RISK SHARING IN GHANAIAN CONSTRUCTION CONTRACTS

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DEPARTMENT OF BUILDING TECHNOLOGY

RISK SHARING IN GHANAIAN CONSTRUCTION CONTRACTS

by

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A PROJECT REPORT PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR A DEGREE OF MASTER OF SCIENCE IN CONSTRUCTION MANAGEMENT

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ABSTRACT

The aim of this study is to identify the major risk factors associated with Ghanaian construction contracts and to develop a tool for risk sharing by participants of a construction contract to improve management practices in the construction industry.

The study identified some thirty-four (34) risk factors that are inherent in Ghanaian construction contracts. Samples of clients, consultants and contractors were surveyed, using structured questionnaires supplemented with interviews with the aim of identifying the most important risk factors perceived by contract participants. The participants also indicated, through the questionnaire survey, their preferences of how risks should be shared in selected clauses of the Ghana Government Conditions of Contract for Building Works (the Pink Form).

The study revealed that clauses in the Conditions of Contract that relate to disputes, variation, fluctuation, degree of inspection and compliance, limited time and funding for design and subsurface investigation, damages and delays during construction, materials and workmanship, contract administration, weather variations and payments are considered to contain the most important risks inherent in the Ghanaian building construction industry. It also revealed that even though contract participants agree that there are risks inherent in the contracts, they have divergent opinions on how these risks should be shared.

A risk sharing mechanism has been developed, in the study, as a tool to help contract participants of the construction industry in Ghana to allocate risks. The mechanism allows a contract to evolve, which optimally distributes the risk elements, reduces the contingencies in mark-up, cut down disputes and improves management practices generally.

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DEDICATION

To my father and mother, the late Nana Yaw

Gyamfi and Madam Amma Pinamang.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

In a typical construction operation, the client obtains a sufficient interest in the land upon which he proposes to build to enable him give the contractor the possession of the site.

The client usually employs a consultant or consultants who translates the client's wishes into detailed drawings and sets this out in detailed Bills of Quantities and other documentation including statutory requirements necessary to actualize the wishes. The contract must then be placed. This is done either by competition or by negotiation. Forms of Tender are sent out with Bills of Quantities, specification, drawings and conditions of contract, or such information as the consultants may think desirable.

The contractor estimates the cost of the works defined in the Bills of Quantities, specification or other documents on the basis of the forecast of direct costs, indirect costs and a markup. The estimated direct cost is the sum of the costs of the appropriate resources of labour, material, plant and equipment that are assumed will be employed by the contractor in the execution of the works as defined in the project drawings, Bills of Quantities, Specification or other documents supplementing or replacing the Bills of Quantities.

The indirect cost is the sum of resources which relate the project as a whole but which are not confined to any particular activity. This is commonly referred to as project overheads.

The markup is a percentage of the estimated total cost which a contractor adds to the estimated direct and indirect costs to take care of the project overhead cost, profit and contingencies (Clough, 1975).(1)

Where the client, with the advice and assistance of the consultants, notifies the contractor of his unqualified acceptance of the offer or the estimate or tender, a binding contract comes into existence.

The contract is often expressed in a formal document such as the Ghana Government Conditions of Contract for Building Works or the Ghana Government Conditions of Contract for Civil Engineering Works.

Construction projects are complex, have a long production time and involve the input of several parties. They also tend to be unique and each new project presents new challenges.

Numerous difficulties may therefore arise.

Risks and uncertainties are some of the inherent difficulties that are associated with the construction projects which arise in the construction process.

Indeed, there is no construction project that can be undertaken without an element of risk (Kwakye, 1997).(2)

The management of risk is therefore an essential task for all participants in the construction industry. However, the identification, analysis and allocation of the risk is not an easy task.

1.2 STATEMENT OF THE PROBLEM

Risk or uncertainty lies at the heart of capital investment decision (Levy, 1994).(3)

Client organizations are often quite unwilling to carry project risks. Clients, aided by their legal advisers, increasingly obtain protection under their contracts for construction works by using exculpatory and hold-harmless clauses. These help them to avoid obligations in construction contracts.

When contractors are obliged to assume the risk, they include high contingencies in their markups for events that often do not actually occur.

Litigation resulting from such construction contracts is also costly and time consuming.

Clients who are willing to share risk with other participants in an attempt to obtain smaller contingencies in markups and thus reduce the expected cost of a construction project find that there is no systematic approach developed to guide them in the selection of a risk-allocation strategy.

Similarly, the other participants seem to have very little guidance in their risk response.

The question then is "who should take the risk?" or "where should risk be allocated?"

A mechanism must be developed to share risks in the Ghanaian construction industry. The development of such a mechanism entails the identification of the risk factors, the current assignment of the risks and the preferences of the participants.

The study is an attempt to develop a mechanism to provide aid in the rational allocation of risks in Ghanaian construction contracts.

1.3 AIMS AND OBJECTIVES

AIMS

The main aim of this research is to identify the major risk factors associated with the Ghanaian construction contracts. A strategy for risk sharing will be developed for analyzing and responding to risks so that rational management practices can minimize effects of risks and uncertainties in the Ghanaian construction industry.

OBJECTIVES

The objectives of this research are:

a. To identify the most important risk factors in Ghanaian construction contracts.

b. To identify the preferred risk allocation of participants of a construction contract.

c. To evaluate the cost effects of risks to participants.

d. To develop a mechanism for the allocation of risks to the participants.

HYPOTHESES

Based on the statement of the problem, the aims and the objectives set for the study, the following hypotheses have been put forward as basis for investigation.

1. Contract participants - clients, consultants and contractors - vary significantly in their perception of risks in construction contracts.

2. Contract participants - clients, consultants and contractors - have divergent opinions on how risks should be shared in construction contracts.

1.4 JUSTIFICATION OF RESEARCH

Most business decision-making takes place on the basis of expectations about the future. Making a decision on the basis of assumptions, expectations, estimates and forecasts of future events involves risk taking.

The construction industry is subject to more risk and uncertainty than probably any other industry (Roger Flanagan, 1985). Getting a project from the inception stage through to completion involves a vast number of people with differing skills, working in an environment over which they have no control (i.e. politically, economically, socially, etc.)

Argenti, 1976; Altman, 1983; Kangari, 1987, severally investigated the causes of business failures in the construction industry to include lower profit margins resulting from increased construction-activity competition and higher business risks; management incompetence and lack of experience, among others.

Low managerial competence in the Ghanaian construction industry exacerbates the already higher business risk of the global construction industry.

It is characteristic of the industry in Ghana to often proceed with the construction process without any risk appraisal. The need to address some of these risks in contracts is often overlooked or postponed, leaving participants to exercise their discretion in the administration of the contracts.

This study will contribute in raising the awareness, perhaps a paradigm shift, of the risks which project participants are exposed to, in the contracts they enter into. It will also provide a tool for decision-making in contract formation and

administration, and substantially help reduce the contingencies in markups, cut down disputes and thereby reduce the number of business failures in the construction industry in Ghana.

1.5 SCOPE OF THE RESEARCH

The research focused on the following:

- Building construction sub-sector contracts in Ghana. This is because the road construction sub sector has only one client - the Government of Ghana and it is the Government of Ghana alone that takes decisions in the sub sector. There is yet to be private sector participation.
- The Ghana Government Conditions of Contract for Building Works was used in the survey. This contract document is widely used throughout the Ghanaian construction industry, even though on some contracts few amendments are introduced to suit peculiar circumstances.
- The fixed price contractual arrangement where Bills of Quantities form part of the contract was used.

1.6 DEFINITION OF TERMS

- **Risk**

  Risk is defined as "the exposure to possible economic loss or gain arising from involvement in the construction process."

- **Uncertainty**

  Uncertainty is used to represent "the probability that an event occurs". In the construction industry, nothing can be predicted with certainty because of the

unique nature of projects. The consequence of project uncertainty or unpredictability is risk.

The term Risk and Uncertainty are used interchangeably in this study.

1.7 RESEARCH METHODOLOGY

The study was carried out in a three-phase approach. The first was to carry out a literature search to gather preliminary information.

In the second phase a questionnaire survey was conducted. Structured interviews were used, where requested by firms, to complement the points that may not have been adequately examined by the questionnaire. Finally, the responses were evaluated to form a basis for developing a suitable mechanism for risk sharing.

1.8 ORGANIZATION OF THE RESEARCH

The study is organized in eight (8) chapters, including this one, the introduction which gives the background, the problem, aims, objectives and the scope of the research.

Chapter Two takes a look at project organization and contracts. It explores how project participants are organized and maintained within the framework of organizational goals and construction contracts.

Chapter Three discusses risk-sharing practices. The broad concepts of appreciation of risks and various methods of risk sharing practices are examined.

Chapter Four gives an overview and review of studies on identification, analysis and allocation of risks in the industry in Ghana.

Chapter Five discusses broadly the research methodology, the type of data to be used and how the data was collected.

In Chapter Six, the survey results were discussed. The results of the responses were analyzed and inferences were drawn.

Chapter Seven explains the risk sharing mechanism developed and presented in the form of a flow chart.

Chapter Eight, the final chapter, incorporates the conclusion and recommendations. It also outlines areas that can benefit from further research.

Five (5) appendices containing details of the questionnaire used for the survey, summary of the categorization of the building contractors, a summary list of registered consultants, a list of clients and comments on the ten (10) important risk factors identified in the study are presented at the end of the report.

1.9 SUMMARY OF MAIN CONCLUSIONS

The following major conclusions were drawn by the research.

1. Disputes, variations, fluctuations, degree of funding for design and subsurface investigation, damages and delays during construction, materials and workmanship, contract administration, weather variations and payments are considered to be the most important risk factors in the Ghanaian building construction industry in Ghana.

2. There is no significant difference in contracting parties' perception of risk in the industry in Ghana.

3. The responsibility and attendant procedure for carrying out risk identification is either ill defined or non-existent in many contract participating firms.

4. Contracting parties have divergent opinions on how risks should be shared.

5. Contracting participants rarely use sensitivity analysis and risk management processes in their cost estimation. Majority of them use guesswork or a contingency sum which is a fixed percentage figure of their estimate through intuition and personal experiences.

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2. Kwakye, A.A. (1997), Construction Project Administration in Practice, Longman Ltd., London.

3. Levy, H. and Sarnat, M., (1995), Capital Investment and Financial Decisions, 5th Edition, Prentice-Hall, New York.

CHAPTER TWO

PROJECT ORGANIZATION AND CONTRACTS

2.1 INTRODUCTION

The basic definition of a "project" is some form of human activity that has a beginning, a productive middle phase and an end, creating something that has not previously existed. In the construction industry, the project will create a building or a civil engineering construction (Neale, 1995).

The Oxford Advanced Learner's Dictionary defines project as "a piece of work that is organized carefully and designed to achieve a particular aim".

This chapter explores how project participants are organized and maintained. Any risk sharing or allocation process is a management tool to achieve value for money. The chapter looks at the management tool within the framework of organizational goals and construction contracts.

2.2 CHARACTERISTICS OF CONSTRUCTION PROJECTS

The construction industry is inherently an uncertain industry. This uncertainty, according to Roger (1985) arises from the nature of the industry itself. A number of key peculiar characteristics responsible for this unique nature associated with the industry have been identified as:

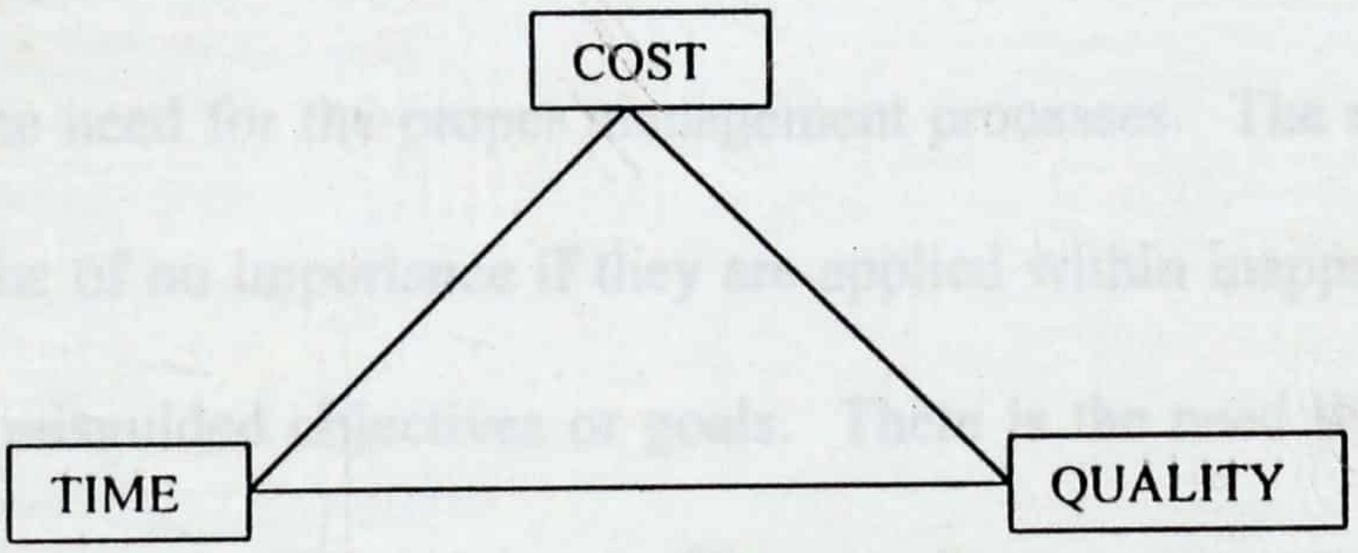
- The projects are constructed wherever they are required.
- The activities and products are influenced by local environmental conditions.
- Majority of its inputs are large, expensive and bulky.
- The unique design nature of the products.

- Fast-moving, intense level of resource demand and the frequent changing nature of construction activities.
- Several parties with different objectives having to come together because of a project and to re-align their objectives towards the project.

A project completed on time, within budget and to the required technical, aesthetic and quality performance standards is the expectation of all clients. Clients are increasingly demanding that all three of these aims are achieved, and are increasingly unwilling to accept the management compromise of these aims, which was, and is in some organizations, the common practice. Quality is an important requirement, and quality assurance procedures, including Total Quality Management procedures, are now commonplace.

If the contractor fails to manage the project effectively, the balance held by the three elements may have to be altered. The only compromise that the contractors can make is to spend more of their own money to achieve the other two aims. This is not good business.

The figure (1.1) below shows the 'eternal triangle', which illustrates what all clients require to obtain "value for money".



- Altering one element will have an effect on the others.

Figure 1.1 - The eternal triangle of value for money

Source: The Aqua Group (1975)

Clients are anxious to reduce costs and gain competitive value. They are therefore insisting on obtaining "value for money", that is to achieve optimum use of resources in an inherently risky industry.

Participants have had no option but to re-organize and move away from unproductive practices.

The way in which the skills and professions have evolved has reduced the organization of firms effectively. There has been increased specialization. The specialization has been accompanied by the creation of independent companies offering the specialist services, and the complexity of construction has led to greater interdependency between the specializations and hence between companies. This produces a high level of differentiation within the construction process and a consequent need for a strong integration of the independent companies and skills (Walker, 1984).

It is against this background that the conventional solution to project organization has attempted to cope with increasing complexity, risk and uncertainty. The strain has shown in recent years through the increasing use and development of special contract terms and conditions of contracts (Walker, 1988).

The pressure from clients has made the professions and industry take more seriously the need for the proper management processes. The use of techniques and tools, will be of no importance if they are applied within inappropriate firms seeking to achieve misguided objectives or goals. There is the need therefore to look at the goal of a firm as a logical step in our attempt to improve management processes.

2.3 THE GOAL OF THE FIRM

A firm is an organization that combines and organizes resources for the purpose of producing goods and/or services for sale (Salvatore, 1993).

A business firm is confronted with many decisions - some important others less so. The theory of the firm, as it relates company finance and investments, states clearly the existence of a goal or combination of goals. The goals often listed over the years include:

1. Maximization of profits
2. Maximization of sales
3. Survival of the firm
4. Achieving a "satisfactory" level of profits
5. Achieving a target market share
6. Some minimum level of employee turnover
7. 'Internal peace', or no ulcers for management
8. Maximization of managerial perks and salaries.

All the above considerations indicate that firms, including those in the construction industry, seek to:

a. maximize profit, and

b. minimize risk.

2.3.1 Conflicting Objectives

The work of firms in the construction industry and its professions presents two types of management issue: the problem of managing firms and that of managing projects.

Several organizationally independent firms are usually involved in construction projects with each of the firms seeking to maximize profits and minimize risks.

The mix of firms change from project to project. Because the firms involved in each project are independent companies and have different goals, they are normally organizationally independent in terms of the project. This situation creates a potential for conflict between the needs of each firm and of each project.

It is important to note these conflicts take place in an industry that has risks and uncertainties as an inherent difficulty.

It has been found that it is unlikely that there is one "best" form of contract for construction projects (Nahapiet & Nahapiet, 1985).

In moving towards the completed project, the process is characterized by a series of problems: potential conflicts, risks and uncertainties and possibility of business failures, etc. through which it must pass if it is to make progress. At each of the stages a decision has to be made which could include the option to abort the project.

All these processes must therefore be governed by the terms of the contract or conditions of contract. The contract then provides a framework within which the parties must operate.

It is the belief of participants in the industry that there is a body of principles which should govern the efficient performance and management of these construction operations, which derive from legal principles and from the construction activity itself (Uff, 1991).

Uff (1991) suggests that these objectives would be more focused if the subject were called Construction Contracts or Management.

2.4 CONSTRUCTION CONTRACTS

Generally, the law is said to exist in order to allow persons to regulate their lives with reasonable certainty, and in a manner which our society presently considers to be just.

A "Construction Contract" is used to include any contract where one person agrees for valuable consideration to carry out building or engineering works for another (Keating et al, 1978). It thus covers every contract from, for example, a simple oral agreement to repair a garage door to elaborate public works contracts. The law of construction contracts is part of the general law of contract. Therefore all the elements of a simple contract must be present and the general values of performance and discharge of contract apply to a construction contract.

2.4.1 Formation of a Contract

The essence of a construction contract, like any other contract, is agreement.

A contract is an agreement which is enforceable by law. A contract contemplates and creates an obligation.

The essentials in the formation of a contract are:

⇒ agreement between the parties

⇒ an offer

⇒ an acceptance of the offer

⇒ a consideration (the price to be paid for the goods or service to be provided).

An agreement between the parties regarding the purpose, rights and the obligations which the contract will create is essential.

In order to create an obligation the agreement must:

⇒ be for a lawful purpose

⇒ be between parties who have the capacity to enter into a contract

⇒ be free from misrepresentation, mistake, duress or other circumstances which will vitiate (invalidate) it.

A contract is effected when an offer made by the offeror is accepted by the offeree. An offer may be in writing or it may be oral. An offer is different from the declaration of intention and a statement of price which is known as an "invitation to treat".

An invitation from a prospective client to a contractor to "give him a price" (to tender for work) is an example of an invitation to treat.

Both, or either, offer and acceptance may be oral or in writing - the contract will be binding on the parties concerned. A difficulty which arises when the parties wish to enforce an oral contract is establishing the parties intentions.

The figure (2.1) below illustrates the contractual relationship between the parties engaged on a typical construction project (Frank, 1991).

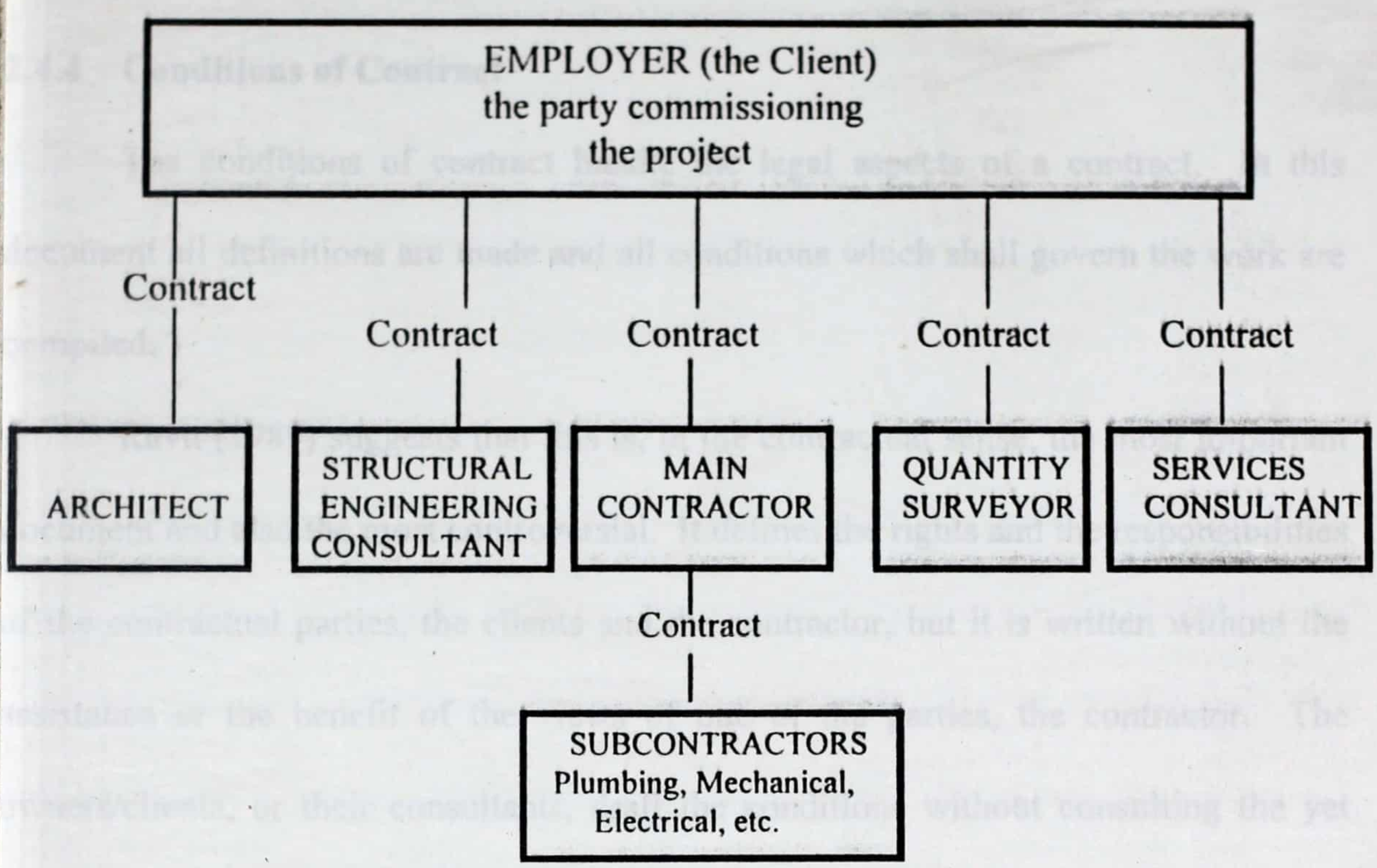


Figure 2.1 - Contractual Relationships on a Typical Construction Project

Source: Frank (1991)

2.4.2 Privity of Contract

Only the parties to a contract may normally benefit from or be bound by the terms of a contract. A third party cannot normally sue upon a contract even if the contract has been made expressly for the third parties benefit.

2.4.3 Assignment

Parties to a contract may not assign their benefits or obligations to a third party without the consent of the party with whom they have entered into a contract. Conditions in Standard Forms of Contract usually require agreement between the contracting parties as a condition of assignment.

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2.4.4 Conditions of Contract

The conditions of contract handle the legal aspects of a contract. In this document all definitions are made and all conditions which shall govern the work are compiled.

Ravn (1989) suggests that this is, in the contractual sense, the most important document and also the most controversial. It defines the rights and the responsibilities of the contractual parties, the clients and the contractor, but it is written without the assistance or the benefit of the views of one of the parties, the contractor. The owners/clients, or their consultants, draft the conditions without consulting the yet unknown contractor. Such a document could therefore, easily, be one-sided. That is, focused too much on the clients' interest and hence a recipe for future disputes.(1)

If this is the case and the conditions are not accepted by the contractor, the result will either be a declination to submit tender or that he submits a tender with high contingencies in their mark-ups (Clough, 1975).

In order to avoid problems of this nature several independent organizations have prepared a set of standard forms of conditions which take care of the interest of the parties. These have the advantage that with time the conditions become familiar to the parties so that they "know where they stand". These conditions can therefore serve as guidelines for drafting of the conditions for a particular project.

Some of the standard forms in use in the Ghanaian Construction industry are:

(a) The Joint Contract Tribunal Standard Form of building contract 1980 edition (JCT 80).

(b) The Federation Internationale Des Ingenieurs - Conseils (FIDIC) for Civil Engineering Construction.

(c) The Ghana Government Conditions of Contract for Civil Engineering Works.

(d) The Ghana Government Conditions of Contract for Building Works.

2.5 SUMMARY

Decisions made under uncertain conditions are more likely to be subject to later review and the evidence suggests that this is a common problem for construction project participants (2).

The uncertainty facing construction project participants has long been recognized (Chrichton, 1966) therefore the drafting of contract documents to take care of these uncertainties and possible conflicts is a difficult and time consuming process which requires considerable experience in a wide range of disciplines.(3)

The understanding of construction contracts and the parties involvement in the formation of the contract will ensure that the foremost objective of the firm of "maximizing shareholders wealth" by maximizing profit whilst minimizing risks is achieved in the broad framework of obtaining value for money for the client.

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CHAPTER THREE

RISK SHARING PRACTICES

3.1 INTRODUCTION

The willingness of parties to take on risks is an important consideration in the sharing of project risks. Contractual sharing of risks is essentially in the hands of the client. If the client is unwilling to bear a particular source of risk, he can pass this on to one or more of the other parties involved in the project.

Of course, the client will pay a price for passing on this risk. Where a professional or contractor is aware that he will be required to bear a given risk, professional fees and tender prices will include an additional premium to reflect the expected cost of this risk, plus a contingency sum in most cases, plus a fee for the risk-bearing service.

The broad concept of appreciation of risks and various methods of risk sharing practices will form the core of this chapter.

3.2 RISK RESPONSE

Economists classify individuals as risk-averters, risk-neutral and risk-lovers.

Those who dislike risk are the risk-averters. A risk-averter will refuse a fair gamble. If the offers are sufficiently favourable the probable monetary profit will overcome the inherent dislike of risk. But the more risk-averse the individual, the more favourable must the odds be before that individual will take the bet.

In contrast, risk-lovers are those who prefer risky prospects. The risk-lover will bet even when a strict mathematical calculation reveals that the odds are

unfavourable. The more risk-loving the individual, the more unfavourable must the odds be before the individual will not bet.

A risk neutral person pays no attention to the degree of dispersion of possible outcomes, betting if and only if the odds on a monetary profit are favourable. Thus, the bet may turn out to be a loser, and there may be quite a long string of unlucky losing bets, a risk neutral person is interested only in whether the odds will yield a profit on average.

The bulk of theoretical and empirical evidence supports the view that the typical individual or firm is risk averse (Levy et al, 1994).

3.3 UTILITY THEORY CONCEPTS

Utility theory recognizes that it is the pleasure or satisfaction that one gets from money, and not money itself, which is important (1).

The theory proposes that an individual faced with a choice between alternatives with uncertain outcomes chooses that alternative which maximizes the expected value of what is referred to as utility. The theory contends that the individual's utility function can be established by asking the individual a series of questions. This process involves arbitrarily defining utility values for any two cash (monetary) amounts, subject only to the restriction that the larger cash amount be assigned the larger of the two utility values. After defining these two points, the utility values for all other profits may be uniquely determined.

For example, let A and C represent two possible cash profits with probabilities of occurrence of P(A) and P(C). Let U(A) and U(C) represent the utilities of A and C

respectively. If the individual is indifferent between a cash-certain equivalent B or a lottery between A and C, the utility of B can be determined as follows:

$$EUV = U(A) \times P(A) + U(C) \times P(C) = U(B) \times P(B)$$

where $P(B) = 1$.

Solving for U(B) provides a third point on the individual's utility function.

The general mathematical function is:

$$E(X) = \sum_{i=1}^{n} Pr_i \, X_i$$

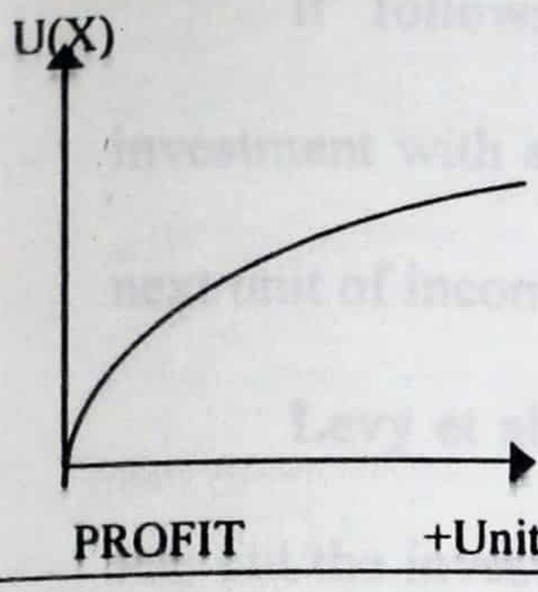
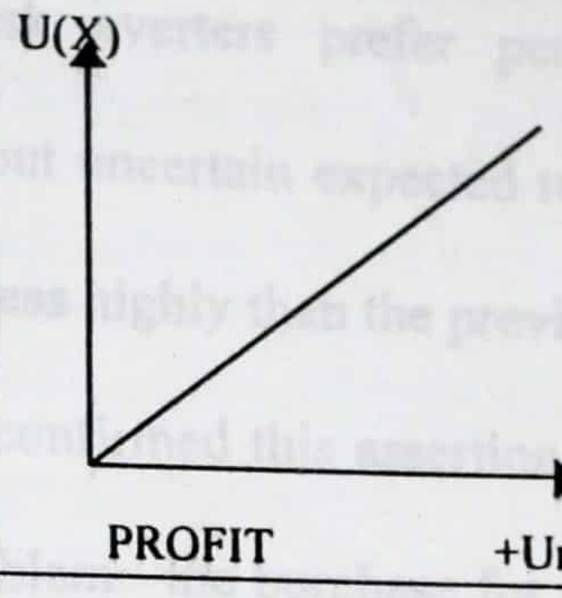
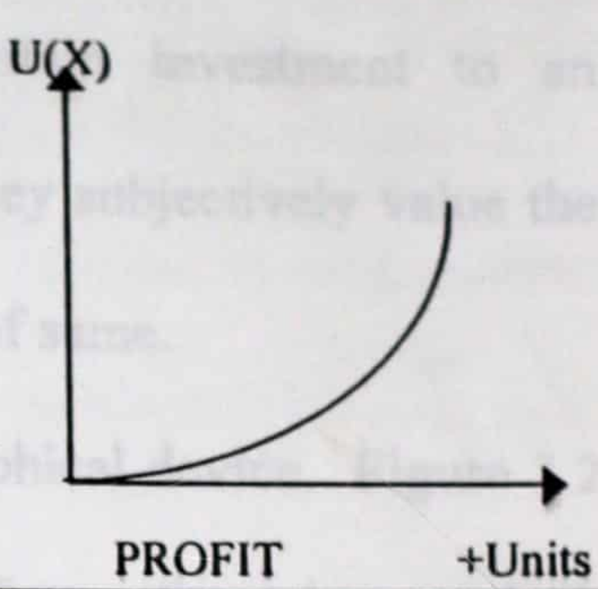
where:

$E(X)$	=	expected value of the project
X_i	=	*i*th possible outcome
Pr_i	=	probability of obtaining the *i*th outcome X_i
n	=	number of possible outcomes

This procedure can be repeated to determine as many points as desired.

Three plots of such relationships are contained in Figure 3.1.

3.1 : Classification of Individual Risk Preferences

	Risk Averse	Risk Neutral	Risk Lover
			
	$\frac{dU}{dP} > 0$ Prefer more money to less money	$\frac{dU}{dP} > 0$ Prefer more money to less money	$\frac{dU}{dP} > 0$ Prefer more money to less money
	$\frac{d^2U}{dP^2} < 0$ Subjectively value the Next Unit of Profit less highly than the previous unit of profit	$\frac{d^2U}{dP^2} = 0$ Subjectively value the Next Unit of profit the same as the previous unit of profit	$\frac{d^2U}{dP^2} > 0$ Subjectively value the Next unit of profit more highly than the previous unit of profit
	Will not willingly assume risk exposure unless the compensation exceeds the expected monetary value of the Risk.	Will assume risk exposure if the compensation is not less than the expected monetary value of the risk.	May be willing to assume risk exposure even if the compensation is less than the expected monetary value of the risk.

Thus, individuals or firms whose preferences are characterized by diminishing marginal utility are called risk averters.

It follows that risk averters prefer perfectly certain investment to an investment with an equal but uncertain expected return. They subjectively value the next unit of income/profit less highly than the previous unit of same.

Levy et al, (1994) confirmed this assertion by a graphical device. Figure 3.2 sets out the investment problem: the purchase for a ¢10m of an option whose end-of-period value has an equal probability of being ¢9m or ¢11m. The possible end of period values are measured along the horizontal axis and utility is measured along the vertical axis. The individual's utility function is drawn in Figure 3.2 as concave curve rising from the origin; this is tantamount to assuming that he is risk-averse.

The expected utility is represented graphically by point C of Figure 3.2, the point at which a perpendicular rising from the point marked 10 on the horizontal axis intersects the chord connecting points A and B. The expected utility, given by point C, is equal to: ½U(9) + ½U(11), where U stands for Utilitv.

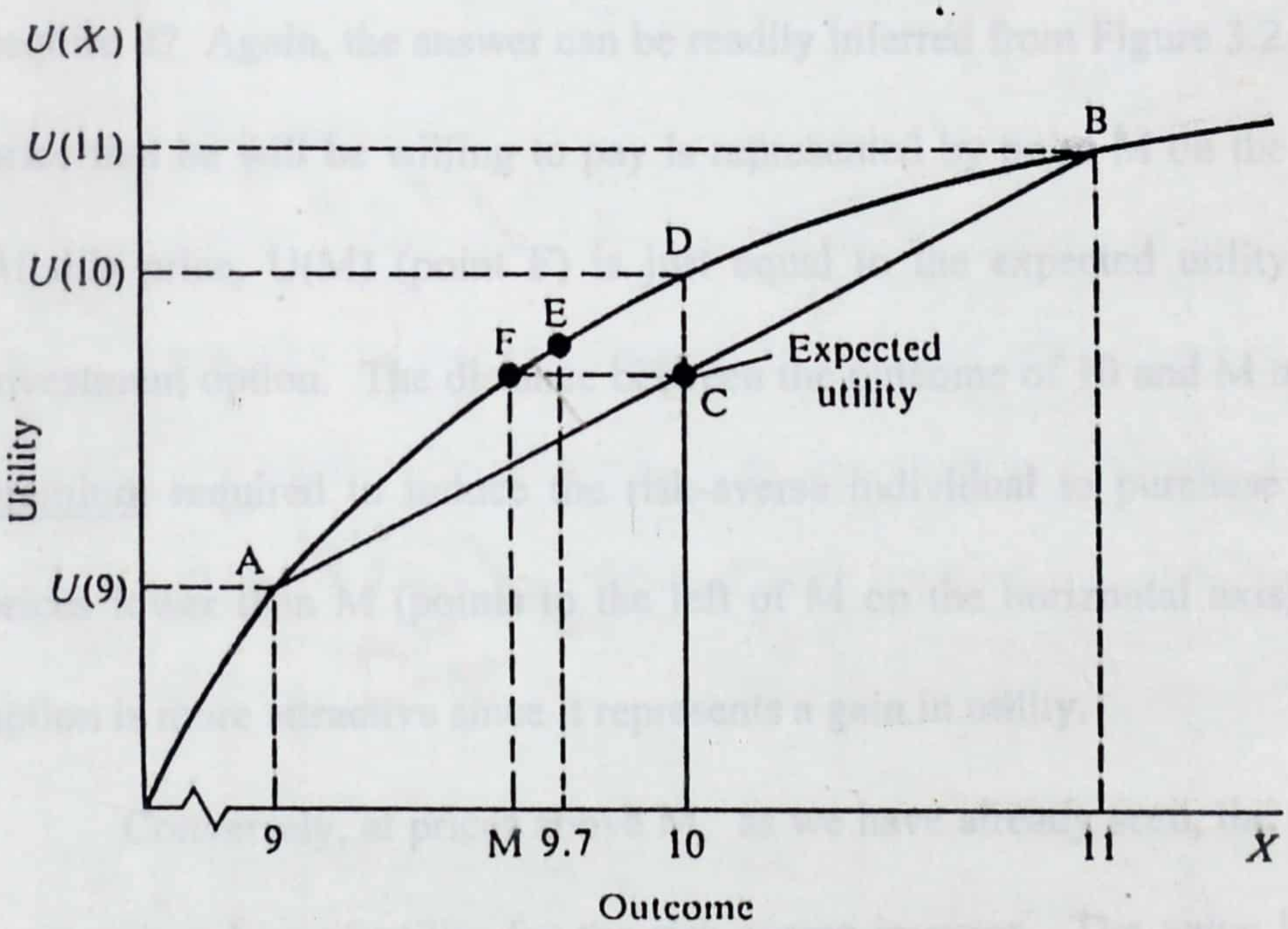


Figure 3.2 - Typical Utility/Outcome Investment Curve

A glance at the diagram shows that the utility of the purchase price U(10), which corresponds to point D on the utility curve, is greater than the expected utility of the investment option, which corresponds to point C. Thus a risk-averse individual will not purchase an uncertain option whose expected value is equal to its purchase price, since the concavity of his utility function translates the zero monetary gain into a utility loss.

Now let us assume that the same individual is offered the same option, but at a lower price say ¢9.7m. The expected end-of-period value remains ¢10m (i.e. 0.5 x 9 + 0.5 x 11) so that the option has a positive expected return (¢10m - ¢9.70 = ¢0.30).

Will the risk-averse individual purchase the option now? Despite the lower price of ¢9.70m, Fig. 3.2 clearly shows that he will not be willing to purchase the option because the utility of a perfectly certain sum of ¢9.70m (point E) still exceeds the expected utility of the risky option (point C).

How far must the price fall before our risk-averse investor will be willing to acquire it? Again, the answer can be readily inferred from Figure 3.2. The maximum price that he will be willing to pay is represented by point M on the horizontal axis. At this price, U(M) (point F) is just equal to the expected utility from the risky investment option. The distance between the outcome of 10 and M measures the risk premium required to induce the risk-averse individual to purchase the option. At prices lower than M (points to the left of M on the horizontal axis) the investment option is more attractive since it represents a gain in utility.

Conversely, at prices above M, as we have already seen, the risky investment represents a loss of utility for the risk-averse investor. The value M represents the certainty Equivalent value of the risky option.

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Mathematically, M is the value which resolves $E\,U(X) = U(M)$, where X is a random variable or outcome.

The risk premium, Π, is given by:

$$\Pi = E(X) - M$$

3.3.1 Critical Assumptions for Implementation

Utility theory can be used to evaluate the price differential between a client's and a contractor's assessment of risk. Once an individual's utility function has been determined, it should be possible to use it to predict the individual's risk preference behaviour in risk situations similar to those under which the utility function was formulated. If factors such as the individual's financial position or the economic situation changes after the utility function is formulated, a new one should be generated.

The Assumptions

⇒ Maximize Utility

Utility theory assumes that individuals attempt to maximize utility. The assumption that contractors and clients behave in this manner appears reasonable. For example, if a large client is risk neutral, he behaves on an expected Monetary Value (EMV) basis and prefers more money to less money.

⇒ Utility Function Known to Client

The client should be able to derive utility function for his firm. Client's knowledge of a contractor's utility function is not essential. A hypothetical

contractor utility function which is more risk averse than the client's may be used.

⇒ Damages

The utility function model assumes that the client and contractor both perceive the possible damages to be the same.

⇒ Probability

The utility function model also assumes that the client and contractor both perceive the probabilities to be the same.

Some critics of the potential benefits of risk sharing claim that contractors do not include contingencies because they would not be competitive. Conversely, it is also contended that:

> "A rational participant will only accept risk if he receives a commensurate reimbursement for the acceptance of that risk".

The consequence of ignoring very low probability which have potentially catastrophic consequences is that the client is exposed to delays and claims by the contractor. The contention that contractors will not accept risk without commensurate reimbursement is also suspect because when work is scarce, contractors with high fixed overheads and equipment costs can be literally forced to take risky projects at an expected loss in order to minimize their overall losses and hope to enjoy better times. And once again, the client is exposed to the probability of delays and claims.

Deductions

Because the model based on utility theory predicts the contractor to be indifferent between the risk alternatives, it can be concluded that an EMV client pays more to the risk-averse contractor for the contractor to assume risk than the client should be willing to pay.

A risk-averse client who is less risk-averse than the contractor would also pay a smaller premium, if the contractor assumes all of the risk.

Erikson (1979) suggests that the easiest way for the client to write a contract is to include a clause stating that the contractor is responsible for every risk, that is to say, to use exculpatory clauses. He states further that even if these clauses are enforceable, the client must assign the risks to a party who is financially able to bear it, as shown in Figure 3.3, because of differing utility functions.(2)

FINANCIAL ABILITY TO PAY	RISK EVENT: OCCURRENCE	RISK EVENT: NON-OCCURRENCE
CAN PAY	Contractor incur costs for which contingency at least partially offsets	Justifiable contractor compensation for Risk exposure
CAN'T PAY	Contractor and/or surety cannot financially cover losses. Client incurs additional costs. Delays, claims, litigation.	Windfall profit for contractor

Figure 3.3 - Financial Ability/Risk event

Source: Erikson (1979)

3.4 ASHLEY'S RISK SHARING MECHANISMS

Ashley, (1977) uses as risk sharing mechanisms, Joint-Venture partnerships and client-contractor negotiations.

The usage of the joint-venture partnerships allows diversification for the contractor and places him in a more financially advantageous position. Here, there is a trade off in increased liabilities and contractor pride.

In the Client-Contractor Negotiation, the choice of contract clauses influence the outcome. Clauses of the contract are selected on the basis of how the two parties comparatively value the risk rather than the absolute risk. Here, any particular risk-share/contract-amount combination may be used as a starting point from which to define all other preferable combinations. If no such additional combinations can be identified, then the original pair is an efficient solution.(3)

Armed with these broad concepts, Ashley gives direction as to how risks associated with a construction project should be treated by the contractor.

Pricing the Risks

Risks associated with a construction project must be analyzed and handled by the contractor. Ashley (1977) suggests that an Estimator or quantity surveyor may classify them as:

1. insurable,
2. risks to be priced in estimate, and
3. risks not priced in estimate.

Insurable Risks

Commercial insurance institutions accept risks from contractors in return for premiums. Insurance is typically available on workmen's compensation, third-party liability, contractors' all risk and equipment facilities.

Contractors can solicit premium quotations from the insurers and include them in bid proposals as an indirect cost of performing work.

Risk Priced in an Estimate

Priced risks and potential reliefs required in a bid are commonly called contingencies. Risks assumed by the contractor and for the most part uninsurable, fall into this category. Examples of risks with associated bid contingencies are:

1. strike costs,
2. deductible on insurance coverage,
3. lost time due to weather,
4. liquidated damages,
5. subsurface variations,
6. changes in prices,
7. incorrect estimates of labour requirements (Carr, 1977).

Total project contingencies, along with the desired profit margin, are usually the last items added to a contractor's bid proposal.

Risk Normally not Priced

These may include:

1. currency devaluation,
2. design inadequacy,
3. changed conditions, and
4. termination of the contract or suspension of the contract,
5. cost of possible disputes.

Such risks are normally retained by the client, but in the event that contract conditions transfer any of these risks to the contractor, he must develop and include a contingency in the bid.

Including the Cost of Risks

Each contractor-priced risk yields an amount to be included in the contingency and profit. No costs are included for the client-assumed risks. A fixed price bid will take the total of the direct costs, indirect costs, contingency, and profit margin, as the total bid amount.

A unit price requires that the indirect costs, contingency and profit margin be spread to the unit prices or rates in bills of quantities. For a "balanced bid" the contractor will typically spread these extra costs proportionately over the rates in the bills of quantities.

Limitations

Joint Venture theorems deal with risk diversification as being beneficial to the individual. Further consideration, however, shows that diversifying does not match industry experience.

For instance, for what reasons do contractors elect not to joint venture to share risk? A contractor does not see an unlimited number of future projects, and may place considerations of risk aside when facing the prospect of sharing hard-won profits with other contractors.

Also in Negotiation, there are always goal conflicts. The contractor's primary objective of profit maximization and the client's desire to achieve low costs are in direct opposition to one another. This quality of the relationship leads to non-co-operative behaviour in drawing up contract documents (4).

3.5 RISK SHARING GENERALLY

3.5.1 Client/Contractor Control

The relationship between risk and control is best illustrated by a discussion of two contract strategies illustrated in the diagrams below.

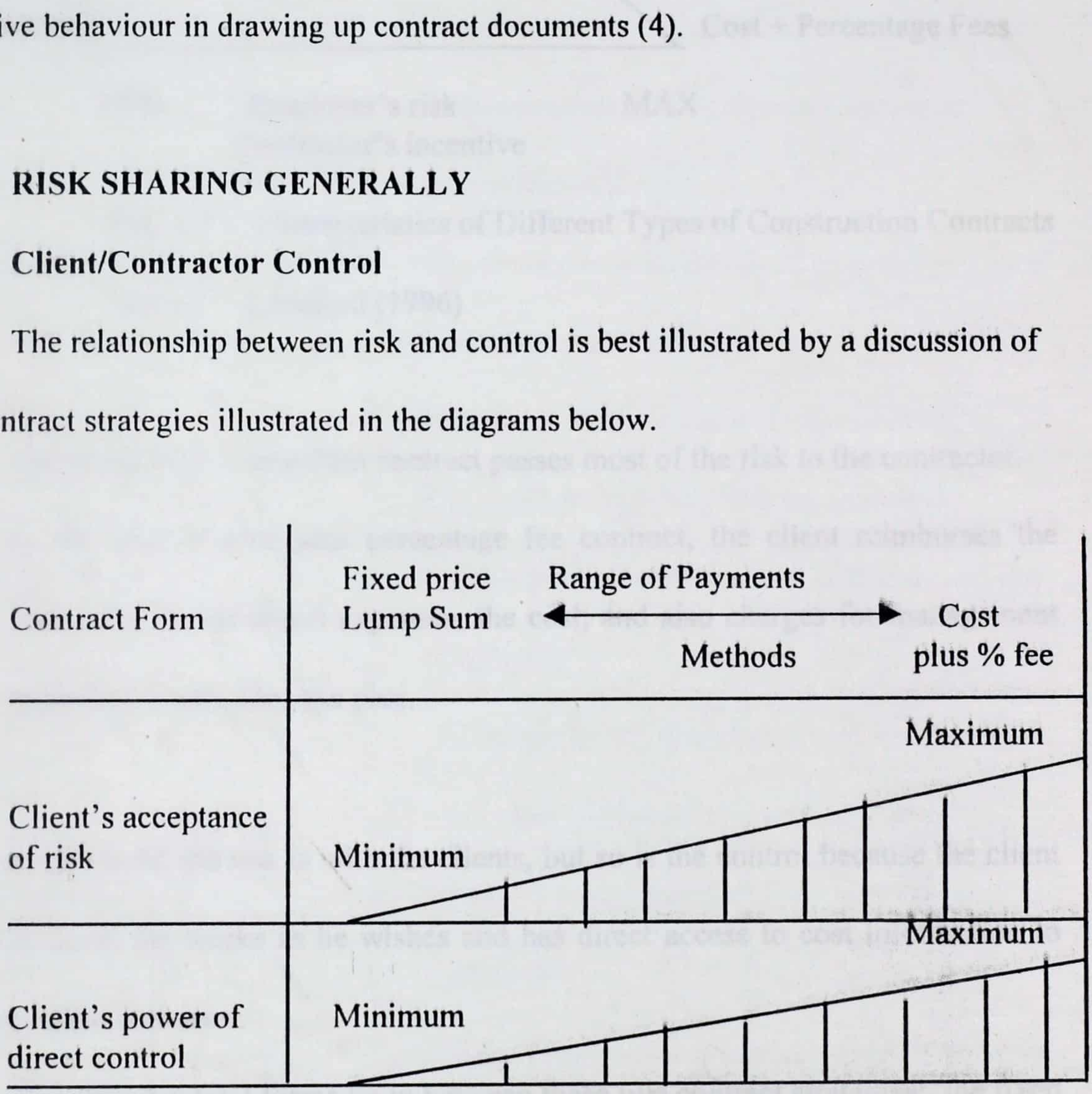


Fig. 3.4 - Illustration of the relationship between contract form, control and risk

Source: Langford and Retik (1996)

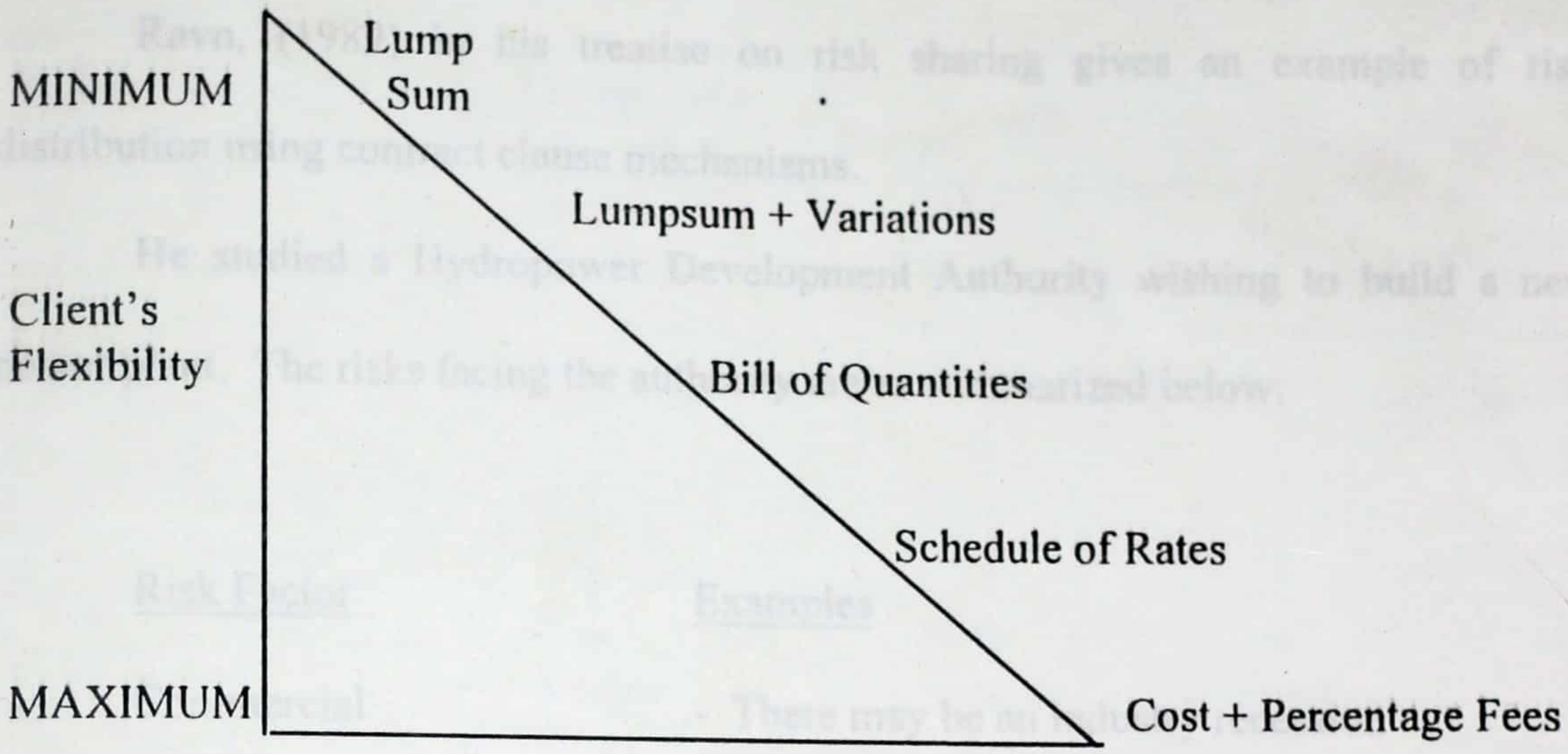


Fig. 3.5 - Characteristics of Different Types of Construction Contracts

Source: Langford (1996)

- The fixed price Lump Sum contract passes most of the risk to the contractor.
- In the case of cost plus percentage fee contract, the client reimburses the contractor for all direct expenses, the cost, and also charges for management and other overheads - the plus.

In this case, the risk is with the clients, but so is the control because the client is free to direct the works as he wishes and has direct access to cost information to help him make decisions.

- The other contract forms lie in between these two contract strategies: the fixed fee Lump Sum and the cost plus percentage fee.

Ravn, (1989) in his treatise on risk sharing gives an example of risk distribution using contract clause mechanisms.

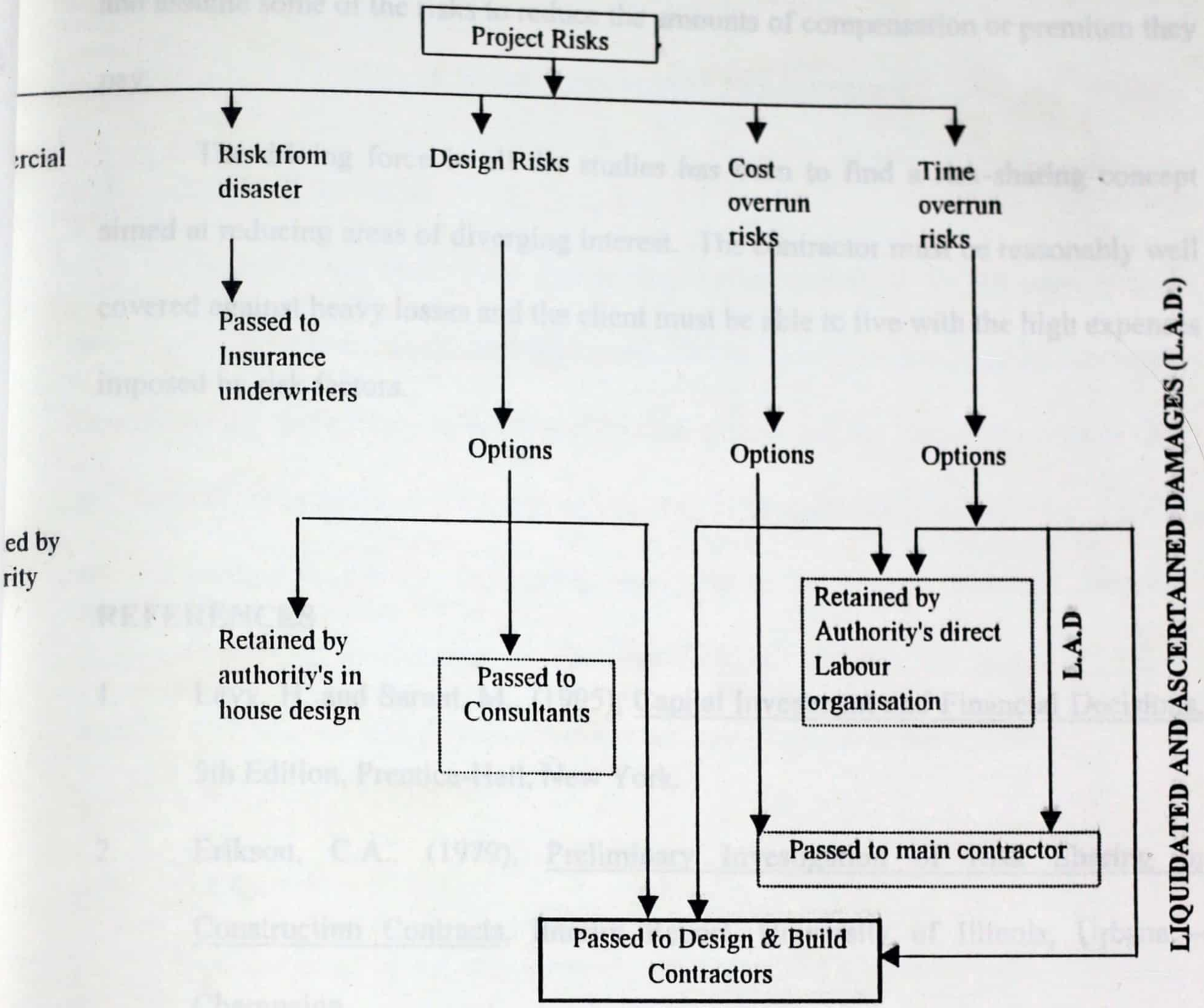
He studied a Hydropower Development Authority wishing to build a new power plant. The risks facing the authority are as summarized below:

Risk Factor	Examples
Commercial	- There may be an industry recession - Another authority may develop a cheaper power alternative
Disaster	- The project may be damaged or destroyed by a natural or man-made disaster.
Design	- The project may not be efficient to operate - The structure may prove to be defective
Cost Overrun	- Estimates of construction cost may be too optimistic. - Efficiencies of workforce and construction plant may fall below acceptable limits.
Time Overrun	- Estimates of construction time may be too optimistic. - It may take longer than the schedule time to complete.

The diagram below shows some of the ways by which these risks are apportioned.

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3.6 Distribution of Risk Using Contract Clause Mechanisms



ce: Ravn (1989)

SUMMARY

From the studies of Erikson, Ashley, Ravn and others, it can be seen that great effort skill is employed in drafiing "water tight" contract in order to protect client against s resulting from the undertaking of projects. The contractor must also have sufficient rmation for fixing his prices. In the best of cases, the contractor is asked to "gamble" as he, eality, is charged with the responsibility for the management of the risks. Contractors are averters and will not willingly assume risk exposure unless the compensation exceeds the

expected monetary value of Risk. Clients, therefore, must weigh the options carefully and assume some of the risks to reduce the amounts of compensation or premium they pay.

The driving force in all the studies has been to find a risk-sharing concept aimed at reducing areas of diverging interest. The contractor must be reasonably well covered against heavy losses and the client must be able to live with the high expenses imposed by risk factors.

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CHAPTER FOUR

REVIEW OF EXISTING LITERATURE

4.1 INTRODUCTION

The risks and uncertainty facing those who contribute to the construction process has long been recognized (Crichton, 1966). Decisions made under uncertain conditions are more likely to be subject to later review and the evidence suggests that this is a common problem for construction project participants (Hibberd et al. 1990). Several studies have been undertaken, especially in the United States of America (USA), to develop mechanisms for the identification, analyses and response to risk factors. This chapter will give an overview and review some of these studies.

4.2 DAWOOD'S STUDY

In the context of the management and economics of construction, a working definition of risk was defined by Chapman, 1991 as:

> "Exposure to the possibility of economic and financial loss or gain, physical damage or injury, or delays as a consequence of the uncertainty associated with pursuing a particular course of action".

Studies by Dawood, (1995) suggested that Risk Management is the name given to a formalized process of balancing the detrimental and favourable events related to a given venture or project. To him, it is the process of determining and quantifying the risk of a project, so that decisions can be made to counter and make allowances for the detrimental events.

Dawood applied the Risk Management Cycle shown in Figure 4.1 below to the water and sewage industry.

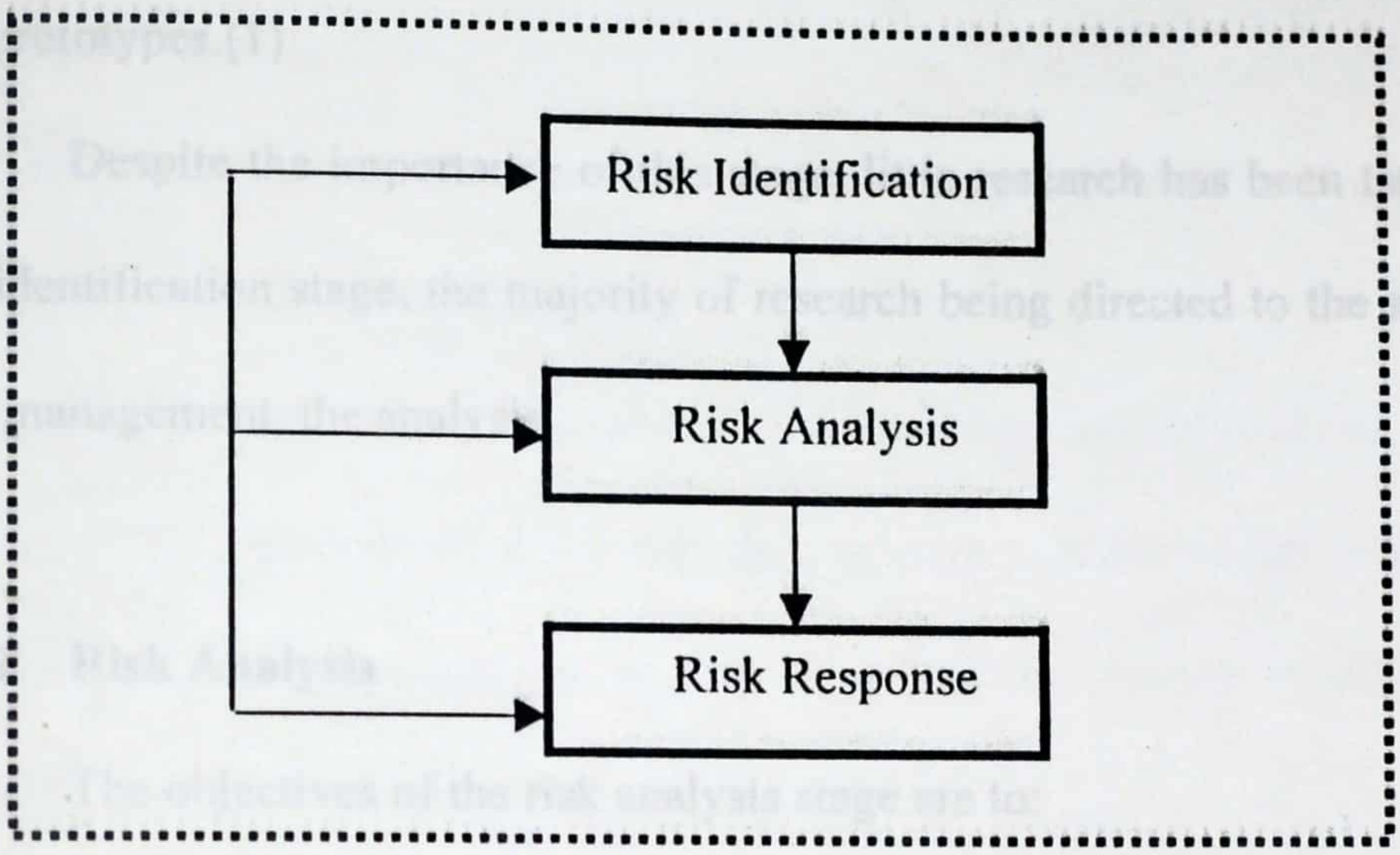


Figure 4.1 - Risk Management

Source: Raftery (1993)

As can be seen the process has three stages (Al Bahar et al 1990 and Diaz et al, 1993):

1. Risk Identification
2. Risk Analysis
3. Risk Response.

4.2.1 Risk Identification

Dawood observed that risk management function has been closely linked with insurance by some commentators but stated that Risk in his proposal had a broader meaning and that it is a process of systematically identifying, analyzing and responding to risk events throughout the life of a project in order to obtain the optimum or acceptable degree of risk control or elimination.

In his view, Risk identification is the most important and perhaps the most difficult stage. It is important because it defines the aspects of the problems to be studied. It is difficult as all projects which risk management is commonly applied to are prototypes.(1)

Despite the importance of this stage, little research has been targeted towards the identification stage, the majority of research being directed to the second stage of risk management, the analysis.

4.2.2 Risk Analysis

The objectives of the risk analysis stage are to:

1. Allocate the effects and chances of occurrence of each risk and or uncertainty.
2. Determine the overall uncertainty in the project, that is, the balance between risks and opportunities (detrimental and favourable events).
3. Determine the significance of the individual uncertainties to the total.

Risk analysis has been widely investigated especially stochastic networks (Bekr, 1990). Several probabilistic methods have been developed to solve the problem of stochastic network. Amongst these methods are:

PERT (Programme Evaluation and Review Techniques)

PNET (Probabilistic Network Evaluation Techniques)

MCS (Monte Carlo Simulation).

Diaz and Hadipriono (1993) found that PERT is the simplest method and yields the most optimistic results, while MCS produce the most conservative results.

Adarus et al (1994) used MCS technique to develop a methodology for optimal risk allocation in a water industry. They concluded that costs saving up to

15% can be achieved through contractor differentiation and the use of client-weighted risk allocation strategy.

4.2.3 Risk Response

Risk Management is an attempt to change the possible futures to bring them in line with what we consider acceptable.

The first two stages of the process, the identification and analysis, according to Dawood, (1995) are important but it is the response to them which is the reason for performing risk management and so it is of greater importance. Previous literature appears to have ignored this concept.

The following are the possible mechanisms available in order to change the balance of risk as suggested by Dawood's study. These are:

1. Accept;
2. Reject/Avoid;
3. Transfer;
4. Insure against;
5. Reduce;
6. Share; and
7. Investigate.

The Risk Response stage has received little attention in literature and this is because of its complexity and the scarcity of industrial information.

4.2.4 Modeling the Risk Factors

Dawood (1995) in his study identified the following risk factors:

- Form of contract strategy
- Client changes
- Design development
- Document deficiencies
- Variation of prices and claims
- Market conditions
- Unforeseen conditions.

Once the risk factors are identified, the next stage is to allocate the effect and chances of occurrence of each factor (risk) and determine the overall risk in the project using MCS (Monte Carlo Simulation). The relationship between risk factors and contract strategies were then established.

Historical information was used to allocate the effect of chances of occurrence of the risk factors and a 'Histogram' distribution is used to model variations.

A computerized model which employs MCS technique is used to encapsulate the risk factors and their relationship. The simulation is performed many times using random numbers to select the outcome variables. The outcomes of the model are recorded and a form of frequency distribution of the final costs is produced.

The results of varying the risk factors are presented in terms of a CDF (Cumulative Density Function) distribution of the total cost and regression sensitivity analysis.

Factors that have high percentage contribution to high cost escalation will be indicated and the high risk one can then be allocated.

Dawood concluded that a considerable cost saving can be achieved if risk management including the allocation or sharing of the risks is achieved at the right time and at the right business level.

4.2.5 Limitation

Dawood acknowledges that certain factors that might not be quantifiable and therefore require judgements from specific interviews and knowledge elicitation sessions with project managers and quantity surveyors present a daunting task. It is also mentioned that factors like contractors' performance and reputation, macro economical issues, client's evaluation strategies of bidders are important but could not be considered.

4.3 ASHLEY'S STUDY

Ashley, D.B. (1977) explored mechanisms and theoretical bases for construction project risk sharing to provide insight into areas of potential improvement.

He believes that construction contractors as entrepreneurs acknowledge risk as a staple of their industry; the manager who appreciates the inherent uncertainties can achieve a portion of the success the market so sparingly allots. Risks going beyond the level which a single contractor can comfortably handle lead to incentives and opportunities for risk sharing.

Ashley agrees with Parker (1970) that each sector of the construction industry has its own inherent risks. Earthmoving contractors find site geological conditions a major determinant of their progress. Basic decisions such as construction method may be completely negated by discovered soil conditions.

Building contractors, on the other hand, find their profits tied to the co-operation of the labour force, subcontractors and the like. Work stoppages by material haulers or specialist craftsmen may disrupt building cycles or even bring a project to a standstill.

He suggests that contractors may classify a job as risky, in, for example, an earth dam construction, for the following reasons:

1. If payment is a Lump Sum, or lineal foot basis, all costs resulting from unexpected bad ground water, etc. are the contractor's responsibility.

2. The job may be in a remote area and therefore have problems in securing competent workers, maintaining access and living accommodations.

3. The job may extend for a considerable period of time with a large exposure to escalation in wages, fringe benefits and subsistence; changes in working hours and working conditions and strikes.

4. Relief from unforeseen conditions may not be in the specifications, and the job may be in ground of such a geological nature that is difficult to determine the type of rock and water conditions that will be encountered.

5. Equipment, supervision, people or materials may not be readily available due to many similar jobs being bid or under construction.

6. Permits may be difficult or time-consuming to obtain.

7. Unfavourable weather conditions or hard to predict states of nature such as river flow may significantly impact the construction time table.

4.3.1 Relative Importance of Risk Factors

The relative importance of each risk factor, depends on the sector of the construction industry and circumstances peculiar to specific projects (Ashley, 1977).

One in-depth study done for the U.S. Department of Transportation to determine the risk elements which most affect construction costs of transit facilities developed rankings among the factors by using experts' subjective opinions.

Results summarized in Table 4.1 show that the most costly item of uncertainty for transit construction is site geology. This results from the relatively high volume of excavation work and tunneling which occurs in this type of construction.

Table 4.1 - Ranking of Risk Factors of Transit Facilities

Ranking	Variable (Factors)	Percentage Weighting
1	Site geology	100
2	Labour productivity	92
3	Regulatory, Environmental	86
4	Equipment Productivity	86
5	Changed Conditions	80
6	Permit Approval	57
7	Funding	57
8	Weather	57
9	Accidents	37
10	Small Business	20

4.3.2 Risk Sharing

According to Ashley's study, the sharing of construction risks can be among several contractors, between client and contractor, or among clients in partnership.

He divides the mechanism of risk sharing into two categories: co-operative and non-co-operative. The co-operative category deals with joint venture partnerships and the non-co-operative rooted in construction contract negotiations.(2)

4.3.3 Co-operative Risk-Sharing

Multiparty interactions can be characterized by the level of goal congruence which exists among the parties; goals can be complementary, independent, or conflicting. When individual's goals involve division or allocation of a single value, they are no longer independent, and become either conflicting or complementary.

Conflicting goals lead to the broad class of non-co-operative behaviour. Complementary goals lead to a behaviour which is, or should be, co-operative in nature. A co-operative partnership formed for purposes of sharing risk is the joint venture.

A joint venture is the association in some form of construction of two or more firms to undertake the construction of a particular project (Turner, 1963). The partnership is further defined to be a group of individual decision makers who must come to an agreement under conditions of risk on the price or bid for doing the work. As a result of this joint decision, a payoff will be shared among them (Wilson, 1968).

4.3.4 Non Co-operative Risk-Sharing

Client-contractor interactions concerning the price of a project typically form the non-co-operative category. Any increase in price benefits the contractor and diminishes the client's position; similarly, uncompensated transfer of risk from one party to another improves the first and disadvantages the second. However, by trading away risk for changes in the contract amount the client can achieve a more preferable position and possibly allow the contractor to also gain (Ashley, 1972).

Young (1975) and Coddington (1968) suggested that various quantitative approaches for negotiation modelling fall into four general categories even though they do not agree on which is the best type of model. These are:

1. Game theory
2. Economic theory
3. Manipulative approach
4. Empirical approach.

Ashley uses the Cross (1975) bargaining model in Figure 4.2 below to suggest an efficient solution towards pareto optimal agreements.

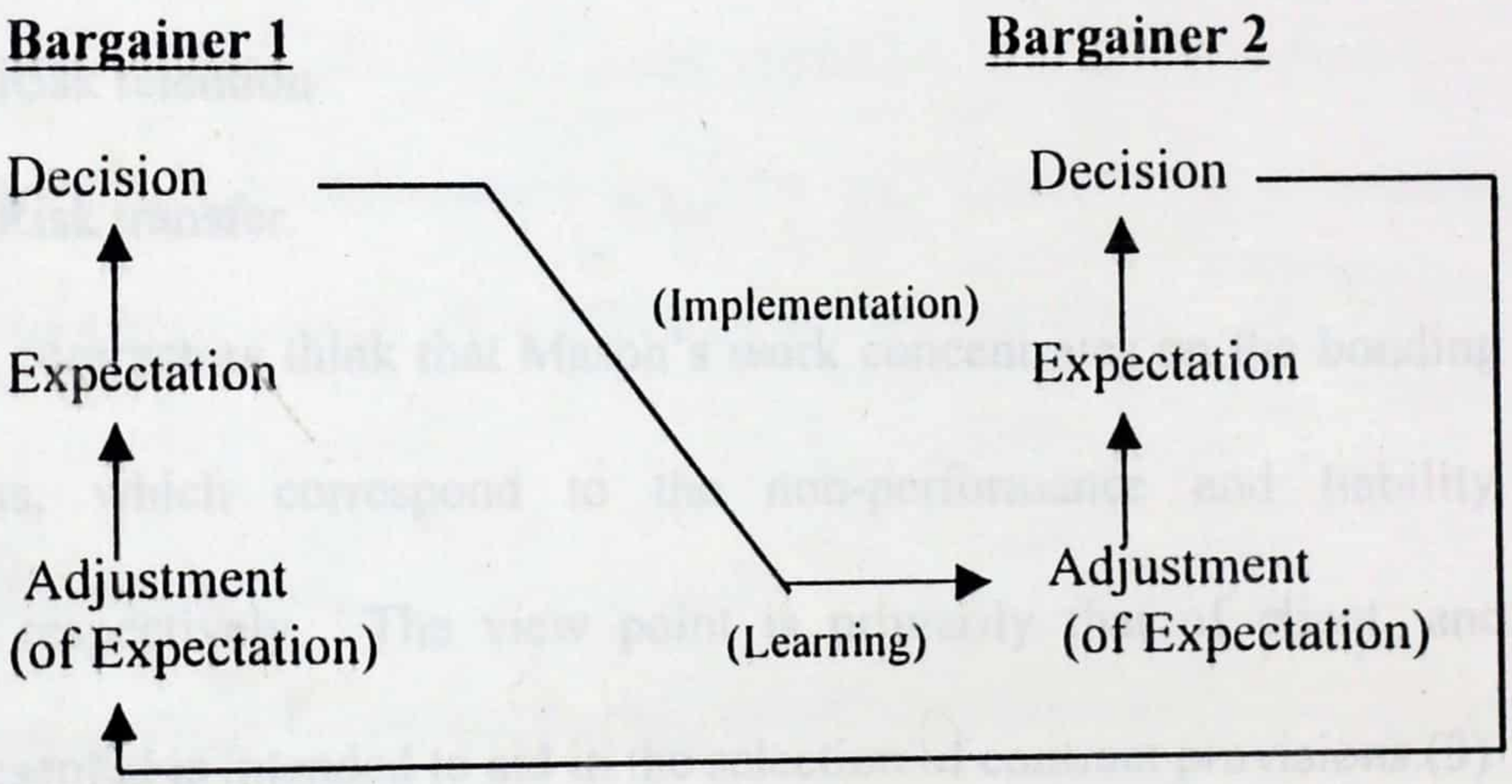


Figure 4.2 - Cross Bargaining Model

Source: Cross (1975)

Ashley calls this the decision/expectation/adjustment framework. The phases of the model symbolizes the learning and concession processes.

Further work by Young (1975) rejects the implementation and learning mechanisms.

4.4 G.E. MASON'S STUDY

Mason (1973) has classified risks into the following areas:

1. Non performance
2. Situation changes
3. Cost of dispute settlements
4. Liability losses
5. Damage to the project during construction

He then formulated methods for managing these risks as:

1. Risk avoidance
2. Risk abatement
3. Risk retention
4. Risk transfer.

Several contractors think that Mason's work concentrates on the bonding and insurance areas, which correspond to the non-performance and liability-loss classifications, respectively. The view point is primarily that of client, and the information presented is intended to aid in the selection of contract provisions.(3)

4.5 ERIKSON'S STUDY

Erikson (1979) presents a working definition to clarify the meaning of risk.

Risk: Exposure to possibie economic loss or gain arising from involvement in the construction process.

The risks to which a construction activity is exposed can be identified and it is possible to describe the following characteristics of risks:

1. Frequency of losses or gains
2. Severity of losses or gains
3. Variability (or standard deviation) of losses or gains.

He believes that the frame of reference for the possible loss or gain may be relative to the anticipated cost associated with the risk exposure, or relative to an ideal cost based on optimal conditions.

Risk is inherent in a construction project and is allocated to the parties involved. Therefore risks can be considered from the viewpoints of these parties: the client, consultant, contractor, sub-contractors, suppliers, sureties or financiers.

Consideration of alternative risk-allocation strategies requires the identification and evaluation of individual risks in the construction process, emphasizing those risks which are deemed most important. Erikson suggests the usage of the characteristics of frequency, severity and variability (or standard deviation) as indicators of the amount of attention a risk warrants.(4)

Erikson's Classification of Risk

Erikson classifies risks as contractual risks or construction risks.

Contractual risks arise primarily from the interaction among the different parties to the construction process. Contractual risk is introduced through lack of contract clarity, absence of perfect communication between the parties involved, and

problems of timeliness in contract administration. These risks expose both the client and the contractor to uncertainties which may increase both parties' costs.

Contractual risks are not risks to be shared; however, the client can reduce them by improving contract clarity and contract administration.

Construction risk arises from factors such as weather, differing site conditions, acts of God, resource availability, etc. Construction risk is inherent in the work itself and would be present even if one company with perfect internal communications performed all of the construction process functions itself.

Although construction risks may be reduced, they are primarily managed by assigning them to one or more of the parties involved.

Many risks may also be viewed as a combination of these two classes.

Erikson believes that the client attempts to maximize the project's benefit/cost ratio. After determining a specified quality level, the client's objective becomes cost minimization. The project's cost of risk is one such cost to be minimized and is one that the client can influence through the selection of the contract provisions assigning risks.

Under a firm fixed-price contract, the expected project cost includes:

1. The contractor's risk-free construction cost
2. The contractor's risk-free overhead and profit
3. A component for contractual risk
4. A component for construction risk
5. A component for the client's contract administration costs.

The total cost of these components may vary substantially depending upon whether the client or the contractor is assigned responsibility for this risk. The sum of

all of the contractor's and client's risk components is minimized by assigning the risk to the party who is best able to assume it.

Erikson offers three methods of sharing or assigning risks under a firm fixed-price contract.

(a) Percentage Basis

Under this method, the client assumes a percentage of the damages resulting from a particular risk exposure, while the contractor retains a smaller share. This reduces the contractor's contingency, since there is less likelihood of the contractor incurring a catastrophic loss. The advantage of this method over complete risk assumption by client is that the contractor's share helps maintain the contractor's incentive to mitigate losses.

(b) Deductible

This approach is to specify a contractor-assumed deductible amount. For example, a ¢20 million deductible requires the contractor to assume the risk for losses less than ¢20 million. The portion of a loss exceeding the ¢20 million deductible would be assumed by the client. A contractor-assumed deductible frees the client from small claims which are costly to process, and provides the contractor with an incentive to manage the construction risks. However, the contractor is not given an incentive to try to mitigate the client's losses after the losses have surpassed the deductible. This method should also reduce contractor contingencies, since it protects the contractor from losses in excess of the deductible.

(c) **Combined Method**

Another method is to specify a small contractor deductible amount above which risks are shared on a percentage basis, example, 80% client to 20% contractor. This risk assignment combines the advantages of the earlier methods and results in an inconsequentially small risk premium .

The determination of the actual percentages and the deductible amount to be used should consider:

1. Which party, if any, can control or influence the risk?
2. Which party is in the best position to financially bear the risk?
3. What is the administrative cost of processing claims?
4. What is the probability of occurrence and the possible damages associated with the risk exposure.
5. Is this risk dependent or independent of other risks which could have severe consequences on the project?

The new risk-sharing clauses could be incorporated into the client's conventional contract by including them as alternates.

4.5.1 Risk-Sharing Model

Erikson (1979) modeled the cost effects of varying risk shares by applying the principles of utility theory.

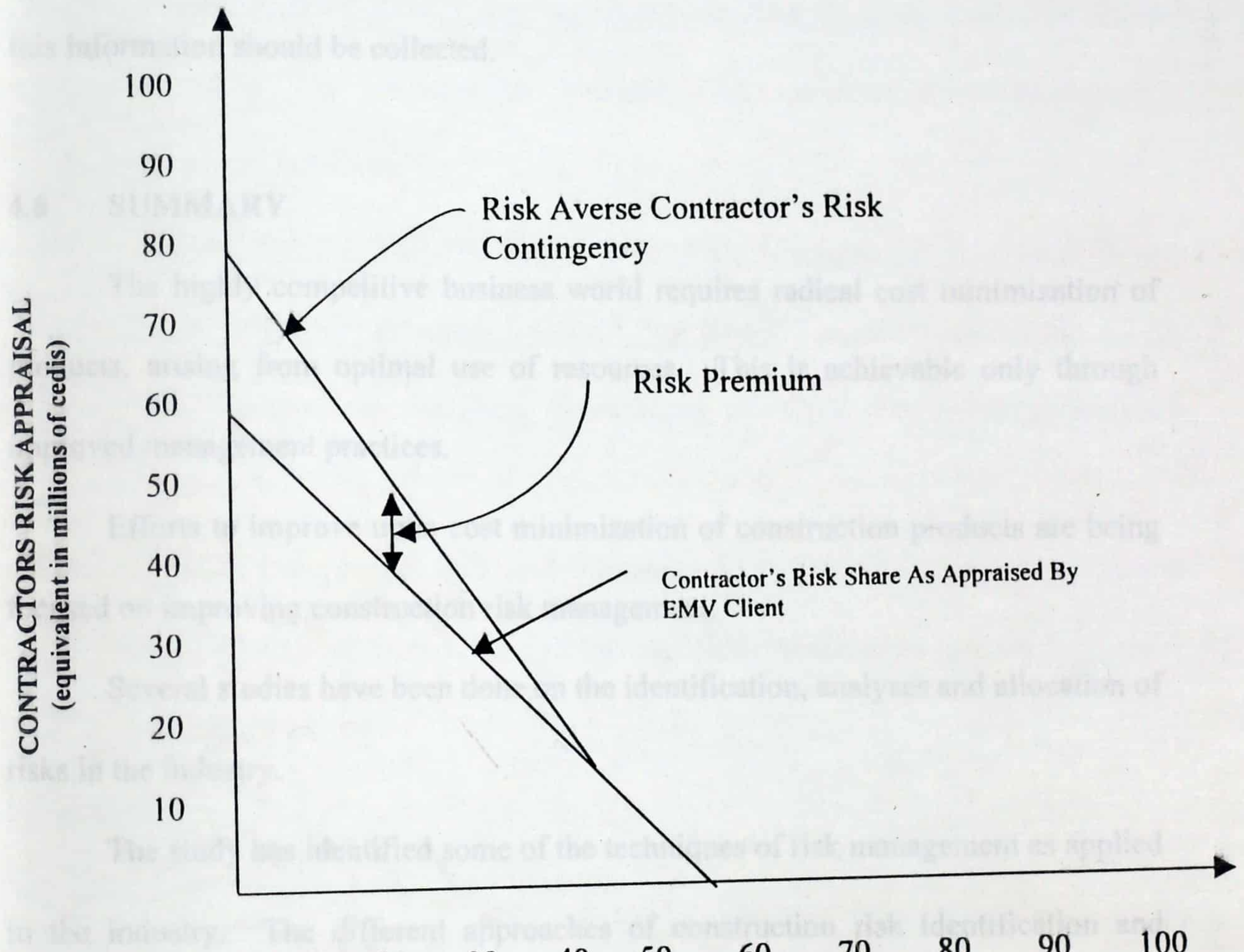
The model's fundamental assumption is that a contractor attempts to maximize utility and is indifferent between different risk assignments for which the contractor's utility remains the same. The contractor is risk averse within a certain range.

Expected Utility Value (EUV) = $P(U\{x_i\} \times P\{x_i\})$ ..... (1)

It is also assumed that the client is risk neutral and behaves in an expected monetary value, EMV, manner.

EMV = $P(x_i \times P\{x_i\})$

Figure 4.3 - Risk appraisal as a Function of EMV Owners Risk Share



Source: Erikson (1979)

The information required and assumption to be made are:

i) Anticipated risk-free costs

ii) Mark-up at a percentage of risk-free costs

iii) Probability of a stream of damage

iv) Probability of a no-stream of damage

v) Mean damage given a stream of damage occurs.

Contractors, after careful consideration of their historical costs and of the specific circumstances of the project at hand, are in the best position to decide how this information should be collected.

4.6 SUMMARY

The highly competitive business world requires radical cost minimization of products, arising from optimal use of resources. This is achievable only through improved management practices.

Efforts to improve upon cost minimization of construction products are being focused on improving construction risk management.

Several studies have been done on the identification, analyses and allocation of risks in the industry.

The study has identified some of the techniques of risk management as applied in the industry. The different approaches of construction risk identification and analysis techniques with respect to risk sharing should be found to be compatible in specific aspects to the Ghanaian industry.

It is therefore the intention of this dissertation to use these techniques to identify the risks important to the Ghanaian industry and how participants want them to be shared.

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CHAPTER FIVE

RESEARCH METHODOLOGY AND DATA COLLECTION

5.1 INTRODUCTION

In this chapter, the strategies of the study and the type of data used in the study are discussed broadly.

5.2 RESEARCH STRATEGIES/PROCEDURE

The procedure for this research has taken the form of a literature review and a survey using the questionnaire approach and supplemented with structured interviews.

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, to gather from current journals, libraries and related textbooks and materials from industry on the subject.

In the second phase a questionnaire survey was conducted on the major risk factors as seen by participants in the industry. This survey provides data and opinions on methods and preferences of risk sharing in the industry.

Finally, the results of the questionnaire were analyzed using statistical techniques and the results used to form a basis for recommending a suitable mechanism for risk sharing and areas for further research.

5.3 DATA COLLECTION

5.3.1 Primary Data

The source of the primary data or raw data was in the form of a postal questionnaire and structured interviews, designed to gather a large volume of data from project consultants, clients and top management of classes D1 and D2 building contractors. This industry-wide survey was also designed to cover all the ten administrative regions of Ghana within the limited time and financial constraints. The primary function of the survey was to collect information that can be analyzed, and inferences made to produce conclusions about risk identification, analysis and sharing decisions.

5.3.2 Secondary Data

1. Secondary data which involves information from published texts were used to complement the primary data.
2. Random numbers were selected from a statistical table according to a preset criteria (i.e. begin from right to left, top to bottom, take one row and leave the other, etc.)
3. The random numbers selected were then compared with the number on the list, and accordingly certain contractors were selected.

There were 96 Class D1 and 446 Class D2 contractors, giving a total of 542 for D1 and D2 contractors. The sample sizes were determined by the use of the following formula: (Kish, 1965) (1).

$$n = n^1/(1 + n^1/N)$$

where,

n = sample size

n^1 = S^2 / V^2

N = total population

V = the standard error of sampling distribution = 0.05

S = the maximum standard deviation of the population elements.

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

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

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

5.3.3 Sampling

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

- **Contractors**

The samples were selected from the 1998 list of Classified Building Contractors prepared by the Ministry of Works and Housing (See Appendix 2). The study was limited to contractors in Classes D1 and D2.

The choice of the sample was made on the basis that they are the well-established firms and by virtue of the type and size of the projects they handle, they are exposed to the greatest risks. Most of the contractors in classes D3 and D4 usually do not have well defined organizational structures and

normally are involved in simple and small-scale projects with short durations which are often times not particularly risky.

The procedures that were followed to ensure the randomness of the sample are as follows:

1. A list which had all the classified contractors whose registration was valid as at September 1998 was sequentially numbered.

2. Substituting N = 542, in the Kish formula a sample size of 84 was introduced.

- **Consultants**

Three main kinds of consultancy firms supplied the data. They are Architectural, Civil Engineering and Quantity Surveying firms. The samples were selected from the list of firms obtained from the directories of the relevant professional institutes or institutions (See Appendix 3).

The random sampling technique used in the selection of the contractors was adopted.

There were 65 Architectural firms, 47 Civil Engineering firms and 39 Quantity Surveying firms, giving a total of 151.

Substituting N = 151, in the Kish formula, a sample size of 60 was introduced.

- **Clients**

These comprise public or private individuals or organizations that commission and finance the construction project. The clients employ the consultants and the contractors. The study was compiled from the Government Ministries, Departments and Agencies, Churches, Universities and non-governmental organizations with construction project management units in operation (See Appendix 4).

Again, the random sampling technique was used.

Substituting N = 20, in the Kish formula, a sample size of 17 was introduced.

Due to the general apathy in the industry towards the response to questionnaires, the sample sizes were increased, thus; Contractors to 250; Consultants to 151 to include all firms on the list and the clients to 20, to reach all on the list. This was done to enable statistically acceptable responses to be received to accommodate the anticipated shortfall in response. This assumes a response rate of 35% for the Contractors, 40% for the Consultants and 85% for the Clients.

5.3.4 Developing the Questionnaire

To achieve the objectives of the study, the questionnaire, with closed-ended questions, were designed to find out the background and experience of the respondents in the industry. The respondents were asked to give information on their company's procedure for risk identification and the method used by the company to value allowances for risks and uncertainties in cost estimation.

A list containing 34 risk factors in construction identified during the literature

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search was provided. They were to indicate the party the various conditions of contract in current use assign these risks to - where the risks lay; to client or to contractor? Then a scale of 1 to 5 was provided to measure the level of importance of each factor to the respondent, where '1' means not important and '5' means extremely important.

Again, respondents were asked to indicate which party the preferred risks, addressed by 23 clauses in the Ghana Government Conditions of Contract for Building Works, be allocated to. A numerical scale was provided assigning risk apportionment options. The choices for risk allocation ranged from 100% risk assumed by the client (-5) through degrees of risk sharing between parties, to 100% assumed by the contractor (+5), zero (0) implied "equally shared by both parties". (See Appendix 1 for detailed format of the questionnaire).

5.3.5 Distribution of Questionnaire

Most of the questionnaires were addressed and sent to the respondents through the Regional Consultants of the Architectural and Engineering Services Ltd., in all the ten (10) administrative regions of Ghana. Some of these were subsequently followed up by personal visits. A good number were also distributed personally by the researcher.

In order to get a high response, addressed and stamped envelopes for the return of the answered questionnaire were added. The respondents were asked to remain anonymous.

REFERENCE

1. Kish, L., (1965), Survey Sampling, John Wiley and Sons Inc., New York.

CHAPTER SIX

SURVEY RESULTS AND DISCUSSION

6.1 ANALYSIS OF RESPONSE

The survey questionnaires were distributed to a cross section of participants in the construction industry. They were drawn from the following contract "groups" as indicated on the questionnaire format (Appendix 1).

- Contractors
- Consultants
- Clients

♦ **The Contractors**

Out of a total of 250 questionnaires sent out to various classes D1 and D2 contractors, 95 were completed and returned properly filled.

The responses received in the survey are indicated in Table 6.1

Table 6.1 - Contractors' Response to Survey Question 2

Class	Issued	Returned	Percentage Returned
D1	82	33	40.2
D2	168	62	36.9
Total	250	95	38.0

- **The Consultants**

Out of a total of 151 questionnaires sent out to the consultants, that is 65 Architectural, 47 Civil Engineering and 39 Quantity Surveying firms, 61 were properly completed and returned.

Table 6.2 shows the survey response.

Table 6.2 - Consultants' Response to Survey Question 2

Consultancy Firms	Issued	Returned	Percentage Returned
Architectural	65	21	32.3
Civil Engineering	47	17	36.2
Quantity Surveying	39	23	59.0
Total	151	61	40.4

- **The Clients**

A total of 20 questionnaires were sent out to various clients in the building construction industry. Of these, 9 were returned. One of the respondents failed to complete the questionnaire fully. This response was rejected and not considered for analysis.

Table 6.3 shows the survey response.

Table 6.3 - Clients' Response to Survey Question 2

	Issued	Returned	Percentage Returned
Clients	20	8	40.0

Table 6.4 shows the response to question 3.

Table 6.4 - Location of Firms

REGION	Clients		Consultants		Contractors	
	Issued	Returned	Issued	Returned	Issued	Returned
GREATER ACCRA	17	5	135	48	80	26
ASHANTI	1	1	10	8	45	19
VOLTA	0	0	0	0	15	5
CENTRAL	1	1	0	0	20	7
WESTERN	0	0	2	2	15	6
BRONG AHAFO	0	0	1	1	10	5
EASTERN	0	0	1	1	20	9
NORTHERN	1	1	2	1	15	7
UPPER WEST	0	0	0	0	15	5
UPPER EAST	0	0	0	0	15	6
TOTAL	20	8	151	61	250	95

Table 6.4 shows that majority of the clients, consultants and contractors are located in the Greater Accra Region. In the case of the clients, they have their head

offices in Accra and have branch offices in the regions.

The consultants on the other hand, have their offices in Accra but carry out their consultancy services throughout the country even though they do not have branch offices in the regions. (See Appendix 3).

Table 6.4a - Overall Survey Response Levels

Group	Issued	Returned	Percentage Returned
Clients	20	8	40.0
Consultants	151	61	40.4
Contractors	250	95	38.0
Total	421	164	39.0

The overall response of 39% was encouraging considering the timing of the survey, starting before the Easter holidays when most people were going on holidays and the general lukewarm attitude of construction participants to questionnaires.

6.2 RESULTS ANALYSIS AND DISCUSSION

The responses to the questionnaire (Appendix 1) were analyzed and discussed. Inferences were then made.

6.2.1 Respondents Job Title

Table 6.5 shows response to question 1.

Table 6.5 - Job Title/Position of Respondents in Firms

Respondents Job Title/ Position	Client		Consultant		Contractor		Overall % Response
	No. of responses	% Response	No. of responses	% Response	No. of responses	% Response	
Managing Director	1	12.5	1	1.6	14	14.7	9.8
Project Manager	1	12.5	2	3.3	31	32.6	20.7
Architect	2	25.0	19	31.1	11	11.6	19.5
Quantity Surveyor	2	25.0	22	36.1	16	16.8	24.4
Civil Engineer	1	12.5	17	27.9	10	10.6	17.1
Others	1	12.5	0	0.0	13	13.7	8.5
Total	8	100.0	61	100.0	95	100.0	100.0

The survey shows that 9.8 percent of the questionnaires were filled by Managing Directors, 20.7 by Project Managers, 19.5 percent by Architects, 24.4 percent by Quantity Surveyors, 17.1 percent by Civil Engineers and 8.5 percent by others.

These show that the bulk of the questionnaire was handled by people who deal directly with contracts and for that matter, have experience in contract preparation and implementation. The questionnaire was designed to be completed by respondents who are routinely involved in contract administration and therefore habitually interpreting contract clauses.

This indicates that the target was achieved.

6.2.2 Experience of Firms

Table 6.6 shows response to question 4.

Table 6.6 - Experience in the industry of respondent firms

Experience	Clients		Consultants		Contractors		Overall Percentage
	Number	%	Number	%	Number	%	
Less than 2 yrs.	0	0.0	5	8.2	7	7.4	4.3
2 –5 yrs.	0	0.0	14	23.0	19	20.0	20.1
More than 5 yrs.	8	100.0	42	68.9	67	72.6	71.3
Total	8	100.0	61	100.0	95	100.0	100.0

The survey shows that the respondent firms have quite a reasonable experience in the construction industry. More than 20 percent have 2 – 5 years experience and over 70% have more than 5 years experience.

From the job titles or positions of respondents (Table 6.5) and their firms' experience in the industry (Table 6.6), it can be inferred that the sample provides a realistic profile, which can be used to represent the general practices of risk identification and risk sharing in the construction industry in Ghana.

6.2.3 Company Procedure for Risk Identification

Table 6.7 shows response to question 5.

Table 6.7 - Procedure for Risk Identification

PROCEDURE	Clients		Consultants		Contractors		Overall % Response
	No. of responses	% Response	No. of responses	% Response	No. of responses	% Response	
By circulating information about tender to team of persons	0	0.0	1	1.6	2	2.1	1.8
Judgement of the Estimator/Quantity Surveyor only	2	25.0	21	34.4	19	20.0	25.6
Opinion of 1 or 2 experienced persons within the company	1	12.5	15	24.6	21	22.1	22.0
Opinion of external consultants	2	25.0	4	6.6	19	20.0	15.9
Brainstorming	1	12.5	12	19.7	9	9.5	12.8
Tender review by Management	2	25.0	5	8.2	17	17.9	15.2
Discussions with Client/Contractor	0	0.0	2	3.3	3	3.1	3.0
None	0	0.0	1	1.6	5	5.3	3.7
Total	8	100.0	61	100.0	95	100.0	100.0

- Table 6.7 lists the results of the company procedure for the process of risk identification. As implied in the results, only 1.8 percent of respondents circulate information about tender to a team of persons. The judgement of the estimator or quantity surveyor forms 25.6 percent. This procedure is used by 25 percent of clients, 34.4 percent of consultants and 20 percent contractors.

The use of the opinion of experienced persons within the company has a result of 22 percent made up of clients – 12.5 percent, consultants – 24.6 percent and contractors – 22.1 percent.

- The opinion of external consultants resulted in 15.9 percent overall with a response of 25 percent from clients, 6.6 percent from consultants and 20 percent contractors.
- The use of brainstorming and tender review by management resulted in 12.8 percent and 15.2 percent respectively.
- 3.3 percent of consultants have discussions with either the client or contractor and 3.1 percent of contractors have discussions with the client. The clients' response show no discussions with contractor at all. The overall response is 3.0 percent.
- Zero (0) percent of clients, 1.6 percent of consultants and 5.3 percent of contractors have no procedure for risk identification. Respondents using no procedure have an overall of 3.7 percent.
- Circulation of information, discussions with client/contractor and no procedure have a total overall response of 8.5 percent. This implies that the bulk of respondents, 91.5 percent, use judgement of the estimator/quantity surveyor, opinion of external consultants, brainstorming or review by management. The response rate for each of these falls in the range of 12.8 – 25.6 percent. The results show that within this 12.8 – 25.6 percent range, there is no single or preferred approach by any company. The methods vary by circumstances.

6.2.4 Methods Used to Value Allowances for Risks and Uncertainties in Cost Estimation

Table 6.8 - Responses to Question 6

METHOD	Clients		Consultants		Contractors		Overall % Response
	No. of responses	% Response	No. of responses	% Response	No. of responses	% Response	
No Explicit Allowance	1	12.5	1	1.6	3	3.2	3.1
Guesswork	1	12.5	2	3.3	8	8.4	6.7
Add a contingency sum, which is a fixed percentage figure of the estimate	3	37.5	51	83.6	79	83.1	81.0
Sensitivity Analysis to determine allowance required	2	25.0	5	8.2	3	3.2	6.1
Risk Management process to determine the Allowance required	1	12.5	2	3.3	2	2.1	3.1
Total	8	100.0	61	100.0	95	100.0	100.0

This survey revealed that sensitivity analysis and Risk Management processes are rarely used by respondents to value allowances for risks in the Ghanaian building industry. 6.1 percent and 3.1 percent of respondents respectively use them. Fewer than 12 percent of Ghanaian consultants and a low 6 percent of contractors use these methods. These few firms amongst the respondents, 7 for consultants and 5 for

contractors, might be the consultants working on or with multi-national contractors on the foreign funded projects.

Most of the respondents, 81 percent, used value allowances for risks by simply adding a contingency sum, which is a fixed percentage figure or Lump Sum figure to their estimates. A greater percentage of consultants, 83.6 percent, contractors, 83.1 percent and clients, 37.5 percent, use this method.

Over 11 percent of top Ghanaian contractors give no explicit allowance or use guesswork in allowing for risks.

An overwhelming majority of 90.8 percent of respondents gives no allowance, use guesswork or only add a contingency sum to their estimates. This seems to suggest that majority of project participants do not use rigorous risk appraisal to inform them of the value allowances for risks in their contracts.

These findings reveal that the traditional cost estimation method of making provision against risks by allowing a fixed amount of contingency sum, which is usually a certain percentage of the total cost of works, prevails in the industry in Ghana.

6.2.5 Ranking of Risks Inherent in Construction Contracts

Tables 6.9, 6.10 and 6.11 contain a list of factors that are thought to be inherent in construction contracts.

These factors were ranked in accordance to their importance to clients (Table 6.9), consultants (Table 6.10), and contractors (Table 6.11) in Ghana.

The relative importance indices for the various factors were measured using the following formula:

able 6.9: **Ranking of Risk Factors in Construction Contracts by Clients**

able 6.9 **Shows Responses to Question 7**

	Risk Factors	SCORE					Weigh-ting	Relative Importance Index	Rank
		1	2	3	4	5			
1	Limited Time and Funding for Design and subsurface investigation	0	0	4	2	2	30	0.750	11
2	Design errors: Conflicts, omissions	1	4	2	0	1	20	0.500	29
3	Constructibility (Unusual designs etc.)	1	4	1	1	1	21	0.525	27
4	Materials and workmanship, contradictory specifications and Drawings	1	0	0	3	4	33	0.825	6
5	Limited Contractor Time for bidding	2	3	1	2	0	19	0.475	31
6	Estimating, planning and Bid preparation errors	0	3	3	2	0	21	0.525	27
7	Visit to Site	1	0	5	1	1	25	0.625	20
8	Competitive Environment (the business cycle)	1	0	3	3	1	27	0.675	16
9	Low bid from contractor	1	2	3	2	0	33	0.550	26
10	Contract Administration	0	1	3	3	1	28	0.700	15
11	Degree of Inspection and Compliance	0	1	1	2	4	33	0.825	3
12	Variations (Authority of Consultant)	0	1	0	2	5	35	0.875	2
13	Fluctuations (changes in cost)	0	1	0	3	4	34	0.850	3
14	Disputes	0	0	1	1	6	37	0.975	1
15	Payment of interest on Contractors claims	0	1	3	1	3	30	0.750	11
16	Determination of employment by Client	1	3	3	1	0	20	0.500	29
17	Determination of employment by Contractor	0	0	3	5	0	29	0.725	14
18	Value Added Tax	1	2	2	2	1	24	0.600	23
19	Bonds/Security	0	1	2	1	4	32	0.800	8
20	Injury to persons	1	0	5	1	1	25	0.625	20
21	Injury to property	1	1	3	2	1	25	0.625	20
22	Damages and delays during construction	0	2	0	2	4	34	0.850	3
23	Contractor Failure to enter into contract	0	0	3	1	4	33	0.825	6
24	Non-payment of creditors	0	1	2	1	4	32	0.800	8
25	Interferences from Acts of Clients	3	2	1	2	0	18	0.450	33
26	Use and possession prior to completion	1	4	2	1	0	19	0.475	31
27	Suspension of work by client	2	3	3	0	0	17	0.425	34
28	Weather Variations	0	0	4	1	3	33	0.775	10
29	Environmental Protection	1	2	3	1	1	23	0.575	20
30	Health and Safety	1	2	3	1	1	23	0.575	24
31	Labour (Significant increment in wages, skill)	0	1	3	1	3	30	0.750	11
32	Supervision (contractors' personnel)	1	1	2	2	2	27	0.675	16
33	Sub-contractors	2	0	2	2	2	26	0.650	18
34	Utilities (Electricity/Telephone/Water)	1	1	2	3	1	76	0.650	18

Table 6.10: Ranking of Risk Factors in Construction Contracts by Consultants

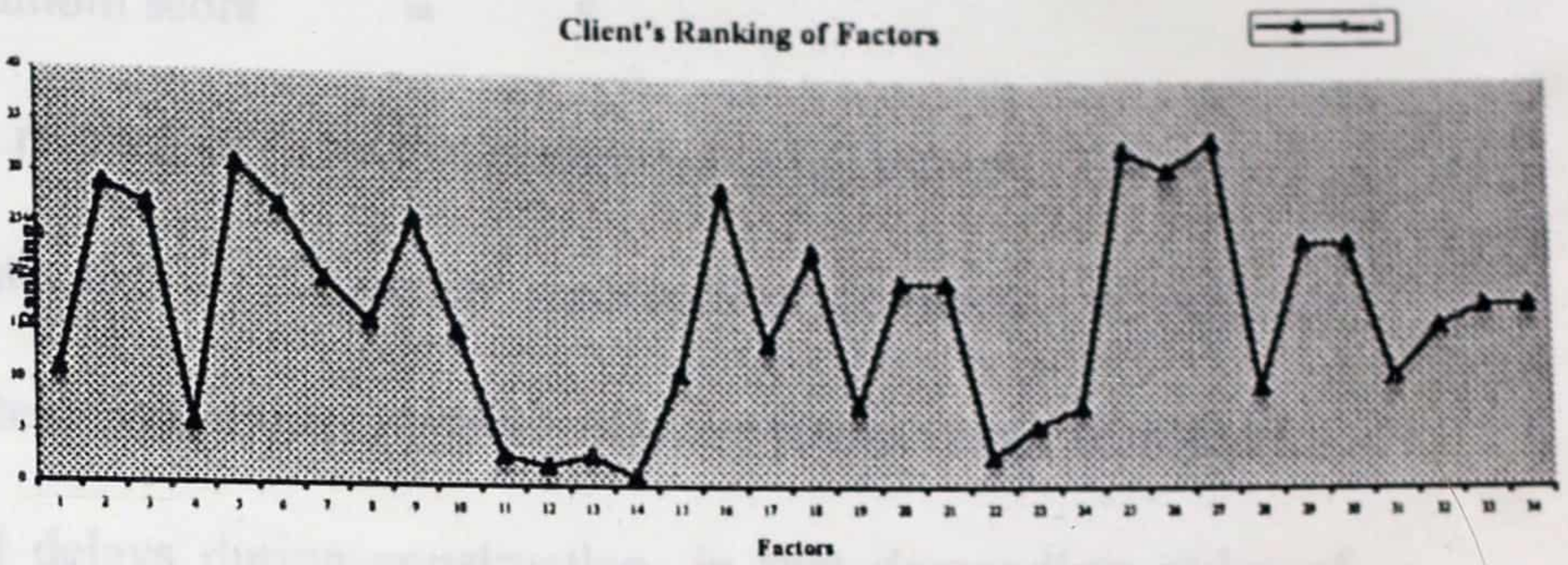
		SCORE					Weighting	Relative Importance Index	Rank
		1	2	3	4	5			
1	Limited Time and Funding for Design and subsurface investigation	1	2	3	38	17	251	0.816	2
2	Design errors: Conflicts, omissions	3	8	19	26	5	205	0.672	20
3	Constructibility (Unusual designs etc.)	2	7	24	23	5	205	0.672	20
4	Materials and workmanship, contradictory specifications and Drawings	0	3	14	39	5	229	0.750	6
5	Limited Contractor Time for bidding	4	13	10	25	9	205	0.672	20
6	Estimating, planning and Bid preparation errors	0	2	31	24	4	213	0.698	15
7	Visit to Site	0	12	17	24	8	211	0.692	18
8	Competitive Environment (the business cycle)	0	9	21	27	4	209	0.685	19
9	Low bid from contractor	1	4	28	21	7	212	0.695	17
10	Contract Administration	1	8	10	40	2	217	0.712	7
11	Degree of Inspection and Compliance	1	1	3	37	19	255	0.836	1
12	Variations (Authority of Consultant)	2	5	6	38	10	232	0.761	4
13	Fluctuations (changes in cost)	2	6	5	38	10	213	0.757	5
14	Disputes	1	4	3	40	13	243	0.797	3
15	Payment of interest on Contractors claims	0	16	28	12	5	189	0.620	26
16	Determination of employment by Client	1	9	19	21	11	215	0.705	10
17	Determination of employment by Contractor	1	13	15	17	15	215	0.705	10
18	Value Added Tax	0	27	31	3	0	159	0.521	30
19	Bonds/Security	7	10	29	15	0	174	0.571	28
20	Injury to persons	0	20	36	5	0	168	0.551	29
21	Injury to property	0	24	37	0	0	159	0.521	30
22	Damages and delays during construction	3	8	15	22	13	217	0.712	7
23	Contractor Failure to enter into contract	2	11	16	15	17	217	0.712	7
24	Non-payment of creditors	0	13	29	18	1	190	0.623	23
25	Interferences from Acts of Clients	1	10	18	21	11	214	0.702	14
26	Use and possession prior to completion	10	38	13	0	0	125	0.410	34
27	Suspension of work by client	1	12	16	18	14	215	0.705	10
28	Weather Variations	0	14	17	14	16	215	0.705	10
29	Environmental Protection	0	31	24	6	0	158	0.518	32
30	Health and Safety	0	35	17	9	0	157	0.515	33
31	Labour (Significant increment in wages, skill)	7	7	23	20	4	190	0.623	23
32	Supervision (contractors' personnel)	4	9	25	22	1	190	0.623	23
33	Sub-contractors	0	2	31	24	4	213	0.698	15
34	Utilities (Electricity/Telephone/Water)	4	15	20	15	7	189	0.620	26

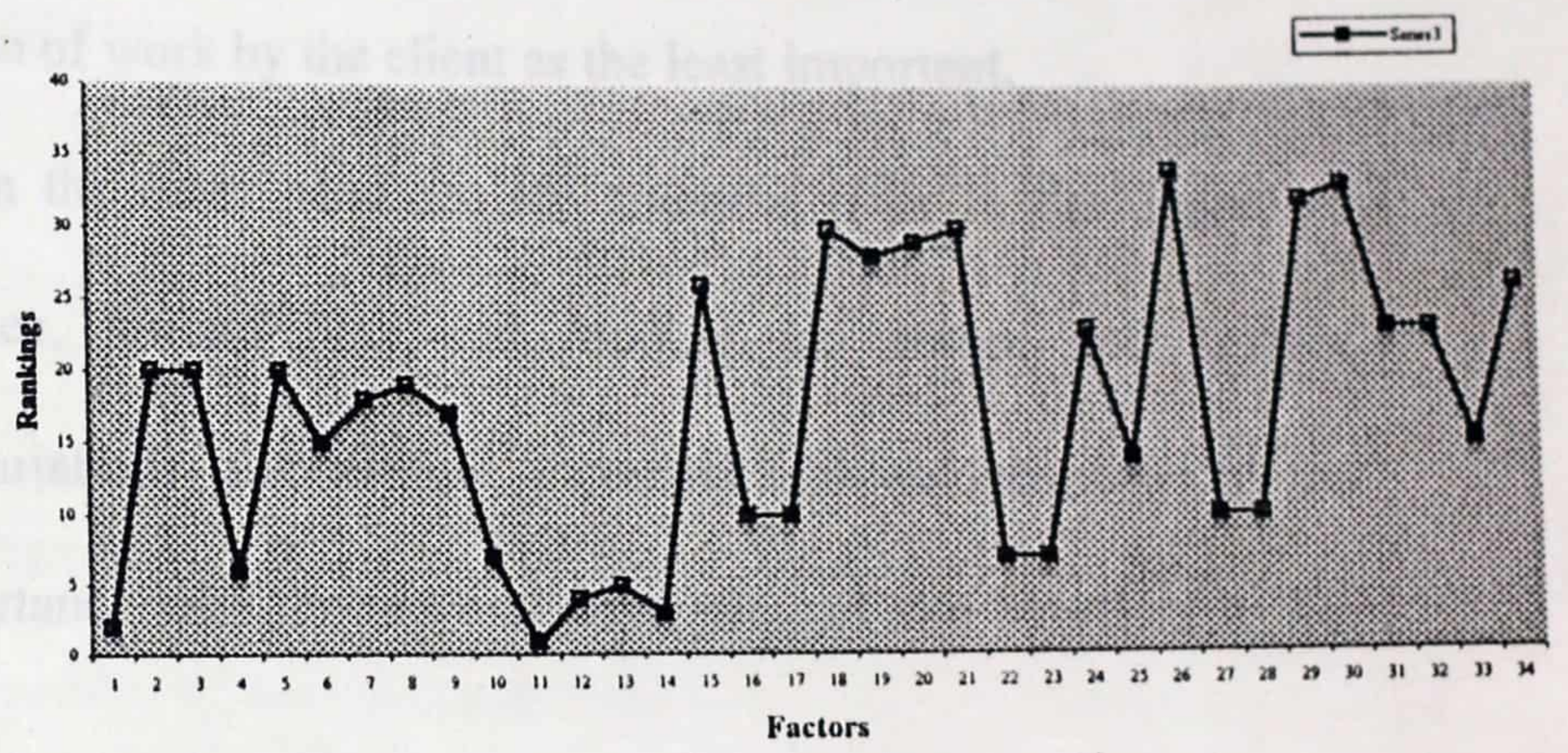
ble 6.11: **Ranking of Risk Factors in Construction Contracts by Contractors**

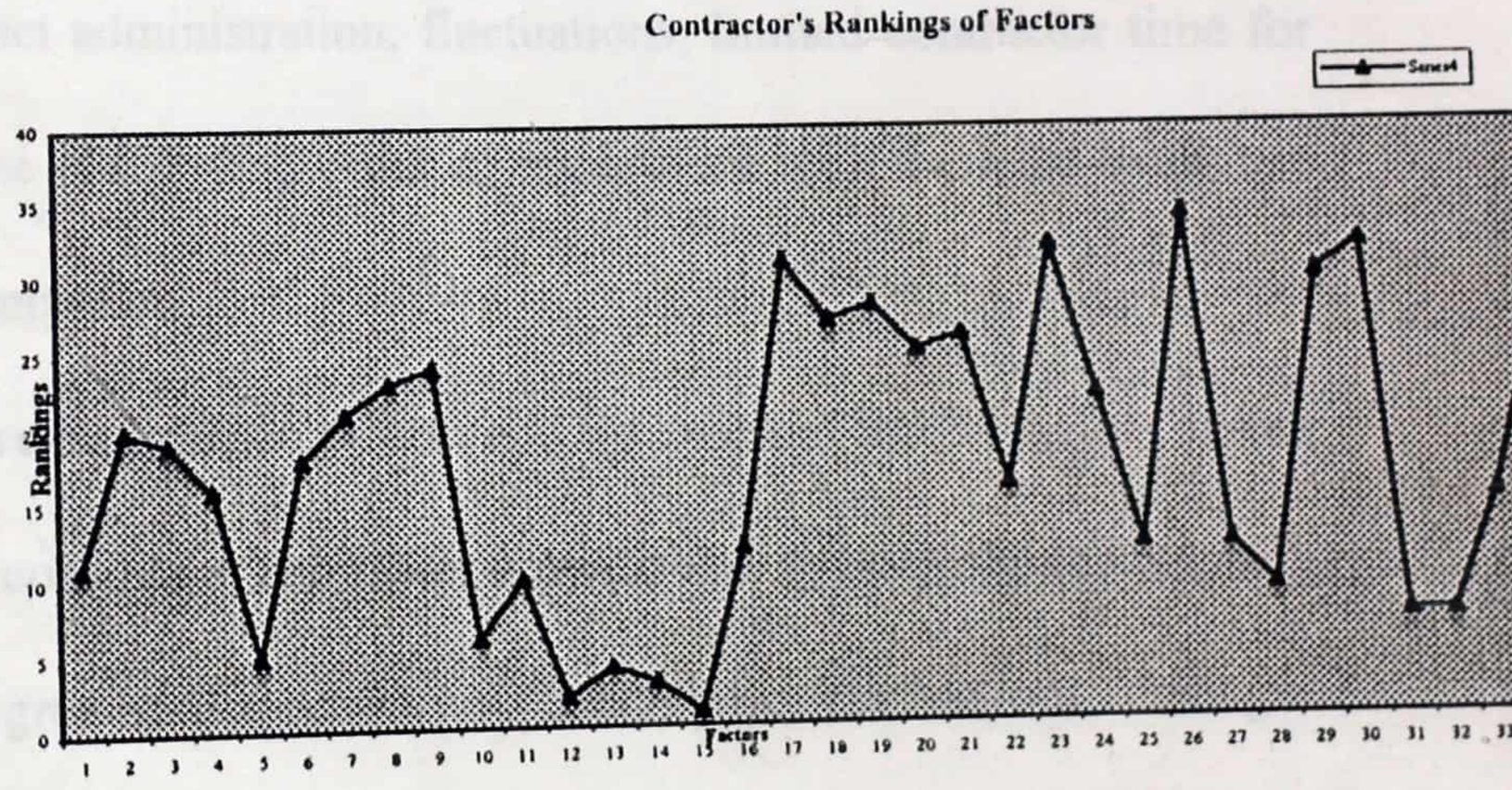
		SCORE					Weigh-ting	Relative Importance Index	Rank
		1	2	3	4	5			
1	Limited Time and Funding for Design and Subsurface Investigation	0	6	20	23	46	394	0.830	11
2	Design Errors: Conflicts, Omissions	3	5	18	26	43	386	0.813	20
3	Constructibility (Unusual designs etc.)	4	10	12	17	52	388	0.817	19
4	Materials and workmanship, contradictory Specifications and Drawings	2	6	18	23	46	390	0.821	16
5	Limited Contractor Time for bidding	0	7	9	35	44	401	0.844	5
6	Estimating, planning and Bid preparation errors	0	2	18	44	31	389	0.819	18
7	Visit to Site	3	5	19	25	43	385	0.811	21
8	Competitive Environment (the business cycle)	10	10	7	40	28	351	0.739	23
9	Low bid from contractor	9	12	11	39	24	342	0.720	24
10	Contract Administration	0	6	19	19	51	400	0.842	6
11	Degree of Inspection and Compliance	0	10	17	16	52	395	0.832	10
12	Variations (Authority of Consultant)	0	10	3	23	59	416	0.876	2
13	Fluctuations (changes in cost)	0	11	2	35	47	403	0.848	4
14	Disputes	0	9	8	30	48	402	0.846	3
15	Payment of interest on Contractors claims	0	0	1	11	83	462	0.973	1
16	Determination of employment by Client	0	4	23	25	43	392	0.825	12
17	Determination of employment by Contractor	10	15	19	36	15	316	0.665	31
18	Value Added Tax	9	14	19	33	20	326	0.686	27
19	Bonds/Security	10	13	21	30	21	324	0.682	28
20	Injury to persons	8	12	25	28	22	329	0.693	25
21	Injury to property	8	14	20	33	20	328	0.619	26
22	Damages and delays during construction	1	7	19	22	46	390	0.821	16
23	Contractor Failure to enter into contract	12	13	20	33	17	315	0.663	32
24	Non-payment of creditors	6	6	19	25	39	370	0.779	22
25	Interferences from Acts of Clients	0	7	20	22	46	392	0.825	12
26	Use and possession prior to completion	12	13	20	34	16	314	0.661	34
27	Suspension of work by client	0	6	21	23	45	392	0.825	12
28	Weather Variations	0	7	18	22	48	396	0.834	9
29	Environmental Protection	9	12	24	36	14	319	0.672	30
30	Health and Safety	10	13	21	35	16	315	0.663	32
31	Labour (Significant increment in wages, skill)	0	6	19	21	49	398	0.838	7
32	Supervision (contractors' personnel)	0	6	19	21	49	398	0.838	7
33	Sub-contractors	1	4	22	24	44	391	0.823	15
34	Utilities (Electricity/Telephone/Water)	10	14	20	29	22	324	0.682	28

ors	Clients Rank	Consul't Rank	Contr't Rank
	11	2	11
	29	20	20
	27	20	19
	6	6	16
	31	20	5
	27	15	18
	20	18	21
	16	19	23
	26	17	24
0	15	7	6
1	3	1	10
2	2	4	2
3	3	5	4
4	1	3	3
5	11	26	1
6	29	10	12
7	14	10	31
8	23	30	27
9	8	28	28
20	20	29	25
21	20	30	26
22	3	7	16
23	6	7	32
24	8	23	22
25	33	14	12
26	31	34	34
27	34	10	12
28	10	10	9
29	24	32	30
30	24	33	32
31	11	23	7
32	16	23	7
33	18	15	15
34	18	26	28

. 6.1
ative Importance Rankings of Risk
tors







Relative Importance Index (RII) = $\Sigma W/(S \times N)$

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.(1)

The results indicate that in Ghanaian construction contracts, clients see potential risks in disputes, variations, degree of inspection and compliance, fluctuations, damages and delays during construction, in that descending order of importance with suspension of work by the client as the least important.

The consultants on the other hand see the potential risks in the degree of inspection and compliance, limited time and funding for design and surface investigation, disputes, variations, fluctuations, materials and workmanship in the descending order of importance with the use and possession of site by client as the least important.

The contractors see the potential risks in payment of interest of claims, variations, disputes, contract administration, fluctuations, limited contractor time for bidding and similarly in the descending order of importance with the least being use and possession prior to completion.

Studying the relative importance indices and the ranks of the 34 factors across the groupings – the client, consultant, contractor – reveal that some of the factors such as disputes, variations, degree of inspection and compliance, fluctuations, damages and delays, materials and workmanship have close rank orders and relative importance indices.

Again, factors which were chosen to be less risky in order of importance, such as use and possession prior to completion, environmental protection and health and safety also have high but close rank orders.

6.2.6 Agreement Analysis (Concordance Test)

To investigate the agreement of the rank correlation between the respondents, a non-parametric statistical method, the Kendall test for concordance, W, between the clients, consultants and contractors was measured using the formula:

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

$$0.0 \leq W \leq 1.0$$

where,

k = the number of sets of ranking

n = the number of factors being ranked

R = average of the ranks assigned to the n^{th} 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 rank assigned by an individual judge to one factor.(2)

Table 6.12 shows the values for the calculation of W.

k = 3; n = 34; R = 17.09

$\sum_{i=1}^{n} (R_i - R)^2$ = 2068.80

$n(n^2 - 1)/12$ = $34(34^2 - 1)/12$ = 3272.50

W = 2068.80/3272.50

W = 0.632

The value of the coefficient of concordance, W = 0.632, expresses the degree of agreement amongst the three (3) groups of clients, consultants and contractors in prioritizing risks in construction contracts.

A coefficient of W = 1 indicates a perfect agreement and zero indicates no agreement.

Test of Hypothesis

H_o: Contracting parties vary significantly in their perception of risks in construction contracts.

H_1: A significant correlation exists between clients, consultants and contractors in their perception of risks in construction contracts.

The significance of W, and for that matter the Hypothesis, were tested using the chi- square distribution.

The chi-square value for this statistic is given by $\chi^2 = k(n-1)W$.

This will be approximately distributed as the chi-square distribution with n – 1 degrees of freedom.

The decision rule will be to reject or accept the null hypothesis, H_o, that the three (3) contracting parties vary significantly in their perception of risks in construction contracts. That is, if the value of calculated chi-square (χ^2_{cal}) equals or exceeds that shown by chi-square distribution table (χ^2_{table}) for a particular level of

	Factor	Clients Rank	Consul't Rank	Contr't Rank	Sum	Mean Ri	Difference Ri-R	Overall Rank
1	Limited Time and Funding for Design and subsurface investigation	11	2	11	24	8.00	-9.09	5
2	Design errors: Conflicts, omissions	29	20	20	69	23.00	5.91	57
3	Constructibility (Unusual designs etc.)	27	20	19	66	22.00	4.91	25
4	Materials and workmanship, contradictory specifications and Drawings	6	6	16	28	9.33	-7.76	7
5	Limited Contractor Time for bidding	31	20	5	56	18.67	1.58	18
6	Estimating, planning and Bid preparation errors	27	15	18	60	20.00	2.91	23
7	Visit to Site	20	18	21	59	19.67	2.58	21
8	Competitive Environment (the business cycle)	16	19	23	58	19.33	2.24	20
9	Low bid from contractor	26	17	24	67	22.33	5.24	26
10	Contract Administration	15	7	6	28	9.33	-7.76	7
11	Degree of Inspection and Compliance	3	1	10	14	4.67	-12.42	4
12	Variations (Authority of Consultant)	2	4	2	8	2.67	-14.42	3
13	Fluctuations (changes in cost)	3	5	4	12	4.00	-13.09	3
14	Disputes	1	3	3	7	2.33	-14.76	1
15	Payment of interest on Contractors claims	11	26	1	38	12.67	-4.42	10
16	Determination of employment by Client	29	10	12	51	17.00	-0.09	15
17	Determination of employment by Contractor	14	10	31	55	18.33	1.24	17
18	Value Added Tax	23	30	27	80	26.67	9.58	31
19	Bonds/Security	8	28	28	64	21.33	4.24	24
20	Injury to persons	20	29	25	74	24.67	7.58	29
21	Injury to property	20	30	26	76	25.33	8.24	32
22	Damages and delays during construction	3	7	16	26	8.67	-8.42	6
23	Contractor Failure to enter into contract	6	7	32	45	15.00	-2.09	12
24	Non-payment of creditors	8	23	22	53	17.67	0.58	16
25	Interferences from Acts of Clients	33	14	12	59	19.67	2.58	21
26	Use and possession prior to completion	31	34	34	99	33.00	15.91	34
27	Suspension of work by client	34	10	12	56	18.67	1.58	18
28	Weather Variations	10	10	9	29	9.67	-7.42	9
29	Environmental Protection	24	32	30	86	28.67	11.58	32
30	Health and Safety	24	33	32	89	29.67	12.58	33
31	Labour (Significant increment in wages, skill)	11	23	7	41	13.67	-3.42	11
32	Supervision (contractors' personnel)	16	23	7	46	15.33	-1.76	13
33	Sub-contractors	18	15	15	48	16.00	-1.09	14
34	Utilities (Electricity/Telephone/Water)	18	26	28	72	24.00	6.91	28

significance and degree of freedom, then the null hypothesis, H_o, that the respondents set of ranks are unrelated or independent may be rejected.

In this study, K = 3; n = 34; W = 0.632

χ^2_{cal} = 3(34 - 1)0.632

= 62.57

χ^2_{table} at significance level, $\propto$ = 0.05 and n-1 degrees of freedom = 34-1 = 33

χ^2_{table} = 47.37

$\chi^2_{cal} > \chi^2_{table\ (0.05;33)}$

Since the χ^2_{cal} exceeds the χ^2_{table} at 0.05 level of significance and 33 degrees of freedom, the null hypothesis, H_o, that the three (3) contracting parties vary significantly in their perception of risks in construction contract is rejected. It is therefore concluded that a significant rank correlation exists between clients, consultants and contractors in prioritizing the risk factors in construction contract. There is a good consensus among the groups.

This result agrees with the findings of Ashley (1977) that construction participants as entrepreneurs acknowledge risk as a staple of their industry and confirms Kwakye (1997) statement that "there is no construction project that can be undertaken without an element of risk".

Major Risk Factors Identified

Kendall (1970) suggested that the best estimate of the true ranking of *n* objects is provided where W is significant by the order of various sum of ranks. If one accepts the criteria used by the judges (evidenced by the magnitude and significance

of W), then 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.

The last column of Table 6.12 shows the overall rankings of the mean of the ranks. Table 6.12a gives the list of the ten (10) major risk factors identified by the overall ranking.

Table 6.12a - Major Factors Identified

Item	Risk Factor	Rank
1.	Disputes	1
2.	Variation (Authority of Consultant)	2
3.	Fluctuations (Changes in Cost)	3
4.	Degree of inspection and compliance	4
5.	Limited Time and Funding for Design and subsurface investigation	5
6.	Damages and delays during construction	6
7.	Materials and Workmanship, contradictory specifications and Drawings	7
8.	Contract Administration	8
9.	Weather Variations	9
10.	Payment of interest on contractors' claims	10

Appendix 5 shows comments on these major factors identified.

This result seems to agree on five factors (sub-surface investigation, fluctuations variations, funding and weather variations) and conflict with the other five factors in the study done for the US Department of Transportation (paragraph

4.3.1).

The difference in the results is explained by Ashley (1977) when he stated that "the relative importance of each risk factor, depends on the sector of the construction industry and circumstances peculiar to specific projects" (Ashley, 1977). The US Department of Transport's study was on transit facilities in underground construction and this study is on the building construction sub-sector in Ghana, implying that the sub-sector and circumstances peculiar to the projects are different. For example, site geology and equipment productivity may be the riskiest elements in underground construction in the Civil Engineering sub-sector in the U.S. In the building construction sub-sector in Ghana, on the other hand, disputes, labour productivity and matters relating to payments are the most important risk elements.

6.2.7 Preferred Risk Sharing/Allocation

The clients, consultants and contractors were asked to indicate on a scale their company's preferred allocation of risk. The risk inherent clauses were selected from the Ghana Government Conditions of Contract for Building Works (The Pink Form, 5th Edition, 1988). The scale, developed by Hartman et al (1996), ranges from 100% risk sharing between the parties, to 100% risk assumed by the client (-5) through degrees of risk sharing between the parties, to 100% risk assumed by the contractor (+5), zero (0) implies "equally shared by parties".(3)

Tables 6.13, 6.14 and 6.15 show the response to question 8 by clients, consultants and contractors respectively.

The survey results were analyzed and quantified from two (2) perspectives: risk allocation and risk dispersion - along the procedures suggested by Hartman (1996).

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Risk Allocation - the average (mean) measure for each contract group (client, consultant, contractor) of how respondents preferred risk to be apportioned, as indicated on the risk scale, for each contract clause.

Risk Dispersion - a measure of the spread of preferred apportionment among respondents within a specific contracting group, as indicated on the risk scale, for each contract clause. The standard deviation of results within each group of respondents was used.

le 6.13: Measurement of Preferred Risk Allocation by Clients

m	Clause	Risk Scale/Score							Mean	Standard Deviation	Rank
		-5	-3	-1	0	1	3	5			
	Consultants Instructions (authority of Consultant) (Clause 2)	0	0	3	5	0	0	0	-0.4	1.3	4
2	Statutory Obligation, Notices & Fees (Clause 4)	0	4	1	1	2	0	0	-1.4	1.9	8
3	Setting out of Works (Clause 5)	0	0	1	1	2	3	1	1.9	3.6	14
4	Materials and Workmanship to conform (Clause 6)	0	0	2	4	2	0	0	0.0	1.1	2
5	Assignment and subletting (Clause 9)	0	0	0	0	1	1	6	4.3	11.0	21
6	Ascertainment of Prices for Variation (Clause 10)	0	0	3	5	0	0	0	-0.4	1.1	2
7	Practical completion and Defects Liability (clause 13).	0	0	0	0	0	2	6	4.5	11.2	22
8	Rates of Wages (clause 14)	0	0	1	2	4	1	0	0.8	1.9	8
9	Injury to Persons and Property (clause 15)	0	0	1	1	2	3	1	1.9	2.4	11
10	Insurance (clause 16)	0	1	3	3	1	0	0	-0.8	1.6	6
11	Date for Possession, Completion of Works (Clause 17)	0	0	0	0	3	5	0	2.3	5.6	16
12	Damages for Non-Completion (clause 18)	0	0	0	0	1	2	5	4.0	9.3	19
13	Delay and Extension of Time (clause 19)	0	2	4	1	1	0	0	-1.1	2.6	12
14	Determination by Employer (clause 20)	0	0	0	0	0	3	5	4.3	9.5	20
15	Determination by Contractor (clause 21)	5	0	2	1	0	0	0	-3.4	9.0	18
16	Other Contractors (clause 22,23)	0	0	1	2	3	2	0	1.0	2.3	10
17	Certificates and Payments (clause 26)	1	1	4	2	0	0	0	-1.5	1.7	7
18	Sectional Completion (clause 26)	0	0	3	3	2	0	0	-0.1	1.5	5
19	Loss and Expense Caused by Disturbance (clause 27)	1	3	1	1	2	0	0	-1.6	3.8	15
20	Fluctuations (clause 28)	0	3	3	1	1	0	0	-1.4	3.5	13
21	Gifts, Inducement and Rewards (clause 30)	0	0	0	0	0	1	7	4.8	5.9	17
22	Antiquities (clause 31)	8	0	0	0	0	0	0	-5.0	15.1	23
23	Arbitration (clause 32)	0	0	1	5	2	0	0	0.1	0.9	1

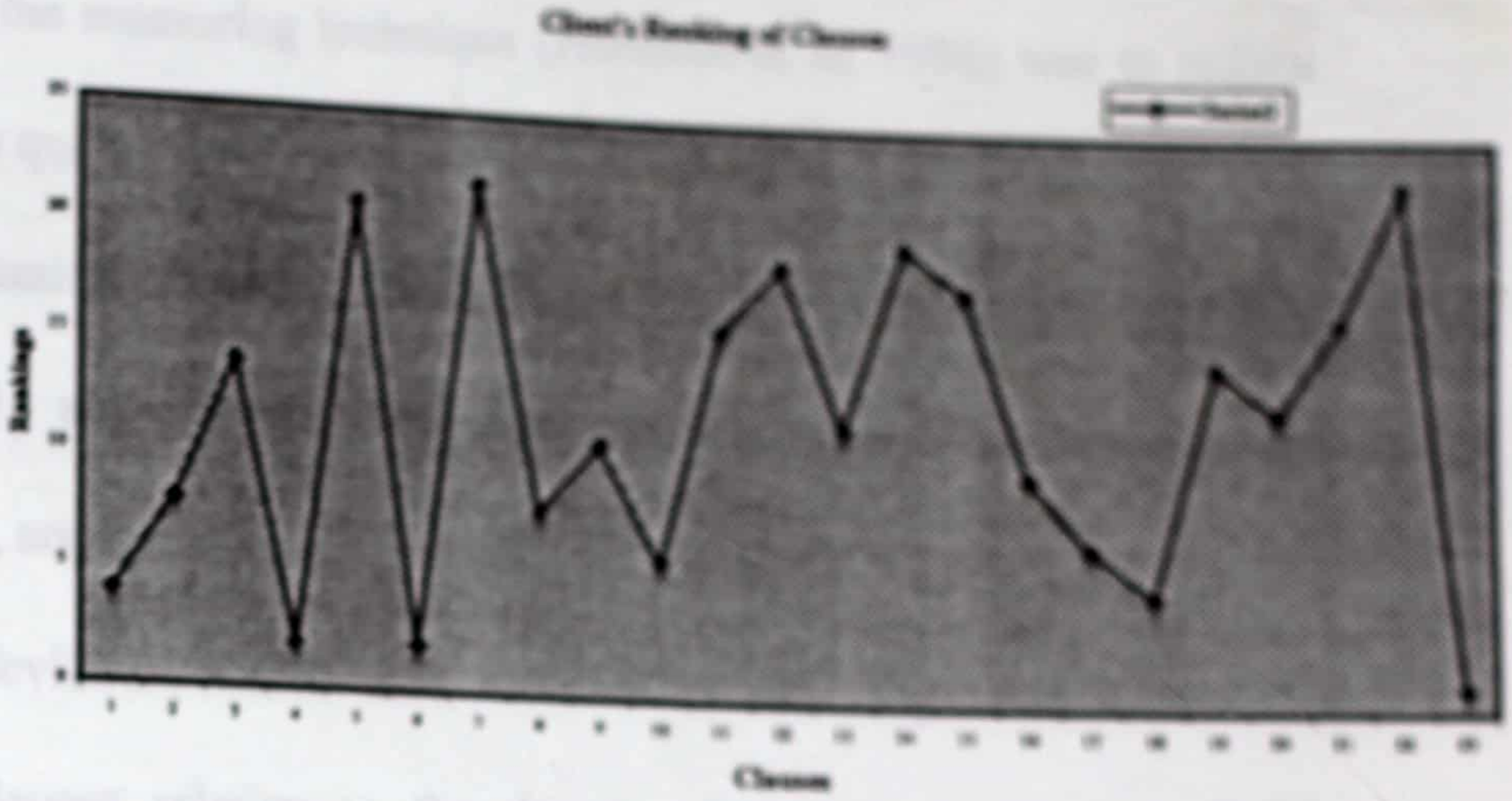
e 6.14: **Measurement of Preferred Risk Allocation by Consultants**

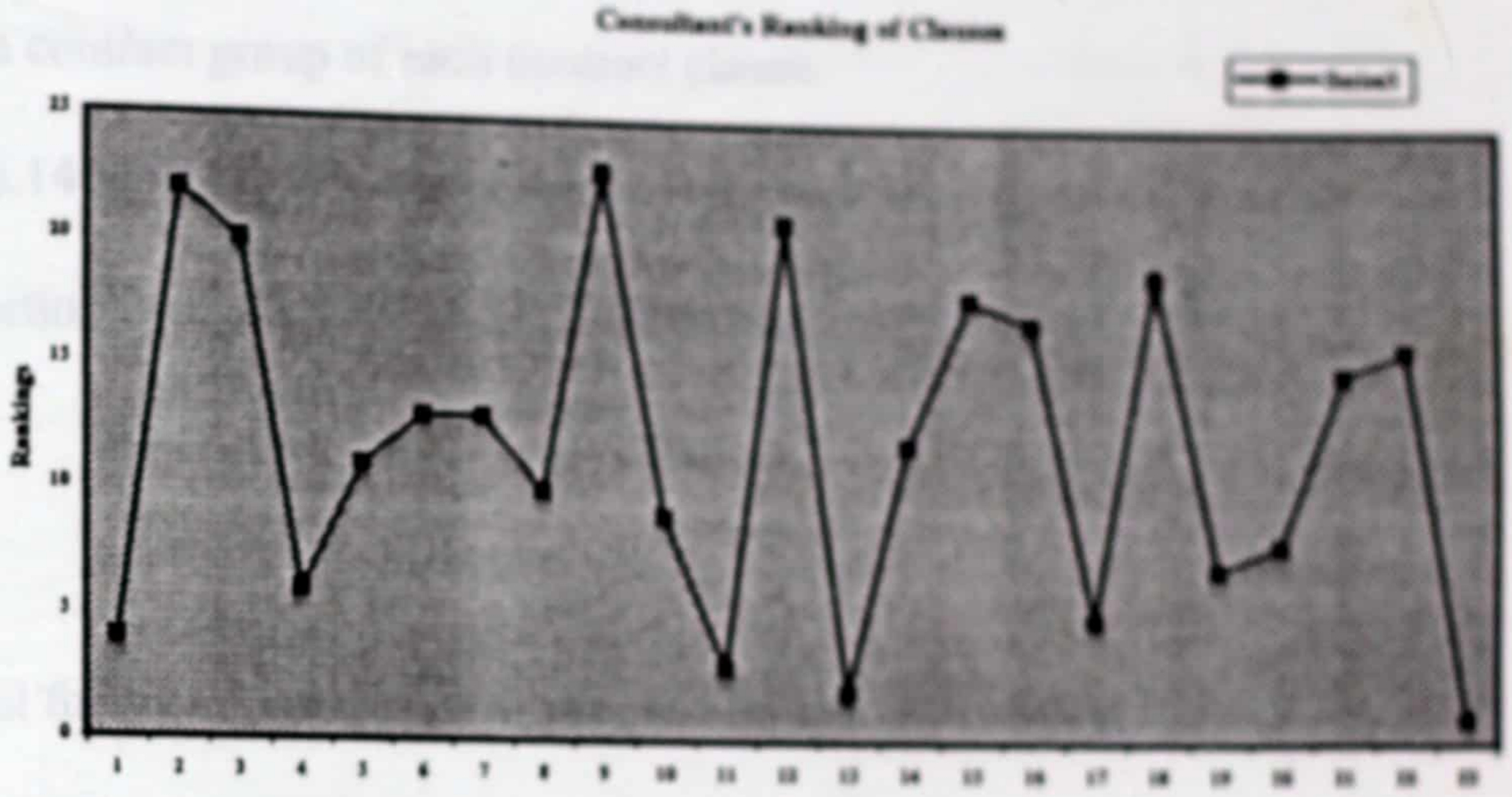
n	Clause	Risk Scale/Score -5	-3	-1	0	1	3	5	Mean	Standard Deviation	Rank
	Consultants Instructions (authority of Consultant) (Clause 2)	0	0	23	30	8	0	0	-0.24	3.1	4
	Statutory Obligation, Notices & Fees (Clause 4)	0	25	8	9	19	0	0	-1.1	9.9	22
	Setting out of Works (Clause 5)	0	0	10	12	16	23	0	1.2	9.1	20
	Materials and Workmanship to conform (Clause 6)	0	0	0	32	29	0	0	0.5	3.7	6
	Assignment and subletting (Clause 9)	0	0	8	23	23	7	0	0.6	5.0	11
	Ascertainment of Prices for Variation (Clause 10)	0	0	0	20	31	10	0	1.0	5.4	13
	Practical completion and Defects Liability (clause 13).	0	0	8	23	17	13	0	0.8	5.4	13
	Rates of Wages (clause 14)	0	0	9	17	35	0	0	0.4	4.6	10
	Injury to Persons and Property (clause 15)	0	0	7	7	15	20	12	2.2	10.9	23
	Insurance (clause 16)	0	8	24	20	9	0	0	-0.6	4.5	9
	Date for Possession, Completion of Works (Clause 17)	0	0	8	31	18	4	0	0.4	2.9	3
	Damages for Non-Completion (clause 18)	0	24	9	10	18	0	0	-1	9.5	21
	Delay and Extension of Time (clause 19)	0	0	7	32	17	4	1	0.4	2.8	2
	Determination by Employer (clause 20)	0	0	0	15	18	22	6	1.9	5.1	12
	Determination by Contractor (clause 21)	1	19	13	12	14	2	0	-0.9	7.6	18
	Other Contractors (clause 22,23)	6	5	7	11	18	9	5	0.3	6.9	17
	Certificates and Payments (clause 26)	1	1	7	30	18	5	0	0.3	3.2	5
	Sectional Completion (clause 26)	1	22	16	12	10	0	0	-1.1	8.9	19
	Loss and Expense Caused by Disturbance (clause 27)	2	3	10	25	14	7	2	0.3	4.0	7
	Fluctuations (clause 28)	4	4	21	17	15	0	0	-0.6	4.4	8
	Gifts, Inducement and Rewards (clause 30)	4	12	16	18	5	4	2	-0.7	-6.0	15
	Antiquities (clause 31)	10	31	5	11	4	0	0	-2.2	6.5	16
	Arbitration (clause 32)	0	0	8	38	15	0	0	0.1	2.2	1

e 6.15: **Measurement of Preferred Risk Allocation by Contractors**

n	Clause	Risk Scale/Score -5	-3	-1	0	1	3	5	Mean	Standard Deviation	Rank
	Consultants Instructions (authority of Consultant) (Clause 2)	4	4	31	42	14	0	0	-0.5	4.2	6
	Statutory Obligation, Notices & Fees (Clause 4)	0	18	23	15	17	22	0	-0.1	9.2	21
	Setting out of Works (Clause 5)	8	7	16	19	11	17	13	0.5	9.8	22
	Materials and Workmanship to conform (Clause 6)	0	3	17	27	35	11	2	0.6	5.4	12
	Assignment and subletting (Clause 9)	0	1	21	38	25	6	5	0.5	4.5	8
	Ascertainment of Prices for Variation (Clause 10)	2	17	20	19	18	12	7	0.1	7.9	18
	Practical completion and Defects Liability (clause 13).	2	1	11	62	15	3	1	0.1	2.4	1
	Rates of Wages (clause 14)	0	5	39	21	24	4	2	-0.1	5.4	11
	Injury to Persons and Property (clause 15)	8	7	15	20	18	20	7	0.4	8.9	20
	Insurance (clause 16)	1	3	15	28	36	12	0	0.5	5.5	13
	Date for Possession, Completion of Works (Clause 17)	23	13	19	28	16	0	0	-1.7	12.5	23
	Damages for Non-Completion (clause 18)	0	0	13	19	39	17	7	1.7	7.4	16
	Delay and Extension of Time (clause 19)	0	0	14	53	28	0	0	0.2	3.2	5
	Determination by Employer (clause 20)	1	1	3	15	45	21	9	1.5	7.8	17
	Determination by Contractor (clause 21)	7	10	40	21	17	0	0	-0.9	6.4	14
	Other Contractors (clause 22,23)	0	5	39	30	25	6	0	-0.1	4.6	10
	Certificates and Payments (clause 26)	0	1	23	59	12	0	0	-0.2	2.6	2
	Sectional Completion (clause 26)	2	1	29	30	31	1	1	-0.1	4.5	8
	Loss and Expense Caused by Disturbance (clause 27)	0	3	29	32	30	1	0	-0.2	2.8	3
	Fluctuations (clause 28)	3	16	19	20	17	13	7	-0.1	7.9	18
	Gifts, Inducement and Rewards (clause 30)	2	2	23	35	24	6	3	0.2	4.4	7
	Antiquities (clause 31)	5	11	23	20	17	13	6	0.1	7.2	15
	Arbitration (clause 32)	0	0	27	54	14	0	0	0.1	3.1	4

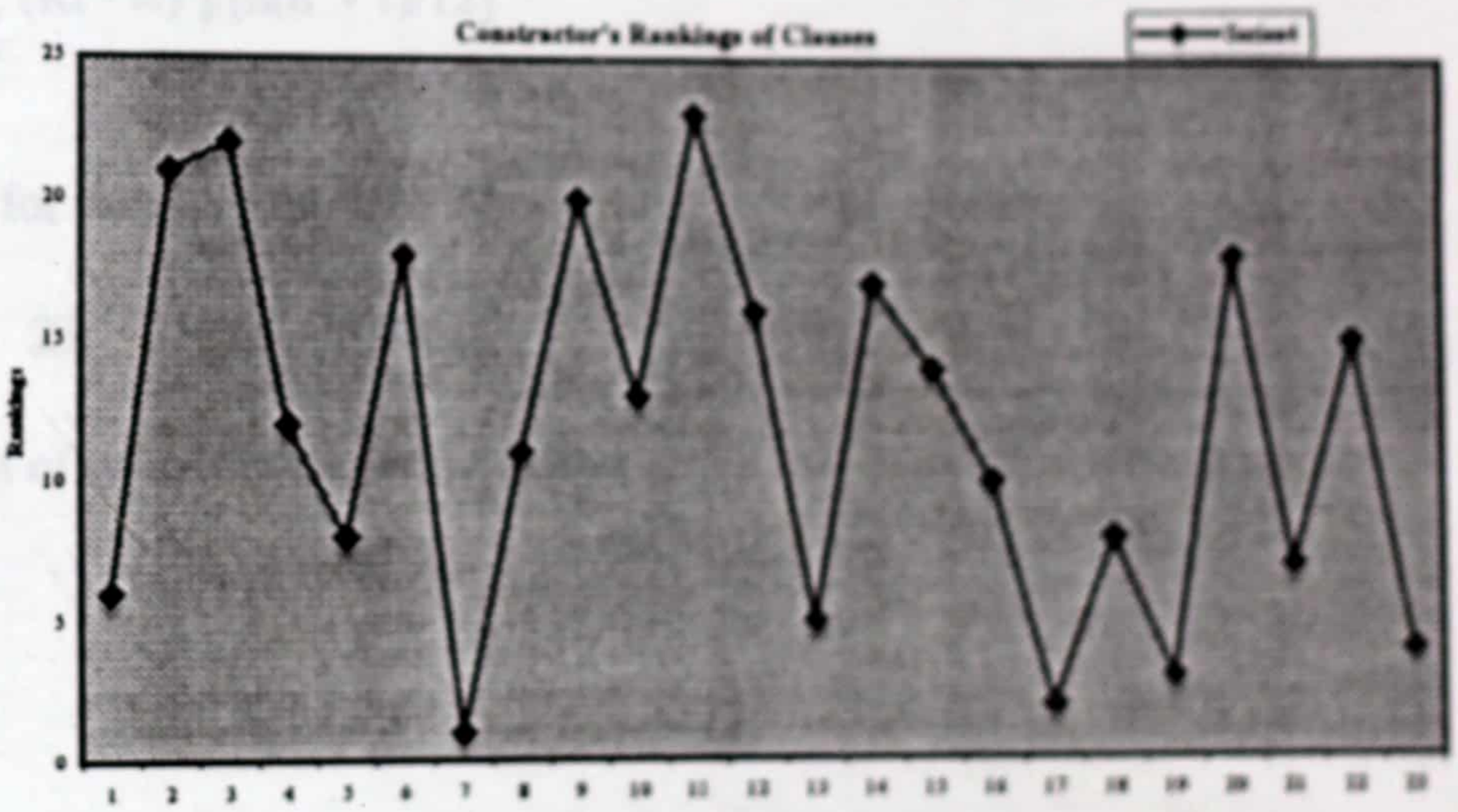
Clause	Client's Rank	Const'l Rank	Const'r Rank
1	4	4	6
2	8	22	21
3	14	20	22
4	2	6	12
5	21	11	8
6	2	13	18
7	22	13	1
8	8	10	11
9	11	23	20
10	6	9	13
11	16	3	23
12	19	21	16
13	12	2	5
14	20	12	17
15	18	18	14
16	10	17	10
17	7	5	2
18	5	19	8
19	15	7	3
20	13	8	18
21	17	15	7
22	23	16	15
23	1	1	4





g. 6.2

lative Importance Rankings of Clauses



The essence of the measuring technique (Hartman et al, 1996) was to reduce subjective judgement to quantifiable measures. These measures enabled a comparison of data and the determination of observable trends.

Tables 6.13, 6.14 and 6.15 show the mean and the standard deviation of the responses of the clients, consultants and contractors respectively.

The standard deviation, which is a measure of risk dispersion allows the ranking of contract clauses relative to the degree of mutual agreement of risk apportionment within a contract group of each contract clause.

Tables 6.13, 6.14 and 6.15 were ranked to show this degree of mutual agreement of risk apportionment using the standard deviation.

Test of Concordance

The Kendall test for concordance was again used for the assessment.

$$\text{Thus, } W = \left[\sum_{i=1}^{k} (Ri - R)^2\right]/[n(n^2 - 1)/12]$$

Table 6.16 shows values for the calculation of W.

$$K = 3; \quad n = 23; \quad R = 11.78$$

the correlation coefficient of concordance, $W = 0.481$.

Test of Hypothesis

H_o: Contracting parties differ significantly in how risks should be shared in construction contracts.

The significance of W and the hypothesis can then be tested using the chi-square distribution.

χ^2_{cal} = K(n - 1)W

= 3(23 - 1) 0.481

= 31.75

χ^2_{table} at 0.05 significance level and 22 degrees of freedom

$\chi^2_{table\ (0.05,22)}$ = 33.92

$\chi^2_{table} > \chi^2_{cal}$

Since the chi-square from table exceeds the chi-square from calculation at 0.05 level of significance and 22 degrees of freedom, the null hypothesis, H_o, that the contracting parties differ significantly in how risks should be shared between them is accepted.

The results show that there is only 48% concordance, indicating that the clients, consultants and contractors tend to have different opinions on how risks should be shared or allocated for most clauses.

The overall ranking in Table 6.16 indicate that the most important clauses in terms of concordance are arbitration, consultants' instructions, certificates and payment, delay and extension of time, materials and workmanship and loss and expense.

This is evidenced by the relative closeness of the "mean" each measure has to the other contracting parties (clients, consultants, contractors). This is also supported by the relatively low measures of standard deviation. The lower the standard deviation, the higher the probability of agreement within the contracting group on how risks should be allocated.

Clauses for which the "mean" are not close and also exhibit high standard deviation suggest that there is a significant divergence of opinion between the contract

Table 6.16: Determination of Rank Correlation for Agreement (Kendall Concordance Analysis)

Item	Clause	Clients Rank	Cons't Rank	Cont'r Rank	Sum	Mean Ri	Difference Ri-R	Overall Ranking
1	Consultants Instructions (authority of Consultant) (Clause 2)	4	4	6	14	4.67	-7.11	2
2	Statutory Obligation, Notices & Fees (Clause 4)	8	22	21	41	13.67	-1.89	16
3	Setting out of Works (Clause 5)	14	20	22	56	18.67	6.89	22
4	Materials and Workmanship to conform (Clause 6)	2	6	12	20	6.67	-5.11	5
5	Assignment and subletting (Clause 9)	21	11	8	40	13.3	-1.52	15
6	Ascertainment of Prices for Variation (Clause 10)	2	13	18	33	11.00	-0.78	10
7	Practical completion and Defects Liability (clause 13).	22	13	1	36	12.00	0.22	11
8	Rates of Wages (clause 14)	8	10	11	29	9.67	-2.11	8
9	Injury to Persons and Property (clause 15)	11	23	20	54	18.00	6.22	20
10	Insurance (clause 16)	6	9	13	28	9.33	-2.45	7
11	Date for Possession, Completion of Works (Clause 17)	16	3	23	42	14.00	2.22	17
12	Damages for Non-Completion (clause 18)	19	21	16	56	18.67	6.89	22
13	Delay and Extension of Time (clause 19)	12	2	5	19	6.33	-5.45	4
14	Determination by Employer (clause 20)	20	12	17	49	16.33	4.55	18
15	Determination by Contractor (clause 21)	18	18	14	50	16.67	4.89	19
16	Other Contractors (clause 22,23)	10	17	10	37	12.33	0.55	12
17	Certificates and Payments (clause 26)	7	5	2	14	4.67	-7.11	2
18	Sectional Completion (clause 26)	5	19	8	32	10.67	-1.11	9
19	Loss and Expense Caused by Disturbance (clause 27)	15	7	3	25	8.33	-3.45	6
20	Fluctuations (clause 28)	13	8	18	39	13.00	1.22	13
21	Gifts, Inducement and Rewards (clause 30)	17	15	7	39	13.00	1.22	14
22	Antiquities (clause 31)	23	16	15	54	18	6.22	20
23	Arbitration (clause 32)	1	1	4	6	2.00	-9.78	1

groups over where risk should lay, for example, determination by employer, determination by contractor, and damages for non completion.

In such cases, the risks may require more effort at negotiation to resolve any differences before formalizing the contract to avoid disputes.

Table 6.17 shows the relationship between the major risk factors identified and the clauses in the Ghana Government Conditions of Contract for Building Works. It also shows the 'mean', standard deviation and the overall ranking of the preferred risk allocation by the clients, consultants and contractors.

Any value of the "mean" less than zero indicates a preference for the client to assume more risk and greater than zero, a preference for the contractor to assume more risk.

A glance at Table 6.17 gives an insight into where contracting parties prefer risk to be allocated. Mean values less than zero out-number those greater than zero. This suggests that contracting parties, including the clients, prefer clients to assume more risk.

The 'mean' column for the contractors show that the contractors prefer a lower risk than the two other contracting parties. The column contain several negative figures. Even those risks contractor prefers to assume have very small figures. This is not surprising. It shows that contractors desire to assume less risk and prefers the owner to assume more. There is no major risk identified that the contractor strongly feels should be assumed more by the contractor than the client, whereas the client wants to assume more risks in, for example, damages and delays to project during construction than the conditions of contract assigned to clients.

These observations show that contractors are more concerned in reducing risk

17: Relationship between major factors identified and the clauses in the pink form

Factor	Related Clause in condition of Contract	Client		Consultant		Contractor		Overall Ranking
		Mean	S.D.	Mean	S.D.	Mean	S.D.	
Disputes	Arbitration (Clause 32)	0.1	0.9	0.1	2.2	-0.1	3.1	1
Variation (Authority of Consultant)	Consultants Instructions (Clause 2)	-0.4	1.3	-0.2	3.1	-0.5	4.2	2
	Ascertainment of Prices of Variations (Clause 10)	1.1	2	1.0	5.4	0.1	7.9	10
Fluctuation (Changes in Cost)	Fluctuations (Clause 28)	-1.4	3.5	-0.6	4.4	0.1	7.9	13
Degree of Inspection and Compliance	Materials and workmanship (Clause 6)	0.0	1.1	0.5	3.7	0.6	5.4	5
	Consultants Instructions (Clause 2)	-0.4	1.3	-0.2	3.1	-0.5	4.2	2
Limited Time and Funding for Design and Subsurface investigation	not expressly catered for under pink form	-	-	-	-	-	-	-
Damages and Delays to project during construction	Damages for non-completion (Clause 18)	4.0	9.3	-1.0	9.5	1.7	7.4	22
	Delays and extension of time (clause 19)	-1.1	2.6	0.4	2.8	0.2	3.2	4
Materials and workmanship, contradictory Specifications and drawings	Materials and workmanship (Clause 6)	1.1	2	1.0	5.4	0.6	5.4	5
	Statutory Obligations	-1.4	1.9	-1.1	9.9	-0.1	9.2	16
Contract Administration	Consultants Instruction (Cl.2)	-0.4	1.3	-0.2	3.1	-0.5	4.2	2
Weather Variations	Delays and extension of time (clause 19)	-1.1	2.6	0.4	2.8	0.2	3.2	4
	Loss and expense (Clause 27)	-1.6	3.8	0.3	4.0	-0.2	2.8	6
Payment of Interest on Contractors Claims	Certificates and Payments (Clause 25)	-1.5	1.7	0.3	3.2	-0.2	2.6	2
	Loss and expense (Clause 27)	-1.6	3.8	0.3	4.0	-0.2	2.8	6

than the other two (2) contracting parties. It also shows that clients are willing to assume more risks than the conditions of contract assigned to them.

The consultants' responses show that risk should be allocated somewhere between the clients and the contractors with a little leaning towards allocating more risks to the contractor than to the client. This may also not be out of place, for the consultants are retained and paid by the clients to protect their interests.

The values given by the standard deviation are relatively high in the contractors and consultants' responses. This was also amplified by the 48 percent measure of concordance. These observations indicate the divergence of opinion on where risk should lay. Large disparities in dispersion (standard deviation) shows the potential for dispute. The finding implies that the parties have to use more of negotiation in allocation of risks addressed by some of the 'standard' clauses.

The practice of using the 'standard' Ghana Government Conditions of Contract without some degree of negotiated agreement is, therefore, questionable.

It can also be seen from Table 6.17 that some of the factors which were identified as being major, for example, "Limited Time and Funding for Design and subsurface investigation" and others are either partially or not at all addressed in the Ghana Government Conditions of Contract for Building Works. The FIDIC (4th Edition) however, addresses some of these concerns.

6.3 SUMMARY

The survey achieved a response rate of 39 percent. The analyses of the responses show the following observations.

There is no single or preferred approach or procedure for risk identification by

construction contract participants. A good number of them rely on the judgement of the quantity surveyor, opinion of 1 or 2 experienced persons or external consultants. The methods vary by circumstances.

Sensitivity analysis and risk management processes are rarely used to value allowances for risk in the Ghanaian construction industry.

A very high correlation exists between clients, consultants and contractors in their perception of risks.

The major risk factors identified by contracting participants relates disputes, variation, fluctuations, degree of inspection and compliance, limited time and funding for subsurface investigation, damages and delays during construction, materials and workmanship, contract administration, weather variations and payments.

Contracting parties have divergent opinions on how risks should be shared.

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2. Kendall, M.G., (1970), Rank Correlation Methods, 4th Edition, Griffin, London.

3. Hartman, F., Snelgrove, P. and Ashrafi, R., (1996), Appropriate Risk Allocation in Lump-Sum Contracts – Who Should Take the Risk?, ASCE Journal of Construction Engineering and Management, Volume 40 No.7.

CHAPTER SEVEN

RISK SHARING MECHANISM

7.1 INTRODUCTION

The studies confirm that indeed the construction process is characterized by many risks and uncertainties and that participants in the Ghanaian construction industry recognize it as such. One observation however, is that even though participants agree that there are risks inherent in Ghanaian construction contracts they have divergent opinions on where these risks should lay.

Most of them lack a straightforward way to combine all the facets of risk systematically into a prioritized and manageable scheme for identification and evaluation.(1)

7.2 THE MECHANISM

A risk sharing mechanism, in the form of a flow chart as shown in Figure 7.1, which captures the conceptual ideas of Ashley (1977), Erikson (1979), Dawood (1995) and the results of this study, has been developed by the researcher, as a tool to help participants of the industry to allocate risks.

The risk sharing approach can be viewed broadly as a three (3) stage process:

1. Risk identification
2. Risk analysis
3. Risk response.

FLOW CHART

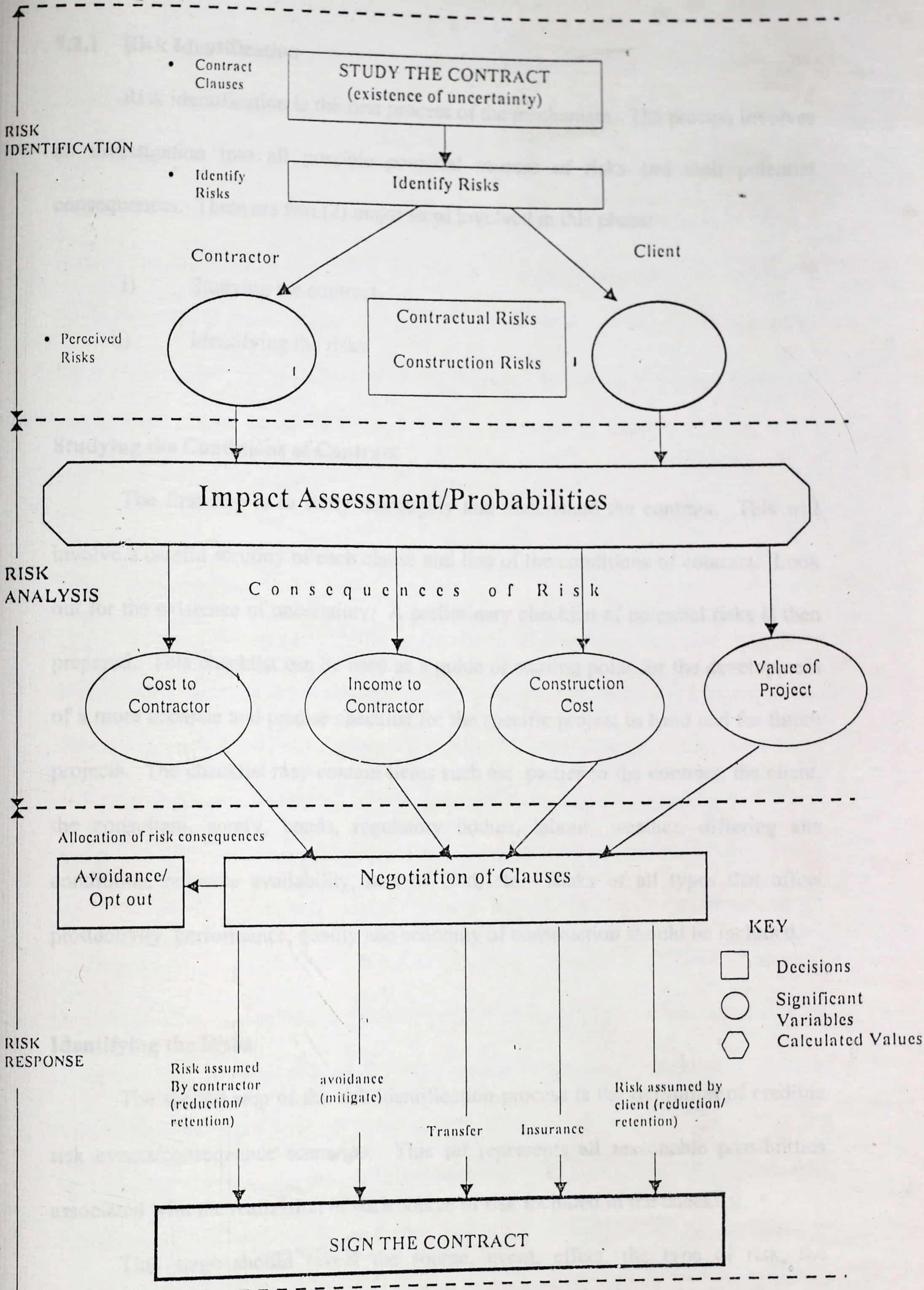


Figure 7.1 Flow Chart for Sharing of Risks

7.2.1 Risk Identification

Risk identification is the first process of the mechanism. The process involves an investigation into all possible potential sources of risks and their potential consequences. There are two (2) major steps involved in this phase:

i) Studying the contract.

ii) Identifying the risks.

Studying the Conditions of Contract

The first step is to study thoroughly and understand the contract. This will involve a careful scrutiny of each clause and line of the conditions of contract. Look out for the existence of uncertainty. A preliminary checklist of potential risks is then prepared. This checklist can be used as a guide or starting point for the development of a more accurate and precise checklist for the specific project in hand and for future projects. The checklist may contain items such as: parties to the contract, the client, the consultant, surety, bonds, regulatory bodies, labour, weather, differing site conditions, resource availability, acts of God, etc. Risks of all types that affect productivity, performance, quality and economy of construction should be included.

Identifying the Risks

The second step of the risk identification process is the definition of credible risk events/consequence scenarios. This set represents all reasonable possibilities associated with the realization of each source of risk included in the checklist.

This stage should reveal the source, event, effect, the type of risk, the likelihood and severity from the point of view of the participants since, from this

study, both the client and contractor perceive risks in any project. The risks are then classified as contractual risks or construction risks or a combination of the two. Contractual risk is risk introduced due to lack of contract clarity, absence of perfect communication between the parties involved and the problem of timeliness in contract administration. Construction risk is risk that is inherent in the work itself and would be present even if one company with perfect internal communication pérformed all of the functions itself - these arise from factors such as weather, differing site conditions, acts of God, resource availability, etc. The primary basis for identifying risks, at this stage, is historical data, experience and insight.

7.2.2 Risk Analysis

It is not enough to identify risk. Some of the risks identified which are considered to be more important are selected for further analysis. The impact of the risks specific to a particular project is assessed. Their significance is determined quantitatively through probabilistic analysis before the response stage. It is assumed that one has no control over the occurrence of a given risk but information available in the form of historical data, experience and insight may assist in assessing the probability. Each construction project is unique, and similar risks may not recur on similar projects. Care must therefore be taken on the reliance on experience. If no one has had experience of a similar project, it is important to assemble a group of suitably qualified people for a brainstorming exercise.

After assessing the probability of occurrence the cost of the risks in monetary terms should be computed for each risk, as the risk premium, and summed up. As stated in Chapter Three, the expected value of each risk event $E(X) = Pr_i X_i$ and the

risk premium, π, can be computed.

For example, let us assume the amount of substructure of a project to be ¢10,000,000.00. From a historical data the risk impact is assessed to be high due to the nature of subsurface conditions in the area and therefore a percentage of 40% is assigned to it. The assessed impact will be ¢4,000,000.00. If the probability of occurrence is also assessed to be 30%, the expected value of risk will be:

$$E(X) = (0.3)(4,000,000) = ¢1,200,000.00.$$

Taking an industry risk-free markup rate of 25% for profit and overheads (Amoa-Mensah, 1995), gives ¢2,500,000.00. The risk appraiser will therefore add the expected risk of ¢1,200,000 to the markup of ¢2,500,000 to make ¢3,700,000.00 for this work section. Substructure will now amount to ¢11,200,000.00.

The stream of expected risks are then summed up using the formula,

$$E(X) = \sum_{I=1}^{n} Pr_i X_i$$

Contractors are normally risk averse and large clients risk neutral (Erikson, 1979). In most cases therefore, clients will utilize the lower risk-free cost of ¢2,500,000.00 and assume that there will be little or no unforeseen difficulties where the project has been completely designed prior to tender, whereas the contractor will utilize the higher cost of ¢3,700,000.00 and assume the worst case scenario for this risk event. In such a case, the risk premium, π, equals the expected risk value of ¢1,200,000.00. Utility theory predicts that the contractors should be indifferent between taking a risk-free project at a mark-up of ¢2,500,000.00 and taking the same project including risks at a ¢3,700,000.00 mark-up in this example. The computer can

be used in the computation of the total cost of the risk events using spreadsheet programs such as Microsoft Excel, Lotus 1-2-3 or open access. The data will also be stored and updated for future projects.

The consequences of all risks identified at the first stage can therefore be assessed at this second stage and channeled into cost of construction, total cost of risks, cost to contractor, value of project. The impact and consequences of a given risk on contractors' expected profit and clients expected value of project are thus captured in the mechanism.

7.2.3 Risk Response

Having identified the risk exposure and evaluated its potential financial impact, the next is the response stage. In the response stage, there are possible alternative response methods or strategies available in order to change the balance of risk. These are:

- Risk avoidance/rejection
- Loss reduction and risk prevention
- Risk retention
- Risk transfer
- Insurance.

Risk Avoidance

This ranges from taking certain contingency actions that can mitigate risks should they occur to a complete risk avoidance, that is, a decision not to tender or not to enter into a contract due to high risks involved. The complete withdrawal only

shifts the risks to other competitors.

Loss Reduction and Risk Prevention

There are risks that can be decreased by taking certain immediate actions. This can be done in two (2) ways:

i) Reducing the probability of a risk; and

ii) Reducing the financial severity of risk if it does occur.

To reduce uncertainty, further investigations should be initiated through better information.

Risk can also be prevented or removed by elimination from the project and therefore no longer poses a threat.

Risk Retention

This is the internal assumption, partially or completely, of the financial impact of risk by a party. The benefits that can be gained from taking the risk should be balanced against the penalties or the Liquidated and Ascertained Damages. A risk retention can either be planned or unplanned. A planned risk retention is a conscious and deliberate assumption of identified risks. An unplanned risk retention exists when a party does not identify the existence of a risk and unwittingly or unconsciously assumes the loss that could occur. A related form of unplanned retention occurs when the party has properly identified the risk exposure but has underestimated the magnitude of the potential losses.

These risks can be passed on to other parties who are not insurers. Here, the risk is not eliminated but it just makes someone else worry about. Transfer involves shifting responsibility for the risk.

Insurance

Commercial insurance is used to shift the financial potential consequences of risks to the insurance company. The majority of parties rely on insurance for the more serious loss exposures through the purchase of an insurance policy.

A single one of these methods is rarely used alone to handle a particular risk. It is much more common to use several of these methods in combination for each type of risk as suggested by Ravn (1989) in Figure 3.6.

All these methods, avoidance, reduction, retention, transfer and insurance, are arrived at after going through a negotiation process (Figure 7.2 shows Ashley's negotiation model that may be followed). The negotiation process is a mutual interaction between the parties where each will gain insight into the other's values, goals and aversion to risk. As the negotiations proceed the best clauses to negotiate and the resulting changes in cost will be easier to identify. Thus, this learning helps ensure that a "win-win" agreement is reached. The process is to exchange risk for contract amount to improve their individual positions towards the "win-win" outcome.

Administration of Mechanism

The two extremes of contract award procedures in Ghana can be identified as:

1. Competitive bidding; and
2. Strictly negotiated bidding.

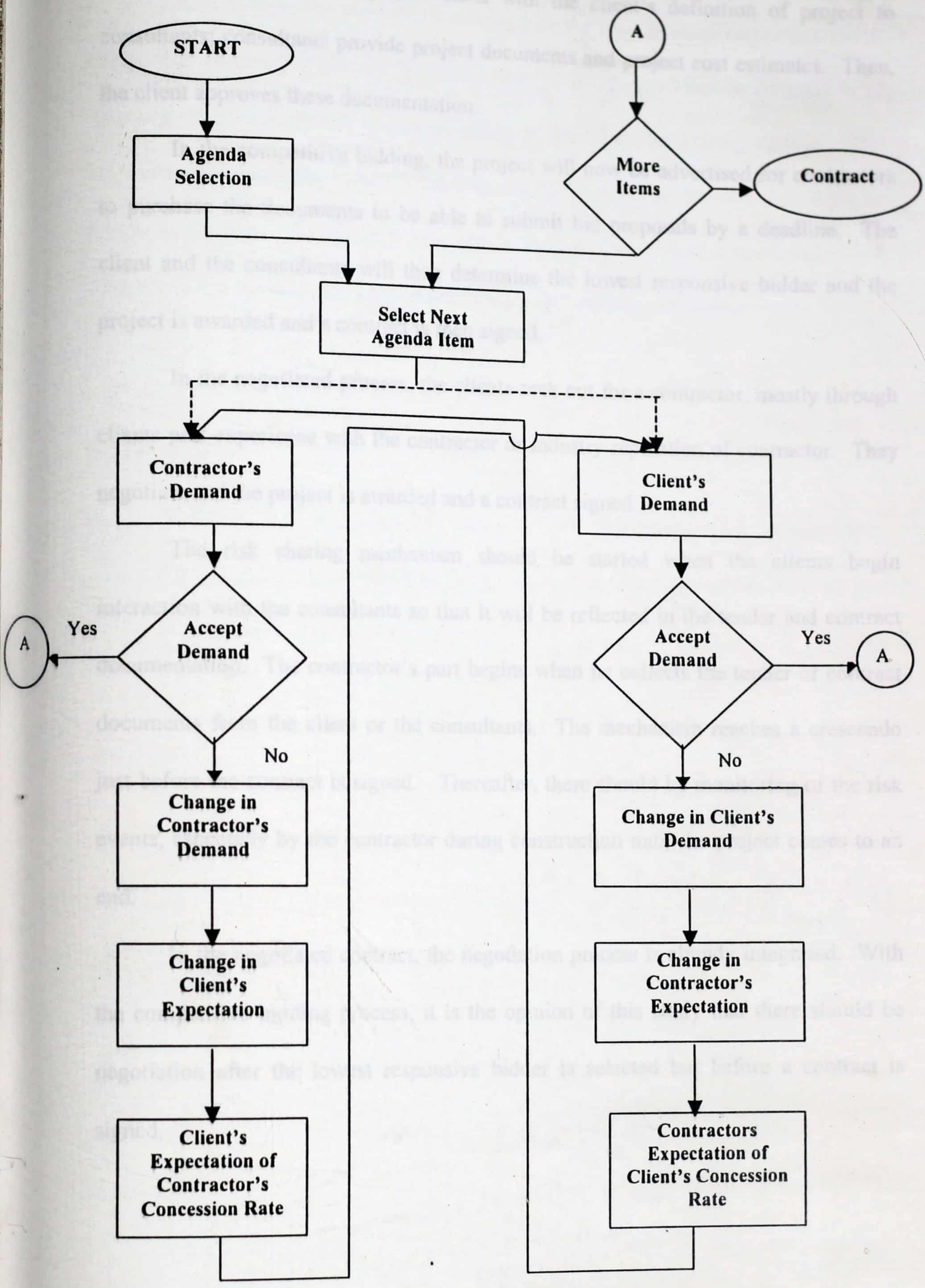


Figure7.2: Ashley's Negotiation Process Model

In both cases, the project starts with the client's definition of project to consultants; consultants provide project documents and project cost estimates. Then, the client approves these documentation.

In the competitive bidding, the project will now be advertised for contractors to purchase the documents to be able to submit bid proposals by a deadline. The client and the consultants will then determine the lowest responsive bidder and the project is awarded and a contract is then signed.

In the negotiated process, the clients seek out for a contractor, mostly through clients past experience with the contractor or industry reputation of contractor. They negotiate and the project is awarded and a contract signed.

The risk sharing mechanism should be started when the clients begin interaction with the consultants so that it will be reflected in the tender and contract documentation. The contractor's part begins when he collects the tender or contract documents from the client or the consultants. The mechanism reaches a crescendo just before the contract is signed. Thereafter, there should be monitoring of the risk events, especially by the contractor during construction until the project comes to an end.

In the negotiated contract, the negotiation process is already integrated. With the competitive bidding process, it is the opinion of this study that there should be negotiation after the lowest responsive bidder is selected but before a contract is signed.

Records and Reports

Keeping appropriate records is essential for the identification and evaluation of risks. The records provide the historical data for statistics needed in the process of deciding on an appropriate course of action in regard to the sharing method. The contractor and consultants should maintain records from the project site that might be unique to the risks envisioned in the project. Such records should include risk event, frequency, risk severity and consequences and other related information.

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CHAPTER EIGHT

CONCLUSIONS AND RECOMMENDATIONS

8.1 INTRODUCTION

Construction, like many other industries in a free enterprise system, has risk built into its profit structure. From the beginning to the end, the construction process is complex and characterized by many uncertainties.

The client, who wants to construct the project in the first place and by whom all decisions are made with the advice of consultants, has the expectation of obtaining value for money invested. He wants a project completed on time, to the required performance standard at a low cost. The contractor on the other hand, wants to execute the project on time, to required performance standards but at a maximum profit.

Meanwhile, the foremost objective of all these players is to "maximize shareholders wealth" by maximizing profit whilst minimizing risks of the firm. These clearly create conflicts. It is notable that these conflicts take place in an industry that has inherent risks and uncertainties. Several studies have been done on the identification, and analysis of risk in the industry.

An attempt to explore ways of analyzing and responding to risks in Ghanaian construction contracts cannot fail to be a useful addition to improving construction risk management.

The aim of the study, as indicated in Chapter One, included identification of the most important factors associated with the Ghanaian construction contracts and the provision of a tool for risk sharing by participants of a construction contract.

Project organization and contracts were reviewed and it was realized that decisions made under uncertain conditions were likely to be subject to later review. Therefore, the drafting of contract documents to take care of the uncertainties and possible conflicts was a difficult and time-consuming process which needed considerable experience and professionalism.

Risk sharing practices were also reviewed. It was found out that the classification of individuals, by economists as risk-averters, risk-neutral and risk-lovers in the Utility theory concepts can be used to calculate a risk premium, π, of a risk event. Levy et al (1994) confirmed the view that a typical individual or firm is risk averse.

A review of the studies by Erikson (1979), Ashley (1977), Ravn (1989) were made in order to look at developments towards finding a risk sharing concept aimed at reducing areas of diverging interest to ensure that the contractor is well covered against heavy losses and the client is also able to live with high expenses imposed by risk factors.

8.2 CONCLUSIONS

Within the parameters set out in this study in investigating the perception of risks in Ghanaian construction contracts of clients, consultants and contractors and the preferences of these groups on where risk should lay, the following conclusions can be drawn from the analysis made in the preceding chapters.

1. In many contract participating firms - clients, consultants, contractors - the responsibility and attendant procedure for carrying out risk identification is

either ill defined or non-existent. Those who do undertake risk identification at all, do not have any preferred approach. Personal experiences play a major role.

2. Contract participants - clients, consultants, contractors – rarely use sensitivity analysis and risk management processes in their cost estimation. Majority of them use guesswork or a contingency sum which is a fixed percentage figure of their estimate through intuition and personal experiences.

3. Contract participants – clients, consultants, contractors – do appreciate the existence of risks and uncertainties in the construction industry in Ghana. The studies show that a significant rank correlation exists between clients, consultants and contractors perception of risks in Ghanaian construction contracts.

4. Clauses in the conditions of contract that relate to disputes, variation, fluctuation, degree of inspection and compliance, limited time and funding for design and subsurface investigation, damages and delays during construction, materials and workmanship, contract administration, weather variations and payments are considered to contain the most important risks inherent in the Ghanaian building construction industry.

5. Contracting parties have divergent opinions on how risks should be shared. The contractors prefer to assume less risk while the clients appear willing to assume more risk than what was perceived in the conditions of contract.

6. Contract participants whilst recognizing the existence of risks and uncertainties in the Ghana Government Conditions of Contract for Building Works, also do have different opinions on how these risks should be shared. This gives an indication that the 'standard' contract clauses must be discussed and agreed upon to reflect the needs of all contracting parties, before the final contract is signed. The discussion is achieved through the process of negotiation. Negotiation will help minimize or avoid the disputes. Disputes, it is to be noted, is ranked first by the participants in the order of importance rankings.

8.3 THE RISK SHARING MECHANISM

The risk-sharing concept as stated earlier, is aimed at reducing areas of diverging interest, thus avoiding arbitrations and litigations. The mechanism will help to make quantitative tradeoffs between the contractor's price for doing the work and the owner's willingness to accept risk.

Negotiation, a procedure for determining the clauses of construction contracts and provide the client with feedback on the relative cost of including each contract clause, is a major cog in the mechanism. A strategic interaction between client and contractor allows a contract to evolve which optimally distributes the risk elements.

It is envisaged that clients, especially public clients, who find it very difficult (for funding and political reasons) to accept risks and uncertainties in contract price and therefore prefer firm fixed contracts with few provisions for price adjustments in which the contractor bears essentially all risks, will have a paradigm shift with the usage of this conceptual risk sharing mechanism.

It is important to implement the mechanism to ensure the "meeting of minds" on what the intent of a contract is, before signatures are appended, something which is most often overlooked in the euphoria of signing a newly-awarded contract. This is to avoid a situation in which, for example, a loosely interpreted rain delay clause could offer a profit incentive to a contractor, encouraging the contractor to send his employees home whenever the clouds begin to form in the sky.

8.4 RECOMMENDATIONS

From the foregoing analysis and conclusions, the following recommendations are made for consideration.

1. Contract participants must develop policies, procedures, goals and responsibilities for risk management. A more formal risk sharing function should be established in their firms, because risk sharing properly undertaken will increase the likelihood of successful completion of a project to cost, time and performance objectives.

2. The industry should move to develop more effective contractual working relationships to achieve, over a period of time, a 'meeting of the minds' on what the intent of a contract is. Alliances and partnering arrangements, formation of joint ventures and value engineering options should be explored. In these options, individuals pass on their risk behaviour to the group which allows the risk premium to decrease with a growing level of wealth or profit.

3. There should be negotiation after a contractor is selected from competitive bidding. Experience of the construction industry in Ghana suggests that

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contractors are often faced with a bid submission deadline that only permits a scanty appraisal of the complex construction problems and risks involved in a project. In the absence of adequate time and information, any evaluation and pricing of potential risk exposure may be on an ad hoc basis so the risk sharing process after bidding should be used to optimally distribute inherent risks.

4. The industry should embrace Alternative Dispute Resolution mechanisms that are being touted around in the country in addition to the Arbitration Clause in the Pink Form. This is because all the participants perceive disputes as the number one risk factor in the overall ranking in this study.

5. The review of the Ghana Government Conditions of Contract for Building Works (the Pink Form), which is currently awaiting approval from the Ministry of Works and Housing, should be encouraged and pushed forward because there was an expression of inadequacy of some of its clauses by contract participants.

6. Information Technology base of the industry must be improved. The various professional institutions including the contractors association must impress on their members, through organized educational programmes, to be interested in information technology since the success of any risk management depends not only on experience and capability but also on the information at one's disposal.

7. The department of Building Technology in the University of Science and Technology should organize education programmes for contractors,

consultants and clients to educate them on modern construction management practices and make research findings, including this one on risk sharing, available to them. Through this, the department will make money and at the same time, contribute towards education in the construction industry in Ghana.

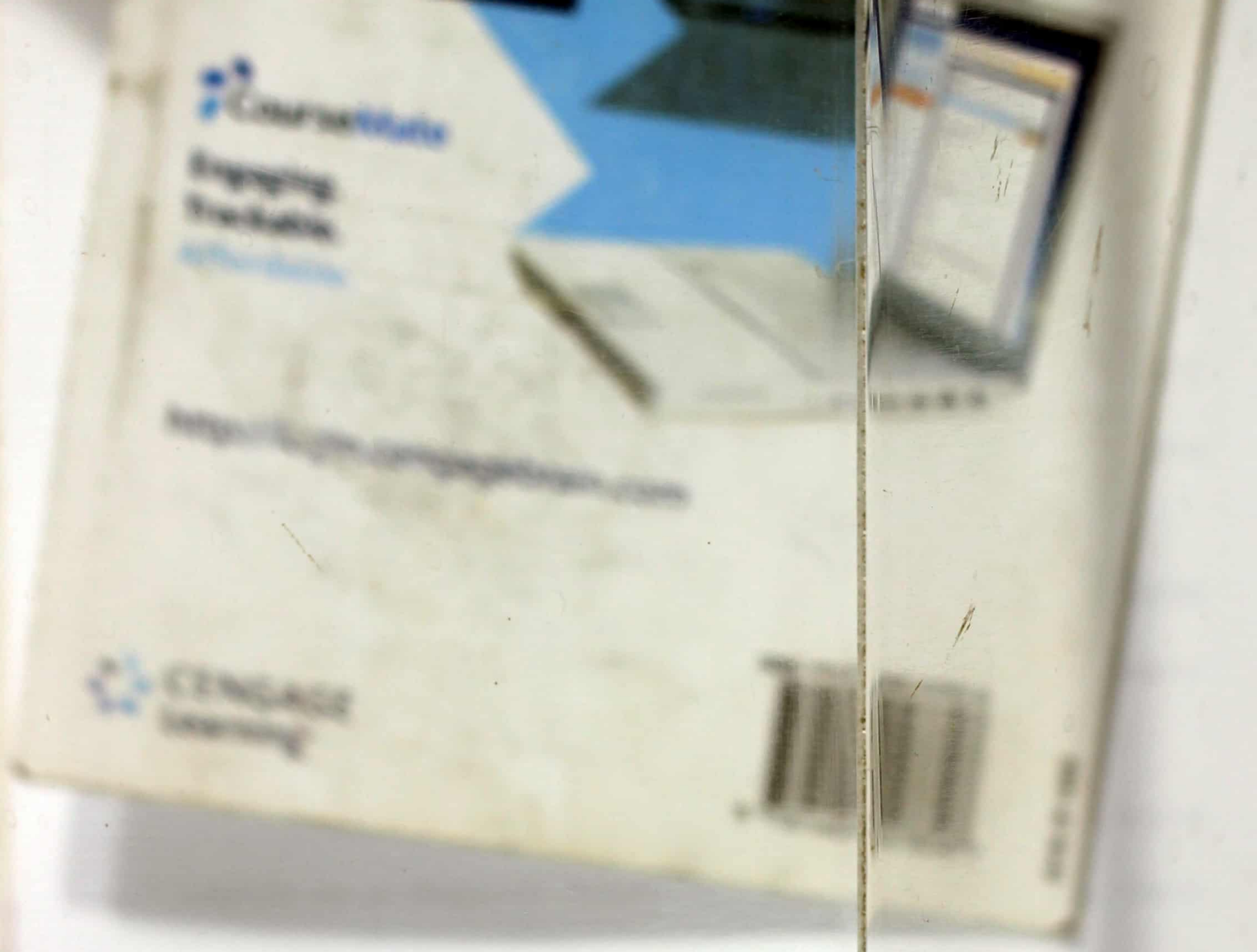
The industry needs a true quality-driven agenda. To achieve the dramatic increases in efficiency and quality as proposed by Sir John Egan (1998) in "Rethinking Construction" and as envisaged in Ghana's Vision 2020, the Ghanaian construction industry contract participants must "rethink risk sharing" to extend it beyond the confines of insurance.

8.5 FUTURE RESEARCH

- The research covered building contractors in financial classes D1 and D2. There is the need to sample the risk perception and preferences of classes D3 and D4 to be able to test whether differences exist between the four (4) categories of building contractors in Ghana.

- Similar research can also be conducted using the FIDIC and again include Civil engineering contractors.

- Further research should be conducted to develop the risk sharing mechanism into a model.



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APPENDICES

APPENDIX 1

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI, GHANA

DEPARTMENT OF BUILDING TECHNOLOGY
CONSTRUCTION MANAGEMENT PROGRAMME

RISK SHARING IN GHANAIAN CONSTRUCTION CONTRACTS

February, 2000

Dear Client/Consultant/Contractor,

The essence of this questionnaire is to gather information on how risk factors are identified and allocated in construction contracts.

Mr. Frimpong Gyamfi of the Department of Building Technology, UST, Kumasi, with assistance from Dr. Theophilus Adjei-Kumi, a Lecturer/Supervisor at the Department, is conducting the research for academic purposes.

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.

Thank you.

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI, GHANA

DEPARTMENT OF BUILDING TECHNOLOGY
CONSTRUCTION MANAGEMENT PROGRAMME

RISK SHARING IN GHANAIAN CONSTRUCTION CONTRACTS

QUESTIONNAIRE

1 Please state your Job Title/Position in the Company (Please tick)

Managing Director ☐ Project Manager ☐ Architect ☐ Quantity Surveyor ☐

Civil Engineer ☐

Any Other (State) .....

2 Could you state which of the following contract group you belong to? (Please tick appropriate box)

Client/Owner ☐

Consultant ☐ Civil Engineering ☐ Architectural ☐ Quantity Surveying ☐

Contractor ☐ Class D1 ☐ D2 ☐ D3 ☐ D4 ☐

3 Could you state the Region in which your head office is located? .....

4 How long have you been in the construction business? (Please tick) .....

Less than 2 years ☐ 2-5 years ☐ More than 5 years ☐

5 What is your company's procedure for risk identification?

By circulating information about tender to team of persons ☐

Judgement of the Estimator/Quantity Surveyor only ☐

Opinion of 1 or 2 experienced persons within the company ☐

Opinion of external consultants ☐

Brainstorming ☐

Tender review by Management ☐

Discussions with Client/Contractor ☐

None ☐

6 **What method is used by your company to value allowances for risks and uncertainties in cost estimation?(Please tick)**

No Explicit Allowance	
Guesswork	
Add a contingency sum, which is a fixed percentage figure of the estimate	
Sensitivity Analysis to determine allowance required	
Risk Management process to determine the Allowance required	

7 The following is a list of risks in construction. Please indicate by ticking who the current conditions assign these risks to. Then Rank them on a scale of 1 to 5

1 = not important; 2 = slightly important; 3 = important;
4 = very important; 5 = extremely important.

	Risk	Tick		Rank				
		Client	Contractor	1	2	3	4	5
1	Limited Time and Funding for Design and subsurface investigation							
2	Design errors: Conflicts, omissions							
3	Constructibility (Unusual designs etc.)							
4	Materials and workmanship, contradictory specifications and Drawings							
5	Limited Contractor Time for bidding							
6	Estimating, planning and Bid preparation errors							
7	Visit to Site							
8	Competitive Environment (the business cycle)							
9	Low bid from contractor							
10	Contract Administration							
11	Degree of Inspection and Compliance							
12	Variations (Authority of Consultant)							
13	Fluctuations (changes in cost)							
14	Disputes							
15	Payment of interest on Contractors claims							
16	Determination of employment by Client							
17	Determination of employment by Contractor							
18	Value Added Tax							
19	Bonds/Security							
20	Injury to persons							
21	Injury to property							
22	Damages and delays during construction							
23	Contractor Failure to enter into contract							
24	Non-payment of creditors							
25	Interference's from Acts of Clients							
26	Use and possession prior to completion							
27	Suspension of work by client							
28	Weather Variations							
29	Environmental Protection							
30	Health and Safety							
31	Labour (Significant increment in wages, skill)							
32	Supervision (contractors' personnel)							
33	Sub-contractors							
34	Utilities (Electricity/Telephone/Water)							

8 Please indicate on the scale below your company's preferred allocation or risk. (These clauses are selected from the Ghana Government Conditions of Contract for Building Works - The Pink Form) The scale ranges from 100% risk assumed by the owner (-5) through degrees of risk sharing between the parties, to 100% risk assumed by the contractor (+5), zero (0) implies "equally shared by parties"

	CLAUSE	-5	-3	-1	0	1	3	5
1	Consultants Instructions (authority of Consultant) (Clause 2)							
2	Statutory Obligation, Notices & Fees (Clause 4)							
3	Setting out of Works (Clause 5)							
4	Materials and Workmanship to conform (Clause 6)							
5	Assignment and subletting (Clause 9)							
6	Ascertainment of Prices for Variation (Clause 10)							
7	Practical completion and Defects Liability (clause 13).							
8	Rates of Wages (clause 14)							
9	Injury to Persons and Property (clause 15)							
10	Insurance (clause 16)							
11	Date for Possession, Completion of Works (Clause 17)							
12	Damages for Non-Completion (clause 18)							
13	Delay and Extension of Time (clause 19)							
14	Determination by Employer (clause 20)							
15	Determination by Contractor (clause 21)							
16	Other Contractors (clause 22,23)							
17	Certificates and Payments (clause 26)							
18	Sectional Completion (clause 26)							
19	Loss and Expense Caused by Disturbance (clause 27)							
20	Fluctuations (clause 28)							
21	Gifts, Inducement and Rewards (clause 30)							
22	Antiquities (clause 31)							
23	Arbitration (clause 32)							

APPENDIX 2

CLASSIFICATION OF BUILDING CONTRACTORS (1998)

REGION CLASS	Greater Accra	Ashanti	Volta	Central	Western	Brong Ahafo	Eastern	Northern	Upper East	Upper West	Total
D1	64	5	6	9	5	1	2	4	0	0	96
D2	207	45	30	33	12	11	25	18	41	24	446
D3	1129	350	138	157	120	122	211	233	129	120	2709
D4	650	361	98	113	101	151	160	305	138	135	2212
TOTAL	2050	761	272	312	238	285	398	560	308	279	5463

Source: Ministry of Works and Housing

APPENDIX 3

REGISTERED CONSULTANCY FIRMS

REGION CONSULTANCY FIRMS	Greater Accra	Ashanti	Volta	Central	Western	Brong Ahafo	Eastern	Northern	Upper East	Upper West	Total
Architectural	53	7	-	-	2	1	1	1	-	-	65
Civil Engineering	45	2	-	-	-	-	-	-	-	-	47
Quantity Surveying	37	1	-	-	-	-	-	1	-	-	39
TOTAL	135	10	-	-	2	1	1	2	-	-	151

SOURCES:

- Ghana Institute of Architects Secretariat, Accra; The Ghana Architect (1998)
- Ghana Institution of Engineers, Engineers Centre, Accra (Members of Good Standing, 1999)

Ghana Institution of Surveyors, Palma House, Accra (Directory of Paid-up Members, 1999)

APPENDIX 4

LIST OF CLIENTS USED IN THIS STUDY

1. Ministry of Health
2. Ministry of Education
3. Ministry of Agriculture
4. Ministry of Works and Housing
5. Ministry of Local Government
6. University of Ghana
7. University of Cape Coast
8. Kwame Nkrumah University of Science and Technology
9. The National Catholic Secretariat
10. The Presbyterian Church of Ghana
11. The Methodist Church of Ghana
12. The Church of Pentecost, Ghana
13. The Ahmadiyya Muslim Mission
14. The Adventist Development Agency
15. Social Security and National Insurance Trust (SSNIT)
16. State Insurance Company Ltd. (SIC)
17. Electricity Company Ghana Ltd. (ECG)
18. Volta River Authority (VRA)
19. Ashanti Goldfields Company Ltd. (AGC)
20. The Bank of Ghana

APPENDIX 5

COMMENTS ON TEN IMPORTANT FACTORS IDENTIFIED

Appendix 5 shows the relationship among the ten (10) important factors identified (Table 6.12a) in the study by construction contract participants and comments on the factors.

1.0 DISPUTES

The appropriate clause in the 'pink form' that bears relationship to this factor is Clause 32 – Arbitration.

COMMENT

The clause requires disputes to be settled by arbitration. The right to arbitrate does not arise unless there is a dispute, that is, a claim by one party to the contract which is rejected by the other. It costs both the contractor and client time and money to go through the procedure for resolving disputes. The risk to the contractor is that if he files a claim, he will incur costs and may not win. The risk to the client is that if he is not fair to the contractor he may lose and have to pay interest on the costs.

2.0 VARIATION

The appropriate clause relating to this factor is Clause 2 – Consultants instructions and clause 10 – the ascertainment of prices for variations.

COMMENT

The client will be bound by any variation order given by the consultant. However, the consultant must ensure that he has authority to order the variation, otherwise he may be liable to the employer for its cost. The effect of clauses 2 and 10 is that a variation must normally be in writing and it does seem that the power to give variations is unlimited.

Clause 52.3 of the FIDIC (4th Edition, 1989) however gives the parties the chance to adjust contract price having regard to the contractor's site and general overhead costs for variations exceeding 15 percent of "Effective Contract Price". This is not so in the 'pink form'.

In the case of the Pink Form, if the contractors perceive that significant changes will be made, they must try to anticipate how the variations will affect such factors as their indirect costs and productivities. The adjustments they make for those anticipated effects may or may not be adequate especially if the variations fall within Clause 10(a) and 10(b). This clause exposes the parties to risk.

3.0 FLUCTUATIONS

This factor relates to Clause 28 - Fluctuations in the 'pink form'.

COMMENT

The 'pink form' provisions allow for reimbursement for increases and decreases in costs only. Clause 28(4) does not allow reimbursement in respect of overhead charges or profit.

The FIDIC (4th Edition, 1989) makes provision for reimbursement for all increases and decreases in costs due to variations in certain indices. Profits are also varied according to some general index.

The element of uncertainty introduced by inflation has an overall influence on construction costs (materials, labour, equipment, interest rates, overhead costs, taxes and profits). There should therefore be compensation on the time value of money effect, which is considerably greater in the long-term contracts.

The changes in the rate of inflation and price escalation may significantly change the contractor's actual costs for the project compared to his estimate.

4.0 DEGREE OF INSPECTION AND COMPLIANCE

Appropriate clauses that relate to the above factor are:

Clause 2 - Consultant's instructions, and

Clause 6 - Materials and Workmanship to conform to description.

COMMENT

These clauses are normally linked to the preambles and specifications in the Bills of Quantities.

Contractors are often faced with insufficient time for tender submission and have sometimes to use guesswork to determine which materials may be used within an "approved or equal" clause or may find it impossible to identify non-standard material that are specified by consultants. If the guess is wrong, he incurs a loss. Even where specifications and Drawings have discrepancies, it is possible for the contractor to incur expenses before the discrepancy becomes apparent.

In all cases, however, the contractor is expected to execute the works with all proper skill and care and the materials should be fit for their purpose and good quality. The bid rates must take care of these.

5.0 LIMITED TIME AND FUNDING FOR DESIGN AND SUBSURFACE INVESTIGATION

COMMENT

This does not seem to be expressly covered by the 'pink form'. The near appropriate clause may be Clause 11 - Bills of Quantities.

This clause states that "....the Bills unless otherwise expressly stated shall be deemed to have been prepared in accordance with the principles of the Standard Method of

Measurement of Building Works (SMM)..." In the SMM subsurface works are measured as a provisional item.

The deduction is that quick, inexpensive design may actually increase total project costs. The contractors, because they base their bids on the Bills which are provisional, may recover their costs if there are differing site conditions. The compensation may not fully cover productivity and overhead costs.

The Limited time and funding results in a less cost effective design. The information given to the contractor may therefore be scanty and this may show in higher rates if the contractor perceives drastic changes on site. For example, the contractor may have a very high rate for rock excavation if he so anticipates. The client then has much risk to bear.

6.0 DAMAGES AND DELAYS DURING CONSTRUCTION

The appropriate clauses in the pink form that relate to this factor are:

Clause 18 - Damages for non-completion.

Clause 19 - Delays and extension of time.

COMMENT

The speed with which a contractor carries out work is often an important element in the performance of a contract. The 'pink form' stipulates, in the appendix, fixed dates of possession and completion, but the period of the work may become extended under the contract.

Failure to proceed regularly and diligently may lead to the payment of Liquidated and Ascertained Damages or determination. Apart from these sanctions the contractor may proceed at his own pace. The consultant is entitled to be provided with a programme, but the 'pink form' does not seem to bind the contractor to perform in accordance with it. The programme is of use, however, only as evidence of what constitutes diligent progress and as a record to support contractors' claims. The time within which the work is performed is a matter of economic importance both to client and contractor.

If the client prevents the contractor from completion, or if any work is suspended for a period of time, the contractor becomes exposed to risk. The period of suspension may not be found to be unreasonable even though the contractor incurs costs from the delay. To the contractor, any suspension of work is for an unreasonable period of time. On the other hand, damages recoverable by the employer for delay are usually limited to "Liquidated and Ascertained Damages".

7.0 MATERIALS AND WORKMANSHIP, CONTRACDICTORY SPECIFICATIONS AND DRAWINGS

The appropriate clauses in the 'pink form' that relate to this factor are:

Clause 4 - Statutory Obligations, Notices and Fees

Clause 6 - Materials and Workmanship to conform to description.

COMMENT

Detailed regulations governing day-to-day activities on construction sites are not readily available in the Ghanaian industry. Compliance with statutory obligations, for example, Local Government bye-laws, Environmental Protection bye-laws and Health and Safety regulations become difficult. Clause 4(1) states that "... the fees and charges if not expressly provided for in the Bills of Quantities shall be added to the Contract Sum". Even though this may be a relief for the contractor it may not adequately compensate him for managing the compliance.

If the performance of the work is suspended or delayed because of say, a court order as a result of environmental litigation, the client risks the increased costs resulting from such a delay. Non compliance by contractor with regulations, through the fault of the contractor will however, expose the contractor to the possibility of additional cost for compliance.

Comments on materials and workmanship to conform to description will be similar to the comments on Degree of Inspection and compliance.

8.0 CONTRACT ADMINISTRATION

The appropriate clause in the 'pink form' that relates to this factor is clause 2 - Consultant's Instructions.

COMMENT

The term is used here to describe the various functions which the consultant may or must perform under a construction contract. Administration is part of the duty normally included under the umbrella description "supervision". It includes many matters not related directly to superintendence on site. The most important of these are: issuing certificates and ordering variations, issuing instructions and drawings.

The client's and for that matter the consultant's timely issuance of certificates, instructions and drawings are very important. During the construction process a delay while waiting for a client's/consultant's approval can cause a costly disruption. If the contractor goes ahead without approval or instruction, his work may be rejected. If he waits, he may incur time and costs overruns.

If the perception of the client and contractor of the responsibilities of the contractor are different, conflicts may result from the administration of the contract and this can expose both the client and the contractor to costly disputes.

9.0 WEATHER VARIATIONS

The factor relates to clause 19 - Delays and Extension of Time.

COMMENT

If in the opinion of the consultant the works be delayed "by reason of any exceptionally inclement weather, ... the consultant shall make a fair and reasonable extension of time.....".

The cause for such a delay is the fault of neither party therefore the client is not required to pay extra money but must release the contractor from the consequences of Liquidated damages by extending the time for completion. The meaning of "exceptionally inclement weather" according to eminent jurists, is a question of fact. The weather must have been so bad when compared with normal records for the locality and have occurred when the outside works were in progress to such an extent that delay was inevitable.

The problem arises when there is variation in weather which is not classified as exceptionally inclement weather but which may cause delay and increase costs. The contractor must appreciate this risk.

10.0 PAYMENT OF INTEREST ON CONTRACTORS CLAIMS

The appropriate clauses that this factor relates are:

Clause 25 - Certificates and Payments

Clause 27 - Loss and Expense caused by disturbance of regular progress of the Works.

COMMENT

Claims are normally applications for payment by the contractor arising other than under the ordinary provisions for payment of the measured value of the work under contract. A legally enforceable claim comprises a right to payment arising under the contract, a claim for damages for breach of contract and, in the less usual case, under some other head of law as e.g. in tort. If a claim is rejected, a dispute arises, Arbitration process can then start. It is instructive to note that questions of fact will normally be decided by the consultant who is an appointed representative of the client. As a result, the possibility of bias against the contractor is high. Payment of interest on the claim, payment of which may take a long time will depend on the judgement of the Arbitrator. The procedure in Litigation is different in terms of the questions of Law. The court is empowered to give interest on any part of a claim for debt or damages which is either included in judgement or which is paid before judgement.

In inflationary times and with the long delays of payment, interest has become an important issue and it is commendable that the Ghana Institution of Surveyors has recommended the payment of interest on delayed certificates in the draft review of the Conditions of Contract. In the meantime, however, there should be interest on claims since they do not come under the ordinary provisions for payment of the measured value of works under the contracts.

The FIDIC makes allowance for the payment of such interests under Clause 60.10.