ASSESSMENT AND MANAGEMENT OF RISK IN CONSTRUCTION PROJECTS IN NIGERIA

By

ODOFIN, ADEREMI A.
(PGD/CE/08/038)

A thesis report submitted to the

DEPARTMENT OF CIVIL ENGINEERING

In partial fulfillment of the requirement for the award

of

POST GRADUATE DIPLOMA

IN

CIVIL ENGINEERING

SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY,

FEDERAL UNIVERSTY OF TECHNOLOGY, MINNA

NIGER STATE.

FEBRUARY 2011

DECLARATION

I hereby declare that this project have no bearing to any work done by any person or group of individuals.

It has been written by me and it is a record of research work.

All quotations and references are duly acknowledged.

18/02/2011

ODOFIN, ADEREMI A.
(PGD/CE/08/038)

DATE

CERTIFICATION

I certify that this project report titled "*ASSESSMENT AND MANAGEMENT OF RISK IN CONSTRUCTION PROJECTS IN NIGERIA*" is the bonafide work of Mr. ODOFIN ADEREMI A., who carried out the research under my supervision. I certify further, that to the best of my knowledge the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

---------- 19-05-2011

ENGR. O. JAMES **DATE**
Project Supervisor

---------- ----------

ENGR. PROF. S. SADIKU **DATE**
Head of Department.

---------- ----------

EXTERNAL EXAMINER **DATE**

---------- ----------

DEAN S.E.E.T **DATE**

---------- ----------

DEAN, POSTGRADUATE SCHOOL **DATE**

DEDICATION

This project work is wholly dedicated to my lovely daughter; "**Adeola Bella Eseose Odofin"** I marvel at the work of GOD in how you have grown so big and active in so short a time. You are a true source of inspiration to me.

ACKNOWLEDGEMENT

My deepest and profound gratitude goes to the Almighty God; for his divine mercy, provision, protection and direction throughout the course of this project and also, my life in general.

I give my sincere thanks to **Engr. O. James (PROJECT SUPERVISOR)** Department of Civil Engineering, for his expert guidance, valuable suggestions and also his kind permission to undertake this project.

The author also expresses his sincere and heartfelt gratitude to **Prof. S. Sadiku, Professor & Head, Department of Civil Engineering, Federal University of Technology, Minna, Niger State** for his expert guidance, fatherly support throughout my stay in this institution.

Many thanks to all the lecturers and staff members of Civil Engineering department, Prof. O.D. Jimoh, Dr. Engr. T. Y. Tsado, Dr. Engr. Amadi, Dr. Engr. Ehijiator, Dr. Engr. J.I. Aguwa, Dr. Engr. P.N. Ndoke, Engr. S.F. Oritola, Engr. A.M. Mustapha, Engr. M. Abdullahi, Engr. S.S. Kolo, Engr. Afiz, Mr. M. Kudu, Alh. D. Dada, Mallam A. B Sule and Laboratory Attendant, Mallam Umar, Badegi.

I would like to express my sincere appreciation to all family members - nuclear and extended. A special love and appreciation goes to my **mum** for always been there for me. Warmest loving regards goes to my wife; **Sandra Odofin** for her encouragement, assistance and understanding in the course of this project work.

Finally, I like to extend my appreciation to friends and course mates, especially Ishaku, Sylvester, Naroka and Imeh. You gentlemen and ladies are the best.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF SYMBOLS

1.	α	the probability level of the risk occurrence
2.	β	the degree of impact or the level of loss if the risk occurs
3.	$\sum$	Summation

CHAPTER 1

INTRODUCTION

Project management is the application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project. Project risk management includes the processes concerned with identifying, analyzing, and responding to project risk. It includes maximizing the results of positive events and minimizing the consequences of adverse events.

Generally, risk is a choice in an environment rather than a fate. BS 6079 (British Standard Institution 1996) defines risk as '...the uncertainty inherent in plans and possibility of something happening that can affect the prospects of achieving, business or project goals'. The word ''risk'' was known in the English language in the 17th century. It is believed that the word was originally a sailor's term that came from the Spanish and meant ''to run into danger or to go against a rock.'' The money spent to fund shipments overseas was the first example of risk business in the early days of travel. Each and every activity we do involve risk, only the amount of risk varies.

Miller of Purdue University defined risk as "Unpredictability in corporations/businesses outcome variables". About Uncertainty he defines as "Unpredictability of environmental and organizational variables that impact the corporations/businesses performance."

Consequences of uncertainty and its exposure in a project, is risk. In a project context, it is the chance of something happening that will have an impact upon objectives. It includes the possibility of loss or gain, or variation from a desired or planned outcome, as a consequence of the uncertainty associated with following a particular course of action. Risk thus has two elements: the likelihood or probability of something happening and the consequences or impacts

if it does. Managing risk is an integral part of good management and fundamental to achieving good business and project outcomes for the effective procurement of goods and services. Risk management provides a structured way of assessing and dealing with future uncertainty.

1.2 AIM OF STUDY

Research on risk assessment and management has been done by various people, mostly on developed countries. In Nigeria, only few research works have been done in this area. Thus this study focuses on risk assessment and management in Nigeria in field of construction.

1.3 OBJECTIVE OF THE STUDY

The Development of infrastructure is one of the most important activities that can boost up the business of the various Industries, thereby increasing the Gross Domestic Product (GDP). Due to this fact countries stress on infrastructure development and provide finances for the same in their yearly budget. These various projects are in themselves vast and big and involve a lot of money. The vastness of this project leaves a lot of scope for various problems from clearances to land acquisition, wastage, unforeseen delays, natural calamities etc. leading to time and cost overrun in the project. The cost overrun can be of huge magnitude in a project involving large amount of money.

1.4 NEED FOR THE STUDY

The loss of services given by the project during the time by which the project overruns can be enormous if put into monetary terms. Hence, to reduce the losses efficient management of a construction project is required. Application of various project management techniques have to be made from the conception to the completion stages which includes managing the various risks associated with the project in its every stage. Risk Management can be viewed as an integral part of project management, as shown in fig 1.1 below:

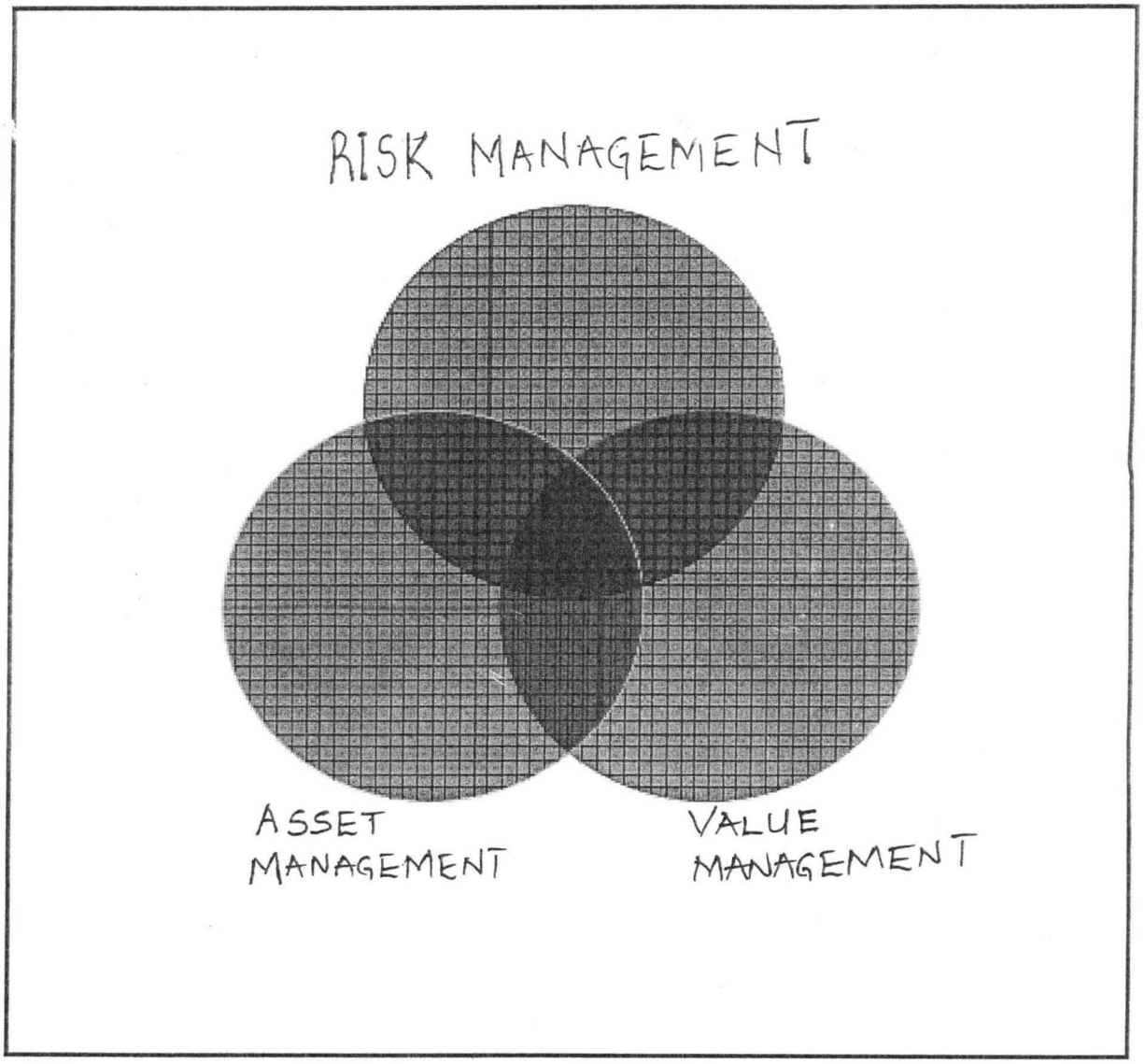

Fig 1.1 Risk Management as an Integral Element of Project Management

1.5 SCOPE OF WORK.

The scope of Risk Assessment and Mitigation is limited to the construction of large building projects like, Multiplexes, Malls, Large residential townships etc.

1.6 METHODOLOGY

The methodology is basically the use of survey

1.7 JUSTIFICATION

The following constitute the justification of the study;

1. Less uncertainty
2. Achievement of objectives
3. Shareholders' reliability
4. Reduction of capital cost
5. Creation of value.

CHAPTER 2

LITERATURE REVIEW

An extensive review of international project risk assessment and management was conducted during the initial phase of the research effort. Previous research suggests that construction activities are particularly subject to more risks than other business activities because of its complexity; a construction project usually requires a multitude of people with different skills and interests and the coordination of a wide range of disparate, yet interrelated, activities. Such complexity is further compounded by the unique features of a project and many other external uncertainties. And also, in general, there is an absence of literature that has focused on this practices, results or development of risk assessment and management techniques for Nigerian construction projects.

PAST RESEARCH WORK ON RISK ASSESSMENT AND MANAGEMENT

According to Grier (1981), the first signs of risk management go back as far as 3200 BC in the Tigris-Euphrates valley with a group of people called the Asipu. One of their functions was to act as risk consultants. Their procedure would be to identify the important dimensions of the problem, propose alternative actions, and collect data on the likely outcomes. Their data sources, though, were signs from the gods.

Each alternative option would be interpreted from the gods, and either a plus or a minus sign would result, whether the idea was a favorable one, or not. Then, the most favorable action would be selected from the pool of positive responses and reported to the client.

Akintoye and MacLeod (1997) studied the construction industry's perception of risk associated with its activities and the extent to which the industry uses risk analysis and management techniques with the help of a questionnaire survey of general contractors and project managers. The authors concluded that risk management is essential to construction activities for minimizing losses and enhancing profitability. Construction risk is generally perceived as events that influence project objectives of cost, time and quality.

Risk analysis and management in construction depend mainly on intuition, judgement and experience. Formal risk analysis and management techniques are rarely used due to a lack of knowledge and doubts on the suitability of these techniques for construction industry activities.

Uher and Toakley (1999) studied the use of risk management in the conceptual phase of the construction project development cycle in the Australian construction industry through a survey. It was found that while most respondents were familiar with risk management; its application in the conceptual phase was relatively low, even though individuals were willing to embrace change.

Bing and Tiong (1999) based on their study categorized the risk factors and their mitigating measures. The most effective risk mitigating measures were categorized into eight groups namely:partner selection, agreement, employment, control, subcontracting, engineering contract, good relationship, and renegotiation. They proposed a risk management model incorporating measures. Three cases of international construction JVs were analyzed from the perspectives of the execution of these measures.

Bing et al (1999) identified the risk factors associated with international construction joint ventures (JVs) from an ''integrated'' perspective. The risk factors were grouped into three main groups: (1) Internal; (2) Project- specific; and (3) External. The study examined the most effective mitigating measures adopted by construction professionals in managing these risks for their construction projects in East Asia. Based on an international survey of contractors, it was found that the most critical risk factors exist in the financial aspects of JVs, government policies, economic conditions, and project relationship. When entering a foreign construction market in the form of a JV, a foreign construction company could reduce its risks if it would carefully select its local partner, ensure that a good JV agreement is drafted, choose the right staff and subcontractors, establish good project relationships, and secure a fair construction contract with its client.

Mulholland and Christian (1999) made a model in a systematic way to consider and quantify uncertainty in construction schedules. The study focused on lessons learned from past projects and describes a risk assessment process involving typical inputs and expected outputs. The model incorporates knowledge and experience acquired from many experts, project-specific information, decision analysis techniques, and a mathematical model to estimate the amount of risk in a construction schedule at the initiation of a project. The model provides the means for sensitive analysis for different outcomes wherein the effect of critical and significant risk factors can be evaluated.

Ye and Tiong (2000) formed a systematic classification of existing evaluation methods developed for a new method—the net-present-value-at-risk (NPV-at-risk) method by combining the weighted average cost of capital and dual risk- return methods. The evaluation of two hypothetical power projects showed that the NPV- at-risk method can provide a better decision for risk evaluation of investment in a privately financed infrastructural projects.

Wang (2000) based on their survey on risk management of build- operate-transfer (BOT) projects in developing countries, with emphasis on infrastructure projects in China, discussed specifically the criticality of the political and force majeure risks. Based on the survey, critical risks, in descending order of criticality, were identified: Chinese Parties' reliability and creditworthiness, change in law, force majeure, delay in approval, expropriation, and corruption. The measures for mitigating each of these risks were also discussed.

Hastak and Shake (2000) developed a risk assessment model for international construction projects named ICRAM-1. The paper discusses some of the existing models for country risk assessment, presents potential risk indicators at the macro, market, and project levels, and explains the ICRAM-1 methodology through an applied example. Four main results are obtained from the ICRAM-1 analysis: (1) High- risk indicators; (2) Impact of country environment on a

specific project; (3) Impact of market environment on a specific project; and (4) Overall project risk.

Hastak and Shaked (2000) in their study classified all risks specific to whole construction scenario into three broad levels, i.e. country, market and project levels. Macroeconomic stability is partly linked to the stance of fiscal and monetary policy, and to a country's vulnerability to economic shocks. Construction market level risks, for a foreign firm, include technological advantage over local competitors, availability of construction resources, complexity of regulatory processes, and attitude of local and foreign governments towards the construction industry while project level risks are specific to construction sites and include logistic constraints, improper design, site safety, improper quality control and environmental protection, etc.

Aleshin (2001) studied the problem of risk management of international and joint venture projects with foreign co-operation in Russia. The author identified classified and assessed risks inherent to joint venture projects in Russia and practical recommendation for risk management.

Kartam and Kartam (2001) based on a questionnaire survey found that contractors show more willingness to accept risks that are contractual and legal related rather than other types of risks. Their research also indicated that the application of formal risk analysis techniques is limited to the Kuwaiti construction industry.

Kapila1 and Hendrickson (2001) they identified the financial risk factors associated with international construction ventures from an integrated perspective. They examined the most effective mitigation measures adopted by construction professionals in managing these risks for their construction projects and suggested other means of risk aversion.

Zayed (2002) made a BOT risk prototype evaluation model that provides a logical, reliable, and consistent procedure for assessing the BOT project risk. The proposed model introduced the BOT risk index (F), which relied on the actual performance of eight main BOT risk areas. Two different modeling approaches were used in constructing this index: a new developed and an adapted Dias and Ioannou model.

Darrin and Lewis (2002) analyzed the principles involved, on practical experience of evaluating projects to form a framework for assessing the risk, with the help of waste water treatment facility in Scotland as a case study which is a typical PPP project.

rahman.M and Kumaraswamy (2002) developed a basic model which conceptualized for improved project delivery through Joint risk management through a survey conducted in Hong Kong and with a case study in mainland China.

Thomas et al (2003) of IIT Madras, carried out risk perception analysis to evaluate the risk criticality, risk management capability, risk allocation/sharing preference, and factors influencing risk acceptance of major stakeholders in BOT projects. They surveyed various senior project participants such as government officials, promoters, lenders and consultants of Indian BOT road projects. Several types of risks have been identified as very critical in the Nigerian road sector under BOT set up with traffic revenue risk being the most critical. The study revealed that the factors and their relative influence on the risk acceptance of stakeholders are considerably different.

Wong and Hui (2003) identified the importance of risk factors by data collected in a postal questionnaire survey conducted to the building contractors in Hong Kong. Out of 60 factors identified the availability of required cash, uncertainty in costs estimates, urgent need for work, past experience in similar projects and contract size are considered most important. The findings suggested that in the upward adjustment of tender prices, the large-size contractors are more

concerned with the uncertainty in costs estimates while the medium- and small-size contractors care more about no past experience.

Shen et al (2003) established a risk significance index, based on a survey to show the relative significance among the risks associated with the joint ventures in the Chinese construction procurement practice. Real cases were examined to show the risk environment faced by joint ventures. The paper also investigated practical applications of risk management in the business of joint ventures.

Jannadi and Almishari (2003) developed and computerized a risk assessor model – RAM, to determine the risk associated with a particular activity and its justification factor.

Daud Nasir et al (2003) developed a method to assist in the determination of the lower and upper activity duration values for schedule risk analysis by program evaluation and review technique analysis or Monte Carlo simulation. Probabilities for various combinations of parents for each risk variable were obtained through an expert interview survey and incorporated into the model. Finally, sensitivity analysis was performed. The model was tested using 17 case studies.

Ye and Tiong (2003) used Monte Carlo simulation, to evaluate the mean net present value (NPV), variance and NPV-at-risk of different concession period structures. They analysed the influence of project characteristics on concession period design to evaluate the feasibility of the design. They concluded that a well-designed concession period structure can create a 'win–win' solution for both project promoter and the host government.

Cho and Seo (2004) presented a risk assessment methodology for underground construction projects. A formalized procedure and associated tools were developed to assess and manage the risks involved in underground construction. The suggested risk assessment procedure is composed of four steps namely: identifying, analyzing, evaluating, and managing the risks inherent in construction projects. The main tool of the proposed risk assessment methodology is

the risk analysis software. The risk analysis software is built upon an uncertainty model which is based on fuzzy concept. Other tools developed in this study include the survey sheets for collecting risk- related information and a detail check sheets for risk identification and analysis. They finally discussed a detailed case study of the developed risk assessment methodology performed for a subway construction project in Korea.

Seung H. Han et.al (2004) focused on a financial portfolio risk management for international projects to integrate the risk hierarchy of both individual projects and at the corporate level, which applies a multicriteria decision making method to maximize the total value of firms. To demonstrate the approach, a case study was conducted based on real projects collected from a multinational general contractor. Finally, they presented lessons learned as well as guidelines for the application of lessons to future projects through a workshop with industry practitioners.

Lyons and Skitmore (2004) conducted a survey of senior management involved in the Queensland engineering construction industry, concerning the usage of risk management techniques. Their survey results were compared with four earlier surveys conducted around the world which indicates that: the use of risk management is moderate to high, with very little differences between the types, sizes and risk tolerance of the organizations and experience and risk tolerance of the individual respondents. Risk management usage in the execution and planning stages of the project life cycle is higher than in the conceptual or termination phases; risk identification and risk assessment are the most often used risk management elements ahead of risk response and risk documentation; brainstorming is the most common risk identification technique used; qualitative methods of risk assessment are used most frequently. Risk reduction is the most frequently used risk response method, with the use of contingencies and contractual transfer preferred over insurance; and project teams are the most frequent group used for risk analysis, ahead of in-house specialists and consultants.

Wang et.al (2003) conducted multiple-case studies using a systematic analytical procedure to identify risks in highway projects in Taiwan, to recognize risk allocation by contract clauses, and to analyze the influence of risk allocation on the contractor's risk handling strategies. The results

show that the owner allocates risks by stipulating specific contract clauses into five kinds of risk allocation conditions. If a risk is more controllable by the contractor, the owner has a greater tendency to allocate the risk to the contractor. Risk allocation determines which kinds of risks the contractor would take and influences the contractor's risk handling decisions.

The analysis furthermore indicated that, if the probability of a certain risk event condition is uncontrollable, then with the increasing possibility of taking the risk, the contractor's tendency of risk handling changes from actively transferring the risk to passively retaining the risk. In contrast, if a risk is controllable and certainly allocated to the contractor, the contractor tends to take the initiative to reduce the impact caused by the risk event rather than retain the risk.

Qing et.al (2004) identified twenty-eight critical risks associated with international construction projects in developing countries and categorized them into three hierarchy levels (Country, Market and Project), of which 22 were evaluated as Critical or Very Much Critical based on a 7-degree rating system. The top 11 critical risks are: Approval and Permit, Change in Law, Justice Reinforcement, Local Partner's Creditworthiness, Political Instability, Cost Overrun, Corruption, Inflation and Interest Rates, Government Policies, Government Influence on Disputes and Termination of JV. The risks at Country level are more critical than that at Market level and the latter are more critical than that in Project level. For each of the identified risks, practical mitigation measures were provided and evaluated. Almost all of the mitigation measures were perceived by the respondents to the survey as effective using a 7-degree rating system. It is suggested that when mitigating a specific risk, the measures with higher effectiveness should be given a higher priority.

Taking into account the higher criticalities of higher risk hierarchy levels, the mitigation measures should also be prioritized by the higher risk hierarchy level, i.e. the risks at higher hierarchy level should be mitigated first with higher priority with their respective more effective mitigation measures. A risk model, named Alien Eyes' Risk Model, was proposed which shows the three risk hierarchy levels and the influence relationship among risks. This model will enable

better categorizing of risks and representing the influence relationship among risks at different hierarchy levels as well as revealing the mitigating sequence/priority of risks.

Bing et.al (2005) conducted a questionnaire survey to explore preferences in risk allocation in United kingdom. Analysis of the response data shows that some risks should still be retained within the public sector or shared with the private sector. These are mainly macro and micro level risks. Majority of risks in PPP/PFI projects, especially those in the macro level risk group, should be allocated to the private sector.

El-Diraby. and Gill (2006) developed taxonomy for relevant concepts in the domain of privatized-infrastructure finance. The taxonomy is an attempt to create information interoperability between the construction and financial industries. The taxonomy models the concepts of a privatized-infrastructure finance into six main domains: processes, products, projects, actors, resources and technical topics (technical details and basic concepts). The taxonomy was designed to be consistent with Open Financial Exchange (OFX). It was developed through the analysis of 10 case studies and involvement in project development and interaction with industry experts. The taxonomy was validated through interviews with domain experts, and through the analysis of two independent case studies. A prototypical semantic web-based portal for communicating project risks was developed in order to illustrate the use of the taxonomy.

2.2 CONCEPTS OF RISK ANALYSIS AND MANAGEMENT.

2.2.1 RISK CONCEPTS

Risk is a multi-facet concept. In the context of construction industry, it could be the likelihood of the occurrence of a definite event/factor or combination of events and factors which occur during the whole process of construction to the detriment of the project, a lack of predictability about structure outcome or consequences in a decision or planning situation, the uncertainty associated with estimates of outcomes. There is a chance that results could be better than expected as well as worse than expected.

In addition to the different definitions of risk, there are various ways for categorizing risk for different purposes too. Some categorize risks in construction projects broadly into external risks and internal risks while others classify risk in more detailed categories of political risk, financial risk, market risk, intellectual property risk, social risk, safety risk, etc. The classification is shown in figure 2.1. The typology of the risks seems to depend mainly upon whether the project is local (domestic) or international. The internal risks are relevant to all projects irrespective of whether they are local or international. International projects tend to be subjected to the external risk such as unawareness of the social conditions, economic and political scenarios, unknown and new procedural formalities, regulatory framework and governing authority.

Risk is inherent and difficult to deal with, and this requires a proper management framework both of theoretical and practical meanings. Risk management is a formal and orderly process of systematically identifying, analyzing, and responding to risks throughout the life-cycle of a project to obtain the optimum degree of risk elimination, mitigation and control.

Significant improvement to construction project management performance may be achieved from adopting the process of risk management.

The types of exposure to risk that an organization is faced with ranges and varies from one organization to another. These exposures could be the risk of business failure, the risk of project financial losses, the occurrences of major construction accidents, default of business associates, dispute and organization risks. It is desirable to understand and identify the risks as early as possible, so that suitable strategy can be implemented to retain particular risks or to transfer them to minimize any likely negative aspect they may occur as shown below overleaf.

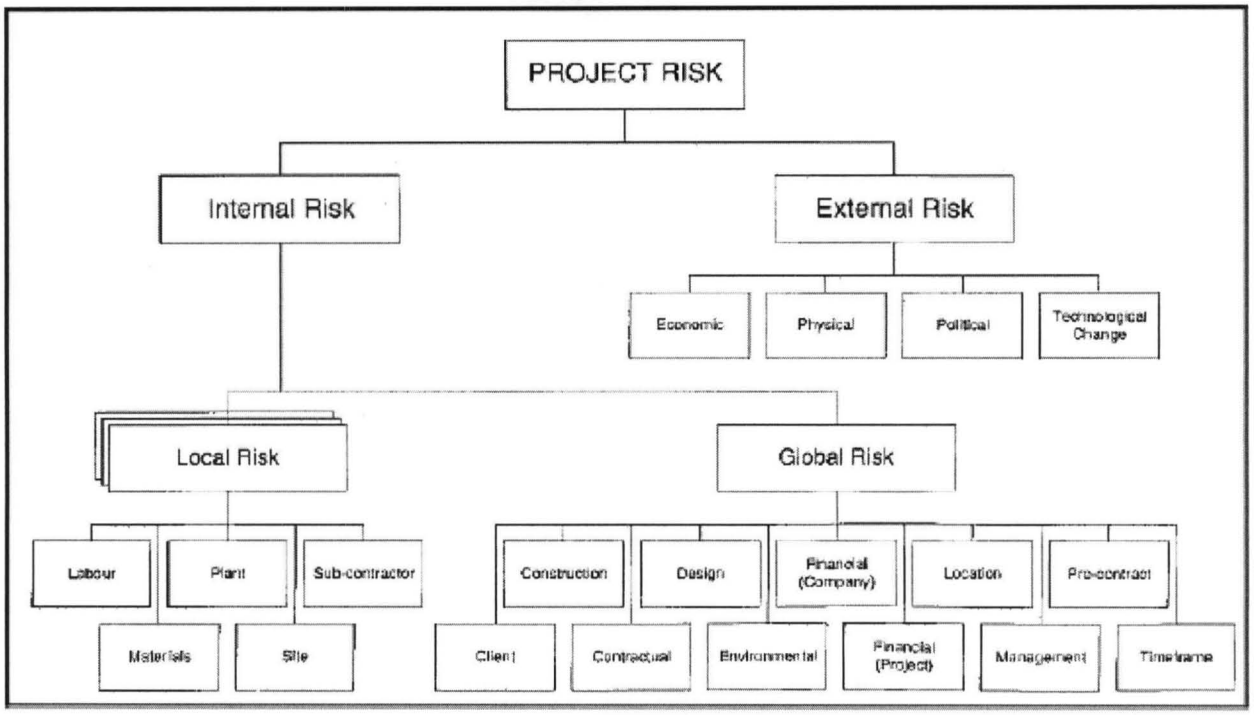

Figure 2.1 Hierarchical risks involved in a project

The risk management process begins with the initial identification of the relevant and potential risks associated with the construction project. It is of considerable importance since the process of risk analysis and response management may only be performed on identified potential risks. Risk analysis and evaluation is the intermediate process between risk identification and management. It incorporates uncertainty in a quantitative and qualitative manner to evaluate the potential impact of risk. The evaluation should generally concentrate on risks with high probabilities, high financial consequences or combinations thereof which yield a substantial financial impact.

Once the risks of a project have been identified and analyzed, an appropriate method of treating risk must be adopted. Within a framework of risk management, contractors should also decide how to handle or treat each risk and formulate suitable risk treatment strategies or mitigation measures. These mitigation measures are generally based on the nature and potential

consequences of the risk. The main objective is to remove as much as possible the potential impact and to increase the level of control of risk. The more the control of one mitigation measure on one risk, the more effective the measure is.

The process of risk management does not aim to remove completely all risks from a project. Its objective is to develop an organized framework to assist decision makers to manage the risks, especially the critical ones, effectively and efficiently.

2.2.2 PROJECT RISK MANAGEMENT

Risk management in a project encompasses identifying influencing factors that could potentially negatively impact a project's cost schedule or quality baselines; quantifying the associated potential impact of the identified risk; and implementing measures to manage and mitigate the potential impact. The riskier the activity is, the costlier the consequences if the wrong decision is made.

Businesses would like to quantify risk for many reasons. Knowing how much risk is involved will help decide the costly measures to reduce the level of risk. It can also help to decide if sharing the risk with an insurance company is justified. Some risks, such as natural disasters, are virtually unavoidable and affect many people. All choices in life involve risk. Risks cannot be totally avoided, but the choice can be made so that the risk is minimized.

Risk = Probability of an event × Consequence of loss due to that event per event

Graphical representation of risk ratings can be made by plotting a graph between probability and seriousness, Figure 2.2 explains this.

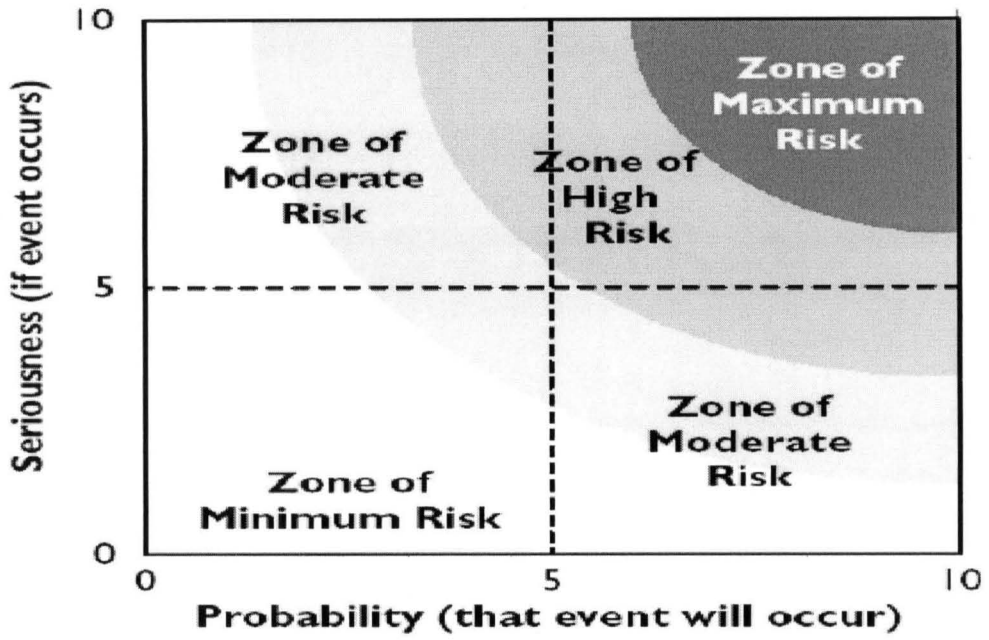

Figure 2.2 Graphical representations of risk rating

2.2.3 RISK ASSESSMENT

Risk assessment is defined in this study as a technique that aims to identify and estimate risks to personnel and property impacted upon by a project. Traditional risk assessment for construction has been synonymous with probabilistic analysis. Such approaches require events to be mutually exclusive, exhaustive, and conditionally independent.

However, construction involves many variables, and it is often difficult to determine causality, dependence and correlations. As a result, subjective analytical methods that rely on historical information and the experiences of individuals and companies have been used to assess the impact of construction risk and uncertainty.

2.2.4 DETERMINATION OF RISK

There are mainly two methods to determine risk, namely the quantitative and the qualitative approach. The quantitative approach relies on statistical calculation to determine risk, its probability of occurrence, and its impact on a project. A common example of the quantitative approach is decision tree analysis, applying probabilities to two or more outcomes. Another approach is the Monte Carlo simulation, which generates a value from a probability distribution and other factors.

The qualitative approach relies on judgments, using criteria to determine outcome. A common qualitative approach is a precedence diagramming method, which uses ordinal numbers to determine priorities and outcomes. An example of a qualitative approach is to list in descending order specific processes of a project, the risk or risks associated with each process, and the control or controls that may or should exist for each risk.

2.2.5 RISK EXPOSURE

Several factors can expose projects to higher than normal risk, they include:

• **Team size** - The larger the team, the higher the probability of a problem arising. For example, communications can be more difficult as the number of participants increases. The number of interactions among people increases and thus they require greater coordination.

• **History** - Newer projects are riskier because the processes have not been refined. The more times a project of a similar nature has been done, the greater the likelihood of success.

• **Staff expertise and experience** - If the staff lacks direct experience and knowledge of the subject, people will struggle to learn as they go along, robbing the project of time and possibly introducing errors.

• **Complexity** - The more sophisticated a project, the greater the opportunity of a mistake or problem occuring.

• **Management stability** - Management stability implies unity of direction, which in turn means reaching goals. Management irritability can lead to unrealistic scheduling and inefficient use of resources.

• **Time compression** - If a schedule is highly compressed, then the risks are magnified. Having more time means greater flexibility and the opportunity to prevent or mitigate the impact of errors.

• **Resource availability** - The more resources that are available, the greater the ability to respond to problems as they arise. For example, more money brings greater ability to secure equipment or people when needed. Plentiful resources, of course, do not guarantee protection from risk; however they do provide the means to respond to it.

2.2.6 GENERAL TYPES OF RISKS

Risks can be viewed as business, technical, or operational. A technical risk is the inability to build the product that will satisfy requirements. An operational risk is the inability of the customer to work with core team members.

Risks are either acceptable or unacceptable. An acceptable risk is one that negatively affects a task on the non-critical path. An unacceptable risk is one that negatively affects the critical path.

Risks are either short or long term. A short-term risk has an immediate impact, such as changing the requirements for a deliverable. A long-term risk has an impact sometime in the distant future, such as releasing a product without adequate testing. Risks are viewed as either manageable or unmanageable. A manageable risk is one you can live with, such as a minor requirement change. An unmanageable risk is impossible to accommodate, such as a huge turnover of core team members.

Finally, risks are either internal or external. An internal risk is peculiar to a project, such as the inability to get the parts of a product to work. An external risk originates from outside the scope of the project, such as when senior management arbitrarily cuts funding.

1. **Delivery/Operational risk**

This risk factor involves issues or concerns associated with actual engineering, procurement, construction execution and operation of the project, including non-traditional approaches such as a public owner's use of design-build contracts.

2. **Technological risk**

This risk factor involves issues or concerns associated with the technologies involved in the execution methods and operational technology of the project.

3. **Financial risk**

This risk factor involves issues or concerns associated with the financing of the project, including the execution period and operations or equity financing.

4. **Procurement-contractual risk**

This risk factor involves issues or concerns associated with the contractual and procurement approach-system-process used for both project execution and operation.

5. **Political risk**

This risk factor involves issues or concerns associated with the local, regional, and national political and regulatory situation confronting the project.

6. **Environmental risk**

This risk factor involves issues or concerns associated with the environmental problems, concerns, and activities confronting the project during the project execution and the project operation.

7. Social risk

This risk factor involves issues or concerns associated with the social and cultural impacts of the project to the community and region within which it is to be located.

8. Economic risk

This risk factor involves issues or concerns associated with the macroeconomic impact of the project to the community and region within which it is to be located.

9. Reserves risk - an operations risk factor

Addresses the extent of reserves and contingency to be transported, and not only the anchor field, but also reserve risk is associated with the prospects and discoveries in the area.

10. Credit risk - a financial risk factor

Customer credit risk is a new risk issue stemming from the large inflow of small capital independents and the formation of many Limited Liability Corporations without any real assets.

11. Engineering risk- a technology risk factor

A large risk consideration is that the meteorological-ocean data current and waves is empirical and is changing with new measurement information becoming available every year.

12. Materials risks - a procurement risk factor

The huge costs of projects are driving the search for the cheapest material that meets specifications which is to be fabricated in a location that has the least cost- often in different countries.

13. Weather risks - an environmental risk factor

Wave currents (storm risks) are plaguing many off-shore projects, yet are increasingly uninsurable.

14. Insurance risks - an economic risk factor

The global reinsurance market currently has severe capital restrictions that are restricting access to project insurance.

15. People risks - a social risk factor

Changing social relationships and forced cultural changes of linear projects, like pipe-lines, are destabilizing local support and long term operability conditions.

16. Interface risks - a delivery risk factor

The risk that several different contractors working on different segments of a project are not being managed in the design phase, as more work must be executed on a fast track basis under design-build delivery methods.

17. Underground risks - a technology risk factor

The unknowns underground will always be a source of risk that affects execution resources and methodologies.

18. Joint venture risks - a financial risk factor

Projects requires many stakeholders to be joint ventures to spread financial risk, which is also forcing differing institutional approaches and cultures to clash and increase, not decreasing, financial risk sharing, although such risk issues are not fundamentally analyzed when joint ventures are established .

19. Design-build risks - a procurement/contractual risk factor

Execution management practices that are not accustomed to design-build stakeholder expectations and industry practices are reducing design-build benefits and exacerbating impacts of risks as they emerge during project execution, especially because many of the key "players" are over-committed.

20. Security risks - a political risk factor

Projects of all types are required in many unstable parts of the world, but the militant and terrorist threat and sophistication is well beyond that hitherto experienced.

21. "Green" risks - an environmental risk factor:

Projects experience increased environmental concerns in developed, developing and underdeveloped countries with equal ferocity, which impacts construction methodologies and resource use.

22. Right of way risks - a social risk factor

Right of way issues are increasingly causing delay as through indigenous populations experiencing broader democratic approaches are asserting rights to extract social improvement with consequently larger cost to projects.

23. Payment risks - an economic risk factor

In both developing and underdeveloped countries, projects are financed privately through concessions that require payment for the commodity transported, which requires both a risky impact on the economy and a culture shift from the perception of having to pay for what is considered a right.

2.2.7 SOURCES OF RISK IN CONSTRUCTION PROJECTS

The common sources of risk in construction projects are listed below:

- Misunderstanding of contract terms and conditions.
- Design changes and errors
- Poorly coordinated work
- Poor estimates

- Poorly defined roles and responsibilities
- Unskilled staff
- Natural hazards
- Political and legal problems.

2.2.8 OVERVIEW OF RISK MANAGEMENT

Project Risk Management includes the processes concerned with identifying, analyzing, and responding to project risk. It includes maximizing the results of positive events and minimizing the consequences of adverse events. Figure 2.3 provides an overview of the following major processes:

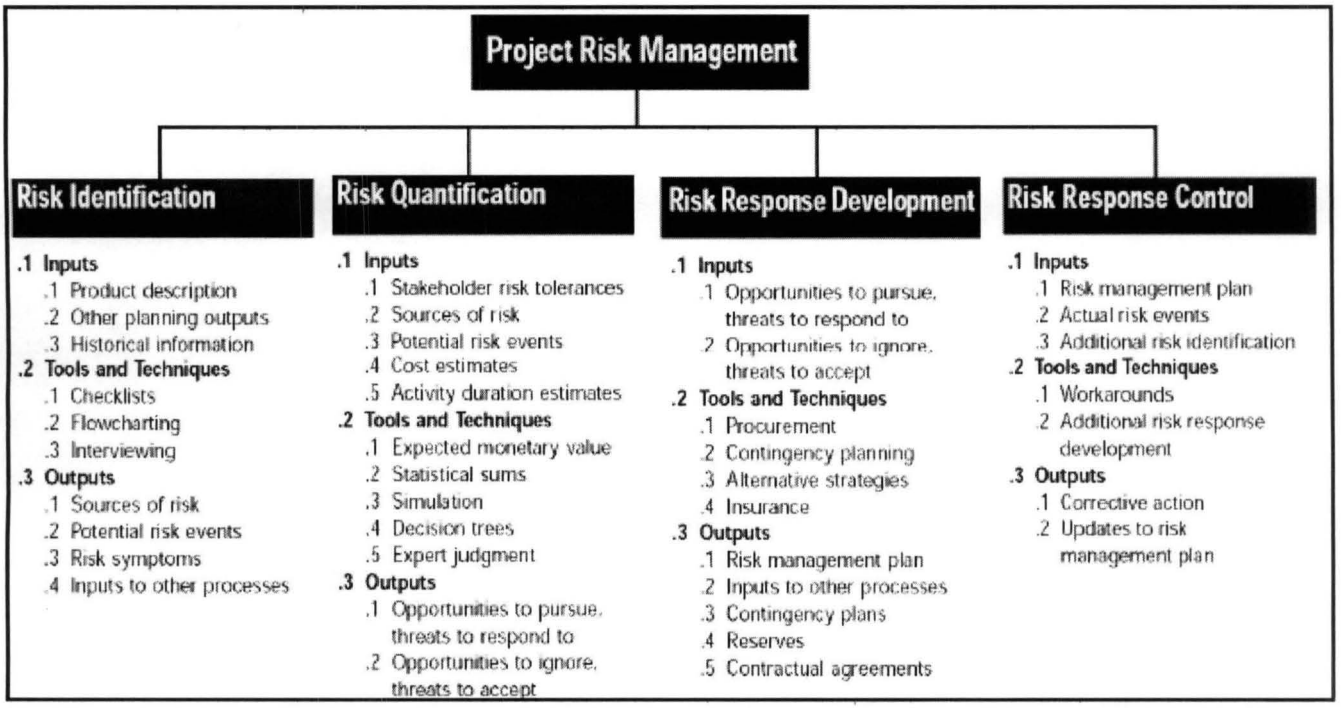

Figure2.3 Overview Risk Management

The processes shown in figure 2.3 interact with each other and with the processes in the other knowledge areas as well. Each process may involve effort from one or more individuals or

groups of individuals based on the needs of the project. Each process generally occurs at least once in every project phase.

Risk identification and risk quantification are sometimes treated as a single process, and the combined process may be called risk analysis or risk assessment. Risk response development is sometimes called response planning or risk mitigation. Risk response development and risk response control are sometimes treated as a single process, and the combined process may be called risk management (PMI 1996).

2.3.0 MAJOR PROCESSES OF PROJECT RISK MANAGEMENT

Risk management involves four processes, namely

1. Risk Identification

   Determining which risks are likely to affect the project and documenting the characteristics of each.

2. Risk Quantification

   Evaluating risks and risk interactions to assess the range of possible project outcomes.

3. Risk Response Development

   Defining enhancement steps for opportunities and responses to threats.

4. Risk Response Control

   Responding to changes in risk over the course of the project.

2.3.1 Risk identification

Risk identification consists of determining which risks are likely to affect the project and documenting the characteristics of each. Risk identification is not a onetime event; it should be performed on a regular basis throughout the project. Risk identification should address both internal and external risks.

Internal risks are things that the project team can control or influence, such as staff assignments and cost estimates. External risks are things beyond the control or influence of the project team, such as market shifts or government action. Risk involves only the possibility of suffering harm or loss. In the project context, however, risk identification is also concerned with opportunities (positive outcomes) as well as threats (negative outcomes).

2.3.2 Tools and techniques for risk identification

Risk can be identified by the following methods: (A.K.Garg 2005)

1. Brainstorming
2. Workshops
3. Interviews
4. Questionnaire survey
5. Feedback from similar projects
6. Use of specialists
7. Previous experience

2.3.3 Risk quantification

Risk quantification involves evaluating risks and risk interactions to assess the range of possible project outcomes. It is primarily concerned with determining which risk events warrant response. It is complicated by a number of factors including, but not limited to:

- Opportunities and threats can interact in unanticipated ways (e.g., schedule delays may force consideration of a new strategy that reduces overall project duration).
- A single risk event can cause multiple effects, as when late delivery of a key component produces cost overruns, schedule delays, penalty payments, and a lower-quality product.
- Opportunities for one stakeholder (reduced cost) may be threats to another (reduced profits).
- The mathematical techniques used can create a false impression of precision and reliability.

2.3.3.1 Tools and techniques for risk quantification

- **Expected monetary value** : The expected monetary value is generally used as input to further analysis (e.g., in a decision tree) since risk events can occur individually or in groups, in parallel or in sequence.

  Risk event probability: An estimate of the probability that a given risk event will occur.

- **Risk event value**: An estimate of the gain or loss that will be incurred if the risk event does

  occur. Deduce the result by equating a small loss with a high probability to a large loss with a small probability.

- **Statistical sums**: Statistical sums can be used to calculate a range of total project costs from the cost estimates for individual work items. (Calculating a range of probable

project completion dates from the activity duration estimates requires simulation). The range of total project costs can be used to quantify the relative risk of alternative project budgets or proposal prices.

- **Simulation**: Simulation uses a representation or model of a system to analyze the behavior or performance of the system. The most common form of simulation on a project is schedule simulation using the project network as the model of the project.

  Most schedule simulations are based on some form of Monte Carlo analysis. This technique, adapted from general management, "performs" the project many times to provide a statistical distribution of the calculated results. The results of a schedule simulation may be used to quantify the risk of various schedule alternatives, different project strategies, different paths through the network, or individual activities.

  Schedule simulation should be used on any large or complex project since traditional mathematical analysis techniques such as the Critical Path Method (CPM) and the Program Evaluation and Review Technique (PERT) do not account for path convergence and thus tend to underestimate project durations. Monte Carlo analysis and other forms of simulation can also be used to assess the range of possible cost outcomes.

- **Decision trees**: A decision tree is a diagram that depicts key interactions among decisions and associated chance events as they are understood by the decision maker. The branches of the tree represent either decisions or chance events are examples of a decision tree.

- **Expert judgment**: Expert judgment can often be applied in lieu of or in addition to the mathematical techniques. For example, risk events could be described as having a high, medium, or low probability of occurrence and a severe, moderate, or limited impact.

be handled during the implementation or construction phase. Many application areas have a substantial body of literature on the potential value of various alternative strategies.

4. Insurance: Insurance or an insurance-like arrangement such as bonding is often available to deal with some categories of risk. The type of coverage available and the cost of coverage vary by application area.

2.3.5 Risk response and control

Risk response control involves executing the risk management plan in order to respond to risk events over the course of the project. When changes occur, the basic cycle of identify, quantify, and respond is repeated.

It is important to understand that even the most thorough and comprehensive analysis cannot identify all risks and probabilities correctly; control and iteration are required.

2.3.5.1 Tools and techniques for risk response control

• Workarounds: Workarounds are unplanned responses to negative risk events. Workarounds are unplanned only in the sense that the response was not defined in advance of the risk event occurring.

• Additional risk response development: If the risk event was not anticipated, or the effect is greater than expected, the planned response may not be adequate, and it will be necessary to repeat the response development process and perhaps the risk quantification process as well.

2.3.6 RESPONSE TO RISK

There are basically five categories of classic risk response strategies namely: accepting, avoiding, monitoring, transferring, and mitigating the risk (Eric Verzuh 2005).

1. <u>Accepting the Risk</u>: Accepting the risk means to understand the risk, its consequences and probability, and thus choose to do nothing about it. If the risk occurs, the project team will react.

This is a common strategy when the consequences or probability that a problem will occur are minimal. As long as the consequences are cheaper than the cure, this strategy makes sense.

2. Avoid the Risk: Avoid a risk by choosing not to do part of the project. The deletion of part of the project could affect more than the project-the business risk could also be affected. Changing the scope of the project might change the business case as well, because a scaled-down product could have smaller revenue or cost-saving opportunities.

3. Monitor the Risk and Prepare Contingency Plans: Monitor a risk by choosing some predictive indicator to watch as the project nears the risk point. The risk strategy is to monitor the risk by being part of the test team. Contingency plans are alternative courses of action prepared before the risk event occurs. The most common contingency plan is to set aside extra money, a contingency fund, to draw on in the event of unforeseen cost overruns.

It is important to make sure that this fund is used only for unforeseen cost overruns-not to make up for underestimating or substandard performance. Contingency plans can be looked on as a kind of insurance and insurance policies, they can be expensive.

4. Transfer the Risk: Many large projects purchase insurance for a variety of risks, ranging from theft to fire. By doing this, they have effectively transferred risk to the insurance company in that, if a disaster should occur, the insurance company will pay for it. While purchasing insurance is the most direct method of transferring risk, there are others. For example, hiring an expert to do the work can also transfer risk. A fixed-price contract states that the work will be done for an amount specified before the work begins. Fixed schedules may also be added to such a contract, with penalties for overruns.

With fixed-price contracts, project managers know exactly what the cost of this part of a project will be. They have effectively transferred the cost and schedule risks from the project to the subcontracting firm; any overruns will be the responsibility of the subcontractor. The only downside to this scenario is that the subcontractor, knowing it will be held to the original bid, will probably make the bid higher to make up for the risk it is assuming.

Another type of contract for service is called a reimbursable or cost-plus, contract. Reimbursable contracts pay subcontractors based on the labour, equipment, and materials they use on a project. The risk of cost and schedule overruns is borne completely by the project on these contracts. The project is not able to transfer risk with this kind of contract, but when the work to be performed is poorly defined. Or the type of service is open-ended, a reimbursable contract is the only type a subcontractor will sign. Clearly, transferring risk to another party has advantages, but it also introduces new risks.

5. **Mitigate the Risk:** Mitigation is a process of response to the risk after impact affects the project. Mitigation covers nearly all the actions the project team can take to overcome risks from the project environment.

2.3.7 ADVANTAGES OF RISK MANAGEMENT

The following are the advantages of risk management;

1. Less uncertainty
2. Achievement of objectives
3. Shareholders' reliability
4. Reduction of capital cost
6. Creation of value.

2.3.8 LIMITATIONS OF RISK MANAGEMENT

If risks are improperly assessed and prioritized, time can be wasted in dealing with risk of losses that are not likely to occur. Spending too much time assessing and managing unlikely risks can divert resources that could be used more profitably. Unlikely events do occur, but if the risk is unlikely to occur. It may be better to simply retain the risk and deal with the result if the loss does in fact occur.

CHAPTER 3

METHODOLOGY

The methodology adopted in this project is given below:

- Study of literature related to Risk Analysis and Risk Management capabilities.
- Preparation of Questionnaire.
- Site visit to major construction project sites.
- Questionnaire survey and personnel interviews with in-charges and managers and collection of data from site.
- Analyzing the Questionnaire.
- Qualitative analysis of data obtained from site and to identify the root cause.
- Remedial measures to be suggested and the present data to be recorded for future reference.
- Conclusions, recommendations and suggestions for future study.

3.1.1 METHOD OF SURVEYING

The general methodology of this study relies largely on the survey questionnaire which will be collected from the local building contractors of different sizes by mail or by personnel meeting. A thorough literature review was initially conducted to identify the risk factors that affect the performance of construction industry as a whole.

This study has adopted the more general and broad definition of risk as presented by Shen et al (2001) on China's construction joint ventures and more risk factors from other literature. Also some interviews with industrial practitioners were conducted to produce to check effectiveness of questionnaires.

3.1.2 QUESTIONNAIRE STRUCTURE

The structured interview questionnaire is shown in Appendix A. The questionnaire was tested with a pilot survey for clarity, ease of use, and value of the information that could be gathered. The questionnaire survey is divided into two parts. The first part consists of general information like type of company, experience, value of their project e.t.c. and the second part consists of the construction risk factors for evaluation.

Risk factors for this study are classified into eight categories, namely:

1. Financial risk
2. Legal risk
3. Management risk
4. Market risk
5. Policy and political risk
6. Technical risk
7. Environmental risk
8. Social risk

3.1.3 QUESTIONNAIRE DESIGN

The survey questionnaire is designed to probe the cross-sectional behavioral pattern of construction risks construction industry. The questionnaire was prepared for the pilot survey and was formulated by seeing the relevant literatures in the area of construction risk. The interviewer was free to ask additional questions that focused on issues arising during the course of the interview. The freedom to follow the interviewee, to ask for clarifications, and to focus on specific projects, risk practices and knowledge, made the interviews insightful.

3.2 RISK RATING

A Likert scale of 1-5 was used in the questionnaire. A Likert scale is a type of psychometric response scale often used in questionnaires, and is the most widely used scale in survey research. When responding to a Likert questionnaire item, respondents specify their level of agreement to a statement. The scale is named after Rensis Likert, who published a report describing its use (Likert, 1932). The respondents were required to indicate the relative criticality/ effectiveness of each of the probability of risk factors and their impact to the management. (In Appendix-A details of evaluation made in the questionnaire survey are given)

3.3 DESIGN OF SURVEY

The respondents were requested to judge the significance or ''expected loss'' of each risk. There are many criteria that respondents may need to consider. One alternative approach adopted by previous researchers (Shen et.al 1998) is to consider two attributes for each risk: the probability level of the risk occurrence, denoted by α; and the degree of impact or the level of loss if the risk occurs, denoted by β. The same type of evaluation is followed in this study also. Therefore, risk significance, denoted as RS, can be described as the function of the two attributes $RS = f(\alpha,\beta)$. By applying this approach, the respondents were asked to respond to the two attributes for each risk. For considering α , the respondents were required to judge the probability level of risk occurrence by selecting one from among five levels namely: Very small, Small, Normal, Large and Very large. For considering β, the respondents were required to judge the degree of impact if the risk concerned occurs by selecting one from among five grades namely: Very low, Low, Medium, High, and Very high.

To assess the relative significance among risks, previous literatures study suggests establishing a risk significance index by calculating a significance score for each risk. For calculating the significance score is to multiply the probability of occurrence by the degree of impact. Thus, the significance score for each risk assessed by each respondent can be obtained through the model;

$$S_j^i = \alpha_j^i \beta_j^i$$

Where Si = significance score assessed by respondent j for risk i;

αj = probability of occurrence of risk i, assessed by respondent j;and

βi = degree of impact of risk i, assessed by respondent j.

By averaging scores from all the responses, it is possible to get an average significance score for each risk, and this average score is called the risk index score and is used to rank among all risks. The model for the calculation of risk index score can be written as

$$RS^i = \frac{\sum_{j=1}^{T} S_j^i}{T}$$

Where RSi = index score for risk i;

Si = significance score assessed by respondent j for risk i and

T = Total number of responses.

To calculate Si, the five point scales for A and β, this will be converted into numerical (Likert scale) scales.

A pilot survey with the questionnaire in the previous phase and follow-up interviews with local contractors were conducted. The purpose was to identify the factors out of the 81 factors that applied overseas could also apply to the local construction industry. The small number interviews and the structure of the questionnaire in the pilot study does not allow for statistical analysis.

Responses to the interviews have been used to identify consistent themes, common practices, and insight provided by active and influential project participants that would provide additional guidance and assistance to the research team.

The survey results formed the basis of modifying the questionnaire for the subsequent full-scale survey. The pilot study attempts to short-list locally relevant factors. The criteria for a short-listing are that the chosen factors are relevant in the local construction industry. As a result, only important and relevant factors were chosen for inclusion in the full-scale survey in the second phase of the research.

CHAPTER 4

RESULTS

RESULTS OF SURVEY

Totally, seventy five companies were given the questionnaires, out of which forty five had an effective reply and two were rejected due to improper answering. Thus the response rate is 60% which is considered a good response in this type of survey. In those forty five companies surveyed, twenty one are contractors and 24 are owners. All the questionnaire survey was done from project manager of the project or project engineer at the site. In some cases, consultant gave the answers on behalf of their clients, both from the owner and the contractor side. Even telephonic and email reply was accepted since it was difficult to get a direct one to one meeting with the Project managers. Sub-contractor related problems, time constraint, and increase in inflation were the major problems concerned with both the contractor and owner. The full results were shown in the table 4.1.

As far as the contractor is concerned shortage of skilful workers has the maximum risk rating and other risks which have maximum risk rating are time constraint, sub-contractor related problems, project delay, improper verification of contract documents, and competition from other companies. For the owners time constraint has the maximum risk rating and other risks which have maximum risk rating shortage of skilful workers, project delay, errors in design drawings, Improper project planning and budgeting, loss due to fluctuation of inflation rate. The least risk rating given by both owners and contactors are environmental risk, relation with government departments, local protectionism and industrial disputes.

TABLE 4.1 OVERALL RANKING OF RISKS

S.No	SUB RISK	MEAN	SD
1	Shortage of skilful workers	4.58	3.61
2	Time constraint	4.12	4.58
3	Sub- contractor related problems	3.94	5.72
4	Project delay	3.94	6.39
5	Improper verification of contract documents	3.83	3.6
6	Competition from other companies	3.51	6.31
7	Improper project planning and budgeting	3.25	2.92
8	Increase of materials price	3.07	4.73
9	Loss due to fluctuation of inflation rate	3.05	3.45
10	Poor communication between clients	3.03	4.47
11	Loss due to fluctuation of interest rate	2.99	6.17
12	Increase of labour costs	2.95	6.88
13	Material shortage	2.94	4.82
14	Internal management problems	2.93	4.19
15	Breach of contracts by project partner	2.91	1.99
16	Improper project feasibility study	2.86	5.07
17	Unknown site conditions	2.83	2.32
18	Improper project organization structure	2.79	3.99
19	Loss due to rise in fuel prices	2.75	5.5
20	Design changes	2.74	3.76
21	Site distance from urban area	2.6	6.27
22	Team work	2.56	3.52
23	Errors in design drawings	2.53	4.78
24	Any adverse impact on project due to climate conditions	2.5	4.24
25	No past experience in similar projects	2.45	2.97
26	Poor quality of procured materials	2.39	3.48
27	Wastage of materials by workers	2.3	4.19
28	Cost increase due to changes of govt policies	2.24	3.37
29	Technical risk	2.15	6.18
30	Lack arbitration clause in agreement	2.13	7.1
31	Poor relation and disputes with partner	2.09	3.76
32	High degree of difficulty in construction	2.07	5.04
33	Stiff environmental regulations	1.93	3.67
34	Incompetence of transportation facilities	1.84	2.98
35	Shortage in supply of water	1.78	4.93
36	Equipment failure	1.77	3.12
37	Inadequate choice of project partner	1.73	2.23
38	Loss due to bureaucracy for late approvals	1.73	1.49

39	Architect Vs structural engineer dispute	1.73	4.84
40	Surplus materials handling	1.71	3.78
41	Following government standards and codes	1.7	4.95
42	Bankruptcy of project partner	1.69	7.53
43	Accidents on site	1.57	3.52
44	Increase of accessory facilities price	1.54	3.65
45	Loss due to fluctuation of exchange rate	1.43	3.34
46	Change of top management	1.43	2.54
47	Shortage in supply fuel	1.43	1.38
48	Inadequate forecast about market demand	1.33	3.88
49	Lack of enforcement of legal judgment	1.26	2.71
50	Unfairness in tendering	1.26	4.07
51	Theft of materials at site	1.2	3.99
52	Fall short of expected income from project	1.15	4.47
53	Uncertainty and unfairness of court justice	1.04	2.51
54	Local protectionism	0.98	2.93
55	Changes in bank formalities and regulations	0.93	3.78
56	Industrial dispute	0.89	3.57
57	Low credibility of shareholders and lenders	0.86	5.06
58	Short tendering time	0.86	3.27
59	Obsoleteness of building equipments	0.85	2.36
60	Any impact on the environment due to the project	0.8	3.43
61	Healthy working environment for the workers	0.8	3.83
62	Loss incurred due to corruption and bribery	0.78	6.52
63	Shortage in supply of electricity	0.77	2.65
64	Loss incurred due to political changes	0.68	3.25
65	Poor relation with government departments	0.57	2.12

4.2 ANALYSIS OF RESULTS

GENERAL ANALYSIS

For easy understanding the survey analysis is divided into two part (i.e.) one for the project costing below Five Hundred Million Naira and the other for projects costing above Five Hundred Million Naira. In each category only the first ten risks (top ten risks) is identified and taken for analysis, since analyzing each and early risk will be laborious process. The factor; shortage of skill workers in the overall survey is the main risk faced by the construction firms. Since a large number of cheap unskilled labours are available for work who have migrated to

construction industry from various other industries, particularly agriculture. But as far as the skilled labour is concerned only, few people are available and thus cost of them is very high. To increase the skilled work force the government and the industry people should set up training institutes across the country. Time constraint is also one of the major risks since construction firms are given a short notice in construction and even penalty is imposed on the construction firms if the project is extended beyond the completion date. Certain Information Technology parks are completed within a very short time, ranging from 8 months to 14 months, which are made in a fast track construction mode. Sub contractor related problems prevail everywhere in the construction industry and in each project. Quality and time are the main reasons for the project delay; this is mainly due to the behaviour of sub – contractors. Competition from other companies is also a major threat faced by smaller firms, since large construction companies are able grab the project with its financial and technical strength. Planning and budgeting problems is faced both in larger and smaller construction companies, and this risk depends on other factors sub risks. Fluctuation in inflation and a steep rise in the interest rate by banks are current main problems faced by all the sectors of the industry, particularly the construction sector. Communication gap is also a major problem between the clients, since improper communication leads to a bad situation which could have been easily avoided.

4.2.1 FINANCIAL RISK

Though inflation rate in Nigeria remains much lower than in many other developing countries, this causes the construction industry a hefty price. Rising fuel prices have also been behind rising inflation in Nigeria. Domestic prices of petrol and diesel were raised by about 8% in Nigeria in the year (2007). The corporate organizations are still not sure whether the interest rates have peaked or there is still scope of further increases by the Central Bank of Nigeria (CBN). The real estate companies have suffered a major setback from FMBN money tightening policies. Their top-lines and bottom-lines have shown a much slower growth than their respective interest costs. There is no single window entry for the investors and developers like in other developing and developed countries; which cause a great time delay. Thus both the state and the central government should make a single window system for their approvals. Ranking of financial risks are given in the table 4.3 and the corresponding bar chart is shown in figure 4.1. overleaf.

Table 4.3: Ranking of financial Risks

s/n	Sub risk	Mean
1	Loss due to fluctuation of inflation rate	3.05
2	Loss due to fluctuation of interest rate	2.99
3	Loss due to ries in fuel cost	2.75
4	Bankcruptcy of project partner	1.69
5	loss due to fluctuation of exchange rate	1.43
6	changes in bank's formalities and regulation	0.93
7	low credibility of shareholders and lenders	0.86

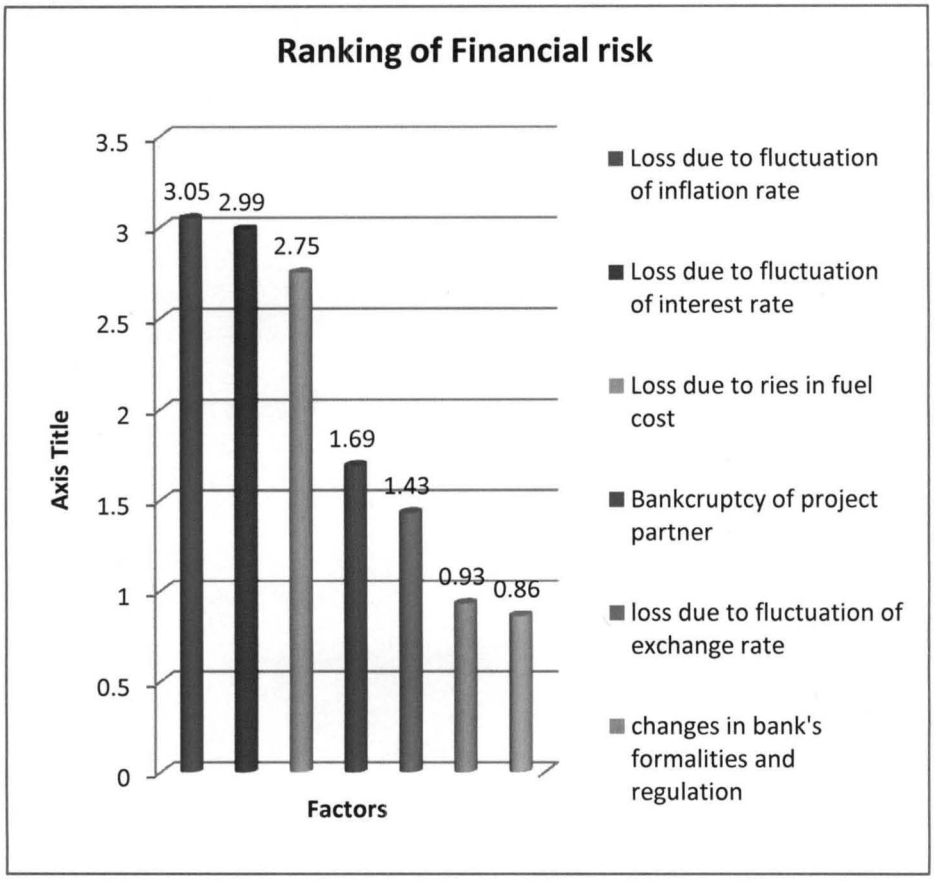

FIG 4.1 BAR CHART FOR FINANCIAL RISKS

4.2.2 MANAGEMENT RISKS

As of now compared with other industries the construction sector suffers a chronic shortage of skilled workers, though unskilled workers are available in large amount from different part of the country. Employment services company Kimberly Ryan estimates a 20 per cent shortfall in the supply of qualified civil engineers needed by the construction industry. People shortage in the construction industry stems from civil engineers abandoning construction in favour of higher-paying IT industry jobs all these years. Within a short span of two years the whole thing may change to vice versa due to higher pay packages given by International /National companies par with IT companies or even more. But now, that the infrastructure sector is growing, there is a huge demand and supply gap. Insufficient manpower may slow down infrastructure projects as companies may phase them longer than necessary. In some companies the problem of frequent design changes occurs due to owners wish, initial design errors, faulty construction etc. To overcome these design problems, the design should revised properly and use of design specialist could solve the problem. Ranking of management risks are given in the table. 4.4. and the corresponding bar chart is shown in figure 4.2. overleaf.

Table 4.4 Ranking of Management risks

s/n	sub risk	Mean
1	Shortage of skilful workers	4.58
2	Material shortage	2.94
3	Unknown site conditions	2.83
4	Design changes	2.74
5	Site distance from urban area	2.6
6	Errors in design drawings	2.53
7	Poor quality of procured materials	2.39
8	Wastage of materials by workers	2.3
9	Technical risk	2.15
10	High degree of difficulty in construction	2.07
11	Stiff environmental regulations	1.93
12	Incompetence of environmental facilities	1.84
13	Shortage in supply of water	1.78
14	Equipment failure	1.77
15	Architect vs Structural Engineer dispute	1.73
16	Surplus material handling	1.71
17	Following government standards and code	1.7
18	Accidents on site	1.57
19	Shortage in supply of fuel	1.43
20	Theft of materials at site	1.2
21	Industrial disputes	0.89
22	Obsoleteness of building materials	0.85
23	Shortage of supply of electricty	0.77

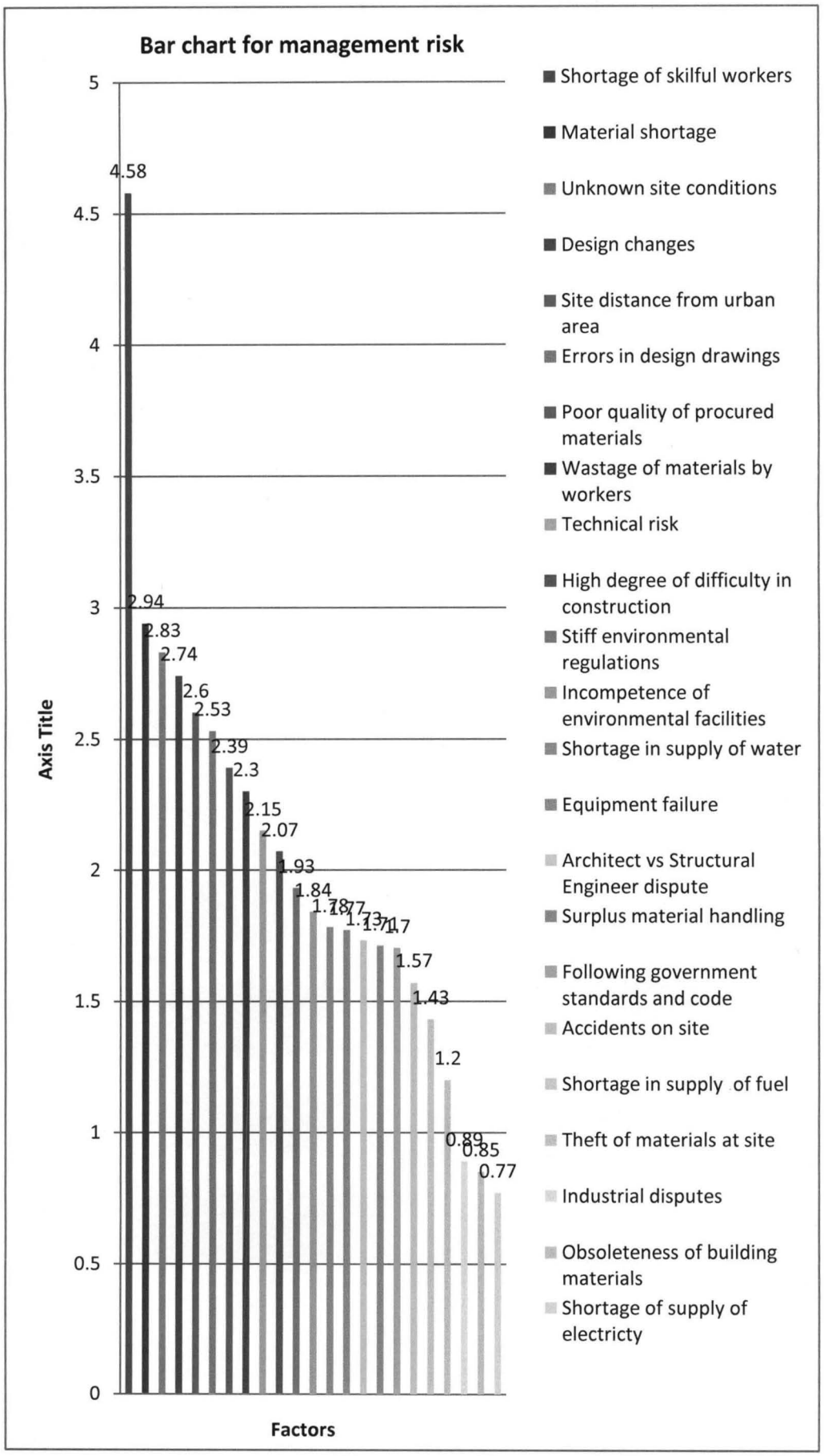

FIG 4.2 BAR CHART FOR MANAGEMENT RISKS

4.2.3 MARKET RISK

Material shortage & steep increase in its price have also affected the construction industry. The National Sample Statistics Organisation has estimated that the materials component accounts for more than 75 per cent to 78 per cent of the construction cost in residential housing. The average construction cost a square feet was N2,400 only, but now due to rise in cement prices it has risen to N3,300. But the only sufferer is the middle class people. The government of India has now allowed import of cement to bring down the cement prices, but this only helps large companies which will order in bulk, and the problem for small & mid size companies remains the same. Ranking of technical risks are given in the table. 4.5. and the corresponding pie chart is shown in figure 4.3. overleaf.

Table 4.5 Market risk

s/n	Sub risks	Mean
1	Competition from other companies	3.51
2	Fall short of expected income from project	1.15
3	Increase of accesssory facilities price	1.54
4	Increase of labour cost	2.95
5	Increase of materials price	3.07
6	Inadequate forecast about market demand	1.33
7	Local protectionism	0.98
8	Unfairness in tendering	1.26

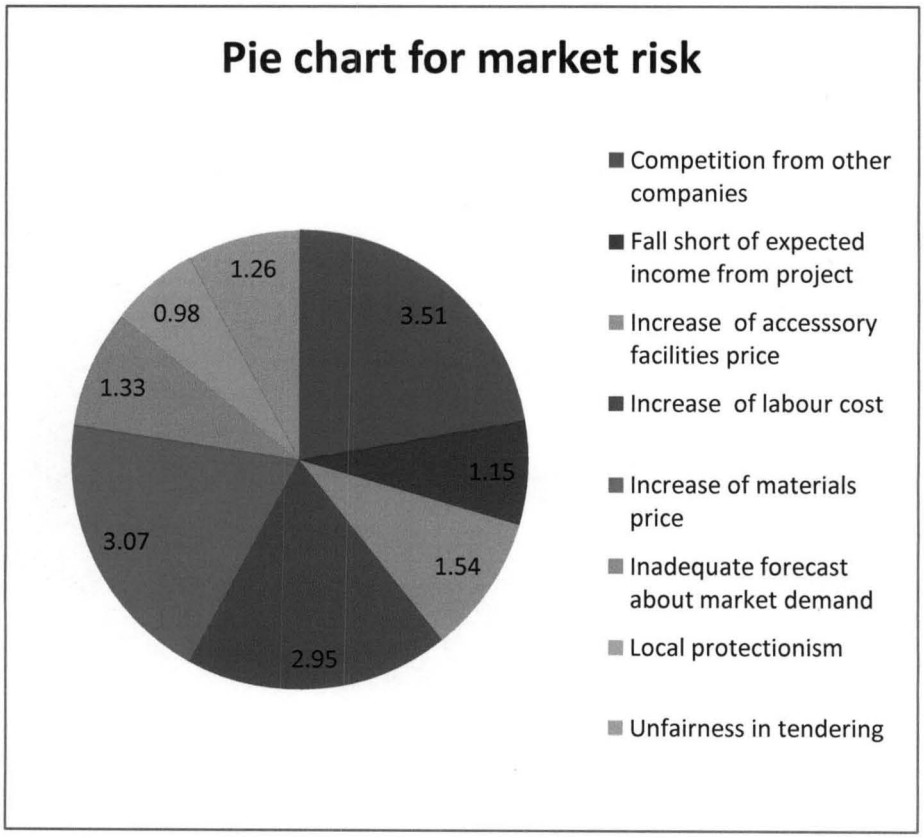

FIG 4.3 PIE CHART FOR MARKET RISKS

4.2.4 TECHNICAL RISK

Improper planning and budgeting, improper feasibility studies, no past experience in similar projects are some technical risk faced by the companies. To overcome these, companies are making joint ventures. Even in leading companies, team work is lagging and causes internal management problems as reported in survey. This may due to top down approach of the companies which commands their employees without consultation particularly lower, middle level management people. Ranking of technical risks are given in the table. 4.6. and the corresponding bar chart is shown in figure 4.4. overleaf.

Table 4.6 Ranking of technical risk

s/n	Sub risks	Mean
1	Time constraints	4.12
2	Sub- contractor related problems	3.94
3	Project delay	3.94
4	Improper project planning and budgeting	3.25
5	Poor communication between clients	3.03
6	Internal management problems	2.93
7	Improper project feasibility study	2.86
8	Improper project organisation structure	2.79
9	Team work	2.56
10	No past experience in similar projects	2.45
11	Poor relationship and disputes with partner	2.09
12	Inadequate choice of project partner	1.73
13	Change of top management	1.43
14	Short tendering time	0.86
15	Poor relationship with government departments	0.57

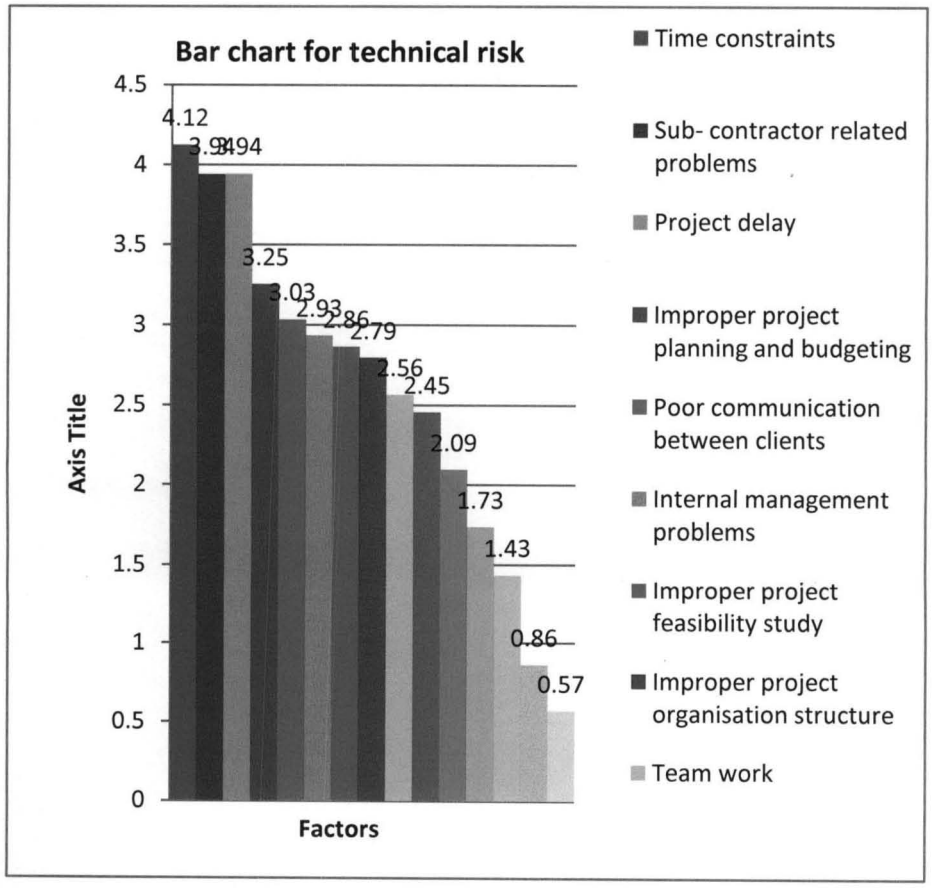

FIG 4.4 BAR CHART FOR TECHNICAL RISKS

4.2.5 LEGAL RISK

Legal risk in Nigeria is not much, but if the contract legal problem arises then settlement dispute takes time & money. Nowadays arbitration clause has made in most of the big projects, but small projects don't involve this clause in the agreement itself. Ranking of legal risks are given in the table. 4.7. and the corresponding pie chart is shown in figure 4.5. below.

Table 4.7 Ranking of Legal risk

s/n	Sub risks	Mean
1	Improper verification of contract documents	3.83
2	Breach of contract by project partner	2.91
3	Lack of arbitration clause in agreement	2.13
4	Lack of enforcement of legal judgement	1.26
5	Uncertainty and unfairness of court justice	1.04

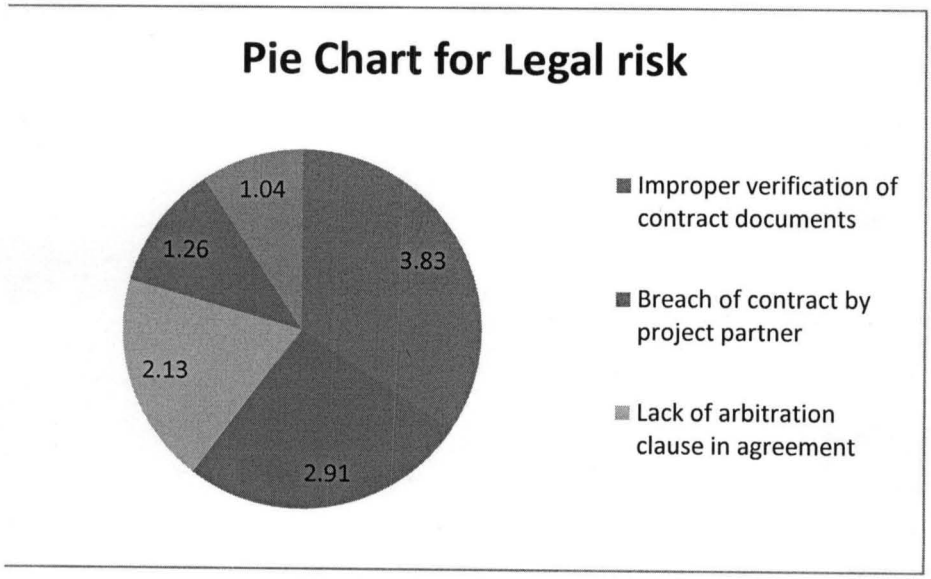

FIG 4.5 BAR CHART FOR LEGAL RISKS

4.2.6 POLITICAL RISK

This is always present but varies differently from state to state. But as far as Nigeria is concerned there is no substantial political risk since, the ruling party/government has not been changed but has improved very much. But as far as getting approval for new projects is concerned, this causes delays and even financial loss for the companies. Ranking of political risks are given in the table. 4.8 and the pie chart is shown in figure 4.6. below.

Table 4.8 Ranking of Political Risk

s/n	Sub risks	Mean
1	Cost increase due to changes in Govt policies	2.24
2	Loss due to bureaucracy for late approvals	1.73
3	Loss incurred due to corruption and bribery	0.78
4	Loss incured due to political crisis	0.68

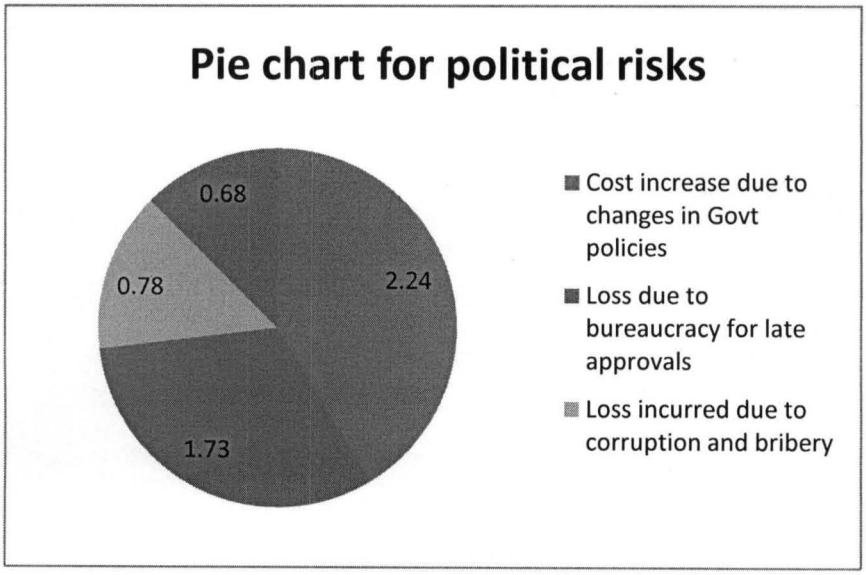

FIG 4.6 PIE CHART FOR POLITICAL RISKS

4.2.7 ENVIRONMENTAL RISK

During rainy season inundation of water in foundation in the starting stage of the project is a great disadvantage for the construction companies. For workers, working under the direct sunlight is difficult, so safety helmets are provided in some companies. Ranking of environmental risks are given in the table. 4.9 and the pie chart for the same is shown in figure 4.7 below.

Table 4.9 Ranking of Environmental risk

s/n	Sub risks	Mean
1	Any adverse impact on project due to climatic conditions	2.5
2	Any impact on the environment due to project	0.8
3	Healthy working environment for workers	0.8

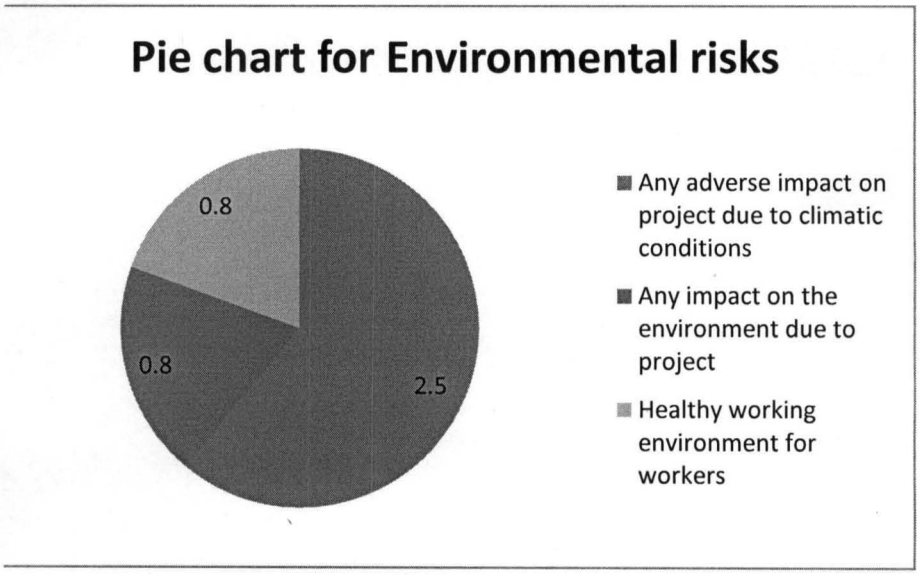

FIG 4.7 PIE CHART FOR ENVIROMENTAL RISKS

For *simply u*nderstanding the risks out of all the risk factors top ten risks were found tabulated in the Table 4.10 and Table 4.11 and the bar chart for the same is shown in figure 4.8 and 4.9 below.

Table 4.11 For project costing for less than 500 Million top ten risks

s/n	Sub risks	Mean	SD
1	Increase of materials price	4.51	3.5
2	Loss due to fluctuation of inflation rate	4.5	4.13
3	Increase of Labour costs	3.93	5.13
4	Materials shortage	3.92	6.56
5	Errors in deign drawings	3.85	3.16
6	Shortage of skilful workers	3.56	6.32
7	Time constraints	3.45	3.93
8	Sub-contractor related problems	3.17	5.71
9	Project delay	3.11	4.44
10	Competition from other companies	2.99	6.17

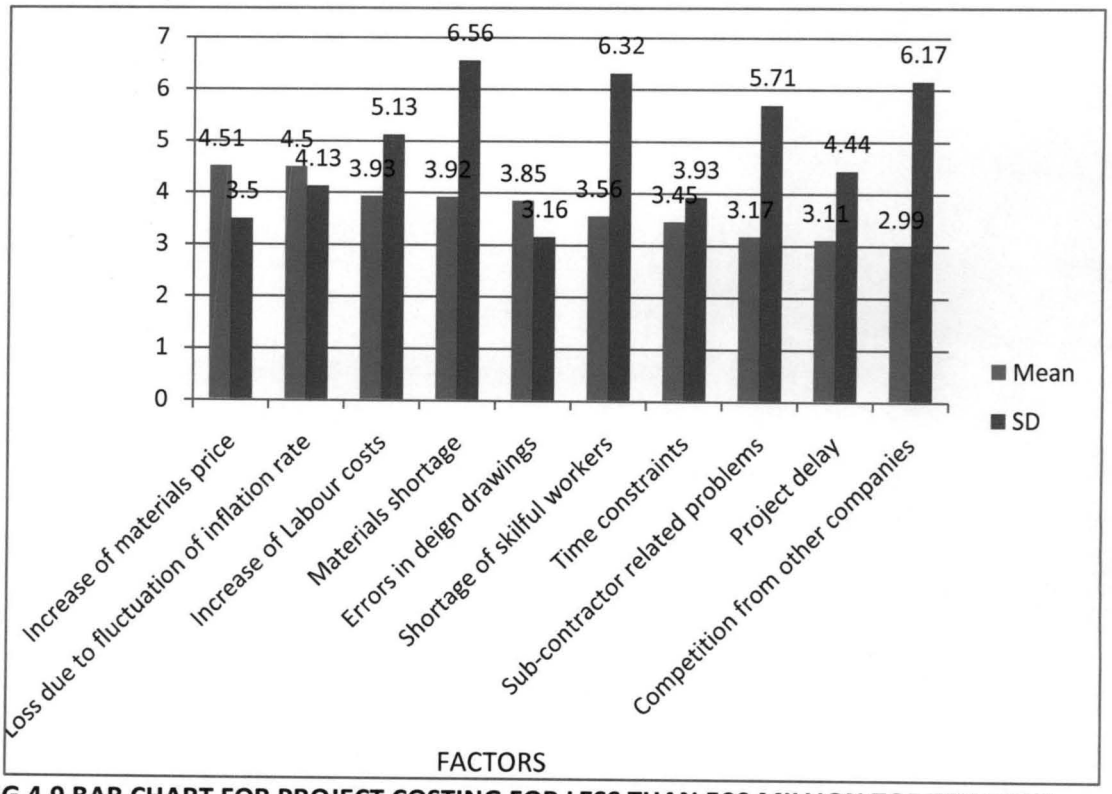

FIG 4.9 BAR CHART FOR PROJECT COSTING FOR LESS THAN 500 MILLION TOP TEN RISKS

Table 4.10 For project costing for 500 Million top ten risks

s/n	Sub risks	Mean	
		Mean	SD
1	Shortage of skilful workers	4.58	3.61
2	Time constraints	4.12	4.58
3	Sub-contractor related problems	3.94	5.72
4	Improper verification of contract document	3.94	6.39
5	Competition from other companies	3.83	3.6
6	Competition from other companies	3.51	6.31
7	Improper project planning and budgeting	3.25	2.92
8	Increase of materials price	3.07	4.73
9	Loss due to fluctuation of inflation rate	3.05	3.45
10	Poor communication between clients	3.03	4.47

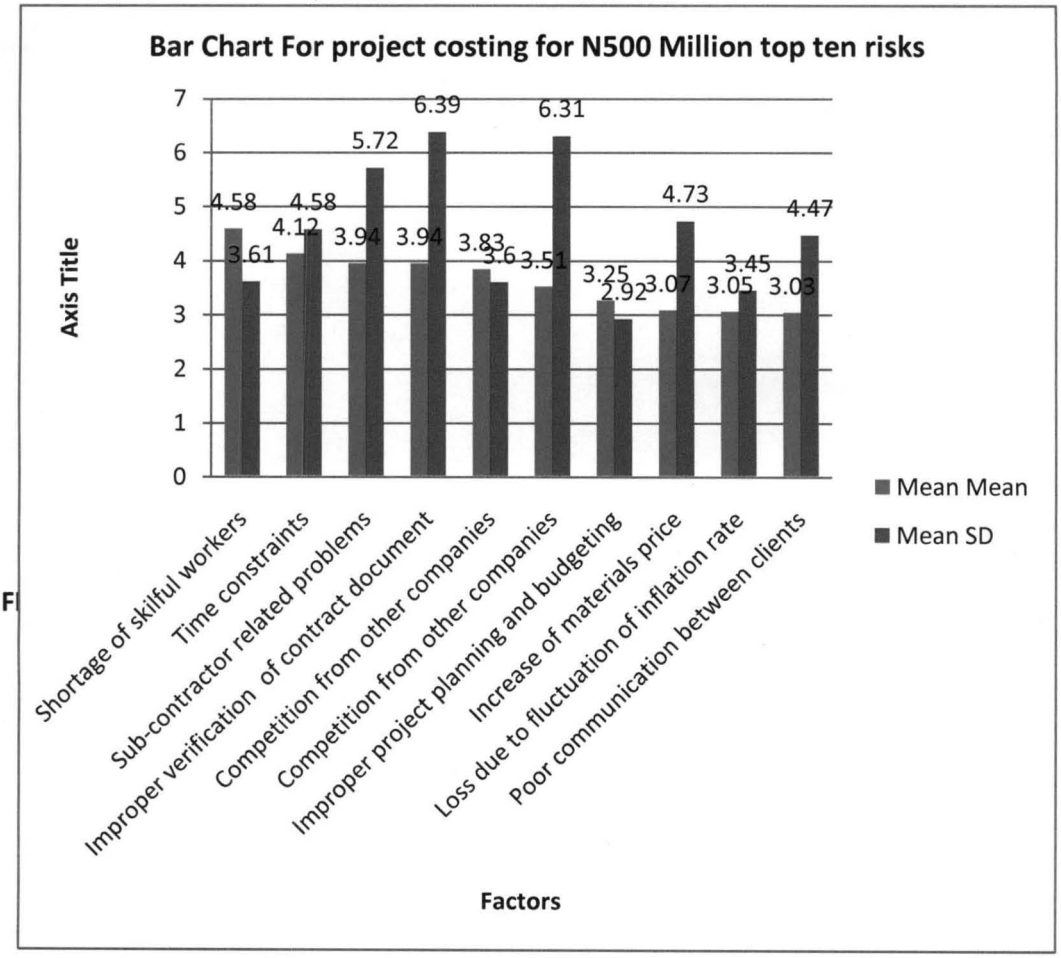

FIG 4.8 BAR CHART FOR PROJECT COSTING FOR N500 MILLION TOP TEN RISKS

CHAPTER 5

CONCLUSIONS

As far as Nigeria is concerned risk management is still a new word in the construction sector and this should be changed as soon as possible. Currently the Government of Nigeria has proposed a risk rating system will help the developers to develop projects at a faster pace by taking quick decisions. Each rating agency will have its own methodology to rate projects. The system will help government to develop a strategy to mitigating risk. This will encourage more response from developers and investors for public-private partnerships projects. It could make the bidding projects more competitive. The system will enable bankers to take quick decisions for lending finances, which could lead to the financial closure of the project at a faster pace. Third party risk rating would certainly raise critical points, which are not normally raised during finalization of project

The following are the conclusions from this thesis work

1. Shortage of skilful workers is the major risk faced by almost all the companies. This is because; the skilled workers are migrating between companies very often due to the high demand in the market. And also huge vacuum is created by the workers who move to abroad where they are offered very high packages when compared to Nigeria.
2. Since real estate, construction sector are in the boom side, construction companies are in move to make profit as soon as possible in current wave itself; but this creates tremendous pressure to the workers to complete the project in a very short span. This time constraint risk prevails in all the companies surveyed.
3. Sub-contractor related risks are also high, since most of the sub contractors are not able to meet the standards of the main contractor and the client due their size of

work. Thus from the above points the management risk has been found to be the critical risk from this survey

4. Delay in the project is also one of the main risks, but this delay is looped with various others factors and risks directly or indirectly.

5. The risk of competition from other companies constitutes major problem to the small & medium sized companies. Larger corporations have created a stiff competition to the local companies both technically and financially.

6. Inflation rate is very high in Nigeria and increasing proportionately with time, this causes the increase in prices of materials like cement, steel which in turn causes financial risk to the land developers and construction firms. Banks have also raised their interest rates for the loan given by them, this has affected the residential construction market hugely. Thus the financial part of risk is very high than any other risk.

7. Political risk is substantially very low for the large firms when compared to other risk.

8. Legal risk is also very low, but the implementation of court directive is not proper; this was the complaint seen from this survey.

9. Large companies are accepting that there are few environmental effects due to their project, but says that it is a global phenomena and it cannot be nullified, but can only be reduced.

10. Overall market, management, and the financial risks are high when compared to other risks.

RECOMMENDATIONS

1. Risk management should be considered a primary tool to assess the project. From the survey we can understand that risk management is not followed in most of the companies as such but if followed also it is not done systematically. Immediate mitigation measures are not in place if a risk event happens.

2. During the planning stage itself a full-fledged risk assessment about the project should be made as a effective measure to curb risks.

3. Financial part of the risk is a global phenomena and this risk should be handled carefully using financial consultants since this cannot be handled by Engineers alone.

4. There is not a single company with a separate person in the manager level who handles risk management within the company and takes decision on his own. Thus a risk management body within the company should be formed and at least monthly evaluation should be done.

5. Most of the company's management follow Top to down approach which is a traditional approach, but Down to top approach should be followed so that the employees' voices are heard.

6. It is better to involve a risk consultant in a project who can expertly advise both owner and the contractor in a better way.

REFERENCES.

Akintoye, Li Bing, P.J. Edwards, C. Hardcastle "The allocation of risk in PPP/PFI construction projects in the UK" International Journal of Project Management 23, 2005, 25–35.

Hyun-Ho Choi Hyo-Nam Cho and J. W. Seo "Risk Assessment Methodology for Underground Construction Projects" Journal of Construction Engineering and Management, ASCE, April 2004, 258-272

Joe Wong and Eddie C. M. Hui, "Construction project risks: further considerations for constructors pricing in Hong Kong", Construction Management and Economics, April 2006, 425-438.

John Walewski and Edward Gibson.G, Jr., "International Project Risk Assessment", A Report of the Centre Construction Industry Studies, University of Texas, Austin, 2003, 11-15.

Li Bing and Robert L. K. Tiong, "Risk management model for international construction joint ventures" Journal of Construction Engineering and Management, ASCE, Vol. 125, No.5, September/October, 1999, 377-384

Makarand Hastak and Aury Shaked "ICRAM-1:Model for international construction risk assessment" Journal of Management in Engineering, Vol. 16, No. 1,January/February, 2000, ASCE, 59-69

Ming-Teh Wang and Hui-Yu Chou "Risk Allocation and Risk Handling of Highway Projects in Taiwan" Journal of management in engineering, ASCE, April 2003, 60-68

Mulholland.B and Christian.J "Risk assessment in construction schedules" Journal of Construction Engineering and Management, Vol. 125, No. 1, January/ February, 1999, 8-15

Nabil A.Kartam and Saied A.Kartam "Risk and its management in the Kuwaiti construction industry a contractor's perspective" International journal of project management 19, 2001, 325-335

Osama Ahmed Jannadi and Salman Almishari, "Risk Assessment in Construction", Journal of Construction Engineering and Management, ASCE Vol. 129, No. 5, 2003, 492-500.

Prashant Kapila and Chris Hendrickson, "Exchange rate risk management in international construction ventures" Journal of Management in Engineering, Vol. 17, No. 4, October, 2001. ASCE,186-191

Roozbeh kangari "Risk management perceptions and trends of U.S construction", Journal of Construction Engineering and Management, Vol. 121, No. 4, December, 1995, 422-429

Seung H. Han, James E. Diekmann, Young Lee, and Jong H. Ock "Multicriteria Financial Portfolio Risk Management for International Projects" Journal of Construction Engineering and Management, ASCE, June 2004, 346-356

Shen L Y "Project risk management in Hong Kong" International Journal of Project Management Vol. 15, No. 2,1997, 101-105

Shen L Y, George.W. C. Wu, and Catherine S. K.Ng "Risk Assessment for Construction joint ventures in China" Journal of Construction Engineering and Management, ASCE, Vol. 127, No. 1, January/February, 2001, 76-81

Shou Qing Wang, Robert L. K. Tiong,S. K. Ting and D. Ashley," Evaluation and management of political risks in China's BOT projects" Journal of Construction Engineering and Management, Vol. 126, No. 3, May/June, 2000, 242-250.

2.3.4 Risk response development

Risk response development involves defining enhancement steps for opportunities and responses to threats. Responses to threats generally fall into one of three categories:

• Avoidance: Eliminating a specific threat, usually by eliminating the cause. The project management team can never eliminate all risk, but specific risk events can often be eliminated.

• Mitigation: Reducing the expected monetary value of a risk event by reducing the probability of occurrence (e.g., using proven technology to lessen the probability that the product of the project will not work), reducing the risk event value (e.g., buying insurance), or both.

• Acceptance: Accepting the consequences. Acceptance can be active (e.g., by developing a contingency plan to execute should the risk event occur) or passive (e.g., by accepting a lower profit if some activities overrun).

2.3.4.1 Tools and techniques for risk response development

1. Procurement: Procurement, acquiring goods or services from outside the immediate project organization, is often an appropriate response to some types of risk. For example, risks associated with using a particular technology may be mitigated by contracting with an organization that has experience with that technology.

Procurement often involves exchanging one risk for another. For example, mitigating cost risk with a fixed price contract may create schedule risk if the seller is unable to perform. In similar fashion, trying to transfer all technical risk to the seller may result in an unacceptably high cost proposal.

2. Contingency planning: Contingency planning involves defining action steps to be taken if an identified risk event should occur.

3. Alternative strategies: Risk events can often be prevented or avoided by changing the planned approach. For example, additional design work may decrease the number of changes which must

Shou Qing Wang, Mohammad F. Dulami and Muhammad Y Aguria "Risk management framework for construction projects in developing countries" Construction Management and Economics , March 2004, 22, 237– 252 .

Shou Qing Wang, Robert L. K. Tiong, Seng Kiong Ting, and David Ashley, "Political risks: Analysis of key contract clauses in china's BOT project", Journal of construction engineering and management, ASCE, June 1999,190-197.

Sudong Ye and Robert L.K Tiong "The effect of concession period design on completion risk management of BOT projects, Construction Management and Economics , July 2003, 21, 471- 482 .

Sudong Ye and Robert L. K. Tiong "NPV-At-Risk method in infrastructure project investment evaluation", Journal of construction engineering and management" June 2000, 227-233 .

Tarek M. Zayed, and Luh-Maan Chang Journal of Management in Engineering, Vol. 18, No. 1, January 2002, 1, 7-16.

Terry Lyons, Martin Skitmore "Project risk management in the Queensland engineering construction industry: a survey" International Journal of Project Management 22, 2004, 51–61.

Thomas E Uher and A Ray Toakley "Risk management in the conceptual phase of a project" International Journal of Project Management Vol. 17, No. 3, 161-169, 1999.

Florence Yean Yng Ling and Linda Hoi "Risks faced by Singapore firms when undertaking construction projects in India" International Journal of Project Management 24, 2006, 261–270

APPENDIX A

"RISK IN CONSTRUCTION INDUSTRY"

QUESTIONAIRE SURVEY

Type of risk		Probability level of risk occurrence (a)						Degree of Impact or the level of loss if risk occurs						Total risk (a) x (b)
		N/A	VERY SMALL	SMALL	NORMAL	LARGE	VERY LARGE	N/A	VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH	
		0	1	2	3	4	5	0	1	2	3	4	5	
S/NO	**i)Finance risk**													
1	Bankruptcy of project partners													
2	Loss due to fluctuation of inflation rate													
3	Loss due to fluctuation of Interest rate													
4	Loss due to fluctuation of exchange rate													
5	loss due to rise in fuel price													
6	low credibility of shareholders and lenders													
7	changes in bank formalities and regulation													
8	insurance risk													
	ii) Legal risk													
1	Breach of contract by project partners													
2	Lack of enforcement of legal judgement													
3	immproper verification of contract document													
4	Lack of knowledge of arbitration													
5	uncertainty and unfirmness of court justice													
	iii) Management risk													
1	change of top management													
2	no past experience in similar project													
3	Short tendering time													
4	Sub-contractorsrelated problems													
5	Improper project feasibility study													

6	Improper project planning and budgeting													
7	inadequate choice of project partners													
8	improper project organisation structure													
9	poor relation and dispute with partners													
10	poor communication between client													
11	internal management probblems													
12	team work													
13	poor relation with government department													
14	Time constrain													
15	project delay													
	iv)Market risk													
1	competition from other companies													
2	fall short of expected income from project													
3	increase of accessory facilities prise													
4	inrease of labour costs													
5	inrease of material price													
6	increase of resettlement costs													
7	inadequate forecaste about market demand													
8	local protectionism													
9	unfairness in tendering													
	v) policy and political risk													
1	cost increase due to exchange of government policies													
2	loss incure due to corruption and bribery													
3	loss incured due to political changes													
4	loss due to bureaucracy for late approval													
	vii) technical risk													
1	accident on site													
2	design changes													
3	equipment failur													

4	errors in design drawings														
5	high degree of difficulty in construction														
6	stiff environmental regulation														
7	incompetence of transportation facilities														
8	industrial disputes														
9	material shortage														
10	obsoleteness of building equipment														
11	poor quality of procured material														
12	problems due to partners different practice														
13	shortage in supply of water														
14	shortage in supply of fuel														
15	shortage in supply of electricity														
16	unknown site physical condition														
17	following government standard and code														
18	wastage of material by workers														
19	theft of materials at site														
20	site distance from urban area														
21	surplus materials handling														
22	archkitect vs structural engineer dispute														
23	shortage of skilful workers														
	vii) Environmental risk														
1	any adverse impact on the environment due to climate condition														
2	any impact on the environment due to the project														
3	healthy working environment for the workers														
	viii) Social risk														

1	resettlement and rehabilitation of people													
2	problem due to adjacent or nearby project													
3	local people support for the project													
	ix) Any other risk													
1														
2														

EXTRA COMMENTS

The table below is fully optional

1. NAME:	
2. AGE:	
3. SEX:	
4. COMPANY:	
5. LOCATION:	
6. TOTAL TIME TAKEN FOR COMPLETING THE FORM	
7. WAS THE SURVEY COMFORTABLE FOR YOU.	

Thank you for spending your valuable time by participating in this survey