11.83	36.32
4	Are the premium charge reasonable relate to the potential loss insured (No respondents)	18	56.25	72	60.00	2	3.13	164	88.17	63.68
5	Do you normally interact with clients and contractors in risk identification, allocation and insurance policies before signing contract (yes respondents)	3	9.09	38	32.20	2	3.13	58	31.18	25.19
6	Do you normally interact with clients and contractors in risk identification, allocation and insurance policies before signing contract (No respondents)	30	90.91	80	67.80	62	96.88	128	68.82	74.81
	Total	97	300.00	358	300.00	192	300.00	558	300.00	300.00

5.3.6 Interaction with Various Contract Groups in Risk Identification, Allocation and Drafting of Insurance Policies Before/During Construction

Table 5.10 shows an interesting finding. It shows that whilst 76.0%, 80.0% and 89.0% of clients, consultants and contractors respectively interact with other contract groups only 8.50% of insurers interact with the contract groups. This clearly shows that insurance companies do not normally involve themselves much in discussing about risk and its management, drafting of insurance policies in the construction industry.

5.3.7 Role Played by various contract groups in Risk Management

Table 5.10 Responses to the role/s they play in risk management in the construction industry

NO.	Role in risk management	CLIENTS		CONSULTANTS		INSUR. COMP.		CONTRACTORS		O.ALL % RESPONSE
		NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	NO. OF RESPONSES	% RESPONSE	
1	Provide insurance cover for the project	18	56.25	12	10.00	58	90.63	152	27.79	15.94
2	Help in drafting the insurance policies for the project	18	56.25	113	94.17	60	93.75	21	3.84	14.08
3	Help in risk identification of the project	12	37.50	56	46.67	28	43.75	16	2.93	7.44
4	Help in the sharing of the risks identify	24	75.00	120	100.0	8	12.50	0	0.00	10.09
5	Educate the parties involved in the project on effective risk management practices.	28	87.50	113	94.17	10	15.63	18	3.29	11.22
6	Have risk management personnel at the project site to ensure proper risk management practices.	30	93.75	103	85.83	1	1.56	168	30.71	20.05
7	Ensure that proper measures and controls are put in place to minimize the occurrence of risk.	29	90.63	116	96.67	2	3.13	172	31.44	21.18
	Total	159	100.0	633	100.0	167	100.0	547	100.0	100.0

From the analysis shown in the above table (5.11), the following picture emerged: (i) Taking an average rating of the seven listed factors, 15.94% of responses considered provision of insurance cover as their role in risk management, 14.08% of responses considered drafting insurance policies for the project as their role in risk management. About 7.44% and 10.09% of responses play the role of risk identification and sharing of risk respectively in risk management. About 11.22%, 20.05% and 21.18% of responses play the role of educating the parties involved in the project on effective risk management practices, have risk management personnel at the project site and ensuring that proper measures and controls are put in place to minimize the occurrence of risk respectively.

(ii) However responses on risk identification, sharing of the risk identified as well as educating the parties involved in the project on effective risk management practices by insurance companies and contractors were not encouraging. Only 1.56% and 3.13% of Insurance companies have risk management personnel at the project site as well as ensuring that proper measures and controls are put in place to minimize the occurrence of risk respectively, 93.75% are involved in drafting of insurance policies. On the other hand, only 2.93% of contractors involved in risk identification but do not involved in risk sharing. These two groups play major roles in risk management in the construction industry and should therefore be involved in these activities.

(iii) About, 90.63% of insurance companies provide insurance cover/policy, indicating clearly that their major role in risk management is the provision of insurance policies.

(iv) Consultants and clients play major roles in ensuring that proper measures and controls are put in place to minimize the occurrence of risk as well as having risk management personnel at project sites. 96.67% and 90.63% of consultants and clients respectively play roles in ensuring that proper measures and controls are put in place to minimize the occurrence of risk as well as

having risk management personnel at project site by whiles 31.44% and 30.71% respectively by contractors.

5.3.8 Methods of Risk Identification

Tables 5.11, 5.12, 5.13 and 5.14 show responses by client, consultants, insurance companies and contractors to methods for risks identification (question 6). These factors were ranked according to how often they are used.

Table 5.11 Client's responses to the ranking of the methods of risks identification

No.	METHODS OF RISK IDENTIFICATION	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Brainstorming amongst a Project team	14	6	3	4	5	76	0.48	7
2	By past experience /Analysis of prior projects	0	1	4	9	18	140	0.88	1
3	Judgment of the estimator/Quantity surveyor	2	3	6	7	14	124	0.78	3
4	By the risk management department in the firm	13	9	1	3	5	71	0.46	8
5	By the opinion of external consultant	8	4	0	8	12	108	0.68	4
6	Checklists	9	6	3	6	8	94	0.59	6
7	Visits to site	0	2	4	7	19	139	0.87	2
8	Tender review by management	6	8	4	6	10	108	0.64	5

Table 5.12: Insurance companies responses to the ranking of the methods of risks identification

No.	METHODS OF RISK IDENTIFICATION	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Brainstorming amongst a Project team	28	14	8	6	8	144	0.45	6
2	By past experience /Analysis of prior projects	0	1	6	18	38	282	0.90	1
3	Judgment of the estimator/Quantity surveyor	23	12	8	4	2	97	0.40	8
4	By the risk management department in the firm	2	4	6	9	23	179	0.81	2
5	By the opinion of external consultant	10	8	4	8	14	140	0.64	4
6	Checklists	7	4	3	12	18	162	0.74	3
7	Visits to site	17	10	5	4	8	108	0.49	5
8	Tender review by management	16	12	6	4	4	94	0.45	7

Table 5.13: Consultant's responses to the ranking of the methods of risks identification

No.	METHODS OF RISK IDENTIFICATION	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Brainstorming amongst a Project team	38	24	16	18	24	326	0.54	6
2	By past experience /Analysis of prior projects	4	10	9	35	62	501	0.84	2
3	Judgment of the estimator/Quantity surveyor	10	9	14	39	48	466	0.78	3
4	By the risk management department in the firm	36	22	16	14	32	344	0.57	5
5	By the opinion of external consultant	48	36	19	10	6	247	0.42	8
6	Checklists	13	18	9	32	48	444	0.74	4
7	Visits to site	2	4	12	32	70	524	0.87	1
8	Tender review by management	40	38	12	12	18	290	0.48	7

Table 5.14: Contractor's responses to the ranking of the methods of risks identification

No.	METHODS OF RISK IDENTIFICATION	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Brainstorming amongst a Project team	86	26	12	22	40	462	0.50	6
2	By past experience /Analysis of prior projects	2	4	6	42	132	856	0.92	1
3	Judgment of the estimator/Quantity surveyor	32	17	28	38	71	657	0.71	3
4	By the risk management department in the firm	52	30	6	29	69 65	591	0.64	4
5	By the opinion of external consultant	6	4	6	4	0	48	0.48	7
6	Checklists	96	38	6	18	28	402	0.43	8
7	Visits to site	6	4	6	43	125	829	0.90	2
8	Tender review by management	60	29	18	23	53	529	0.58	5

Tables 5.11, 5.12, 5.13 and 5.14 show the results of the contract groups methods of risks identification. The survey shows the client, the insurer and the contractor ranking "By past experience/Analysis of prior projects" as the number one method of risk identification, the consultant on the other hand ranked it as the number 2. This clearly shows that majority of the contract groups use past experience/analysis of prior projects as a method of risk identification.

The use of brainstorming amongst a project team was ranked no. 6 by the insurance companies, the consultants and the contractors. The clients ranked it as no.7. Visit to the site was ranked no. 1 by consultants and ranked no.2 by clients and contractors. On the other hand the insurance companies ranked it no. 5. This clearly shows that insurance companies rarely visit the site when it comes to risks identification.

Judgment of the estimator/Quantity surveyor was ranked 3 by client, 8 by insurance company, 3 by consultants and contractors. By the use of risk management department in the firm, it was ranked as 8, 2, 5 and 4 by clients, insurance companies, consultants and contractors respectively.

5.3.9 Factors in Determining whether a Risk is Insurable or not

Tables 5.15, 5.16, 5.17 and 5.18 show responses of clients, consultants, insurance companies and contractors to whether a risk is insurable or not

Table 5.15: Client's responses to the ranking of factors in determining whether a risk is insurable.

No.	FACTORS	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Past history of the risk	0	1	2	8	21	145	0.91	1
2	Easy to assess the extent of damage	5	3	3	7	14	118	0.74	2
3	Easy to determine the cause of damage	10	3	4	6	8	92	0.59	4
4	Risks with high premiums	14	6	3	5	4	75	0.47	6
5	Difficult in assessing the risk premium	15	5	5	3	4	72	0.45	8
6	Unquantifiable risks	12	7	4	5	4	78	0.49	5
7	Foreseeable risks	6	5	2	8	14	124	0.71	3
8	Unforeseeable risks	14	5	5	4	4	75	0.47	7

Table 5.16: Consultant's responses to the ranking of factors in determining whether a risk is insurable or not.

No.	FACTORS	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Past history of the risk	2	7	16	29	66	510	0.85	1
2	Easy to assess the extent of damage	4	10	18	30	58	488	0.81	2
3	Easy to determine the cause of damage	11	16	13	31	49	451	0.75	4
4	Risks with high premiums	42	38	21	11	8	265	0.44	5
5	Difficult in assessing the risk premium	54	37	12	14	3	235	0.39	8
6	Unquantifiable risks	44	38	22	10	6	256	0.43	6
7	Foreseeable risks	6	9	15	34	56	485	0.81	3
8	Unforeseeable risks	46	41	16	11	6	250	0.42	7

Table 5.17: Insurance Companies' responses to the ranking of factors in determining whether a risk is insurable.

No.	FACTORS	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Past history of the risk	0	0	1	15	48	303	0.95	1
2	Easy to assess the extent of damage	0	0	1	20	43	298	0.93	3
3	Easy to determine the cause of damage	0	1	4	8	51	301	0.94	2
4	Risks with high premiums	40	20	1	3	0	95	0.30	6
5	Difficult in assessing the risk premium	48	12	3	1	0	85	0.27	7
6	Unquantifiable risks	47	13	4	0	0	85	0.27	8
7	Foreseeable risks	3	1	4	18	36	269	0.87	4
8	Unforeseeable risks	14	5	5	4	4	75	0.47	5

Table 5.18: Contractor's responses to the ranking of factors in determining whether a risk is insurable or not

No.	FACTORS	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Past history of the risk	19	30	21	48	68	674	0.72	3
2	Easy to assess the extent of damage	17	25	31	41	72	684	0.74	1
3	Easy to determine the cause of damage	21	29	32	42	62	653	0.70	4
4	Risks with high premiums	76	43	32	16	18	412	0.45	5
5	Difficulty in assessing the risk premium	80	48	33	21	4	379	0.41	8
6	Unquantifiable risks	76	46	21	29	14	417	0.45	6
7	Foreseeable risks	16	22	26	57	65	691	0.74	2
8	Unforeseeable risks	69	53	29	23	12	414	0.45	7

Tables 5.15, 5.16, 5.17 and 5.18 show the responses by the contract groups in determining whether a risk is insurable or not. The survey shows the client, the insurer and the consultant ranking "Past history of the risk" as the number one factor in determining the insurability of risk, on the other hand the contractor ranks it as the number 2. This clearly shows that majority of the various contract groups use past history of the risk as a factor in determining whether a risk is insurable or not.

"Difficulty in assessing the risk premium" was ranked no. 8 by the clients, the consultants and the contractors. The insurance companies ranked it as no.7. The results clearly show that difficulty in assessing the risk premium is one of the list factors in determining whether a risk is insurable or not.

"Easy to assess the extent of damage" was ranked no. 1 by contractors and ranked no.2 by clients and consultants. On the other hand the insurance companies ranked it no. 3.

Foreseeable risk was ranked 2 by contractors, 4 by insurance company, 3 by consultants and clients.

"Easy to determine the cause of damage" was ranked as 4, 2, 2 and 4 by clients, insurance companies, consultants and contractors respectively.

5.4 RANKING OF RISK FACTORS IN CONSTRUCTION

Appendices 2 (a-d) show the relative importance indices and the relative ranking of the 59 list of factors that are considered to be risk factors in construction. The rankings were assigned based on the factor relative importance index.

The formula for relative importance index is:

$$\frac{\Sigma W}{S \times N} \qquad 0 \leq INDEX \leq 1$$

Where ΣW = the summation of the weighting given to each factor

S = maximum score = 5

N = total number of firms that responded in the sample

Apart from relative importance scale, weighted averages of all the RII were calculated (see tables 5.24, 5.29 and 5.35). This was to select the factors that were important in all the groups. For each factor the weighted average was achieved by adding the products of

(a) The RII of each group and

(b) The proportion of the total respondents

$$\text{Weighted average} = \frac{n_1\ \text{RII}(1)}{N} + \frac{n_2\ \text{RII}(2)}{N} + \frac{n_3\ \text{RII}(3)}{N} + \frac{n_4\ \text{RII}(3)}{N}$$

Where n_1 = No of respondents for clients

n_2 = No of respondents for consultants

n_3 = No of respondents for insurance companies

n_4 = No of respondents for contractors

RII = Relative importance index for clients

RII = Relative importance index for consultants

RII = Relative importance index for insurance companies

RII = Relative importance index for contractors

Based on the analysis of the results shown in the above tables, the following were deduced:

5.4.1 Clients

With reference to appendices 2a, 3a and 4a which respectively show the rankings for risk factors, most used insurance policies and insurable risks in construction, it was observed that clients ranked the following as the ten most risk factors, insurable risks and insurance policies in the Ghanaian construction industry:

Table 5.19: Ten most important risk factors, insurable risks and most used insurance policies by clients

	Ten most important risk factors	Ten most important insurable risks	Ten most used insurance policies
1	Payment to contractors for work done,	Injury to person	Bid bond
2	Poor site management and supervision,	Injury to property	Contractors all risk
3	Mistakes and discrepancies in design documents,	Damages and delay during construction	Performance bond
4	Slow flow of information between project team members	Fire	Third party insurance
5	Shortage of materials in the market,	Weather	Third party insurance
6	Inadequate contractor experience	Extra ordinary wind	Professional Indemnity
7	Shortage of liquidity	Heavy rain	Workers compensation
8	Delay in design information	Theft	Fire perils insurance on premises and contents
9	Delay in subcontract work	Materials damage during transportation	Employers' liability
10	Fluctuations (cost)	Earth quake	Public liability

5.4.2 Consultants

In a similar vein, Table 5.20 shows the ranking by consultants the ten most important risk factors, the ten most insurable risks as well as the ten most used insurance policies:

Table 5.20: Ten most important risk factors, insurable risks and most used insurance policies by consultants

	Ten most important risk factors	**Ten most important insurable risks**	**Ten most used insurance policies**
1	Payment to contractors for work done,	Injury to person	Bid bond
2	Weather	Injury to property	Performance bond
3	Poor site management and supervision	Damages and delay during construction	Contractors all risk
4	Inadequate contractor experience	Fire	Third party insurance
5	Shortage of liquidity	Poor site management and supervision	Professional Indemnity
6	Shortage of materials in the market	Extra ordinary wind	Workers compensation
7	Fluctuations	Heavy rain	Motor insurance to cover vehicles
8	Defective that must be removed and replaced	Theft	Employers' liability
9	Mistakes and discrepancies in design documents,	Materials damage during transportation	Public liability
10	Poor construction method	High number of storeys of building	Fire perils insurance on premises and contents

5.4.3 Insurance Companies

Table 5.21 shows the ten most important risk factors, the ten most insurable risks and ten most used insurance policies by Insurance Companies in construction:

Table 5.21: Ten most important risk factors, insurable risks and most used insurance policies by insurance companies

	Ten most important risk factors	**Ten most important insurable risks**	**Ten most used insurance policies**
1	Payment to contractors for work done,	Injury to person	Bid bond
2	Inadequate contractors experience,	Injury to property	Contractors all risk
3	Poor site management and supervision	Damages and delay during construction	Performance bond
4	Shortage of liquidity	Fire	Motor insurance to cover vehicles
5	Weather	Heavy rain	Third party insurance
6	Shortage of materials in the market	Extra ordinary wind	Key men life insurance
7	Mistakes and discrepancies in design documents,	High number of storeys of building	Professional Indemnity
8	Defective that must be removed and replaced	Theft	Workers compensation
9	Inadequate managerial skills	Materials damage during transportation	Public liability
10	Poor construction method	Delay in design information	Liability Insurance

5.4.4 Contractors

Table 5.22 shows the ten most important risk factors, the ten most insurable risks and the ten most used insurance policies in the Ghanaian construction industry by contractors. Details of these are shown in Appendices 2d, 4f and 3d respectively.

Table 5.22: The ten most important risk factors, insurable risks and most used insurance policies by contractors

	Ten most important risk factors	**Ten most important insurable risks**	**Ten most used insurance policies**
1	Delay in Payment to contractors for work done,	Injury to person	Bid bond
2	Poor site management and supervision	Injury to property	Contractors all risk
3	Inadequate contractors experience	Heavy rain	Performance bond
4	Shortage of liquidity	Fire	Workers compensation
5	Shortage of materials in the market,	Poor construction method	Motor insurance to cover vehicles
6	Weather,	Poor site management and supervision	Third party insurance
7	Labour shortage	Damages and delay during construction	Employers liability
8	Delay in sub contract work	Extra ordinary wind	Public liability
9	Low productivity	Materials damage during transportation	Contractor's protective public and property
10	Inaccurate material estimating	Delay in subcontract works	Liability Insurance

5.5 AGREEMENT ANALYSIS (CONCORDANCE TEST)

Kendall test for concordance is used to measure the degree of agreement of the rank correlation between the respondents. The Kendall test for concordance, w, between the clients, consultants, insurance companies and contractors was measured using the formula:

$$W = \sum_{i=1}^{k}(Ri - R)2/[\frac{n(n2-1)}{12}]$$

$$0.0 \leq w \leq 1.0$$

Where,

K = the number of sets of ranking

n = the number of factors being ranked

R = average of the ranks assigned to the nth factor being ranked

$n\ (n^2 - 1\ )/12$= the maximum possible squared deviations, i.e. the numerator which will occur if there were perfect agreement among k sets of ranks, and the average ranking were 1, 2, 3, ……, n;

R_i = the assigned by an individual judge to one factor. (2)

Table 5.23 shows the values for the calculation of w.

K = 4; n = 59; R = 29.56

$\sum_{i=1}^{n}(Ri - R)\ 2$ = 14,533.26

$n(n^2 - 1)/12 = 59(59^2 - 1)/12 = 17,110$

$w = 14,533.26/17,110$

$w = 0.85$

A coefficient of w = 1 indicates a perfect agreement and zero indicates no agreement. Therefore the value of the coefficient of concordance, w = 0.85 from the above analysis indicates a high degree of agreement amongst the four contract groups.

Major Risk Factors Identified

The best estimate for the true ranking of n objects (according to Kendall, 1970) is provided where w is significant by the order of various sums of ranks. That is evidenced by the magnitude and significance of w, therefore the best true ranking is provided by the mean of the ranks. This implies that the most important factor is the highest overall ranking one.

From the analysis in the above tables, the ten most important risk factors, ten most important insurable risk and ten most used insurance policies from all the groups are shown in the table below:

Table 5.25: Major risk factors, insurable risks and most used insurance policies (Using the Kandall concordance test).

	Ten most important risk factors	**Ten most important insurable risks**	**Ten most used insurance policies**
1	Delay in Payment to contractors for work done,	Injury to person	Bid bond
2	Poor site management and supervision	Injury to property	Contractors all risk
3	Inadequate contractors experience	Damages and delay during construction	Performance bond
4	Weather	Fire	Motor insurance to cover vehicles
5	Shortage of liquidity	Heavy rain	Third party insurance
6	Shortage of materials in the market	Extra ordinary wind	Workers compensation
7	Mistakes and discrepancies in design documents	High number of storeys of building	Professional indemnity
8	Poor construction method	Poor construction method	Public liability
9	Inadequate managerial skills	Materials damage during transportation	Employers liability
10	Delay in design information	Theft	Key men Life Insurance

Studying the relative importance indices and the ranks of the various factors across the groupings, reveals that all the groups rank the various factors differently; with some level of agreement among the various groups. For example all the groups ranked delay in payment for work done by contractors first.

There were also a lot of similarities in the ranking of Insurable risks as well as Insurance policies as shown in the above tables.

5.6 SUMMARY

The survey achieved an overall response rate of 67.91%. The analyses of the survey reveal the following observations:

i) Majority of contract groups in the construction industry uses "past experience/Analysis of prior projects" in the identification of risk factors in the construction industry;

ii) It was also shown that "past history of the risk" is mostly used in determining whether a risk is insurable or not; and

iii) It further revealed that clients, insurance companies, consultants and contractors have their individual preferences on the ranking of risk factors in the construction industry.

By using Kandall concordance test, the following factors as shown below were considered the ten most major risk factors, the ten most used insurance policies and the ten most insurable risks.

Table 5.26: Major risk factors, insurable risks and most used insurance policies (Using the Kandall concordance test).

	Ten most important risk factors	**Ten most important insurable risks**	**Ten most used insurance policies**
1	Delay in Payment to contractors for work done,	Injury to person	Bid bond
2	Poor site management and supervision	Injury to property	Contractors all risk
3	Inadequate contractors experience	Damages and delay during construction	Performance bond
4	Weather	Fire	Motor insurance to cover vehicles
5	Shortage of liquidity	Heavy rain	Third party insurance
6	Shortage of materials in the market	Extra ordinary wind	Workers compensation
7	Mistakes and discrepancies in design documents	High number of storeys of building	Professional indemnity
8	Poor construction method	Poor construction method	Public liability
9	Inadequate managerial skills	Materials damage during transportation	Employers liability
10	Delay in design information	Theft	Key men Life Insurance

It was also clear that in the survey that insurance companies only provide insurance covers but do not visit project site or educate other participants especially contractors as to the control or minimizing the occurrence of risk.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

Construction insurance is a practice of exchanging a contingent claim for a fixed payment to protect the interests of parties involved in a construction project. It is a major method of managing risks in the construction industry. Its primary function is to transfer certain risks from clients, contractors, subcontractors and other parties involved in the construction project to insurers to provide contingent funding in time of difficulty. Construction insurance plays an increasingly important role in guaranteeing the success of projects, with insurers sharing losses resulting from natural disasters and other contingencies. The aim of this research as indicated in chapter one is to conduct an investigation into how insurance is used as a risk transfer tool in the Ghanaian construction industry and examine the interaction between construction players and insurance companies with respect to risk management.

6.2 CONCLUSION

The following conclusions are drawn from the research:

The ten major risk factors in the construction industry according to the four main parties are shown in the table below:

Table 6.1: The ten major risk factors in the construction

NO.	CLIENTS	INSURANCE COMPANIES	CONSULTANTS	CONTRACTORS
1	Delay Payment to contractors for work done,	Delay in Payment to contractors for work done,	Delay in Payment to contractors for work done,	Delay in Payment to contractors for work done,
2	Poor site management and supervision,	Inadequate contractors experience,	Weather	Poor site management and supervision
3	Mistakes and discrepancies in design documents,	Poor site management and supervision	Poor site management and supervision	Inadequate contractors experience
4	Slow flow of information between project team members	Shortage of liquidity	Inadequate contractor experience	Shortage of liquidity
5	Shortage of materials in the market,	Weather	Shortage of liquidity	Shortage of materials in the market,
6	Inadequate contractor experience	Shortage of materials in the market	Shortage of materials in the market	Weather,
7	Shortage of liquidity	Mistakes and discrepancies in design documents,	Fluctuations	Labour shortage
8	Delay in design information	Defective that must be removed and replaced	Defective that must be removed and replaced	Delay in sub contract work
9	Delay in subcontract work	Inadequate managerial skills	Mistakes and discrepancies in design documents,	Low productivity
10	Fluctuations (cost)	Poor construction method	Poor construction method	Inaccurate material estimating

The ten most used insurance policies in the construction industry according to the four main parties are shown in the table below:

Table 6.2: Ten most used insurance policies in the construction industry

NO.	CLIENTS	INSURANCE COMPANIES	CONSULTANTS	CONTRACTORS
1	Bid bond	Bid bond	Bid bond	Bid bond
2	Contractors all risk	Contractors all risk	Performance bond	Contractors all risk
3	Performance bond	Performance bond	Contractors all risk	Performance bond
4	Third party insurance	Motor insurance to cover vehicles	Third party insurance	Workers compensation
5	Third party insurance	Third party insurance	Professional Indemnity	Motor insurance to cover vehicles
6	Professional Indemnity	Key men life insurance	Workers compensation	Third party insurance
7	Workers compensation	Professional Indemnity	Motor insurance to cover vehicles	Employers liability
8	Fire perils insurance on premises and contents	Workers compensation	Employers' liability	Public liability
9	Employers' liability	Public liability	Public liability	Contractor's protective public and property
10	Public liability	Liability Insurance	Fire perils insurance on premises and contents	Liability Insurance

The ten most insurable risks in the construction industry according to the four main parties are shown in the table below:

Table 6.3: Ten most insurable risks in the construction industry

NO.	CLIENTS	INSURANCE COMPANIES	CONSULTANTS	CONTRACTORS
1	Injury to person	Injury to person	Injury to person	Injury to person
2	Injury to property	Injury to property	Injury to property	Injury to property
3	Damages and delay during construction	Damages and delay during construction	Damages and delay during construction	Heavy rain
4	Fire	Fire	Fire	Fire
5	Weather	Heavy rain	Poor site management and supervision	Poor construction method
6	Extra ordinary wind	Extra ordinary wind	Extra ordinary wind	Poor site management and supervision
7	Heavy rain	High number of storeys of building	Heavy rain	Damages and delay during construction
8	Theft	Theft	Theft	Extra ordinary wind
9	Materials damage during transportation	Materials damage during transportation	Materials damage during transportation	Materials damage during transportation
10	Earth quake	Delay in design information	High number of storeys of building	Delay in subcontract works

- It shows that clients, insurance companies, consultants and contractors have their individual preferences on the ranking of various factors. All the four groups have a lot of common major risk factors, insurable risk and insurance policies among them but in different ranks. There is therefore a fairly general agreement among the participants in the construction industry as shown in the Kandall test for concordance.

- Majority of participants in the construction industry use past "experience/Analysis of prior projects" in the identification of risk factors in the construction industry.
- Insurance companies only provide insurance covers to projects but do not normally visit project site or educate other participants especially contractors as to the control or minimizing the occurrence of risk.

6.3 RECOMMENDATION

From the analysis and conclusions, the goal of all the parties involved is to obtain the broadest insurance coverage, at the lowest costs, while ensuring minimum risk during the construction work. In other to achieve the above objectives, the following management strategies are recommended for consideration.

6.3.1 Clients / Consultants

The clients / consultants of the industry ultimately pay the bill and it is important to understand their needs and expectations. The following management strategies should be adopted;

(i) Right from the briefing stage till handover to users, the client should involve the various contract groups, that is, the architect, quantity surveyor, the civil engineer and insurers in discussing the risk management process. This should include identification of risk, allocation, control and mitigation of those risks as well as drafting of insurance policies before and during construction.

(ii) Contractors should be adequately compensated for any risks for which they take responsibility as the most cost-effective route for a client. This can be done by reimbursing them a sum of money for taking those responsibilities.

(iii) Clients/consultants should engage experts to ensure that insurance policies are specifically designed according to the nature of project, the types of procurement and construction contract as well as its limitation and coverage.

6.3.2 Insurers

(i) While contractors are mainly responsible for successful risk management of a project, insurers can provide their expertise to assist the contractors' risk management in recognizing potential risks and reducing the probability of such risks.

(ii) Due to construction complex characteristics, a construction insurers' opportunity lies in the drafting, negotiating, and concluding of bearable long-term, multi-line insurance agreements, it is therefore necessary for construction insurers' to get involved in risk identification, allocation and drafting and negotiation of insurance policies before and during construction.

(iii) Co-operation with Contractor and clients

Not only the probability and severity of risks but also appropriate risk management system have a significant impact on the insurance premium and the acceptance of the risk.

Therefore, sound co-operation should be achieved between all parties since they all share the identical objective of successful and scheduled project completion without losses and within budget.

(iv) Insurers could recommend appropriate risk management procedures for contractors to:

- Reduce the probability of a risk happening;
- Reduce the size of a claim when it happens;

• Give insurers a better understanding of the risks during underwriting process; and

• Increase certainty on financial exposure.

(v) Insurance companies should visit project site from as early a stage as possible (not only when problems arise) and throughout construction, erection, testing, commissioning and during the first operating years, provides the engineering insurer with the opportunity to keep in close contact with the risk.

(vii) Involvement in Loss Prevention

In order to reduce incidents and therefore claims, insurers should take an active attitude to assist the insured to control risks for works. The engineer appointed by the insurer should be familiar with the type of projects, be experienced in risk identification and analysis processes and have the ability to recommend useful solutions. The risk survey should be carried out with the cooperation between the engineer of an insurance company and the contractor. The survey result will help to analyze the past, current and future situations of projects; assist in compiling a list of weak points and potential risks; work out steps for improvement; and increase the awareness to parties involved.

6.3.3 Contractors

Contractors have the major responsibility to deal with construction risks. They are responsible for successful risk management of the project (Treceno et al., 2003). A contractor's capability in risk management is one of the key factors to project performance (Wang and Chou, 2003).

The following management strategies should be adopted;

(i) Assessment of risks and needs

The contractor needs to assess the risks to be retained or insured. If insurance policy is not issued accurately according to the risks, it might lead to the lack of indemnity cover by insurers when claims arise.

(ii) Contractors should be innovative and have the ability to negotiate with the insurers to improved conditions of insurance, which are adapted to the changed needs as well as obtain best premium reduction through implementing proper loss control and risk management measures via their experienced expert team.

(iii) The right insurer and the appropriate insurance policy

A contractor is expected to be familiar with a wide range of construction insurance policies. The contractor should also be aware of the quality of the various insurers in respect of their financial strength / claims paying ability and market reputation. The quality of insurance can only be tested when the insurer is called upon to pay a justifiable claim.

(iv) Underwriting and claim settlement

Contractors play an important role in deciding the value of items to be insured and the premium to be paid. Price alone should not be the determining factor in the decision to accept an insurance cover.

(v) In order to effectively employ construction insurance, contractors must:

- Understand how insurers view the construction industry and developing technology;
- Maintain a good relationship with an insurer who is qualified in construction insurance products;
- Implement effective risk management system, safety management programs and quality control to alleviate risks;
- Maintain a good track record on their performance over the years; and

• Improve the understanding of their employees on current insurances.

(vi) Contractors need to undertake more education and training on insurance and the type of policies available and appropriate for a particular risk.

Ideally all parties should be undertaking the early assessment process in conjunction with their negotiation of the agreements to identify those areas where insurance is required and to provide co-ordinated approach to obtaining appropriate policies of insurance. This will:

- maximise the prospect of identification of appropriate policies of insurance to apply throughout the project;
- maximise the prospect that policies of insurance obtained will be co-ordinated and consistent;
- maximise the prospect that by co-ordinated approach to underwriters, duplication in policy cover will be avoided and cost savings obtained;
- maximise the prospect of reduced premiums and cost savings; and
- lessen the prospects for costly and disruptive disputes between the parties and between the parties and their insurers.

6.4 FUTURE RESEARCH

Construction insurance plays an important role in transferring risks in the construction industry. Future research can focus on the issues of motives for construction insurance purchase, special risk considerations, changing environment, interaction to risk management, and alternative risk transfer solutions. They will contribute a better understanding for both industries, i.e. the insurance industry and especially the construction industry because the changing business environment needs the construction industry to improve its ability to manage construction risks.

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APPENDIX

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF BUILDING TECHNOLOGY

MSc CONSTRUCTION MANAGEMENT PROGRAMME

QUESTIONNIARE TO PROJECT CONTRACTORS, CONSULTANTS, INSURANCE COMPANIES AND CLIENTS

Student / Researcher: YAKUBU OSMAN

Institution: KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Department: BUILDING TECHNOLOGY

Dear Client/Consultant/Insurer/Contractor:

RISK TRANSFER IN THE GHANAIAN CONSTRUCTION INDUSTRY: THE USE OF INSURANCE AS A MAJOR TOOL

The questionnaire forms part of an MSc research being undertaken at the Kwame Nkrumah University of Science and technology.

The purpose of the questionnaire is to enable the achievement of the following research objectives:

(1) To identify major risks factors in the Ghanaian construction industry;
(2) To identify insurable risks and the types of insurance policies mostly used in the construction industry;
(3) To identify the role of insurance as a means of managing risks;
(4) To recommend management strategies to insurance companies, construction firms as well as client in the use of insurance as a tool for risk transfer;

Your assistance in answering the questions set out below would be much appreciated.

Please do not leave any identification marks on the forms in order that the replies remain anonymous. The information provided will be used solely for academic purposes and will be treated confidentially.

Thank you.

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF BUILDING TECHNOLOGY

MSc CONSTRUCTION MANAGEMENT PROGRAMME

QUESTIONNIARE TO PROJECT CONTRACTORS, CONSULTANTS AND CLIENTS

Please answer the following questions, ticking or filling where appropriate

(1) What is the name of your firm?.....

(2)Could you state which of the contract group you belong to

Client/Owner [ ] Consultant [ ] Contract [ ]

(3) Please kindly indicate your status in your organization

Director/principal partner [ ] Associate partner [ ] Senior staff [ ] Junior staff [ ]

Any other (state).....

(4) Please indicate your area of specialization as far as practicing in the construction industry is concerned

Project Management [ ] Structural Engineering [ ], Quantity surveying [ ] Services Engineering [ ] Any other (state).....

(5) How long have you been in practice?

2 years or less [ ] From 2 to 5 years [ ] Above 5 years [ ]

(6) Please indicate the ministry of water resources, works and housing classification your company belong to (If applicable);

D1/K1 [ ] D2/K2 [ ] D3/K3 [ ] D4/K4 [ ]

(7) Indicate your level of understanding of the concept of Risk Management practices

Understand deeply through reading and practice. [ ] Only read about it [ ]

Not read about it but understand from practice [ ] No knowledge about it [ ]

(8)At what stage of a project do you start practicing risk management?

Briefing stage [ ] Design stage [ ] Tendering stag [ ] Construction stage [ ]

(9)Which of the following methods do you often use to identify risks associated with a project? Rank them on the scale of 1 – 5 (from 1=least to 5= most use).

	METHODS	RANK				
		1	2	3	4	5
1	Brainstorming amongst a Project team					
2	By past experience /Analysis of prior projects					
3	Judgement of the estimator/Quantity surveyor					
4	By the risk management department in the firm					
5	By the opinion of external consultant					
6	Checklists					
7	Visits to site					
8	Tender review by management					

Any other (state).....

(10)Which of the following factors do you consider in determining whether a risk is insurable or not? Rank them on the scale of 1 – 5 (from 1=least to 5=most used).

	FACTORS	RANK				
		1	2	3	4	5
1	Past history of the risk					
2	Easy to assess the extent of the damage					
3	Easy to determine the cause of the damage					
4	Risks with high premiums					
5	Difficult in assessing the risk premiums					
6	Unquantifiable risks					
7	Foreseeable risks					

Any other (state).....

(11)The following is a list of risk factors in construction. Please indicate by ticking which risks are insurable and those uninsurable. Then rank them on a scale of 1 to 5 points based on their effect on the project.

- Critical risk – five points – would cause program failure.
- Serious risk – four points – would cause major cost or schedule increases and secondary requirements may not be achieved.
- Moderate risk – three points – would cause moderate cost/schedule increases; important requirements would still be met.
- Minor risk – two points – would cause only small cost/schedule increases.
- Negligible risk – one point – would have no substantive effect on cost or schedule.

	RISK FACTORS IN CONSTRUCTION	TICK		RANK				
		INSURABLE	UNINSURABLE	1	2	3	4	5
1	Permits delayed or take longer than expected							
2	Environmental regulations change							
3	Pressure to deliver project on an accelerated schedule							
4	Labour shortage							
5	Strikes and labour disputes							
6	Low productivity							
7	Labour relations							
8	Change orders							
9	Unforeseen general conditions							
10	High number of storeys of buildings							
11	Inappropriate type of foundation							
12	Errors in drawings							
13	Location and project restriction							
14	Variations							
15	Fluctuations (changes in cost)							
16	Long waiting time for approval of drawings							
17	Type of client (eg- public, private, joint venture)							
18	Unrealistic contract duration							
19	Delay in Payment to contractor for work done							
20	Lack of communication between client and consultants							
21	Lack of communication between consultants and contractors							
22	Slow flow of information between project team members							
23	Inadequate client experience							
24	Delay in design information							
25	Mistakes and discrepancies in design documents							
26	Inadequate design team experience							
27	Long waiting time for approval of test samples							
28	Injury to persons							
29	Injury to property							
30	Damages and delays during construction							
31	Contractor failure to enter into contract							
32	Shortage of materials in market							
33	Inaccurate materials estimating							
34	Poor site management and supervision							
35	Inadequate contractor experience							

36	Inadequate managerial skills							
37	Defective work that must be removed and replaced							
38	Delays in subcontractors work							
39	Shortage of liquidity							
40	Shortage of plant/equipment							
41	Inaccurate prediction of equipment production output							
42	Weather							
43	Fire							
44	Earth quake							
45	War							
46	Nuclear weapons material							
47	Radioactive materials							
48	Extraordinary wind							
49	Heavy rain							
50	Frequent changes in law							
51	Exchange rate fluctuation							
52	Inflation							
53	Financial problem due to errors in Estimation							
54	Insufficient insurance							
55	Theft							
56	Materials damage during transportation							
57	Interference by client							
58	Poor construction method							
59	Low productivity of subcontractors							

(12)The following are insurance policies typically involved in construction projects. Rank them, based on the most purchased, on a scale of 1 to 5(from 1=least to 5= most use).

NO.	Insurance policies	RANK				
		1	2	3	4	5
1	Contractors all risk					
2	Performance bond					
3	Professional Indemnity					
4	Workers compensation					
5	Motor insurance to cover vehicles					
6	Public liability					
7	Employers' liability					
8	Fidelity guarantee					
9	Third party insurance					
10	Fire perils insurance on premises and contents					
11	Bid bond					
12	Goods in transit					

(13) Why do you provide the above insurance cover? Tick all those applicable

To meet the demand of the client [ ], to transfer risk [ ]

To reduce the impact of any disaster during construction [ ]

To meet tender and contract requirement [ ]

(14) Which of the following insurance groups do you deal with when insuring your project?

Insurance company [ ], Insurance agent [ ], Insurance broker [ ]

Any other (state).....

(15) Which of the following problems or concerns are faced with respect to insurance? Tick all those applicable

Rising cost of premiums [ ], Fewer companies willing to insure [ ], Complex policy language [ ], Lack of proper coverage or exclusion [ ], High collateral demands by insurance companies [ ]

Lack of knowledge in insurance [ ]

(16) Do you normally interact with insurance companies in risk identification, allocation and insurance policies before or during construction?

Yes [ ] No [ ]

(17)Do the insurance companies visit the project site during construction?

Yes [ ] No [ ]

APPENDIX 2

Appendix 2: Risks Factors in the Construction Industry

2a: Clients' ranking of risk factors in the construction industry.

NO.	RISK FACTORS IN CONSTRUCTION	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Permits delayed or take longer than expected	6	4	7	6	9	104	0.65	26
2	Environmental regulations change	10	7	1	6	7	86	0.55	36
3	Pressure to deliver project on an accelerated schedule	13	10	2	2	5	72	0.45	46
4	Low productivity	5	4	2	9	12	115	0.72	19
5	Labour shortage	3	5	1	11	12	120	0.75	16
6	Strikes and labour disputes	6	7	5	5	9	100	0.63	28
7	Labour relations	7	5	4	6	10	103	0.64	27
8	Change orders	14	7	4	1	6	74	0.46	45
9	Unforeseen general conditions	4	7	1	11	9	110	0.69	22
10	High number of storeys of buildings	12	6	1	6	7	86	0.54	37
11	Inappropriate type of foundation	9	7	4	5	7	90	0.56	35
12	Errors in drawings	5	6	4	5	12	109	0.68	23
13	Location and project restriction	7	13	3	4	5	83	0.52	39
14	Variations	6	3	5	10	8	107	0.67	24
15	Fluctuations (changes in cost)	2	3	1	12	14	129	0.81	10
16	Long waiting time for approval of drawings	5	7	4	12	5	104	0.63	31
17	Type of client (eg- public, private, joint venture)	14	15	1	1	1	56	0.35	55
18	Unrealistic contract duration	9	5	2	6	10	99	0.62	29
19	Delay in Payment to contractor for work done	0	0	2	5	25	151	0.94	1
20	Lack of communication between client and consultants	7	6	8	4	7	94	0.59	32
21	Lack of communication between consultants and contractors	7	3	3	11	8	106	0.66	25
22	Slow flow of information between project team members	0	1	2	10	19	143	0.89	4
23	Inadequate client experience	12	9	2	6	3	75	0.47	44
24	Delay in design information	2	2	2	10	16	132	0.83	8
25	Mistakes and discrepancies in design documents	1	1	2	10	18	139	0.87	3
26	Inadequate design team experience	4	2	3	9	14	123	0.77	14
27	Long waiting time for approval of test samples	4	6	3	7	12	113	0.71	20
28	Injury to persons	14	10	1	2	5	70	0.44	47
29	Injury to property	14	12	1	3	4	73	0.43	48
30	Damages and delays during construction	10	7	1	6	8	91	0.57	34
31	Contractor failure to enter into contract	16	12	2	1	1	55	0.34	56
32	Shortage of materials in market	1	1	2	10	18	139	0.87	5
33	Inaccurate materials estimating	4	3	2	12	11	119	0.74	17
34	Poor site management and supervision	0	1	2	6	23	147	0.92	2
35	Inadequate contractor experience	1	1	3	9	18	138	0.86	6
36	Inadequate managerial skills	3	2	2	10	15	128	0.80	11
37	Defective work that must be removed and replaced	20	10	0	1	2	54	0.33	57
38	Delays in subcontractors work	3	2	1	9	17	131	0.82	9
39	Shortage of liquidity	1	2	3	10	16	134	0.84	7
40	Shortage of plant/equipment	3	4	2	10	13	122	0.76	15
41	Inaccurate prediction of equipment production output	4	5	2	8	13	117	0.73	18
42	Weather	0	1	2	9	20	144	0.90	3
43	Fire	14	11	1	2	4	67	0.42	49
44	Earth quake	15	10	3	1	3	63	0.39	52
45	War	13	11	3	3	2	66	0.41	50
46	Nuclear weapons material	16	9	1	3	3	64	0.40	51
47	Radioactive materials	17	9	2	2	2	59	0.37	54
48	Extraordinary wind	9	7	3	5	8	92	0.58	33
49	Heavy rain	8	5	5	6	8	97	0.61	30
50	Frequent changes in law	14	4	3	5	6	81	0.51	40
51	Exchange rate fluctuation	13	7	2	3	7	80	0.50	41
52	Inflation	10	8	2	7	5	85	0.53	38
53	Financial problem due to errors in Estimation	9	12	2	8	1	76	0.48	43
54	Insufficient insurance	16	9	2	4	1	61	0.38	53
55	Theft	6	2	5	8	11	112	0.70	21
56	Materials damage during transportation	12	8	2	6	4	78	0.49	42
57	Interference by client	18	12	0	1	1	51	0.32	58
58	Poor construction method	4	1	3	11	13	124	0.78	13
59	Low productivity of subcontractors	3	1	2	14	12	127	0.79	12

2b: Consultants' ranking of risk factors in the construction industry.

NO.	RISK FACTORS IN CONSTRUCTION	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Permits delayed or take longer than expected	27	36	14	24	19	332	0.55	34
2	Environmental regulations change	80	35	1	4	0	169	0.28	59
3	Pressure to deliver project on an accelerated schedule	64	38	4	5	9	217	0.36	51
4	Low productivity	12	23	8	23	54	444	0.74	16
5	Labour shortage	23	12	12	13	60	435	0.73	17
6	Strikes and labour disputes	18	23	9	21	49	420	0.70	20
7	Labour relations	22	17	2	23	56	434	0.72	18
8	Change orders	62	44	2	5	7	211	0.35	52
9	Unforeseen general conditions	29	38	17	16	20	320	0.53	36
10	High number of storeys of buildings	29	25	10	14	42	375	0.63	27
11	Inappropriate type of foundation	65	32	3	8	12	230	0.38	50
12	Errors in drawings	15	20	1	20	64	458	0.76	14
13	Location and project restriction	10	15	18	30	47	449	0.75	15
14	Variations	19	25	6	14	56	423	0.71	19
15	Fluctuations (changes in cost)	4	2	8	30	80	552	0.89	7
16	Long waiting time for approval of drawings	31	33	12	12	32	341	0.57	32
17	Type of client (eg- public, private, joint venture)	37	30	1	24	28	336	0.56	33
18	Unrealistic contract duration	50	31	18	12	9	259	0.43	46
19	Delay in Payment to contractor for work done	0	0	2	20	98	576	0.96	**1**
20	Lack of communication between client and consultants	40	18	8	24	30	346	0.58	31
21	Lack of communication between consultants and contractors	37	21	6	24	32	353	0.59	30
22	Slow flow of information between project team members	19	23	5	32	41	413	0.69	21
23	Inadequate client experience	38	45	14	13	10	272	0.45	45
24	Delay in design information	15	6	8	26	65	480	0.80	12
25	Mistakes and discrepancies in design documents	9	3	8	31	69	508	0.85	9
26	Inadequate design team experience	24	27	1	17	51	404	0.67	23
27	Long waiting time for approval of test samples	34	29	12	27	18	326	0.54	35
28	Injury to persons	27	31	5	19	38	370	0.62	28
29	Injury to property	32	24	7	18	39	368	0.61	29
30	Damages and delays during construction	18	10	6	20	66	466	0.78	13
31	Contractor failure to enter into contract	60	34	4	13	9	237	0.40	49
32	Shortage of materials in market	3	4	3	23	87	547	0.91	6
33	Inaccurate materials estimating	15	35	1	25	44	408	0.68	22
34	Poor site management and supervision	1	3	1	19	96	566	0.94	3
35	Inadequate contractor experience	1	3	5	17	94	560	0.93	4
36	Inadequate managerial skills	8	8	8	30	66	498	0.83	11
37	Defective work that must be removed and replaced	3	6	12	25	74	521	0.87	8
38	Delays in subcontractors work	22	33	2	19	44	390	0.65	25
39	Shortage of liquidity	3	3	3	20	91	553	0.92	5
40	Shortage of plant/equipment	27	21	5	22	45	397	0.66	24
41	Inaccurate prediction of equipment production output	58	38	1	8	15	244	0.41	48
42	Weather	58	1	3	19	97	630	0.71	2
43	Fire	58	31	10	22	19	333	0.48	37
44	Earth quake	58	42	5	3	5	194	0.34	53
45	War	64	45	2	3	5	197	0.33	54
46	Nuclear weapons material	64	48	2	2	4	194	0.32	55
47	Radioactive materials	68	45	4	1	2	184	0.31	56
48	Extraordinary wind	58	31	15	13	20	317	0.46	39
49	Heavy rain	54	24	5	19	18	283	0.47	38
50	Frequent changes in law	73	40	2	2	3	182	0.30	57
51	Exchange rate fluctuation	44	32	8	21	15	291	0.49	40
52	Inflation	76	41	0	2	1	171	0.29	58
53	Financial problem due to errors in Estimation	21	36	1	22	40	384	0.64	26
54	Insufficient insurance	35	46	11	12	16	288	0.48	41
55	Theft	47	34	12	11	16	275	0.46	44
56	Materials damage during transportation	49	24	21	11	15	279	0.47	43
57	Interference by client	51	36	11	12	10	254	0.42	47
58	Poor construction method	9	8	8	22	73	502	0.84	10
59	Low productivity of subcontractors	43	41	1	22	13	281	0.47	42

2c: Insurance companies' ranking of risk factors in the construction industry.

NO.	RISK FACTORS IN CONSTRUCTION	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Permits delayed or take longer than expected	30	17	6	6	5	131	0.41	38
2	Environmental regulations change	56	8	0	0	0	72	0.23	59
3	Pressure to deliver project on an accelerated schedule	47	15	1	1	0	84	0.26	51
4	Low productivity	8	14	3	19	20	221	0.69	16
5	Labour shortage	16	9	5	12	22	207	0.65	19
6	Strikes and labour disputes	11	17	6	14	16	199	0.62	21
7	Labour relations	10	8	2	25	19	227	0.71	15
8	Change orders	49	14	0	0	1	82	0.26	52
9	Unforeseen general conditions	26	21	6	6	5	135	0.42	36
10	High number of storeys of buildings	20	12	5	12	15	182	0.57	23
11	Inappropriate type of foundation	39	19	3	1	2	100	0.31	46
12	Errors in drawings	6	11	2	14	31	245	0.77	12
13	Location and project restriction	7	8	3	18	28	244	0.76	13
14	Variations	11	13	4	14	22	215	0.67	18
15	Fluctuations (changes in cost)	8	6	1	20	29	248	0.78	11
16	Long waiting time for approval of drawings	23	15	10	9	7	154	0.48	30
17	Type of client (eg- public, private, joint venture)	24	16	8	10	6	150	0.47	31
18	Unrealistic contract duration	35	20	3	4	2	110	0.34	44
19	Delay in Payment to contractor for work done	0	0	3	16	45	298	0.93	1
20	Lack of communication between client and consultants	26	20	6	5	7	139	0.43	35
21	Lack of communication between consultants and contractors	20	23	9	5	7	148	0.46	32
22	Slow flow of information between project team members	11	20	6	15	12	189	0.59	22
23	Inadequate client experience	28	22	6	5	3	125	0.39	40
24	Delay in design information	13	6	4	24	17	218	0.68	17
25	Mistakes and discrepancies in design documents	3	2	8	20	31	266	0.83	7
26	Inadequate design team experience	15	18	7	13	11	179	0.56	24
27	Long waiting time for approval of test samples	28	19	6	4	7	135	0.42	37
28	Injury to persons	21	12	5	16	10	174	0.54	26
29	Injury to property	18	21	6	8	11	165	0.52	28
30	Damages and delays during construction	8	10	3	20	23	232	0.73	14
31	Contractor failure to enter into contract	36	26	0	1	1	97	0.30	47
32	Shortage of materials in market	3	2	3	20	36	276	0.86	6
33	Inaccurate materials estimating	18	19	5	13	9	168	0.53	27
34	Poor site management and supervision	1	2	2	18	41	288	0.90	3
35	Inadequate contractor experience	0	0	5	17	42	293	0.92	2
36	Inadequate managerial skills	6	4	4	21	29	255	0.80	9
37	Defective work that must be removed and replaced	3	6	6	18	31	260	0.81	8
38	Delays in subcontractors work	14	15	2	15	18	200	0.63	20
39	Shortage of liquidity	1	3	3	16	41	285	0.89	4
40	Shortage of plant/equipment	19	15	6	11	13	176	0.55	25
41	Inaccurate prediction of equipment production output	39	24	1	0	1	95	0.29	48
42	Weather	1	3	2	22	36	281	0.88	5
43	Fire	22	15	8	10	9	161	0.50	29
44	Earth quake	52	10	0	1	1	81	0.25	54
45	War	50	13	1	0	0	79	0.25	53
46	Nuclear weapons material	53	10	1	0	0	76	0.24	55
47	Radioactive materials	54	9	0	1	0	76	0.24	56
48	Extraordinary wind	25	21	4	5	9	144	0.45	33
49	Heavy rain	21	26	6	6	5	140	0.44	34
50	Frequent changes in law	54	10	0	0	0	74	0.23	57
51	Exchange rate fluctuation	31	22	3	3	5	121	0.38	41
52	Inflation	47	14	1	1	1	87	0.27	50
53	Financial problem due to errors in Estimation	54	10	0	0	0	74	0.23	58
54	Insufficient insurance	33	19	3	6	3	119	0.37	42
55	Theft	27	24	2	7	5	134	0.41	39
56	Materials damage during transportation	31	23	4	3	3	116	0.36	43
57	Interference by client	41	20	1	1	0	88	0.28	49
58	Poor construction method	6	7	2	17	32	254	0.79	10
59	Low productivity of subcontractors	34	25	1	3	1	104	0.33	45

2d: Contractors' ranking of risk factors in the construction industry.

NO.	RISK FACTORS IN CONSTRUCTION	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Permits delayed or take longer than expected	38	49	24	35	40	548	0.59	36
2	Environmental regulations change	60	50	11	35	30	483	0.52	43
3	Pressure to deliver project on an accelerated schedule	72	60	10	19	25	423	0.45	50
4	Low productivity	11	10	6	68	91	776	0.83	9
5	Labour shortage	11	7	5	69	94	786	0.85	7
6	Strikes and labour disputes	16	22	9	76	63	706	0.76	18
7	Labour relations	22	17	13	72	62	693	0.75	19
8	Change orders	76	56	23	19	12	393	0.42	52
9	Unforeseen general conditions	43	38	19	36	50	570	0.61	34
10	High number of storeys of buildings	36	26	8	60	56	632	0.68	27
11	Inappropriate type of foundation	70	58	12	21	25	431	0.46	48
12	Errors in drawings	15	20	15	65	71	715	0.77	16
13	Location and project restriction	14	22	11	65	74	721	0.78	15
14	Variations	22	25	15	68	56	669	0.72	23
15	Fluctuations (changes in cost)	26	32	8	54	66	660	0.71	24
16	Long waiting time for approval of drawings	40	33	8	41	64	614	0.66	29
17	Type of client (eg- public, private, joint venture)	64	51	16	32	23	457	0.49	46
18	Unrealistic contract duration	48	30	28	38	42	554	0.60	35
19	Delay in Payment to contractor for work done	0	1	2	56	127	867	0.93	1
20	Lack of communication between client and consultants	40	20	8	51	40	508	0.64	31
21	Lack of communication between consultants and contractors	40	25	7	61	53	620	0.67	28
22	Slow flow of information between project team members	19	23	16	61	67	692	0.74	20
23	Inadequate client experience	65	45	26	22	28	461	0.50	45
24	Delay in design information	15	12	9	62	88	754	0.81	12
25	Mistakes and discrepancies in design documents	18	5	8	61	94	766	0.82	11
26	Inadequate design team experience	24	16	16	77	53	677	0.73	21
27	Long waiting time for approval of test samples	56	41	21	32	36	509	0.55	40
28	Injury to persons	41	31	13	46	56	606	0.65	30
29	Injury to property	36	39	18	48	45	585	0.63	32
30	Damages and delays during construction	16	13	6	67	84	748	0.80	13
31	Contractor failure to enter into contract	64	54	23	15	30	451	0.48	47
32	Shortage of materials in market	8	9	3	45	121	820	0.88	5
33	Inaccurate materials estimating	12	18	2	60	94	764	0.82	10
34	Poor site management and supervision	1	2	2	62	118	849	0.92	2
35	Inadequate contractor experience	5	3	5	53	120	838	0.90	3
36	Inadequate managerial skills	10	20	8	76	72	738	0.79	14
37	Defective work that must be removed and replaced	23	17	12	59	75	704	0.76	17
38	Delays in subcontractors work	13	9	3	68	93	777	0.84	8
39	Shortage of liquidity	4	3	8	59	112	830	0.89	4
40	Shortage of plant/equipment	26	18	16	69	57	671	0.72	22
41	Inaccurate prediction of equipment production output	63	43	25	21	34	478	0.51	44
42	Weather	10	5	3	68	100	801	0.86	6
43	Fire	62	31	10	41	42	528	0.57	38
44	Earth quake	79	63	16	8	20	385	0.41	53
45	War	71	79	12	11	13	374	0.40	55
46	Nuclear weapons material	80	82	4	8	12	348	0.37	58
47	Radioactive materials	78	71	12	15	10	366	0.39	56
48	Extraordinary wind	55	31	16	48	36	537	0.58	37
49	Heavy rain	61	29	21	34	41	523	0.56	39
50	Frequent changes in law	84	72	7	7	16	357	0.38	57
51	Exchange rate fluctuation	48	32	14	42	50	572	0.62	33
52	Inflation	83	65	10	11	17	372	0.40	54
53	Financial problem due to errors in Estimation	23	36	13	58	56	646	0.69	26
54	Insufficient insurance	51	57	12	26	40	505	0.54	41
55	Theft	72	60	13	23	18	413	0.44	51
56	Materials damage during transportation	59	46	20	27	34	489	0.53	42
57	Interference by client	67	63	11	26	19	425	0.46	49
58	Poor construction method	9	8	8	22	73	502	0.84	10
59	Low productivity of subcontractors	29	32	7	52	66	652	0.70	25

2e: Weighted average and ranking for all four respondents on risk factors in construction

NO.	RISK FACTORS IN CONSTRUCTION	CLIENTS RII	CONSULTANTS RII	INSURANCE COMPANY RII	CONTRACTORS RII	WEIGHTED AVERAGE	RANK
1	Permits delayed or take longer than expected	0.65	0.55	0.41	0.59	0.56	34
2	Environmental regulations change	0.55	0.28	0.23	0.52	0.42	49
3	Pressure to deliver project on an accelerated schedule	0.45	0.36	0.26	0.45	0.40	51
4	Low productivity	0.72	0.74	0.69	0.83	0.79	10
5	Labour shortage	0.75	0.73	0.65	0.85	0.78	11
6	Strikes and labour disputes	0.63	0.70	0.62	0.76	0.72	21
7	Labour relations	0.64	0.72	0.71	0.75	0.73	20
8	Change orders	0.46	0.35	0.26	0.42	0.38	52
9	Unforeseen general conditions	0.69	0.53	0.42	0.61	0.57	33
10	High number of storeys of buildings	0.54	0.63	0.57	0.68	0.64	25
11	Inappropriate type of foundation	0.56	0.38	0.31	0.46	0.43	47
12	Errors in drawings	0.68	0.76	0.77	0.77	0.77	14
13	Location and project restriction	0.52	0.75	0.76	0.78	0.75	18
14	Variations	0.67	0.71	0.67	0.72	0.71	22
15	Fluctuations (changes in cost)	0.81	0.89	0.78	0.71	0.78	13
16	Long waiting time for approval of drawings	0.63	0.57	0.48	0.66	0.61	28
17	Type of client (eg- public, private, joint venture)	0.35	0.56	0.47	0.49	0.49	42
18	Unrealistic contract duration	0.62	0.43	0.34	0.60	0.52	40
19	Delay in Payment to contractor for work done	0.94	0.96	0.93	0.93	0.95	1
20	Lack of communication between client and consultants	0.59	0.58	0.43	0.64	0.59	31
21	Lack of communication between consultants and contractors	0.66	0.59	0.46	0.67	0.62	26
22	Slow flow of information between project team members	0.89	0.69	0.59	0.74	0.73	19
23	Inadequate client experience	0.47	0.45	0.39	0.50	0.47	46
24	Delay in design information	0.83	0.80	0.68	0.81	0.79	12
25	Mistakes and discrepancies in design documents	0.87	0.85	0.83	0.82	0.84	7
26	Inadequate design team experience	0.77	0.67	0.56	0.73	0.70	23
27	Long waiting time for approval of test samples	0.71	0.54	0.42	0.55	0.54	35
28	Injury to persons	0.44	0.62	0.54	0.65	0.61	27
29	Injury to property	0.43	0.61	0.52	0.63	0.59	30
30	Damages and delays during construction	0.57	0.78	0.73	0.80	0.77	15
31	Contractor failure to enter into contract	0.34	0.40	0.30	0.48	0.42	48
32	Shortage of materials in market	0.87	0.91	0.86	0.88	0.89	5
33	Inaccurate materials estimating	0.74	0.68	0.53	0.82	0.74	19
34	Poor site management and supervision	0.92	0.94	0.90	0.92	0.93	2
35	Inadequate contractor experience	0.86	0.93	0.92	0.90	0.92	3
36	Inadequate managerial skills	0.80	0.83	0.80	0.79	0.81	9
37	Defective work that must be removed and replaced	0.33	0.87	0.81	0.76	0.76	16
38	Delays in subcontractors work	0.82	0.65	0.63	0.84	0.76	17
39	Shortage of liquidity	0.84	0.92	0.89	0.89	0.90	4
40	Shortage of plant/equipment	0.76	0.66	0.55	0.72	0.69	24
41	Inaccurate prediction of equipment production output	0.73	0.41	0.29	0.51	0.48	43
42	Weather	0.90	0.71	0.88	0.86	0.85	6
43	Fire	0.42	0.48	0.50	0.57	0.53	38
44	Earth quake	0.39	0.34	0.25	0.41	0.37	53
45	War	0.41	0.33	0.25	0.40	0.36	55
46	Nuclear weapons material	0.40	0.32	0.24	0.37	0.34	57
47	Radioactive materials	0.37	0.31	0.24	0.39	0.35	56
48	Extraordinary wind	0.58	0.46	0.45	0.58	0.54	36
49	Heavy rain	0.61	0.47	0.44	0.56	0.53	39
50	Frequent changes in law	0.51	0.30	0.23	0.38	0.35	58
51	Exchange rate fluctuation	0.50	0.49	0.38	0.62	0.54	37
52	Inflation	0.53	0.29	0.27	0.40	0.37	54
53	Financial problem due to errors in Estimation	0.48	0.64	0.23	0.69	0.58	32
54	Insufficient insurance	0.38	0.48	0.37	0.54	0.49	41
55	Theft	0.70	0.46	0.41	0.44	0.47	45
56	Materials damage during transportation	0.49	0.47	0.36	0.53	0.48	44
57	Interference by client	0.32	0.42	0.28	0.46	0.41	50
58	Poor construction method	0.78	0.84	0.79	0.84	0.83	8
59	Low productivity of subcontractors	0.79	0.47	0.33	0.70	0.60	29

Appendix 3. Insurance Policies in the Construction Industry

3a: Clients' ranking of Insurance policies in the construction industry.

NO.	INSURANCE POLICIES	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Contractors all risk	0	0	1	8	22	145	0.94	2
2	Performance bond	0	0	1	9	21	144	0.93	3
3	Professional Indemnity	0	1	1	2	19	148	0.90	6
4	Workers compensation	1	1	1	0	19	141	0.88	7
5	Motor insurance to cover vehicles	1	0	1	1	20	147	0.92	4
6	Public liability	1	2	0	5	14	135	0.84	10
7	Employers' liability	1	0	3	2	16	138	0.86	9
8	Fidelity guarantee	3	6	2	5	6	81	0.51	19
9	Third party insurance	0	1	1	9	21	146	0.91	5
10	Fire perils insurance on premises and contents	1	1	2	0	18	139	0.87	8
11	Bid bond	0	0	0	7	25	153	0.96	1
12	Goods in transit/Transport floater	3	2	2	0	15	128	0.80	12
13	Earthquake Insurance	4	9	2	3	4	70	0.44	21
14	Contractor's Protective Public and Property	1	3	3	9	16	132	0.83	11
15	Liability Insurance	6	4	3	2	7	106	0.66	16
16	Completed-Operation Liability Insurance	6	3	2	0	11	113	0.71	14
17	Key men Life Insurance	3	2	1	5	11	125	0.78	13
18	Group Life Insurance	8	3	2	7	12	108	0.68	15
19	Major Medical Insurance	8	4	3	8	9	102	0.64	17
20	Accidental Death and Dismemberment	7	6	4	5	10	101	0.63	18
21	Disability Insurance	2	6	5	3	6	81	0.51	20

3b: Consultants' ranking of most purchased Insurance policies in the construction industry.

NO.	INSURANCE POLICIES	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Contractors all risk	6	4	8	32	70	516	0.86	3
2	Performance bond	3	5	7	23	78	516	0.89	2
3	Professional Indemnity	20	8	4	25	63	463	0.77	5
4	Workers compensation	15	13	14	18	60	455	0.76	6
5	Motor insurance to cover vehicles	23	12	14	13	58	431	0.72	7
6	Public liability	25	15	9	21	50	416	0.69	9
7	Employers' liability	29	12	6	16	57	420	0.70	8
8	Fidelity guarantee	50	43	14	6	7	237	0.40	20
9	Third party insurance	12	8	3	29	68	493	0.82	4
10	Fire perils insurance on premises and contents	18	28	14	15	45	401	0.67	10
11	Bid bond	4	5	2	26	83	539	0.90	1
12	Goods in transit/Transport floater	37	36	16	10	21	302	0.50	14
13	Earthquake Insurance	58	33	12	9	8	236	0.39	21
14	Contractor's Protective Public and Property	35	29	12	20	24	329	0.55	11
15	Liability Insurance	37	32	10	15	26	321	0.54	12
16	Completed-Operation Liability Insurance	45	40	16	12	7	256	0.43	19
17	Key men Life Insurance	40	27	16	14	23	313	0.52	13
18	Group Life Insurance	39	45	14	12	10	269	0.45	17
19	Major Medical Insurance	40	44	6	10	20	286	0.48	16
20	Accidental Death and Dismemberment	38	36	16	12	18	296	0.49	15
21	Disability Insurance	37	45	21	11	6	264	0.44	18

3c: Insurance companies' ranking of most purchased Insurance policies in the construction industry.

NO.	INSURANCE POLICIES	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Contractors all risk	0	1	3	4	56	307	0.96	2
2	Performance bond	1	3	2	1	57	302	0.94	3
3	Professional Indemnity	3	5	7	11	38	268	0.84	7
4	Workers compensation	9	5	2	8	40	257	0.80	8
5	Motor insurance to cover vehicles	1	3	3	7	50	294	0.92	4
6	Public liability	8	5	6	9	36	252	0.79	9
7	Employers' liability	16	12	6	9	21	199	0.62	12
8	Fidelity guarantee	30	23	2	4	5	123	0.38	20
9	Third party insurance	2	4	3	3	52	291	0.91	5
10	Fire perils insurance on premises and contents	27	21	2	7	7	138	0.43	18
11	Bid bond	0	0	1	5	58	313	0.98	1
12	Goods in transit/Transport floater	24	21	3	6	10	149	0.47	16
13	Earthquake Insurance	47	14	2	1	0	85	0.27	21
14	Contractor's Protective Public and Property	18	16	5	16	9	174	0.54	14
15	Liability Insurance	13	7	5	13	26	224	0.70	10
16	Completed-Operation Liability Insurance	20	6	5	8	25	204	0.64	11
17	Key men Life Insurance	1	3	5	15	40	282	0.88	6
18	Group Life Insurance	27	23	6	2	6	129	0.40	19
19	Major Medical Insurance	20	14	5	10	15	178	0.56	13
20	Accidental Death and Dismemberment	24	14	9	7	10	157	0.49	15
21	Disability Insurance	24	23	4	5	8	142	0.44	17

3d: Contractors' to the ranking of most purchased Insurance policies in the construction industry.

NO.	INSURANCE POLICIES	SCORE					WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5			
1	Contractors all risk	0	0	0	47	139	883	0.95	2
2	Performance bond	0	3	8	48	127	857	0.92	3
3	Professional Indemnity	54	31	45	35	21	496	0.53	13
4	Workers compensation	2	4	14	43	123	839	0.90	4
5	Motor insurance to cover vehicles	0	7	12	56	111	829	0.89	5
6	Public liability	23	12	47	32	72	676	0.73	8
7	Employers' liability	3	4	40	37	102	789	0.85	7
8	Fidelity guarantee	86	68	27	5	0	323	0.35	20
9	Third party insurance	5	7	21	32	121	815	0.88	6
10	Fire perils insurance on premises and contents	68	70	14	13	21	407	0.44	18
11	Bid bond	0	0	0	38	148	892	0.96	1
12	Goods in transit/Transport floater	47	56	38	25	20	473	0.51	14
13	Earthquake Insurance	10	82	1	0	0	270	0.29	21
14	Contractor's Protective Public and Property		27	47	38	53	633	0.68	9
15	Liability Insurance	26	35	34	41	50	612	0.66	10
16	Completed-Operation Liability Insurance	68	48	25	29	16	435	0.47	15
17	Key men Life Insurance	50	29	37	32	38	537	0.58	12
18	Group Life Insurance	72	42	38	18	16	422	0.45	17
19	Major Medical Insurance	64	55	32	16	17	419	0.46	16
20	Accidental Death and Dismemberment	42	32	35	32	45	564	0.61	11
21	Disability Insurance	68	71	23	15	9	384	0.41	19

3e: Weighted average and ranking for all four respondents on insurance policies in construction

NO.	Insurance Policies	CLIENTS RII	CONSULTANTS RII	INSURANCE COMPANY RII	CONTRACTORS RII	WEIGHTED AVERAGE	RANK
1	Contractors all risk	0.94	0.86	0.96	0.95	0.94	2
2	Performance bond	0.93	0.89	0.94	0.92	0.93	3
3	Professional Indemnity	0.90	0.77	0.84	0.53	0.68	9
4	Workers compensation	0.88	0.76	0.80	0.90	0.86	6
5	Motor insurance to cover vehicles	0.92	0.72	0.92	0.89	0.88	5
6	Public liability	0.84	0.69	0.79	0.73	0.75	8
7	Employers' liability	0.86	0.70	0.62	0.85	0.79	7
8	Fidelity guarantee	0.51	0.40	0.38	0.35	0.38	20
9	Third party insurance	0.91	0.82	0.91	0.88	0.89	4
10	Fire perils insurance on premises and contents	0.87	0.67	0.43	0.44	0.53	14
11	Bid bond	0.96	0.90	0.98	0.96	0.96	1
12	Goods in transit/Transport floater	0.80	0.50	0.47	0.51	0.53	15
13	Earthquake Insurance	0.44	0.39	0.27	0.29	0.32	21
14	Contractor's Protective Public and Property	0.83	0.55	0.54	0.68	0.65	10
15	Liability Insurance	0.66	0.54	0.70	0.66	0.65	11
16	Completed-Operation Liability Insurance	0.71	0.43	0.64	0.47	0.52	16
17	Key men Life Insurance	0.78	0.52	0.88	0.58	0.65	12
18	Group Life Insurance	0.68	0.45	0.40	0.45	0.47	18
19	Major Medical Insurance	0.64	0.48	0.56	0.46	0.50	17
20	Accidental Death and Dismemberment	0.63	0.49	0.49	0.61	0.57	13
21	Disability Insurance	0.51	0.44	0.44	0.41	0.44	19

Appendix 4. Insurable and Uninsurable Risks in the Construction Industry

4a: Client responses on risk factors that are insurable or not in the construction industry.

NO.	RISK FACTORS	CLIENTS			
		NO. OF RESPONSES for insurable	% RESPONSE	NO. OF RESPONSES for uninsurable	% RESPONSE
1	Permits delayed or take longer than expected	3	9.38	29	90.63
2	Environmental regulations change	18	56.25	14	43.75
3	Pressure to deliver project on an accelerated schedule	14	43.75	18	56.25
4	Low productivity	8	25.00	24	75.00
5	Labour shortage	10	31.25	22	68.75
6	Strikes and labour disputes	25	78.13	7	21.88
7	Labour relations	4	12.50	28	87.50
8	Change orders	3	9.38	29	90.63
9	Unforeseen general conditions	28	87.50	4	12.50
10	High number of storeys of buildings	30	93.75	2	6.25
11	Inappropriate type of foundation	26	81.25	6	18.75
12	Errors in drawings	28	87.50	4	12.50
13	Location and project restriction	26	81.25	6	18.75
14	Variations	2	6.25	30	93.75
15	Fluctuations (changes in cost)	14	43.75	18	56.25
16	Long waiting time for approval of drawings	5	15.63	27	84.38
17	Type of client (eg- public, private, joint venture)	1	3.13	31	96.88
18	Unrealistic contract duration	2	6.25	30	93.75
19	Delay in Payment to contractor for work done	18	56.25	14	43.75
20	Lack of communication between client and consultants	1	3.13	31	96.88
21	Lack of communication between consultants and contractors	1	3.13	31	96.88
22	Slow flow of information between project team members	0	0.00	32	100.00
23	Inadequate client experience	0	0.00	32	100.00
24	Delay in design information	19	63.33	11	36.67
25	Mistakes and discrepancies in design documents	26	81.25	6	18.75
26	Inadequate design team experience	20	62.50	12	37.50
27	Long waiting time for approval of test samples	4	12.50	28	87.50
28	Injury to persons	32	100.00	0	0.00
29	Injury to property	32	100.00	0	0.00
30	Damages and delays during construction	32	100.00	0	0.00
31	Contractor failure to enter into contract	0	0.00	32	100.00
32	Shortage of materials in market	13	40.63	19	59.38
33	Inaccurate materials estimating	5	15.63	27	84.38
34	Poor site management and supervision	18	56.25	14	43.75
35	Inadequate contractor experience	23	71.88	9	28.13
36	Inadequate managerial skills	23	71.88	9	28.13
37	Defective work that must be removed and replaced	30	93.75	2	6.25
38	Delays in subcontractors work	28	87.50	4	12.50
39	Shortage of liquidity	23	71.88	9	28.13
40	Shortage of plant/equipment	11	34.38	21	65.63
41	Inaccurate prediction of equipment production output	10	31.25	22	68.75
42	Weather	32	100.00	0	0.00
43	Fire	32	100.00	0	0.00
44	Earth quake	32	100.00	0	0.00
45	War	30	93.75	2	6.25
46	Nuclear weapons material	27	84.38	5	15.63
47	Radioactive materials	21	65.63	11	34.38
48	Extraordinary wind	32	100.00	0	0.00
49	Heavy rain	32	100.00	0	0.00
50	Frequent changes in law	12	37.50	20	62.50
51	Exchange rate fluctuation	16	50.00	16	50.00
52	Inflation	21	65.63	11	34.38
53	Financial problem due to errors in Estimation	13	40.63	19	59.38
54	Insufficient insurance	2	6.25	30	93.75
55	Theft	32	100.00	0	0.00
56	Materials damage during transportation	31	96.88	1	3.13
57	Interference by client	11	34.38	21	65.63
58	Poor construction method	29	90.63	3	9.38
59	Low productivity of subcontractors	30	93.75	2	6.25

4b: Insurance companies' response on risk factors that are insurable or not in the construction industry.

NO.	RISK FACTORS	INSURANCE COMPANIES			
		NO. OF RESPONSES for insurable	% RESPONSE	NO. OF RESPONSES for uninsurable	% RESPONSE
1	Permits delayed or take longer than expected	4	6.25	60	93.75
2	Environmental regulations change	38	59.38	26	40.63
3	Pressure to deliver project on an accelerated schedule	38	59.38	26	40.63
4	Low productivity	60	93.75	4	6.25
5	Labour shortage	21	32.81	43	67.19
6	Strikes and labour disputes	59	92.19	5	7.81
7	Labour relations	6	9.38	58	90.63
8	Change orders	4	6.25	60	93.75
9	Unforeseen general conditions	60	93.75	4	6.25
10	High number of storeys of buildings	63	98.44	1	1.56
11	Inappropriate type of foundation	60	93.75	4	6.25
12	Errors in drawings	58	90.63	6	9.38
13	Location and project restriction	53	82.81	11	17.19
14	Variations	12	18.75	52	81.25
15	Fluctuations (changes in cost)	51	79.69	13	20.31
16	Long waiting time for approval of drawings	7	10.94	57	89.06
17	Type of client (eg- public, private, joint venture)	5	7.81	59	92.19
18	Unrealistic contract duration	8	12.50	56	87.50
19	Delay in Payment to contractor for work done	11	17.19	53	82.81
20	Lack of communication between client and consultants	4	6.25	60	93.75
21	Lack of communication between consultants and contractors	3	4.69	61	95.31
22	Slow flow of information between project team members	1	1.56	63	98.44
23	Inadequate client experience	3	4.69	61	95.31
24	Delay in design information	63	98.44	1	1.56
25	Mistakes and discrepancies in design documents	57	89.06	7	10.94
26	Inadequate design team experience	58	90.63	6	9.38
27	Long waiting time for approval of test samples	2	3.13	62	96.88
28	Injury to persons	64	100.00	0	0.00
29	Injury to property	64	100.00	0	0.00
30	Damages and delays during construction	64	100.00	0	0.00
31	Contractor failure to enter into contract	2	3.13	62	96.88
32	Shortage of materials in market	38	59.38	26	40.63
33	Inaccurate materials estimating	21	32.81	43	67.19
34	Poor site management and supervision	58	90.63	6	9.38
35	Inadequate contractor experience	60	93.75	4	6.25
36	Inadequate managerial skills	49	76.56	15	23.44
37	Defective work that must be removed and replaced	52	81.25	12	18.75
38	Delays in subcontractors work	62	96.88	2	3.13
39	Shortage of liquidity	41	64.06	23	35.94
40	Shortage of plant/equipment	38	59.38	26	40.63
41	Inaccurate prediction of equipment production output	31	48.44	33	51.56
42	Weather	53	82.81	11	17.19
43	Fire	64	100.00	0	0.00
44	Earth quake	61	95.31	3	4.69
45	War	59	92.19	5	7.81
46	Nuclear weapons material	47	73.44	17	26.56
47	Radioactive materials	51	79.69	13	20.31
48	Extraordinary wind	63	98.44	1	1.56
49	Heavy rain	64	100.00	0	0.00
50	Frequent changes in law	8	12.50	56	87.50
51	Exchange rate fluctuation	38	59.38	26	40.63
52	Inflation	46	71.88	18	28.13
53	Financial problem due to errors in Estimation	16	25.00	48	75.00
54	Insufficient insurance	2	3.13	62	96.88
55	Theft	64	100.00	0	0.00
56	Materials damage during transportation	61	95.31	3	4.69
57	Interference by client	2	3.13	62	96.88
58	Poor construction method	63	98.44	1	1.56
59	Low productivity of subcontractors	61	95.31	3	4.69

4c: Consultants response on risk factors that is insurable or not insurable in the construction industry.

NO.	RISK FACTORS	CONSULTANTS			
		NO. OF RESPONSES for insurable	% RESPONSE	NO. OF RESPONSES for uninsurable	% RESPONSE
1	Permits delayed or take longer than expected	5	4.17	115	95.83
2	Environmental regulations change	2	1.67	118	98.33
3	Pressure to deliver project on an accelerated schedule	82	68.33	38	31.67
4	Low productivity	114	95.00	6	5.00
5	Labour shortage	31	25.83	89	74.17
6	Strikes and labour disputes	115	95.83	5	4.17
7	Labour relations	4	3.33	116	96.67
8	Change orders	18	15.00	102	85.00
9	Unforeseen general conditions	110	91.67	10	8.33
10	High number of storeys of buildings	120	100.00	0	0.00
11	Inappropriate type of foundation	105	87.50	15	12.50
12	Errors in drawings	101	84.17	19	15.83
13	Location and project restriction	120	100.00	0	0.00
14	Variations	12	10.00	108	90.00
15	Fluctuations (changes in cost)	96	80.00	24	20.00
16	Long waiting time for approval of drawings	23	19.17	97	80.83
17	Type of client (eg- public, private, joint venture)	2	1.67	118	98.33
18	Unrealistic contract duration	56	46.67	64	53.33
19	Delay in Payment to contractor for work done	35	29.17	85	70.83
20	Lack of communication between client and consultants	8	6.67	112	93.33
21	Lack of communication between consultants and contractors	8	6.67	112	93.33
22	Slow flow of information between project team members	3	2.50	117	97.50
23	Inadequate client experience	2	1.67	118	98.33
24	Delay in design information	118	98.33	2	1.67
25	Mistakes and discrepancies in design documents	120	100.00	0	0.00
26	Inadequate design team experience	114	95.00	6	5.00
27	Long waiting time for approval of test samples	7	5.83	113	94.17
28	Injury to persons	120	100.00	0	0.00
29	Injury to property	120	100.00	0	0.00
30	Damages and delays during construction	120	100.00	0	0.00
31	Contractor failure to enter into contract	5	4.17	115	95.83
32	Shortage of materials in market	61	50.83	59	49.17
33	Inaccurate materials estimating	10	8.33	110	91.67
34	Poor site management and supervision	120	100.00	0	0.00
35	Inadequate contractor experience	120	100.00	0	0.00
36	Inadequate managerial skills	87	72.50	33	27.50
37	Defective work that must be removed and replaced	96	80.00	24	20.00
38	Delays in subcontractors work	101	84.17	19	15.83
39	Shortage of liquidity	76	63.33	44	36.67
40	Shortage of plant/equipment	72	60.00	48	40.00
41	Inaccurate prediction of equipment production output	23	19.17	97	80.83
42	Weather	116	96.67	4	3.33
43	Fire	120	100.00	0	0.00
44	Earth quake	102	85.00	18	15.00
45	War	95	79.17	25	20.83
46	Nuclear weapons material	89	74.17	31	25.83
47	Radioactive materials	78	65.00	42	35.00
48	Extraordinary wind	120	100.00	0	0.00
49	Heavy rain	120	100.00	0	0.00
50	Frequent changes in law	18	15.00	102	85.00
51	Exchange rate fluctuation	64	53.33	56	46.67
52	Inflation	76	63.33	44	36.67
53	Financial problem due to errors in Estimation	14	11.67	106	88.33
54	Insufficient insurance	3	2.50	117	97.50
55	Theft	120	100.00	0	0.00
56	Materials damage during transportation	120	100.00	0	0.00
57	Interference by client	2	1.67	118	98.33
58	Poor construction method	118	98.33	2	1.67
59	Low productivity of subcontractors	116	96.67	4	3.33

4d: Contractors response on risk factors that are insurable or not insurable in the construction industry

NO.	RISK FACTORS	CONTRACTOR			
		NO. OF RESPONSES for insurable	% RESPONSE	NO. OF RESPONSES for uninsurable	% RESPONSE
1	Permits delayed or take longer than expected	20	10.75	166	89.25
2	Environmental regulations change	8	4.30	178	95.70
3	Pressure to deliver project on an accelerated schedule	56	30.11	130	69.89
4	Low productivity	148	79.57	38	20.43
5	Labour shortage	56	30.11	130	69.89
6	Strikes and labour disputes	148	79.57	38	20.43
7	Labour relations	8	4.30	178	95.70
8	Change orders	5	2.69	181	97.31
9	Unforeseen general conditions	178	95.70	8	4.30
10	High number of storeys of buildings	180	96.77	6	3.23
11	Inappropriate type of foundation	178	95.70	8	4.30
12	Errors in drawings	156	83.87	30	16.13
13	Location and project restriction	135	72.58	51	27.42
14	Variations	6	3.23	180	96.77
15	Fluctuations (changes in cost)	89	47.85	97	52.15
16	Long waiting time for approval of drawings	45	24.19	141	75.81
17	Type of client (eg- public, private, joint venture)	10	5.38	176	94.62
18	Unrealistic contract duration	16	8.60	170	91.40
19	Delay in Payment to contractor for work done	79	42.47	107	57.53
20	Lack of communication between client and consultants	34	18.28	152	81.72
21	Lack of communication between consultants and contractors	26	13.98	160	86.02
22	Slow flow of information between project team members	21	11.29	165	88.71
23	Inadequate client experience	58	31.18	128	68.82
24	Delay in design information	157	84.41	29	15.59
25	Mistakes and discrepancies in design documents	179	96.24	7	3.76
26	Inadequate design team experience	1	0.54	185	99.46
27	Long waiting time for approval of test samples	43	23.12	143	76.88
28	Injury to persons	186	100.00	0	0.00
29	Injury to property	186	100.00	0	0.00
30	Damages and delays during construction	180	96.77	6	3.23
31	Contractor failure to enter into contract	6	3.23	180	96.77
32	Shortage of materials in market	90	48.39	96	51.61
33	Inaccurate materials estimating	48	25.81	138	74.19
34	Poor site management and supervision	183	98.39	3	1.61
35	Inadequate contractor experience	10	5.38	176	94.62
36	Inadequate managerial skills	159	85.48	27	14.52
37	Defective work that must be removed and replaced	180	96.77	6	3.23
38	Delays in subcontractors work	182	97.85	4	2.15
39	Shortage of liquidity	98	52.69	88	47.31
40	Shortage of plant/equipment	48	25.81	138	74.19
41	Inaccurate prediction of equipment production output	31	16.67	155	83.33
42	Weather	146	78.49	40	21.51
43	Fire	186	100.00	0	0.00
44	Earth quake	158	84.95	28	15.05
45	War	145	77.96	41	22.04
46	Nuclear weapons material	163	87.63	23	12.37
47	Radioactive materials	129	69.35	57	30.65
48	Extraordinary wind	186	100.00	0	0.00
49	Heavy rain	186	100.00	0	0.00
50	Frequent changes in law	25	13.44	161	86.56
51	Exchange rate fluctuation	76	40.86	110	59.14
52	Inflation	129	69.35	57	30.65
53	Financial problem due to errors in Estimation	32	17.20	154	82.80
54	Insufficient insurance	9	4.84	177	95.16
55	Theft	147	79.03	39	20.97
56	Materials damage during transportation	169	90.86	17	9.14
57	Interference by client	2	1.08	184	98.92
58	Poor construction method	179	96.24	7	3.76
59	Low productivity of subcontractors	156	83.87	30	16.13

4e: Weighted average and ranking for all four respondents on which risk factors are insurable.

NO.	INSURABLE RISKS	% RESPONSES				O.ALL % RESPONSE AVERAGE
		CLIENTS	INSURANCE COMP.	CONSULTANCE	CONTRACTORS	
1	Permits delayed or take longer than expected	9.38	6.25	4.17	10.75	7.64
2	Environmental regulations change	56.25	59.38	1.67	4.30	30.40
3	Pressure to deliver project on an accelerated schedule	43.75	59.38	68.33	30.11	50.39
4	Low productivity	25.00	93.75	95.00	79.57	73.33
5	Labour shortage	31.25	32.81	25.83	30.11	30.00
6	Strikes and labour disputes	78.13	92.19	95.83	79.57	86.43
7	Labour relations	12.50	9.38	3.33	4.30	7.38
8	Change orders	9.38	6.25	15.00	2.69	8.33
9	Unforeseen general conditions	87.50	93.75	91.67	95.70	92.15
10	High number of storeys of buildings	93.75	98.44	100.00	96.77	97.24
11	Inappropriate type of foundation	81.25	93.75	87.50	95.70	89.55
12	Errors in drawings	87.50	90.63	84.17	83.87	86.54
13	Location and project restriction	81.25	82.81	100.00	72.58	84.16
14	Variations	6.25	18.75	10.00	3.23	9.56
15	Fluctuations (changes in cost)	43.75	79.69	80.00	47.85	62.82
16	Long waiting time for approval of drawings	15.63	10.94	19.17	24.19	17.48
17	Type of client (eg- public, private, joint venture)	3.13	7.81	1.67	5.38	4.50
18	Unrealistic contract duration	6.25	12.50	46.67	8.60	18.50
19	Delay in Payment to contractor for work done	56.25	17.19	29.17	42.47	36.27
20	Lack of communication between client and consultants	3.13	6.25	6.67	18.28	8.58
21	Lack of communication between consultants and contractors	3.13	4.69	6.67	13.98	7.11
22	Slow flow of information between project team members	0.00	1.56	2.50	11.29	3.84
23	Inadequate client experience	0.00	4.69	1.67	31.18	9.38
24	Delay in design information	63.33	98.44	98.33	84.41	86.13
25	Mistakes and discrepancies in design documents	81.25	89.06	100.00	96.24	91.64
26	Inadequate design team experience	62.50	90.63	95.00	0.54	62.17
27	Long waiting time for approval of test samples	12.50	3.13	5.83	23.12	11.14
28	Injury to persons	100.00	100.00	100.00	100.00	100.00
29	Injury to property	100.00	100.00	100.00	100.00	100.00
30	Damages and delays during construction	100.00	100.00	100.00	96.77	99.19
31	Contractor failure to enter into contract	0.00	3.13	4.17	3.23	2.63
32	Shortage of materials in market	40.63	59.38	50.83	48.39	49.81
33	Inaccurate materials estimating	15.63	32.81	8.33	25.81	20.64
34	Poor site management and supervision	56.25	90.63	100.00	98.39	86.32
35	Inadequate contractor experience	71.88	93.75	100.00	5.38	67.75
36	Inadequate managerial skills	71.88	76.56	72.50	85.48	76.61
37	Defective work that must be removed and replaced	93.75	81.25	80.00	96.77	87.94
38	Delays in subcontractors work	87.50	96.88	84.17	97.85	91.60
39	Shortage of liquidity	71.88	64.06	63.33	52.69	62.99
40	Shortage of plant/equipment	34.38	59.38	60.00	25.81	44.89
41	Inaccurate prediction of equipment production output	31.25	48.44	19.17	16.67	28.88
42	Weather	100.00	82.81	96.67	78.49	89.49
43	Fire	100.00	100.00	100.00	100.00	100.00
44	Earth quake	100.00	95.31	85.00	84.95	91.31
45	War	93.75	92.19	79.17	77.96	85.77
46	Nuclear weapons material	84.38	73.44	74.17	87.63	79.90
47	Radioactive materials	65.63	79.69	65.00	69.35	69.92
48	Extraordinary wind	100.00	98.44	100.00	100.00	99.61
49	Heavy rain	100.00	100.00	100.00	100.00	100.00
50	Frequent changes in law	37.50	12.50	15.00	13.44	19.61
51	Exchange rate fluctuation	50.00	59.38	53.33	40.86	50.89
52	Inflation	65.63	71.88	63.33	69.35	67.55
53	Financial problem due to errors in Estimation	40.63	25.00	11.67	17.20	23.62
54	Insufficient insurance	6.25	3.13	2.50	4.84	4.18
55	Theft	100.00	100.00	100.00	79.03	94.76
56	Materials damage during transportation	96.88	95.31	100.00	90.86	95.76
57	Interference by client	34.38	3.13	1.67	1.08	10.06
58	Poor construction method	90.63	98.44	98.33	96.24	95.91
59	Low productivity of subcontractors	93.75	95.31	96.67	83.87	92.40

4f: Weighted average and ranking for all four respondents on which risk factors are uninsurable.

NO.	UNINSURABLE RISKS	% RESPONSES				O.ALL % RESPONSE AVERAGE
		CLIENTS	INSURANCE COMP.	CONSULTANCE	CONTRACTORS	
1	Permits delayed or take longer than expected	90.63	93.75	95.83	89.25	92.36
2	Environmental regulations change	43.75	40.63	98.33	95.70	69.60
3	Pressure to deliver project on an accelerated schedule	56.25	40.63	31.67	69.89	49.61
4	Low productivity	75.00	6.25	5.00	20.43	26.67
5	Labour shortage	68.75	67.19	74.17	69.89	70.00
6	Strikes and labour disputes	21.88	7.81	4.17	20.43	13.57
7	Labour relations	87.50	90.63	96.67	95.70	92.62
8	Change orders	90.63	93.75	85.00	97.31	91.67
9	Unforeseen general conditions	12.50	6.25	8.33	4.30	7.85
10	High number of storeys of buildings	6.25	1.56	0.00	3.23	2.76
11	Inappropriate type of foundation	18.75	6.25	12.50	4.30	10.45
12	Errors in drawings	12.50	9.38	15.83	16.13	13.46
13	Location and project restriction	18.75	17.19	0.00	27.42	15.84
14	Variations	93.75	81.25	90.00	96.77	90.44
15	Fluctuations (changes in cost)	56.25	20.31	20.00	52.15	37.18
16	Long waiting time for approval of drawings	84.38	89.06	80.83	75.81	82.52
17	Type of client (eg- public, private, joint venture)	96.88	92.19	98.33	94.62	95.50
18	Unrealistic contract duration	93.75	87.50	53.33	91.40	81.50
19	Delay in Payment to contractor for work done	43.75	82.81	70.83	57.53	63.73
20	Lack of communication between client and consultants	96.88	93.75	93.33	81.72	91.42
21	Lack of communication between consultants and contractors	96.88	95.31	93.33	86.02	92.89
22	Slow flow of information between project team members	100.00	98.44	97.50	88.71	96.16
23	Inadequate client experience	100.00	95.31	98.33	68.82	90.62
24	Delay in design information	36.67	1.56	1.67	15.59	13.87
25	Mistakes and discrepancies in design documents	18.75	10.94	0.00	3.76	8.36
26	Inadequate design team experience	37.50	9.38	5.00	99.46	37.83
27	Long waiting time for approval of test samples	87.50	96.88	94.17	76.88	88.86
28	Injury to persons	0.00	0.00	0.00	0.00	0.00
29	Injury to property	0.00	0.00	0.00	0.00	0.00
30	Damages and delays during construction	0.00	0.00	0.00	3.23	0.81
31	Contractor failure to enter into contract	100.00	96.88	95.83	96.77	97.37
32	Shortage of materials in market	59.38	40.63	49.17	51.61	50.19
33	Inaccurate materials estimating	84.38	67.19	91.67	74.19	79.36
34	Poor site management and supervision	43.75	9.38	0.00	1.61	13.68
35	Inadequate contractor experience	28.13	6.25	0.00	94.62	32.25
36	Inadequate managerial skills	28.13	23.44	27.50	14.52	23.39
37	Defective work that must be removed and replaced	6.25	18.75	20.00	3.23	12.06
38	Delays in subcontractors work	12.50	3.13	15.83	2.15	8.40
39	Shortage of liquidity	28.13	35.94	36.67	47.31	37.01
40	Shortage of plant/equipment	65.63	40.63	40.00	74.19	55.11
41	Inaccurate prediction of equipment production output	68.75	51.56	80.83	83.33	71.12
42	Weather	0.00	17.19	3.33	21.51	10.51
43	Fire	0.00	0.00	0.00	0.00	0.00
44	Earth quake	0.00	4.69	15.00	15.05	8.69
45	War	6.25	7.81	20.83	22.04	14.23
46	Nuclear weapons material	15.63	26.56	25.83	12.37	20.10
47	Radioactive materials	34.38	20.31	35.00	30.65	30.08
48	Extraordinary wind	0.00	1.56	0.00	0.00	0.39
49	Heavy rain	0.00	0.00	0.00	0.00	0.00
50	Frequent changes in law	62.50	87.50	85.00	86.56	80.39
51	Exchange rate fluctuation	50.00	40.63	46.67	59.14	49.11
52	Inflation	34.38	28.13	36.67	30.65	32.45
53	Financial problem due to errors in Estimation	59.38	75.00	88.33	82.80	76.38
54	Insufficient insurance	93.75	96.88	97.50	95.16	95.82
55	Theft	0.00	0.00	0.00	20.97	5.24
56	Materials damage during transportation	3.13	4.69	0.00	9.14	4.24
57	Interference by client	65.63	96.88	98.33	98.92	89.94
58	Poor construction method	9.38	1.56	1.67	3.76	4.09
59	Low productivity of subcontractors	6.25	4.69	3.33	16.13	7.60