ST. MARY'S UNIVERSITY

SCHOOL OF GRADUATE STUDIES

AN ASSESSMENT OF RISKMANAGEMENT PRACTICE AT DEFENCE CONSTRUCTON ENTEPRISE(DCE)

BY

YOHANNES AYELE

JUNE, 2015

ADDIS ABABA, ETHIOPIA

AN ASSESSMENT OF RISK MANAGEMENTR PRACTICE

AT DEFENSE CONSTRUCTION ENTERPRISE

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ID NO. SGS/0179/2006

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APPROVED BY BOARD OF EXAMINERS

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Thank you,
Yohannes Ayele

DECLARATION

I, undersigned, declare that this work entitled "An *Assessment of risk management practice at Defense construction enterprise (DCE)*" is outcome of my own effort and study and that all sources of materials used for the study have been duly acknowledged. I have produced it independently except for the guidance and suggestion of the Research Advisor.

This study has not been submitted for any degree in this University or any other University. It is offered for the partial fulfillment of the degree of Master of Business Administration [MBA] .

By: Yohannes Ayele

Signature_____

Date_____

ENDORSEMENT

This is to certify that this project work, "An *Assessment of risk management practice at Defense construction enterprise (DCE)***"** undertaken by Yohannes Ayele for the partial fulfillment of Master's of Business Administration [MBA] at St. Mary University, is an original work and not submitted earlier for any degree either at this University or any other University.

Research Advisor

_____ _____

Gotom Abirham(Asst.pro) ***Date***

Abbreviations/ Acrimonies

AA-Addis Ababa

DCE-Defense Construction Enterprise

MoD- Ministry of Defense

RMP-Risk management practices

RMI- Risk management index

Abstract

The purpose of this research to assess and identify Defense construction enterprise (DCE) employees' perception on the significance of construction risk and to explore risk management practice i.e. identifying, analyzing and risk controlling practices. Thus due to its work nature complexity, construction industry requires continues evaluation and formulation of risk management; however, Defense construction enterprise is yet introduce of a risk rating tool for its construction. Descriptive research design was under taken with the help of closed-ended questionnaires, interviews and document analysis to conduct the research. The research had done based on the responses of enterprise's management staff and professional engineers at head office and 13 building construction project working in Addis Ababa. The statistical findings revealed that among the identified 38 risk factors, 34 risks factors as highly incorporated risk, 27 as medium risk and the rest 4 considered as low significance risk factors. Accordingly the most significant risk factors identified by respondents' were unmanaged cash flow, defective design, design change, increase material cost, and inflation .In allocation to whom responsible those risk faces show 14 type indicated enterprise as contractor handle,9 risk factors with owner as client,3 risks shared the responsibility both owner and client and 12 type of risk factors could not decided to allocate. As this research provided valuable knowledge in risk management practice regarding the management and professional engineers' perception towards Enterprise risk management. Defense construction enterprise Management must focus on the significance of identified risk factors to achieve higher levels of financial performance and improve the perception on risk management practice that have high effect on Enterprise and allocate sufficient resources to practice risk management successfully to have industry competitive advantage. Finally, this study offers the base to conduct similar research in related area.

Key words: Risk management practice, risk factors, and Defense construction enterprise

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CHAPTER ONE

Introduction

This chapter presents background of the study, basic research questions ,objectives of the study, statement of the problem, the significance of the study, conceptual definitions of terms, the scope or delimitation of the study and organization of the paper.

1.1 Background of the study

According to the project management Institute PMI,(2004), project risk management is one of the nine most critical parts of project commissioning. This indicates a strong relationship between managing risks and a project success. While risk Management is described as the most difficult area with in construction managements Potts,(2008) its application is promoted in all projects in order to avoid negative consequences. One concept which is widely used within the field of Risk Management is called the risk Management Process (RMP) and consists of four main steps: identification, assessment, taking action and monitoring the risks cooper *et al*., (2005). In each of these steps, there are a number of methods and techniques which facilitate handling the risks.

Risk Management has become a timely issue widely discussed across industries. However with regard to the construction industry, risk management is not commonly used Klemtt,(2006). More construction companies are still not using models and techniques aimed for managing risks. This contradicts the fact that the industry is trying to be more cost and time efficient as well as have more control over projects. Risk is associated to any project regardless the industry and thus risk management should be of interest to any project manager. Risks differ between projects due to the fact that every project is unique, especially in the construction industry Gould and Joyce,(2002). However there are still many professionals that have not realized the importance of including risk management in the process of delivering the project (smith *et al*.), 2006. Even though there is an awareness of risks and their consequences, defense construction enterprise doesn't adopt itself with established risk management methods. Therefore the purpose of the study is to evaluate how the risk management process is used and how the professions are managing risks which have influence in achieving performance.

1.2. DCE'S Organizational Profile

DCE is established by the council of ministers under the supervision of Ministry of National Defense by merging two construction companies, Defense construction and Engineering enterprise and Kality construction and construction material production enterprise in 2003 E.C. The enterprise engaged in construction of roads, dams, irrigation, infrastructure, buildings and other constructions works in the country mainly to satisfy the national defense construction needs. As shown in the organization structure the enterprise has two core sub category and two support process. It has five road, one irrigation, one dam and fifteen building construction projects which are operating at Addis Ababa, and thought the country. Due to its number of projects and geographical dispersion, the data collection for the research was delimited to head office and Addis Ababa, construction project.

1.3 Statement of the problem

Construction industry development is a goal of many development policies in different countries to stop companies from sudden collaps Chan&Lee, (2008). Development of construction industry also requires knowledge of risk management policies. It is a well-established fact that every stage of the construction used build facility that is subject to risk for all the parties involved.

Risk is important to contractors as well as clients and consultants within the construction industry; however, the problems of risk assessment are complex and poorly understood in practice Smith.et al., (2004). In a related development Ashworth & Hogg (2002) pointed out that construction activities are full of risk which include those that many relate to external, commercial, design, construction and operation. However, they have to be considered for effective management in order to retain the initial objective of the project.

To define the problems that the study tries to addresses the following statement:

- DCE faces that most of the projects over run beyond schedule on cost and time due to lack planed risk management techniques .
- The enterprise doesn't use formal risk assessment analysis and hence the owner-customer (MoD) always raised question on building quality issues.
- There was frequent design change, defective material supply, price escalation of materials.
- The CDE Risk Management index (severity) has not been developed, thus management called rely on when decisions are to be taken.
- The allocation and responsibility to handle the risk is not properly recorded
- Sources: monthly enterprise's report sheet, management meeting memorandum

The awareness of such problems about risk helps DCE to design the techniques to mitigate the effects and improve the performance by implementing risk management methods. Thus, the present study was attempted to produce empirical evidence on the subject matter by analyzing risk management process on the Enterprise; and it therefore bridge a gap in the literature regarding risk management practice. Furthermore, this research would clearly contribute to the discipline of risk of management practices the Enterprise case conducted. Unless and otherwise it is difficult to use the resources efficiently and improve the overall performance.

1.4 Research Questioned

Therefore the researcher is initiated to raise the following questions to solve the above problems related with risk

1. What methods of risk management system/techniques the enterprise currently place?
2. What are the main risks factors that the project of the enterprise currently faces?
3. Who does responsible to take the risks those are faces?
4. What kind of technique use for analyzing risk?
5. What mechanism should be developed to prevent or reduce the risks that hampered the achievement of the Enterprise?

1.5 Objectives of the study

1.5.1. General Objective of the research

The main objective of this research was to set sights on management practice from the nature of project perspectives and identifies key risk variables that affect on enterprise's achievement and their allocations for whom responsible to handle.

1.5.2. The Specific objectives of the study

To identify the DCE existing risk management tools in relation to the review literature to bridge the gap

- To assess and identify risk factors that currently influences the objectives of the enterprise.
- To analyze the level of risk factor significance based on their frequency.
- To identify the responsibility parties to handle the risks.
- To develop a framework that assist decision makers to manage the risks factors, i.e. insight the management to implement proper risk management mechanism.
- To analysis the level of risk factor significance based on their frequency.
- Providing practical suggestions and recommendations pointing toward upgrading the risk management process in construction and improve the performance of the enterprise.

1.6 Conceptual Definition.

Risk factor: it entails capturing all the potential risks that could arise with the project.

Uncertainty: is a situation in which a number of possibilities exists and which of them has occurred.

Risk identification: list risks which have potential to create problems

Risk Control: to prevent, to reduce the risks

Risk analyze: deals with the cause and effects of events which cause have.

Severity: Refers the degree of i.e. seriousness

Mitigative action: Mechanism for reducing risk.

Sources :Potts,(2008),Lester,(2007), Edwards,(1995)

1.7 Significance of the study

The results of the study provided an understanding on how to identify, analyze and manage risk to enterprise employees. It also helps the key project stake holders: client, contractor, or developer, consultant and supplier to meet their commitment and minimize negative effect of identified risk factors on project performance in relation to cost, time and quality of the enterprise .And also the findings of this research will help the enterprise to better diagnose the impact of risk management practice on its performance. and finally, this study was serve as the ground for those who want to conduct further studies in the related area. As such, it is expected to benefit both researchers and practitioners.

1.8. Delimitation of the study

Defense Construction Enterprise encompasses two construction sub-category i.e. building and road sector. Since the road one has many projects far away and remote from the capital city Addis, the researcher delimitated the study on DCE Head Office and 13 building construction projects found in Addis Ababa. On the other hand, due to the constraints of time, budget and complexity of the work the researcher selected only the building sector currently under operation in AA.

1.9. Organization of the paper

The study organized under the five chapters. The first chapter deals with the introduction of the study which contains the background, statement of the problem, basic research questions, and objectives of the study, definition of terms, significance of the study and delimitation of the study.

The second chapter revealed with the review of related literature. The third chapter presented methods of the study which described the type and design of the research, the source of data, the data collection tools and the methods of data analysis used. The fourth chapter come up with the results and discussion that summarize the findings and results of the study. The fifth chapter presented the summary, conclusions and recommendations.

CHAPTER TWO

RVIEW OF RELATED LITERATURE

The chapter briefly described the related conceptual literature about risk management which include: identification risk as factors ,analysis (measurement of risk),control type of mechanism for risk and theirs allocation ,the empirical literature and the theoretical frame work literature.

2.1. The concept of risk management

Many explanations and definitions of risks and risk management have been recently developed, and thus it is difficult to choose one which is always true. Each author provides his own perception of what risk means and how to manage it. The description depends on the profession, project and type of business Samson,(2009). Risk management in general is a very broad subject and definitions of risk can therefore differ and be difficult to apply in all industries in general. Risk and uncertainty are the two most often used concepts in the literature covering RM field. Although these terms are closely related, a number of authors differentiate between them Samson, (2009). Also practitioners working with risk have difficulty in defining and distinguishing between these two. Often definitions of risk or uncertainty are tailored for the use of a particular project. To make it more systematized, a literature research was done. The findings of this search resulted in a number of definitions of risk and uncertainties. These have been compiled and are presented in Table 2.1.

Table 2.1 Definitions of risk and uncertainty

Author:	**Risk definition**	**Uncertainty definition**
Winch (2002)	A stage where there is a lack of information, but by looking at past experience, it is easier to predict the future. Events where the outcome is known and expected.	Uncertainty is a part of the information required in order to take a decision. The required information consists of the amount of available information and uncertainty will decrease the further a project is proceeding throughout the lifecycle.
Cleden (2009)	Risk is the statement of what may arise from that lack of knowledge. Risks are gaps in knowledge which we think constitute a threat to the project.	Uncertainty is the intangible measure of what we don't know. Uncertainty is what is left behind when all the risks have been identified. Uncertainly is gaps in our knowledge we may not even be aware of.
Smith *et al*. (2006)	Risks occur where there is some knowledge about the event.	There might be not enough information about the occurrence of an event, but we know that it might occur.
Webb (2003)	Risk is a situation in which he possesses some objective information about what the outcome might be. Risk exposure can be valued either positively or negatively	Uncertainty is a situation with an outcome about which a person has no knowledge.
Darnall and Presto (2010)	Risk is a possibility of loss or injury	
Cooper *et al*. (2005)	Risk is exposure to the consequences of uncertainty.	

Source Smith(2009)

All risk definitions complied in Table 2.1 describe risk as a situation where lack of some aspect can cause a threat to the project. Lack of information and knowledge are those factors which are most commonly mentioned by all the authors as leading reasons for a failure. The description provided by Cleden (2009) will best fit the purpose of this paper; it concerns how risk is defined as a gap in knowledge which, if not handled correctly, will constitute a threat to the project.

Uncertainty is defined in a more abstract way. The descriptions provided in Table 2.1 are similar to each other and the common factor is again lack of information and knowledge. The biggest difference by definition is awareness. For the purpose of this thesis, the definition of uncertainty provided by Cleden (2009) will be used. These two chosen definitions best show the difference between risk and uncertainty and help to be consistent with terminology in the paper.

Darnall and Preston (2010) find some of the risks to be predictable and easy to identify before they occur, while the others are unforeseeable and can result in unexpected time delays or additional costs. This statement finds confirmation in the definition provided by Cleden (2009) who uses the same arguments defining uncertainty as rather unpredicted, unforeseeable events, while risk should be possible to foresee. The overview of definitions which can be found in literature regarding those two terms implies that uncertainty is a broad concept and risk is a part of it. This confirms close relation between those two concepts but at the same time distinguishes them.

Smith *et al.* (2006) provide a comprehensive description of the concept of RM and how it can be used in practice. According to the authors, risk management cannot be perceived as a tool to predict the future, since that is rather impossible. Instead, they describe it as a tool to facilitate the project in order to make better decisions based on the information from the investment. In this way, decisions based on insufficient information can be avoided, and this will lead to better overall performance. In the literature, RM is described as a process with some predefined procedures. The scope of its definition differs among the authors, however the core information is the same. From a number of definitions which can be found in the management literature Cooper *et al.* (2005) explanation brings the essence of this concept:

> *The risk management process involves the systematic application of management policies, processes and procedures to the tasks of establishing the context, identifying, analyzing, assessing, treating, monitoring and communicating risks* Cooper *et al.*, (2005).

Risk management process (RMP) is the basic principle of understanding and managing risks in a project. It consists of the main phases: identification, assessment and analysis, and response Smith *et al.* (2006) as shown in Figure 2.1. All steps in RMP should be included when dealing with risks, in order to efficiently implement the process in the project. There are many variations of RMP available in literature, but most commonly described frameworks consist of those mentioned steps. In some models there is one more step added, and the majority of sources identify it as risk monitoring or review. For the purpose of this paper the model of RMP described by Smith *et al.* (2006) will be used for further analysis and will be further explained in the following section.

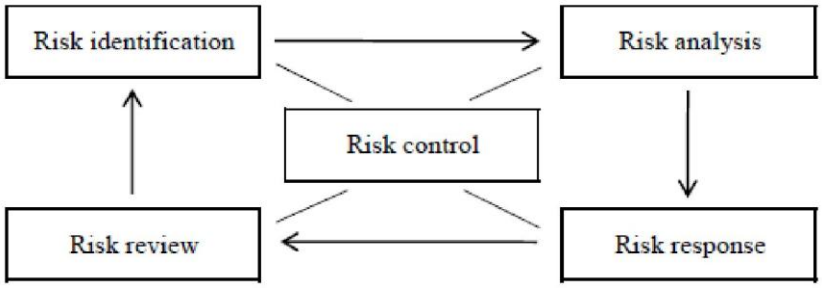


Figure 2.1 The Process of managing risks Smith et al., (2006)

2.1.2 Risks in construction projects

Due to the nature of the construction sector, RM is a very important process here. It is most widely used in those projects which include high level of uncertainty. These types of risk investments are characterized by more formal planning, monitor and control processes.. The easiest way to identify risk is to analyze and draw a conclusion from projects which failed in the past. To make sure that the project objectives are met, the portfolio of risks associated with all actors across the project life cycle (PLC) should be considered Cleland and Gareis, (2006). In the early stages of the project where planning and contracting of work, together with the preliminary capital budget are being drawn, risk management procedures should be initiated. In later stages, RM applied

systemically, helps to control those critical elements which can negatively impact project performance. In other words, to keep track of previously identified threats, will result in early warnings to the project manager if any of the objectives, time, cost or quality, are not being met Tummala and Burchett,(1999).

There are a number of risks which can be identified in the construction industry and which can be faced in each construction project regardless of its size and scope. Changes in design and scope along with time frames for project completion are the most common risks for the construction sector. The further in the process, changes in scope or design are implemented, the more additional resources, time and cost, those changes require. Project completion ahead of time may be as troublesome as delays in a schedule. Too quick completion may be a result of insufficient planning or design problems which in fact shorten the completion time but on the other hand lead to a low quality of final product and increased overall cost. Being behind schedule generates greater costs for both investors and contractors due to non-compliance with contracted works Gould and Joyce,(2002). And thus it is important to keep a balance in the concept of time-cost-quality tradeoff, which more widely is becoming an important issue for the construction sector Zhang and Xing,(2010). Depending on the project scope, types of risks may differ among investments.

2.1.3 The risk management process

. This section will further explain the RMP, its four stages and how it can be used in managing risks.

2.1.3.1 Risk identification

Winch,(2002) claims that the first step in the RMP is usually informal and can be performed in various ways, depending on the organization and the project team. It means that the identification of risks relies mostly on past experience that should be used in upcoming projects. In order to find the potential risks, an allocation needs to be done. This can be decided and arranged by the organization. In this case, no method is better than another, since the only purpose is to establish the possible risks in a project.

Risks and other threats can be hard to eliminate, but when they have been identified, it is easier to take actions and have control over them. If the causes of the risks have been identified and allocated before any problems occur, the risk management will be more effective PMI,(2004). RM is not only solving problems in advance, but also being prepared for potential problems that can occur unexpectedly. Handling potential threats is not only a way to minimize losses within the project, but also a way to transfer risks into opportunities, which can lead to economical profitability, environmental and other advantages Winch,(2002).

The purpose of identifying risks is to obtain a list with potential risks to be managed in a project PMI,(2004). In order to find all potential risks which might impact a specific project, different techniques can be applied. It is important to use a method that the project team is most familiar with and the project will benefit from. The aim is to highlight the potential problems, in order for the project team to be aware of them. Authors describe many creative alternative methods. To systematize this process, all the methods which can be found in the literature have been put together in Table 2.2 Smith *et al.* (2006); Lester, 2007; PMI, (2004)

Information gathering methods	Workshops
	Brainstorming
	Interviews
	Questionnaires
	Benchmarking
	Consulting experts
	Past experience
	Delphi technique
	Risk breakdown structure
	Visit locations
Documentation	Databases, historical data from similar projects
	Templates
	Checklists
	Study project documentation (plan, files etc.)

Research	Stakeholders analysis
	Research assumptions
	Research interfaces

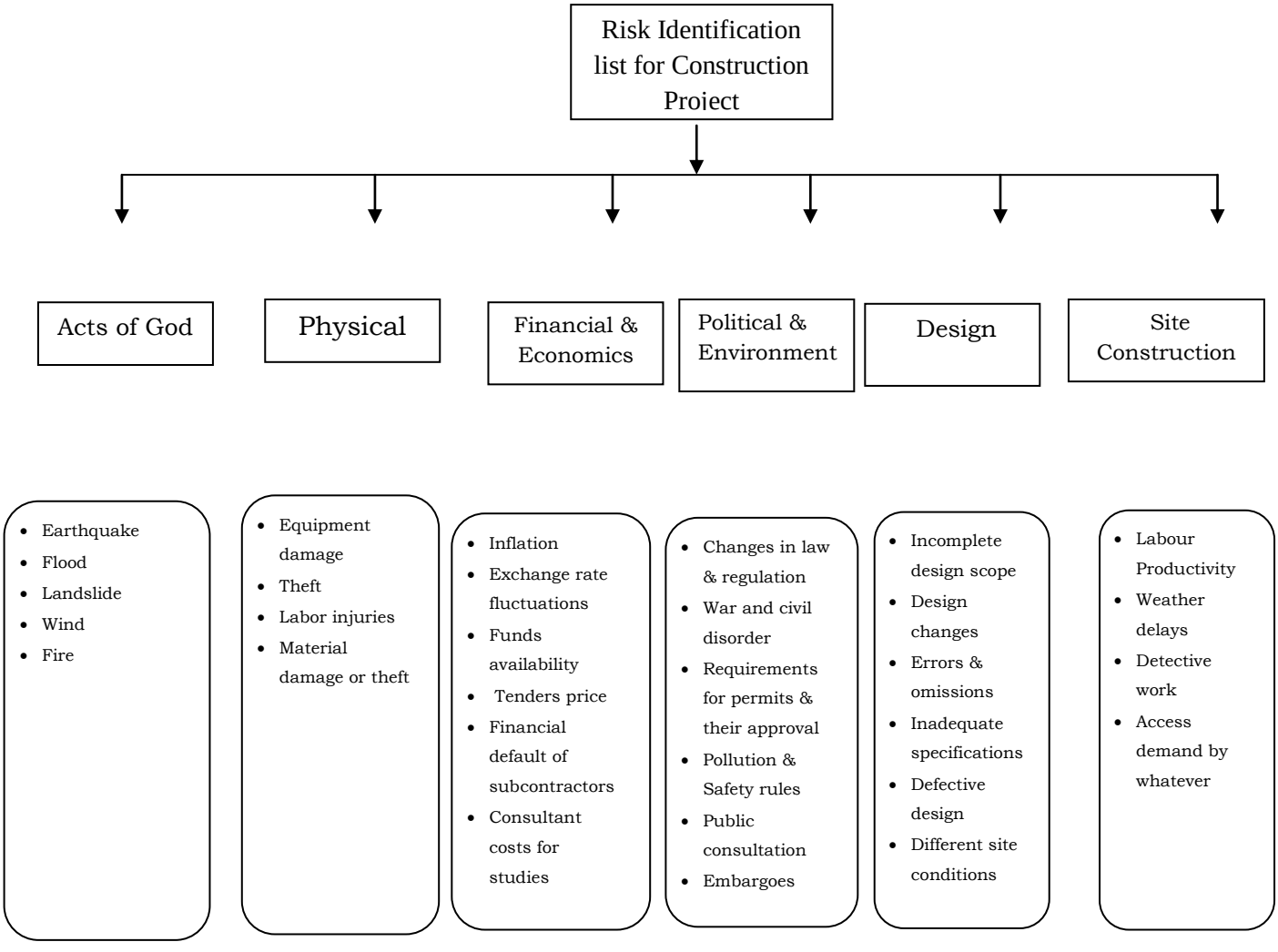
Lists with potential problems are created on different bases and are tailored for a certain project individually. In the literature, examples of risks can be found which can be used in creating those compilations. Possible risks which can be found in the literature are combined in Table 2.3 Smith *et al.* (2006); Potts, (2008); Lester,(2007); Bing, et al, (2005); Webb, (2003); Darnall and Preston, (2010); Edwards, (1995); Jeynes, (2002)

Table 2.3 Risk categories divided into groups

Risk categories	
Groups:	Risks:
Monetary	Financial
	Economical
	Investment
Political	Legal
	Political
Environmental	Environmental
	Natural, physical
Technical	Technical
Project	Contractual, client
	Project objectives
	Planning, scheduling
	Construction
	Design
	Quality
	Operational
	Organizational
Human	Labor, stakeholder
	Human factors
	Cultural

Market	Market
Safety	Safety
	Security, crime
Materials	Resources
	Logistics

In addition the categorization of construction risk adopted from Enshasis& Mayer, (2001) put as follows(fig.2.2)



2.1.3.2 Assessment/analysis

Risk analysis is the second stage in the RMP where collected data about the potential risk are analyzed. Risk analysis can be described as short listing risks with the highest impact on the project, out of all threats mentioned in the identification phase Cooper *et al.,* (2005). Although some researchers distinguish between terms risk assessment and risk analysis and describe them as two separate processes, for the purpose of this paper, this part of RMP will be consistent with the model provided by Smith *et al.* (2006) and described as one process.

In the analysis of the identified risk, two categories of methods - qualitative and quantitative - have been developed. The qualitative methods are most applicable when risks can be placed somewhere on a descriptive scale from high to low level. The quantitative methods are used to determine the probability and impact of the risks identified and are based on numeric estimations Winch, (2002). Companies tend to use a qualitative approach since it is more convenient to describe the risks than to quantify them Lichtenstein,(1996). In addition, there is also one approach called semi-quantitative analysis, which combines numerical values from quantitative analysis and description of risk factors, the qualitative method Cooper *et al.,(*2005). However, this approach will not be further addressed in this paper.

Within the quantitative and qualitative categories, a number of methods which use different assumptions can be found, and it may be problematic to choose an appropriate risk assessment model for a specific project. The methods should be chosen depending on the type of risk, project scope as well as on the specific method's requirements and criteria. Regardless of the

method chosen, the desired outcome of such assessment should be reliable Lichtenstein, (1996), Perry (1986) mentions that the selection of the right technique often depends on past experience, expertise, and nowadays it also depends on the available computer software.

Lichtenstein (1996) explains a number of factors that can influence the selection of the most appropriate methods in the risk assessment for the right purpose. It is up to each organization to decide which of these factors are the most critical for them and develop

the assessment accordingly. In a survey conducted by Lichtenstein (1996), many factors were discovered, and the most important ones are listed below.

- Cost of using the method, both the employment cost and the method itself
- Adaptability, the need of adapting to the organization's requirement
- Complexity, how limited and simple the method is
- Completeness, the method needs to be feasible
- Usability, the method should be understandable to use
- Validity, the results should be valid
- Credibility

Below is a brief description of various risk analysis methods. All of these methods are used in the construction industry Azari,(2010).

2.1.3.2.1 Quantitative methods

Quantitative methods need a lot of work for the analysis to be performed. The effort should be weighed against the benefits and outcomes from the chosen method, for example smaller projects may sometimes require only identification and taking action on the identified risks, while larger projects require more in depth analysis. The quantitative methods estimate the impact of a risk in a project PMI, (2009). They are more suitable for medium and large projects due to the number of required resources such as complex software and skilled personnel Heldman,(2005).

Scenario technique - Monte Carlo simulation

The Monte Carlo method is based on statistics which are used in a simulation to assess the risks. The simulation is used for forecasting, estimations and risk analysis by generating different scenarios Mun, (2006). Information collected for the simulation is, for instance, historical data from previous projects. The data represent variables of schedule and costs for each small activity in a project, and may contain pessimistic, most likely and optimistic scenarios Heldman, (2005). The simulation can be presented as a basket with golf balls, as Mun,(2006) explains the process. Data (the golf balls) are mixed and one of them is picked each time the simulation is done. The chosen unit is an outcome which is recorded and the ball will be put back into the basket. The simulation is then redone a number of times and all outcomes are recorded. After completing the

simulations required number of times, the average is drawn from all of the outcomes, which will constitute the forecast for the risk Mun,(2006). The result from this method is a probability of a risk to occur, often expressed in a percentage Darnall and Preston, (2010).

The most common way of performing the Monte Carlo simulation is to use the program Risk Simulator software, where more efficient simulations can be performed. This analysis can be also done in Microsoft Excel where a special function is used to pick the data randomly, but the results can be very limited Mun,(2006).

Modeling technique - Sensitivity analysis

The purpose of a sensitivity analysis is to establish the risk events which have the greatest impact or value. Those events are later weighed against the objectives of the project. The higher the level of uncertainty a specific risk has, the more sensitive it is concerning the objectives. In other words, the risk events which are the most critical to the project are the most sensitive and appropriate action needs to be taken. Heldman, (2005)

The result from the analysis can be presented in a spider diagram, Figure 2.3, that shows the areas in the project which are the most critical and sensitive. Moreover, one disadvantage with this analysis is that the variables are considered separately, which means that there is no connection between them Perry, (1986) and Smith *et al.* (2006).

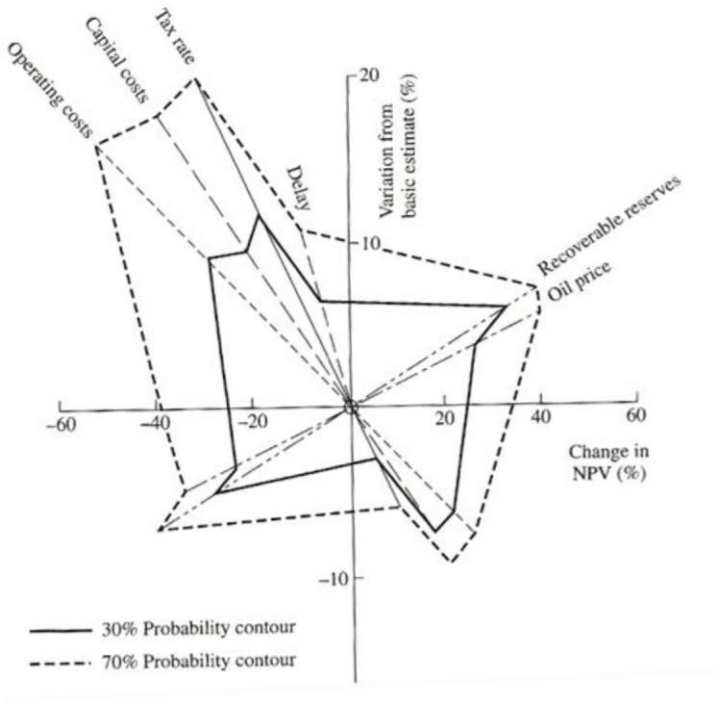


Figure 2.3 This figure shows how a sensitivity analysis can look like. Smith et al,(2006)

The method requires a model of project in order to be analyzed with computer software. According to Smith *et al.,* (2006), the project will benefit if the method is carried out in the project's initial phases in order to focus on critical areas during the project.

2.1.3.2.2 Qualitative methods

Qualitative methods for risk assessment are based on descriptive scales, and are used for describing the likelihood and impact of a risk. These relatively simple techniques apply when quick assessment is required Cooper *et al*,(2005) in small and medium size projects Heldman,(2005). Moreover, this method is often used in case of inadequate, limited or unavailable numerical data as well as limited resources of time and money Radu,(2009). The main aim is to prioritize potential threats in order to identify those of greatest impact on the project Cooper *et al.* (2005), and by focusing on those threats, improve the project's overall performance PMI, (2004). The complexity of scales Cooper *et al.*,(2005) and definitions PMI, (2004) used in this examination reflect the project's size and its objectives. During the phases of the PLC, risks may change, and thus continuous risk assessment helps to establish actual risk status Cooper *et al*. (2005).

Limitations of qualitative methods lie in the accuracy of the data needed to provide credible analysis. In order for the risk analysis to be of use for the project team, the accuracy, quality, reliability, and integrity of the information as well as understanding the risk is essential.

Qualitative methods are related to the quantitative methods, and in some cases constitute its foundations PMI, (2004).

PMI (2004) identifies four qualitative methods for risk assessment: Risk probability and impact assessment, Probability/impact risk rating matrix, Risk Categorization and Risk Urgency Assessment. These methods are briefly discussed below.

Risk probability and impact assessment

By applying the method called risk probability and impact assessment, the likelihood of a specific risk to occur is evaluated. Furthermore, risk impact on a project's objectives is assessed regarding its positive effects for opportunities, as well as negative effects which result from threats. For the purpose of this assessment, probability and impact should be defined and tailored to a particular project PMI, (2004). This means that clear definitions of scale should be drawn up and its scope depends on the project's nature, criteria and objectives Cooper *et al.* (2005). PMI, (2004) identifies exemplary range of probability from 'very unlikely' to 'almost certain', however, corresponding numerical assessment is admissible. The impact scale varies from 'very low' to 'very high'. Moreover, as shown in Figure 2.5, assessing impact of project factors like time, cost or quality requires further definitions of each degree in scale to be drawn up. Each risk listed under the identification phase is assessed in terms of the probability and the impact of its occurrence (PMI), 2004.

Defined Conditions for Impact Scales of a Risk on Major Project Objectives					
Project Objective	Relative or numerical scales are shown				
	Very low /.05	Low /.10	Moderate /.20	High /AO	Very high /.80
Cost	Insignificant cost increase	<10% cost increase	10-20% cost increase	20-40% cost increase	>40% cost increase
Time	Insignificant time increase	<5% time increase	5-10% time increase	10-20% time increase	>20% time increase
Scope	Scope decrease	Minor areas of scope affected	Major areas of scope affected	Scope reduction	Project end item is effectively useless
Quality	Quality degradation	Only very demanding	Quality reduction	Quality reduction	Project end item is effectively useless
This table presents examples of risk impact definitions for four different project objectives. They should be tailored in the Risk Management Planning process to the individual project and to the organization's risk thresholds. Impact definitions can be developed for opportunities in a similar way.					

Figure 2.5 Definition of Impact Scales for Four Project Objectives (PMI, 2004)

Risk impact assessment investigates the potential effect on a project objective such as time, cost, scope, or quality. Risk probability assessment investigates the likelihood of each specific risk to occur. The level of probability for each risk and its impact on each objective is evaluated during an interview or meeting. Explanatory detail, including assumptions justifying the levels assigned, are also recorded. Risk probabilities and impacts are rated according to the definitions given in the risk management plan. Sometimes, risks with obviously low ratings of probability and impact will not be rated, but will be included on a watch-list for future monitoring Ritter, (2008).

Probability/impact risk rating matrix

Probability and impact, which were assessed in the previous step, are used as basis for quantitative analysis and risk response which will be explained further in the paper. For this reason findings from the assessment are prioritized by using various methods of calculation which can be found in the literature PMI, (2004). Westland, (2006) computes the priority score as the average of the probability and impact. The range of priority score, the rating and color are assigned to indicate the importance of each risk Westland, (2006). In order to set priorities, impact is multiplied by probability. The compiled results are shown in the matrix in Figure 2.6 PMI,(2004). Such combination of factors

indicates which risks are of low, moderate or high priority. Regardless of the calculation method chosen, such a combination of data shows priority of previously identified risks by use of i.e. corresponding colors or numerical system and helps to assign appropriate risk response. For instance, threats with high impact and likelihood are identified as high-risk and may require immediate response, while low priority score threats can be monitored with action being taken only if, or when, needed PMI,(2004).

Probability and Impact Matrix

Probab	Threats					Opportunities				
0.90	0.0	0.0	0.1	0.3	0.72	0.72	0.3	0.1	0.0	0.05
0.70	0.0	0.0	0.1	0.2	0.56	0.56	0.2	0.1	0.0	0.04
0.50	0.0	0.0	0.1	0.2	0.40	0.40	0.2	0.1	0.0	0.03
0.30	0.0	0.0	0.0	0.1	0.24	0.24	0.1	0.0	0.0	0.02
0.10	0.0	0.0	0.0	0.0	0.08	0.08	0.0	0.0	0.0	0.01
	0.0	0.1	0.2	0.4	0.80	0.80	0.4	0.2	0.1	0.05

Figure2. 6 Probability and Impact Matrix PMI, (2004)

Impact (ratio scale) on an objective (e.g., cost, time, scope or quality)

Each risk is rated on its probability of occurring and impact on an objective if it**does occur. The organization's thresholds** for **low, moderate or high risks are shown in the matrix and determine whether the risk is scored as high, moderate or low for that objective.**

Risk categorization, and Risk Urgency Assessment

Two methods mentioned by PMI, (2004) are not as commonly used as probability and impact. Risk categorization is a way of systematizing project threats according to e.g. their sources, in order to identify areas of the project that are most exposed to those risks. Tools which can be used in this method are work break down structure (WBS) or risk breakdown structure (RBS), and their role is to develop effective risk response PMI, (2004). WBS breaks down large activities into small, manageable units and creates linked, hierarchical series of independent activities Maylor, (2005). RBS categorizes risks and shows their dependencies Dallas,(2006). The role of the second method, Risk Urgency Assessment, is to prioritize risks according to how quick response they require.

Lists with risks prioritized by applying qualitative methods, can be used to bring attention to significant problems to the project. Problems that are classified as a medium level risks can be a subject of a quantitative analysis to have better control over them. The threats that are assessed as low impact can be placed on a watch list and monitored. It will allow the project team to focus on more important issues. Risk categorization helps reveal the weak links in the project organization where more attention should be directed PMI,(2004). According to Ward and Champ,(1997) the technique of risk analysis summarize as follows (table 2.4) :

Risk Analysis	
Qualitative	**Quantitative**
a. Direct judgment b. Ranking options c. Comparing options d. Descriptive analysis	e. Probability analysis f. Sensitivity analysis g. Scenario analysis h. Simulation analysis

2.1.4. Risk Control (response)

This third step of the RMP indicates what action should be taken towards the identified risks and threats. The response strategy and approach chosen depend on the kind of risks concerned Winch, (2002). Other requirements are that the risk needs to have a supervisor to monitor the development of the response, which will be agreed by the actors involved in this risk management process. PMI, (2004)

Winch ,(2002) claims that the lower impact the risk has, the better it can be managed. Most common strategies for risk response are: avoidance, reduction, transfer and retention Potts,(2008). Beyond those types of responses, Winch (2002) describes that sometimes it is difficult to take a decision based on too little information. This may be avoided by waiting until the appropriate information is available in order to deal with the risk. This way of acting is called 'Delay the decision' but this approach is not appropriate in all situations, especially when handling critical risks. Those need to be managed earlier in the process.

2.1.4.1 Avoidance/prevention

If the risk is classified as bringing negative consequences to the whole project, it is of importance to review the project's aim. In other words, if the risk has significant impact on the project, the best solution is to avoid it by changing the scope of the project or, worst scenario, cancel it. There are many potential risks that a project can be exposed to, and which can impact its success Potts,(2008). This is why risk management is required in the early stages of a project instead of dealing with the damage after the occurrence of the risk PMI,(2004).

The avoidance means that by looking at alternatives in the project, many risks can be eliminated. If major changes are required in the project in order to avoid risks, Darnall and Preston, (2010) suggest applying known and well developed strategies instead of new ones, even if the new ones may appear to be more cost efficient. In this way, the risks can be avoided and work can proceed smoothly because strategy is less stressful to the users.

2.1.4.2 Reduction/mitigation

By having an overview over the whole project it is easy to identify problems which are causing damage. In order to reduce the level of risk, the exposed areas should be changed Potts, (2008). This is a way of minimizing the potential risks by mitigating their likelihood Thomas,(2009). One way to reduce risks in a project is to add expenditures that can provide benefits in the long term. Some projects invest in guarantees or hire experts to manage high- risk activities. Those experts may find solutions that the project team has not considered Darnall and Preston, (2010).

Mitigation strategies can, according to Cooper *et al.* (2005), include:

- Contingency planning
- Quality assurance
- Separation or relocation of activities and resources
- Contract terms and conditions
- Crisis management and disaster recovery plans

Those risks which should be reduced can also be shared with parties that have more appropriate resources and knowledge about the consequences Thomas, (2009). Sharing

can also be an alternative, by cooperating with other parties. In this way, one project team can take advantage of another's resources and experience. It is a way to share responsibilities concerning risks in the project Darnall and Preston,(2010).

2.1.4.3 Transfer

If a risk can be managed by another actor who has a greater capability or capacity, the best option is to transfer it. Potts, (2008) states that the risk should be transferred to those who know how to manage it. The actors that the risks can be transferred to are, for example, the client, contractor, subcontractor, designer etc, depending on the risk's character. As a result this could lead to higher costs and additional work, usually called risk premium Potts,(2008). It must be recognized that the risk is not eliminated, it is only transferred to the party that is best able to manage it PMI,(2004). Shifting risks and the negative impacts they bring is also an option when the risks are outside the project management's control, for example political issues or labor strikes Darnall and Preston, (2010). The situation may also consist of catastrophes that are rare and unpredictable in a certain environment. Winch,(2002) Such risks that are beyond the management's control should be transferred through insurance policies.

2.1.4.4 Retention

When a risk cannot be transferred or avoided, the best solution is to retain the risk. In this case the risk must be controlled, in order to minimize the impact of its occurrence Potts, (2008). Retention can also be an option when other solutions are uneconomical Thomas,(2009).

2.1.5 Monitoring

This final step of RMP is vital since all information about the identified risks is collected and monitored Winch,(2002). The continuous supervision over the RMP helps to discover new risks, keep track of identified risks and eliminate past risks from the risk assessment and project PMI, (2004). PMI,(2004) also states that the assumptions for monitoring and controlling are to supervise the status of the risks and take corrective actions if needed.

Tools and techniques used to risk monitor and control may be PMI,(2004):

- Risk reassessment - identification of new potential risks. This is a constantly repeated process throughout the whole project.
- Monitoring of the overall project status - are there any changes in the project that can effect and cause new possible risks?
- Status meetings - discussions with risk's owner, share experience and helping managing the risks.
- Risk register updates

By managing the whole RMP, the process can be evaluated. This is a method of creating a risk register where all risks and their management can be allocated in order to facilitate future projects PMI, (2004). This is also a way to improve the project work, since the advantages and disadvantages will be brought up.

Accordingly project management institute PMI,(2004) the significance of the risk measurement, the preventive methods, mitigative methods and analysis techniques could be measured as follows respectively:

2.2 EMPERICAL LITERATURE REVIEW

according to Ijigah EdokaAugustine,(2010) study finding, financial, management, market, technical, legal and environmental risk factors in his studied. Under financial risk ,fluctuation of inflation rate was ranked as the most financial risk indicator. Under assessment of management risk indicators improper planning and budgeting is high influence risk factor, in marketing assessment :competition risk, other companies was ranked as the most affecting the construction in industry. In assessment of technical risk factors unknown site condition was ranked as the most severe indicators . Law of arbitration under legal risk indicators has the most sever one influence the project .In technical risk indicators that unknown site condition was ranked as the most sever technical risk. In Environmental risk factors healthy working environment for the workers was ranked as the most significant risk. He concluded that that the RMI will reduce cost and time over run and improves quality of construction project. From his analysis, efficient in risk management will have positive effect on the construction industry and the economy at large. The researcher Ahmed, (1999) confirmed that supply of defective materials is the most important risk in physical group risk factors, lack of consistency between bill of quantities, drawings and specifications was ranked as the most sever in design group. Under financial risk factors most of the writers Hallaq, (2003), Kartum(2001), smith (2006) agreed on the following most significant risks sequential: financial failure, delayed payment of the contractor, un managed cash flow, inflation and exchange rate of fluctuation. In technical risk factors different authors concluded differently. An author Ahmed,(1999) reached the most significant risk faced under technical factors are undocumented design change, lower work quality in presence of time constraints and design changed. Smith,(2006) concluded that rush bidding, lower work quality in presence of time constraints and undocumented design changes are the most sever risk factors. Under management risk factors the researcher Edokaaugstine arrived that internal management problem, absence of team, changes in management ways are the most sever risks. This is also concluded by Ahmed,(1999).

A lot of researches have been undertaken in the field of risk management in construction industry in the remarks rated as follows:

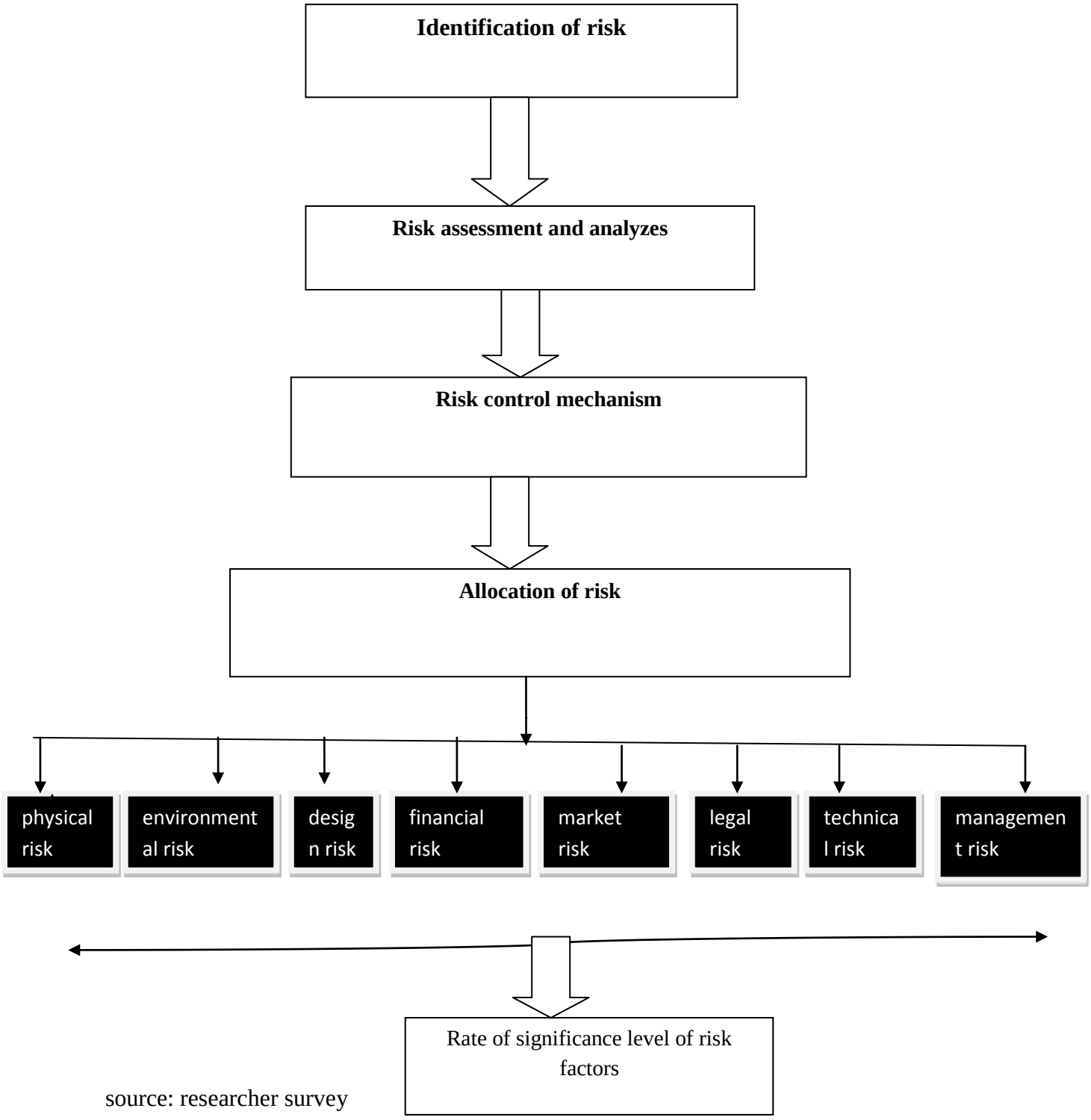
1) According to Akintoye and Macleod,(2006) risk analysis and management in construction industry is dependent on three factors; experience, judgment and intuition of team members. Unfortunately, formal activities to analyze and manage risk are rarely used in construction industry. The main reason for this is the ignorance of project teams towards such techniques and the associated myths that the techniques are unsuitable to be used in the construction industry (ibd).

2) Uher and Toakely, (2005) studied cases from Australian construction industry where risk management was used in the conceptual phase of project development. They found that although a majority of respondents had familiarity with risk management processed and techniques; but despite their willingness to adapt these techniques, they were rarely employed in the conceptual phase of projects .

3) In a survey on international construction joint ventures by Lei Bing three main groups were made to identify risk factors; external, internal and project specific. The study examined some cases where risk mitigation measures were used effectively, for risk management, by construction professionals in East Asia. An international survey of contractors revealed that the most critical risk factors existed in the financial aspects of joint ventures, government policies, economic conditions, and project relationships. When a local company enters a foreign construction market by forming a joint venture with a foreign company, risks could be reduced by a careful selection of the partner and by a careful drafting of the contract agreement. The right staff and sub contractors must be chosen, good relationships must be established and fair construction contracts be secured with the clients .

4) Hastak and Shaked conducted a study in which they made three braod categories of construction risks; project, market and country level risks. Country risks are associated with macroeconomic stability of the country and are linked with the monetary and fiscal policy of the country and the resistance of the country against economic variability. Market level risks arise from foreign risks, include technical advantage of the firm local competitors, availability of related resources and government support at local and foreign level towards construction.

Fig.2.6 Conceptual frame work of the study



source: researcher survey

CHAPTER THREE
RESEARCH DESIGN AND METHODOLOGY

. This chapter is a review of the various approaches to data collection and analysis adopted in conducting the research; it explains the type of research strategy adopted the mode of data collection and the methodology used in carrying out this research. It includes the research design, sample size and sampling technique, data source and collection method, procedure of data collection, method of data analysis and questionnaire reliability test was presented

3.1 Research Design

The main purpose of this research was to assess the risk management practice in DCE. research employed is descriptive method because the study is intended to find out how the enterprises identify the risks and their significance, to whom allocate the risks and what mechanism adopted to control risks. Kothari (2004) defines descriptive research study as "Descriptive research studies are those studies which are concerned with describing the characteristics of a particular individual, or of a group statistics.

Depending on nature of data and analysis procedures widely used in business and management research according to Saunders et al, (2009) are quantitative and qualitative methods. One way of distinguishing between the two is the focus on numeric (numbers) or non-numeric (words) data. Quantitative is predominantly used for any data collection technique (such as a questionnaire) or data analysis procedure (such as graphs or statistics) that generates or uses numerical data. In contrast, qualitative is used predominantly as a synonym for any data collection technique (such as an interview) or data analysis procedure (such as categorizing data) that generates or uses non-numerical data.

In order to make it suit to the collection of the required information from a larger sample and make the analysis easier, the study was used both qualitative and quantitative

method. Thus, data was gathered from sample management staff and professional engineers via self-administered closed ended questionnaire and structured interview.

3.2 Population and Sampling Technique For Head office and Projects

The target groups in this study were Defense construction enterprise management staff and professional engineers at head office and project. According to human resource of the enterprise there are 58 management staff and engineers at head office, and 90 at building construction projects . In order to determine a sufficient sample size, Phaniraj and Sreekuma (2014) showed that the sample size can be calculated as following equation for 95% confidence level

$$n = n'/ [1+(n'/N)]$$

Where

- N = total number of population
- n= sample size from finite population
- n' = sample size from infinite population = S^2/V^2; where S2 is the variance of the population elements and V is a standard error of sampling population.

(Usually S= 0.5 and V = 0.06) (Phaniiraja and sreekuma 2014)

So, for 58 head office management staff and engineers

- n= n'/ [1+(n'/N)]
- n'= S^2/V^2 = (0.5)2/(0.06)2 = 69.44
- N = 58
- n= 69.44/ [1+(69.44 / 58)] = 32

This means that the 32 questionnaire should be distributed to head office management staff and engineers in order to achieve 95% confidence level

For 90 building project management staffs and engineers:

- n= n'/ [1+(n'/N)]
- n'= S^2/V^2 = (0.5)2/(0.06)2 = 69.44
- N = 90
- n= 69.44/ [1+(69.44 / 90)] = 40

This means that 40 questionnaire should be distributed to building project management staffs and engineers in order to achieve 95% confidence level. Therefore out of total the 72 (32+40) questionnaires distributed randomly 65 (90.2%) actually response.

Table 3.1: Sample frame and proportionate sampling

Strata	Head Office	Building project	Total Population	Sample size
Management Staff	28	10	38(26%)	24(33%)
Professional engineers	30	80	110(74%)	48(67%)
Total	**58(39%)**	**90(61%)**	**148(100%)**	**72(100%)**
Sample Size	32(44.4%)	40(55.6%)		**72(100%)**
Actual Response	28(43%)	37(57%)		**65(90.2%)**

(**Source:** DCE Human Resource Division, April, 2015)

3.3 Source of Data and Data collection Tools

The choice of the research methods are based on identifying of research questions and also to answer the problem statement as well. To collect the useful information for conducting this research, the author decided to collect information from both primary and secondary data. Therefore compilation of quantitative and qualitative data collection approaches has been used with the aim of making the information achievable to the intended goal this paper use. Thus approach was designed to triangulate the data which means the combined use of qualitative and quantitative data collections methods would enabled the researcher to captured data from different perspectives.

The primary data in this research was obtained from primary sources of the enterprise employees ,mainly through questionnaire. These beneficial for the performance of the research conduct. According to fisher(2007) ,primary data is the new data ,which is collected by the researcher and is original .It is the new data specifically collected in the current research project. In the same way ,this study the questionnaires prepare in English version.

The questionnaire was composed of five sections to accomplish the aim of this research, as follows:

1. The organization respondent profile .
2. Risk factors that have been identified by literature, experts and by the researcher.
3. Risk preventive methods which could be used to avoid risk to take place.
4. Risk mitigative methods that could be used to mitigate risk impact or likelihood.
5. Risk analysis techniques that could be used to analyze and estimate risk factors impact.

The questionnaire was prepared in English language (Annex 1) to ensure obtaining complete and meaningful response to the questionnaire, an interview was conducted with each respondent to explain the objective of the study and to get input towards the questionnaire design, especially towards identifying risk types and management actions for controlling these risks. Some of the questionnaires were filled throughout the interview.

A draft questionnaire, with 36 risk factors (Annex 3), prepared from literature and distributed into eight groups – by adding two groups to the literature (Hillson, 2002); and test validity content by knowledge experts an construction practitioners in projects . Content validity was conducted by sending the draft questionnaire with covering letter to three experts to evaluate the content validity of questionnaire, to check readability, offensiveness of the language and to add more factors and information if needed (Annex 3). As a result, good comments regarding the shape and the factors were taken into consideration and 6 additional factors were added and 4 were omitted to reflect the nature of construction in enterprise. These factors were amalgamated with the original factors and the required modifications have been introduced to the final questionnaire. A total of 38 factors which categorized in to eight groups were distributed to form the final questionnaire (Annex 1). This paper also used as secondary source :Enterprise's audit committee chart regarding risk, meeting minutes and monthly price escalation report which encourage the primary data in accomplish analysis process.

3.4 procedures of data collection

Primary ,the researcher prepared the questionnaire and checked its clarity through forwarding to the experts, where useful comments were obtained on the content of each question . These comments were incorporated to upgrade the quality of data gathering

instruments, the researcher identified the sample period of time .Before distributing the questionnaire ,by asking the respondents willingness the questionnaires were distributed and orientation was given about the purpose of the questionnaires and how to respond to the questions then were filled. During collection of the questionnaires, the researcher had checked on questionnaires at a glance to check that the questions were filled accordingly. With regard to the interview and focus group discussion the objectives for the study were respectively selected carefully and purposefully .The researcher arranges appropriate time for interview. A schedule was arranged and the interview held accordingly sample.

3.5 Methods of Data analysis

Analysis is an interactive process by which answers to be examined to see whether these results support the underlying each question Hallaq,(2003). Quantitative statistical analysis for questionnaire was done by using statistical Package for Social Sciences (SPSS). The analysis of data is done to rank the severity of causes of objectives failure in. Ranking was followed by comparison of mean values within groups and for the overall sub-factors.

The following statistical analysis steps were done:

- Data entry
- Mean and rank of each cause
- Comparing of mean values for each main group and overall sub-factors

3.6 Reliability and validity of Data Collection Tools Used

Validity refers to the degree to which an instrument measures what it is supposed to be measuring Pilot and Hungler,(1985). High validity is the absence of systematic errors in the measuring instrument. When an instrument is valid; it truly reflects the concept it is supposed to measure Wood and Haber,(1998). Validity has a number of different aspects and assessment approaches Polit and Hangler, (1985). Below, several routes to evaluating an instrument's validity are listed:

- § Content validity
- § Criterion-related validity
- § Construct validity

Questionnaire was reviewed by two groups of experts. The first was requested to

identify whether the questions agreed with the scope of the items and the extent to which these items reflect the concept of the research problem. The other was requested to identify that the instrument used is valid statistically and that the questionnaire was designed well

enough to provide relations and tests between variables. The two groups of experts do agree that the questionnaire was valid and suitable enough to measure the concept of interest with some amendments, the most important of which are:

- 6 additional risk factors were added to the questionnaire and 4 were omitted due to recurrence and ambiguity, (see Annex 3 and Annex 1).
- Instead of impact measure on quality, time and cost ,allocation of responsibility to handle the risk is substituted.(see Annex 3 and Annex 1)

Reliability of an instrument is the degree of consistency with which it measures the attribute it is supposed to be measuring Polit & Hunger,(1985). The less variation an instrument produces in repeated measurements of an attribute, the higher its reliability. Reliability can be equated with the stability, consistency, or dependability of a measuring tool. The test is repeated to the same sample of people on two occasions and then the scores obtained were compared by computing a reliability coefficient Polit & Hunger, (1985). . Cronbachs alpha a reliability coefficient that indicates how well items in a set are positively related one another.

According to hair, Anderson (2006), if X is greater than 0.7, it means that it has high reliability and if X is smaller than 0.3, then it implies that there is low reliability. Ten questionnaires were re-distributed to employees.. The reliability coefficient was (0.87) which indicates a high level of reliability .

3.7 Ethical Consideration

The researcher reflects on ethical issues in every aspect of the activity doing the study. While revising the literature which done previously by different scholars the researcher try to acknowledge each of the literature source. When distributing the questionnaires, respondents are assured that the information they provide was confidential. Moreover a statement conform the prohibition of including any identify details or personal

references in the questionnaire. This helped to avoid any biased response or unauthentic data provided by respondents and to make participants safer in filling the questionnaire. As a result the gather data kept confidential and would not be used for any personal internet and also the whole process of the study controlled to be within acceptable professional ethics.

CHAPTER FOUR
DATA PRESENTATION,ANALYSIS AND INTERPRETATION

Introduction

The aim of this study is to determine the risk factors in Defense construction enterprise, methods used to deal with risks and the techniques adopted in analyzing these risks. The results of the study are illustrated in this chapter mainly, the significance of risk factors, the allocation of risk to whom handle and control mechanism. The presentation, analysis and interpretation are based on the data collected from the questionnaires and conducting an interview with the focus group. The discussion attempts to accomplish the objectives of the study and answer the research questions.

A total of 72 questionnaires which dealt about respondents character, risk factors of the construction ,its severity(significance) , allocation and include the control mechanism that absorbed the enterprise practice were distributed to the respondents. However only 65 questionnaires were collected and usable responses (90.27% response rate) ,interview and relevant documents have been reviewed. All the data has been analyzed in SPPS so that the accuracy of the information is maintained.

4.1 Demographic characteristics of respondents

The demographic variables about the respondents were summarized and described in different figures and tables .These variables include: sex, educational qualification, work experience and job position.

Table 4.1 General Information about Respondents

Variables	Frequency	Percent
Sex		
Female	20	30.8
Male	45	69.2
Total	65	100.0
Educational qualification		
BA/BSC	62	95.4
MA/MSC	3	4.6
College diploma	_	_
Total	100	100.0
Work experience		
Less than 5 years	4	6.2
5-10 years	45	69.2
10-15 years	10	15.4
Above 15 years	6	9.2
Total	65	100.0
Job position		
top management	7	10.8
middle management	5	7.7
project manager	9	13.8
Office engineer	11	16.9
Construction engineer	10	15.4
Site engineer	14	21.5
Project planning and monitoring	9	13.8
Total	65	100.0

Source: Survey data

The above table shows that general information about sex, education, work experience and job position. Most (69.2%0 of the respondents are male and the rest 30.8% respondents are females. The combination help to consider various perspective on the

issue of risk factors.

Most of the respondents have a BA/BSC degree which is 95.4% and MA/MSC has 4.6%.There was not diploma holder participated. In relation to risk subject matter it needs highly educated employees that more fit to get more understand.

About 69.2% of the respondents have a work experience of above 5 years followed 15.4% above 10 years and 9.2% &6.2& above 15 and less than 4 years respectively. This show the respondents have enough experience to judge the risk factors.

The respondents job positions above show that the engineers group has the first high percentage ,21.5% for site engineer,16.9% office engineers and 15.4% construction engineers. The project managers and project planning and monitoring have the same percentages 13.8%.Then top management position participate about 10.8%.The least percentage share the middle level management :7.7%.

4.2 Descriptive Analysis of data pertaining to the study

As mentioned in chapter 3, the questionnaire included 38 risk factors, which have been categorized in eight main groups: physical group, environmental group, design group, market group, financial group, legal group, technical group and management group. The factors of each group were demonstrated in the terms of severity and probability according to the participants' answers and allocate to whom responsible. Finally the result of Descriptive statistics displayed as flows.

4.2.1Physicalgroup (Group1)

4.2.1.1 Severity

Table 4.2 Physical Group Risks Ranking

No.	Physical Group Risks	Severity Frequency (percentage)					Severity Weight	Severity Mean
		No risk	Low risk	Medium	High	V.high		
2	Supplies of defective materials	-	12 (18.5%)	11 (16.9%)	21 (40%)	16 (24.6%)	241	3.71
3	Varied labor and equipment productivity	-	5 (7.7%)	43 (66.2%)	14 (21.5%)	3 (4.6%)	210	3.23
1	Occurrence of accidents because poor safety procedures	-	14 (21.5%)	31 (40.7%)	20 (30.8%)	20 (30.8%)	201	3.09

According to the respondents (table 4.2) ,40% of supplies of defective materials has high risk, 24.6% indicated very high risk ,the rest 16.9% and 18.5% replied medium and low risk. The second significant risk is Varied labor and equipment productivity which show 66.2% as high risk, 4.6 as very high risk, and the rest, 21.5% and 7.7% indicated as a medium and low risk respectively. The Occurrence of accidents because of safety procedures shows 47% as medium risk, 30.8% of them indicted as high risk. The other 21% agreed it is low risk. When compare to each other the supply of defect materials is the most important risk in the physical group, i.e, 3.71 mean of severity. The variation in labor and equipment productivity is the second from importance, i.e. 3.23 and the third one is occurrence of accidents i.e. 3.09(Table 4.2). These indicate that the concerns of the enterprise are about on suitability of materials supplies.

4.2.1.2 Risk Allocation

The criterion for a risk that appropriated to particular category (enterprise, owner ,shared, insurance or ignored),was that it should get at least (60%) response rate to achieve the mainstream of the rates. Those that failed to get such responses rate in favor of any category were listed as Undecided. As shown(Figure 4.2) :38.5% of enterprises tried to shift the consequences of accident to other parties like insurance,41.5% of the company appear to be ready to bear these consequences and 20% of them seemed to

share these consequence with owners. That means the enterprise(contractor) are undecided about the allocation of safety risks .In fact the enterprise is better able to control such risks by supervising the application of safety precautions inside the construction sites. Moreover ,the existence of insurance premiums for accidents and injuries can mitigate some of this risk consequences. The enterprise should consciously pay more effort to mitigate the accidents costs and other consequences by applying effective training and increasing awareness of safety precautions. The majority of enterprise employees (96.9) accepted the risks of supplying defect materials and variation in productivity 61.5%. In fact not only did enterprise designated them as their responsibilities, but most researchers also support the positionKartum,(2001).

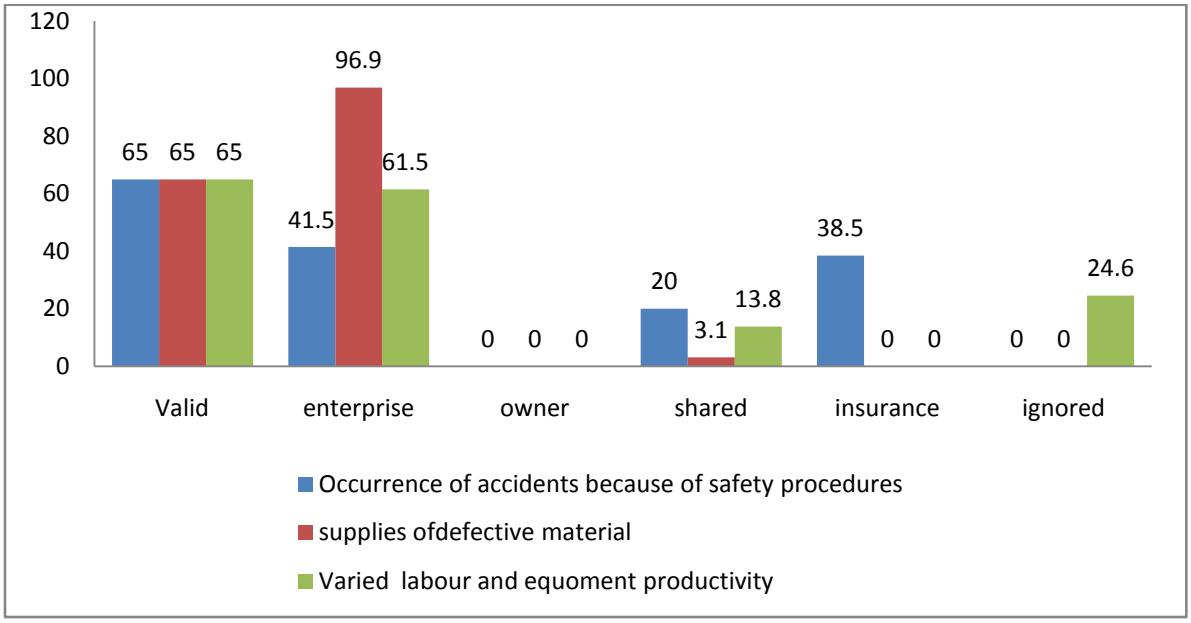


Fig 4.2 Physical risk allocation

4.2.2 Environmental group (Group)

4.2.2.1 Severity

Table 4.3 Environmental Group Risk Ranking

No.	Environmental Group Risk	Severity Frequency (percentage)					Severity Weight	Severity Mean
		No risk	Low risk	Medium	High	V.high		
6	Healthy working environmental for the workers	-	4(6.2)	11(16.9)	43(66.2)	7(10.8)	248	3.82
5	Environmental impact of the projects	-	20(3.8)	16(24.6)	27(47.5)	2(3.1)	206	3.1692
4	Change in climate condition	-	30(46.2)	22(33.8)	11(16.9)	2(3)	180	2.7692

66% of the respondent indicated that the healthy working environment for the workers has high risk,7% of the respondent agreed it is very high risk. The rest 16.9% and 6.2% show medium and low risk respectively.41.55% of Environmental impact of the projects show highly significant, 24% of the respondents indicated it has medium risk. 20% of them not agreed as its significant and the rest of 3.1% replied as high risk. Change in climate condition has low risk based on the respondents, that show 46.2%. 33.8% of the respondents agreed it has medium risk. And the rest 19% indicated that it has high risk. In Environmental risk group , based on severity average, healthy working environment for the workers considered highly significant risk that show severity mean is 3.8154. The next significant risk in the group is environment impact of the project which measure severity 3.1692 and The third one in the group is change in climate which is 2.7692 severity measure.

4.2.2 Risk Allocation

Change in climate condition is happen as nature so the respondents agreed that the risk bear more with the enterprise (i. e 32.3%).Due to the nature of the relationship of the

enterprise and the owner(defense minister) bear itself and share the consequence of the risk as shown below (Figure 4.3) ,27.7% and 21.5%.Some allocated to insurance about 18.5% but it has high premium for natural climate distortion .Environmental impact of the project, its impact studied before construction made so the risk is allocated to the owner that is why the respondents highly agreed by 60.1% .The enterprise also shared indirectly that indicated 30.8%.In healthy working environment for the workers is the enterprise duties to prepare suitable working area so the risk allocated about 30.8% with them. Sometimes the enterprise built remote area due to fulfill the interest of Ministry of defense in that case the owner should share the risk that is why the respondent allocate 20% and 9.2%(as individual and commonly share).More percentage given to allocate with insurance i.e 40%.The enterprise should take precaution to minimize the premium by creating health environment or working area.

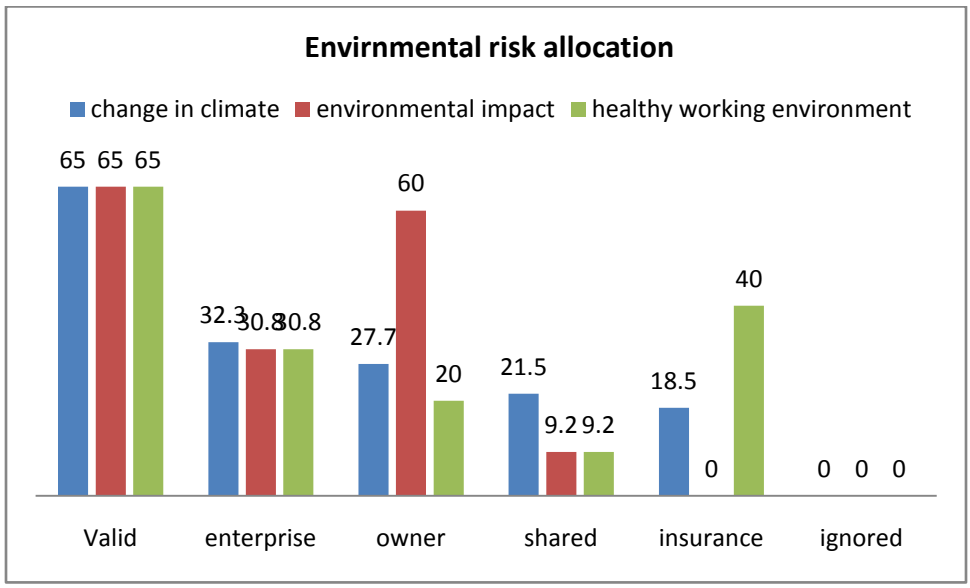


Fig.4.3 Environmental risk allocation

4.2.3 Design group (Group 3)

4.2.3.1 Severity

Table 4.4Design Group Risks Ranking

No.	Design Group Risks	Severity Frequency (percentage)					Severity Weight	Severity Mean
		No risk	Low risk	Medium	High	V.high		
7	Defective Design	-	2(3.1)	9(13.8)	35(53.8)	19(29.2)	266	4.0923
12	Lack of consistency between bill of quantities, drawings & specifications	-	9(13.8)	10(15.4)	36(55.4)	10(15.4)	242	3.7231
8	Not coordinated design	1(1.5)	2(3.1)	25(38.5)	25(38.5)	12(18.5)	215	3.6923
9	Inaccurate quantities	-	2(3.1)	21(32.3)	39(60)	3(4.6)	238	3.6615
10	Rush Design	-	22(33.8)	5(7.7)	30(46.2)	8(12.3)	219	3.3692
11	Awarding the design to unqualified designers	1(1.5)	22(33.8)	4(6.2)	28(43.1)	10(15.4)	223	3.3692

Table (4.4) below demonstrates percentage and ranks of design group factors. Under this group defective design and lack of consistency between bill of quantities, drawings and specification are the most significant risk which have 83% and 70.8% each. The degrees of their severities are 4.0923 and 3.7231 which are highly significant. The risk of Not coordinate design and Inaccurate quantities as a medium risk that measure their severity 3.6923 and 3.6615 respectively. The rush design and awarding the design to unqualified designers have low risk, their severity show lower than the rest type of risk. It has to be noted that the enterprise concerned about defective design issues because they could be the trigger for many disputes and undesirable consequences. This risk if not treated

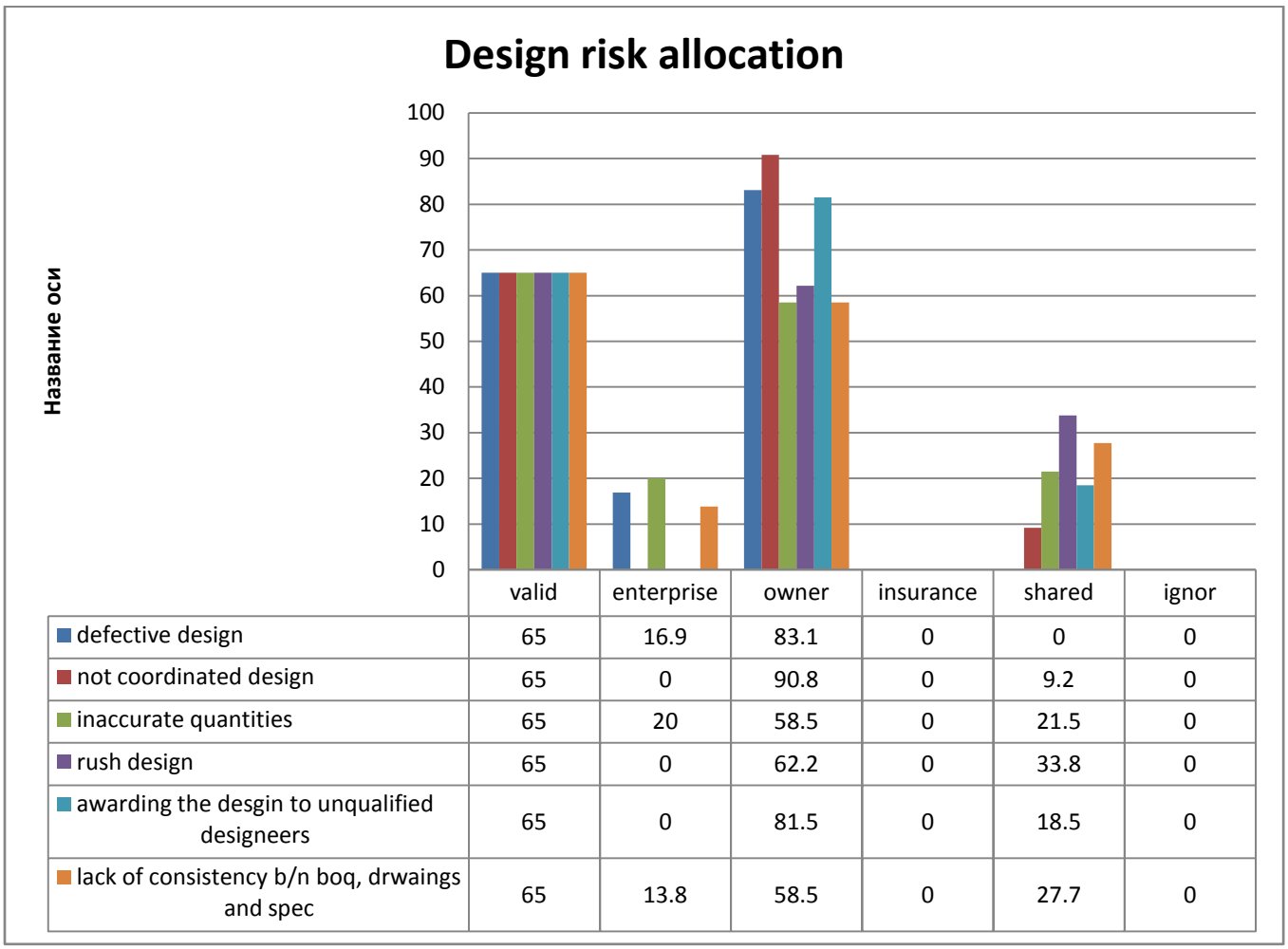
properly it could lead to undesirable consequences specially in construction. These findings are strengthened by the results of Ahmed, et al (1999), Lemos et al, (2004) and Shen, (1997).

4.2.3.2 Risk Allocation

Figure (4.4) illustrates that greater part of contractors allocate design risks onto owners. Enterprise had considered that owners should bear the risks of:

- Defective design (83.1%) Not coordinated design (90.8%)
- Inaccurate quantities (58.5%)
- Lack of consistency between bill of quantities, drawings and specifications (58.5%)
- Rush design (66.2%)

Awarding design to unqualified designers (81.5%) allocation percents were heading towards owners who are in a better position to supply sufficient and accurate drawings on the design and services. These findings complied with results of Ahmed et al.,(1999) and Kartam, (2001) who stated that the owner could best manage deficiencies in specifications and drawings by appointing a capable consultant and providing sufficient design budget.



	valid	enterprise	owner	insurance	shared	ignor
defective design	65	16.9	83.1	0	0	0
not coordinated design	65	0	90.8	0	9.2	0
inaccurate quantities	65	20	58.5	0	21.5	0
rush design	65	0	62.2	0	33.8	0
awarding the desgin to unqualified designeers	65	0	81.5	0	18.5	0
lack of consistency b/n boq, drwaings and spec	65	13.8	58.5	0	27.7	0

Fig.4.4 Design risk allocation

4.2.4 Marketing group risk(group 4)

4.2.4.1 Severity

Table 4.5 Market Group Risk Ranking

No.	Market Group Risks	Severity Frequency (percentage)					Severity Weight	Severity Mean
		No risk(1)	Low risk(2)	Medium (3)	High(4)	V.high(5)		
14	Increase of material cost	-	-	12(18.5)	39(60)	14(21.05)	262	4.0308
16	Inadequate forecast about market	-	10(15.4)	11(16.9)	38(58.9)	6(9.2)	235	3.6154
13	Increase of labor cost	1(1.5)	12(18.5)	9(13.8)	40(61.5)	3(4.6)	227	3.4923
15	High competition from other companies	2(3.1)	31(47.7)	19(29.2)	7(10.8)	6(9.2)	179	2.7538

As its shown from table Increase of material cost is the highest significant risk. The degree of severity and its percentage (4.0308&81.5%) shown table 4.5 that it is the most market risk indicators affecting the construction.81.5% put it as high risk, the rest 18.5% show as medium. The severity weigh 4.0308 which is higher than the other type of risk in the group. The second risk factor is inadequate forecast about market, Its severity measure 3.6615 . 64.6% respondents replied high risk,32.3% as medium and 3.1% said low. The third significant market risk is increase of labor cost which weigh 3.4923 severity .The researcher conducted interview to justify why not increase of labor cost significant ? they replied that the enterprise staffs are not only civilly but also many militaries who have a profession and employed in lower payment than others.

High competition from other companies is not significant risk. It measure 2.7538 severity. Most clients of the enterprise are its sister companies which are under minister of defense and others government enterprise that is why competition risk has less significant risk.

4.2.4.2 Risk Allocation

Under market group risk the increase of labor cost bear the enterprise itself .Because the responsibilities of planning and hiring is its own responsibilities that is why 72.3% of the respondent allocated with their enterprise. The increase of material cost risk shown 75.4%, allocated with owner and 53.8% with enterprise (figure 4.5). The researcher discussed with selected professionals replied that such type of case decided based on the type of agreement. Mostly material cost increment is refunded by the owner to the extent of percentages that notice in agreement that is the reason such risks allocated to owners.

In adequate forecast about market demand indicated more allocate with enterprise. since the enterprise has interest to engage the work out of the ministry of defense it should forecast certainly the market using considering many factors related to the market.

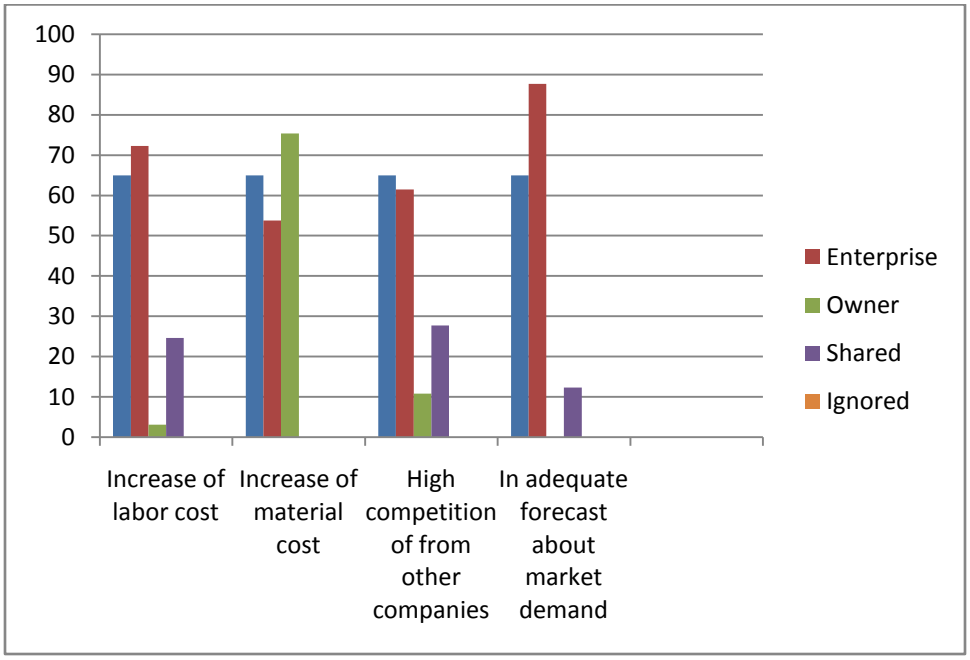


Fig.4.5 Market risk allocation

4.2.5 Financial group (Group 5) 4.2.5.1 Severity

Table 4.6 Financial Group Risks Ranking

No.	Financial Group Risk	Severity Frequency (percentage)					Severity Weight	Severity Mean
		No risk	Low risk	Medium	High	V.high		
19	Unmanaged cash flow	1(1.5)	2(3.1)	4(6.2)	36(55.4)	22(33.8)	271	4.1692
17	Inflation	-	2(3.1)	10(13.4)	39(60)	14(21.5)	260	4
18	Delayed payment	1(1.5)	1(1.5)	14(21.5)	41(63.1)	8(12.3)	248	3.83
20	Exchange rate of fluctuation	1(1.5)	11(16.9)	7(10.8)	40(61.5)	6(9.2)	234	3.6

As seen in table (4.6) above, unmanaged cash flow risks and inflation have got the highest scores of surveyed risk factors given by enterprise respondents. 89.2% indicated higher risk of un managed cash flow,6.2% show as medium and 3.1% &1.5% refer low and not represent risk. The severity of the risk also high i.e. 4.1692 . The respondents also considered that 81.5% inflation has significant risk in the group which severity score 4. The delayed payment and exchange rate has medium risk each one. The fore the enterprise require trained staff to manage properly its cash flow and to control the budgeting system .

4.2.5.2 Risk Allocation

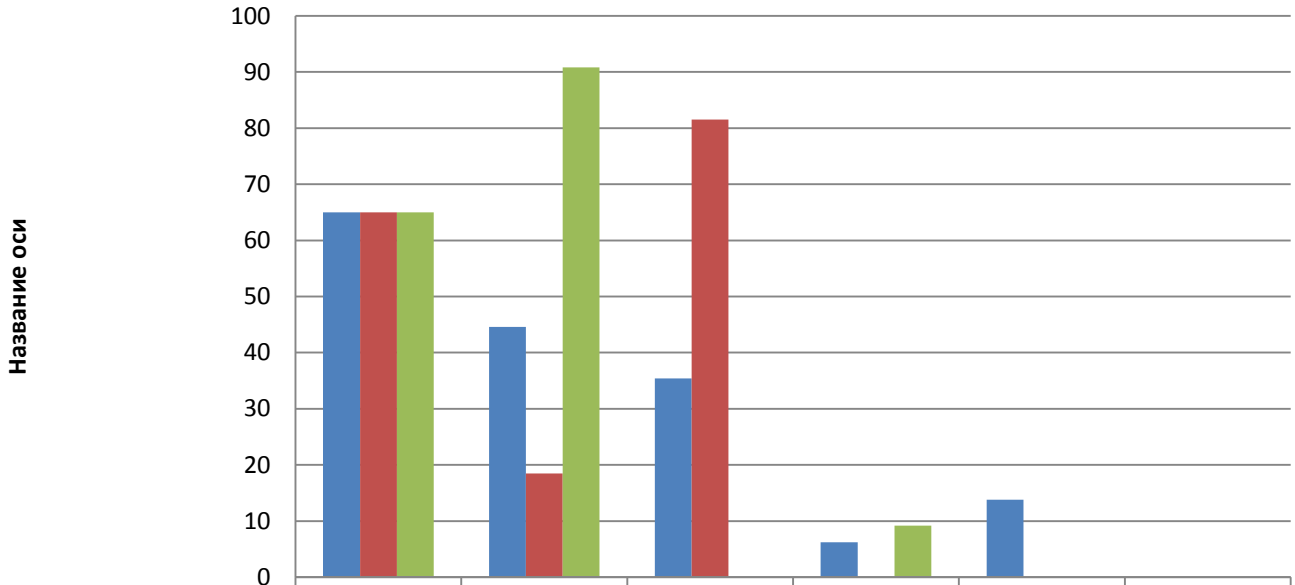
Figure (4.6) shows that enterprise appear to be ready to bear the risks of:

- Inflation risk (44.6%)
- Unmanaged cash flow (90.8%)

Majority of respondents (81.5%) allocated the delayed payments risk to the owners and 35% of inflation also allocated to the owner that mean they couldn't decided to whom allocate in general. The enterprise employee also undecided about exchange rate fluctuation .

Inflation and exchange rate fluctuation risks should be best shared between the owner and the contractor by including contract clauses that define the required parameters and conditions for sharing. These are risks where each party may be able to manage better under different conditions and could be specified in contracts as suggested above.

Fig.4.6 Financial risk allocation



	Valid	Enterprise	Owner	Shared	Insurance	Ignored
Inflation	65	44.6	35.4	6.2	13.8	0
Delayed Payment	65	18.5	81.5	0	0	0
Un managed cash flow	65	90.8	0	9.2	0	0

4.2.6 Legal group (Group 6)

4.2.6.1 Severity

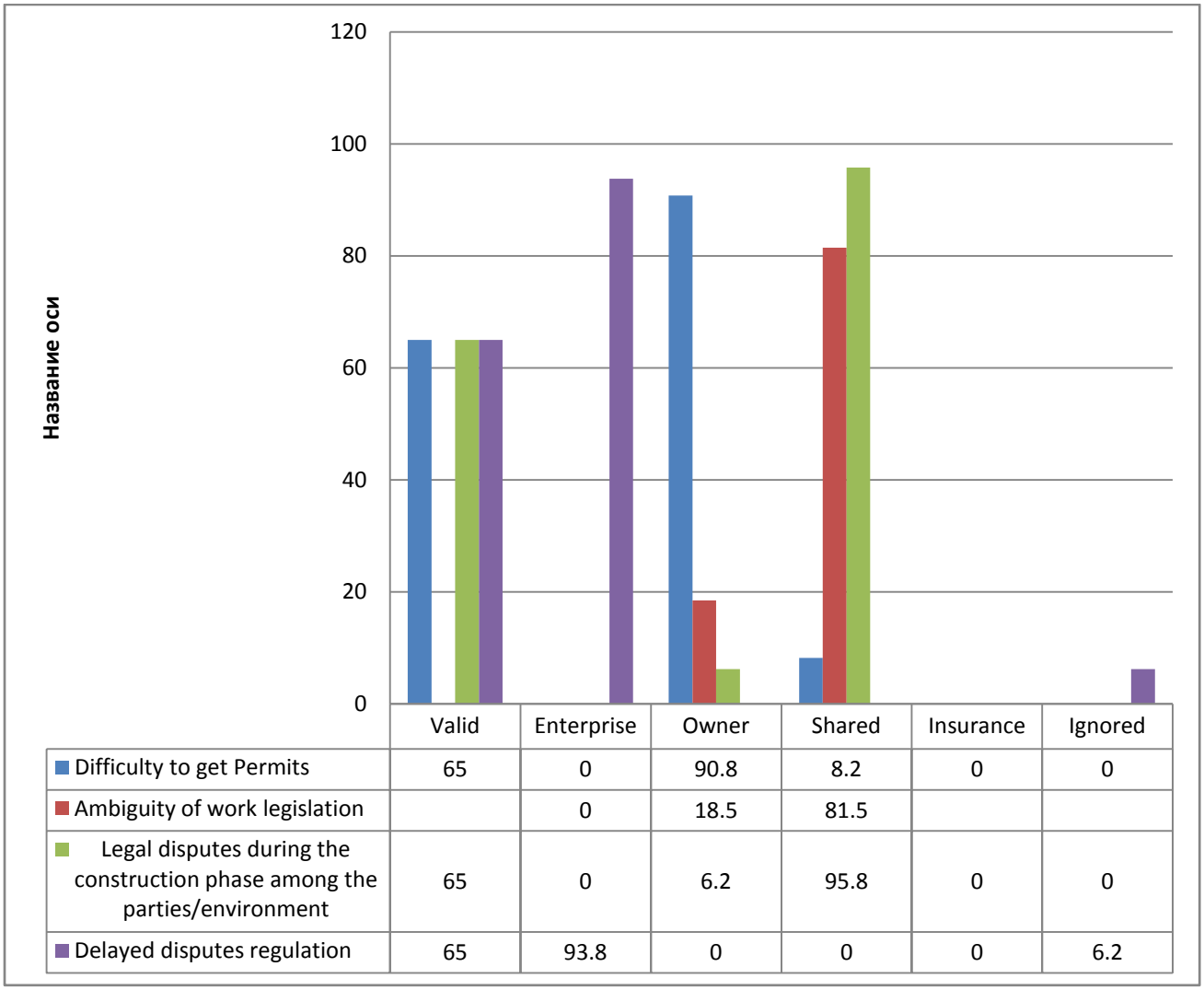
Table 4.7 Legal group Risk Ranking

No.	Legal Group Risk	Severity Frequency (percentage)					Severity Weight	Severity Mean
		No risk	Low risk	Medium	High	V.high		
23	Legal Disputes during the construction Phase among the parties	6(9.2)	30(46.2)	10(15.4)	18(27.7)	1(1.5)	173	2.6615
22	Ambiguity of work legislation	1(1.5)	38(58.5)	11(16.9)	15(23.1)	-	170	2.6154
21	Difficulty to get permits	1(1.5)	32(49.2)	27(41.5)	3(4.6)	2(3.1)	168	2.584
24	Delayed dispute resolution	14(24.6)	23(35.4)	6(9.2)	13(20)	7(10.8)	165	2.5692

Table (4.7) shows that all the risks under legal group: difficult to get permits, ambiguity of work, legal dispute and delaying disputes are not significant risk .The reason what i got during the interview that the government make clear every aspects before contractual agreement made. All the clients of the enterprise are under government any legal issue solved with in them. That is why the significance become low. The low weight indicates that contractors are not suffering of these risks.

4.2.6.2 Risk Allocation

Figure (4.7) illustrates the allocation of legal group factors according to contractors respondents. It is obvious that the greatest part of contractor respondents deal with legal risks as shared risks. 90.8% of respondents considered the risk of difficulty to get permits an owner risk 81.5% of respondents dealt with ambiguity of work legislations as shared too. The greatest part of respondents (93.8%) preferred to share legal disputes and delayed resolution with owners. Disputes could originate due to mistake or misunderstanding by either party. Hence, these risks should really be shared risks.



	Valid	Enterprise	Owner	Shared	Insurance	Ignored
Difficulty to get Permits	65	0	90.8	8.2	0	0
Ambiguity of work legislation		0	18.5	81.5		
Legal disputes during the construction phase among the parties/environment	65	0	6.2	95.8	0	0
Delayed disputes regulation	65	93.8	0	0	0	6.2

Fig.4.7 legal risk allocation

4.2.7 Technical group (Group 7)

4.2.7.1 Severity

Table 4.8 Technical Group Risks Rank

No.	Technical Group Risks	Severity Frequency (percentage)					Severity Weight	Severity Mean
		No risk(1)	Low risk(2)	Medium(3)	High(4)	V.high(5)		
29	Design charge	1(1.5)	1(1.5)	10(15.4)	37(56.9)	17(26.2)	266	4.0769
28	Lower work quality in presence of time constraints	2(3.1)	7(10.8)	13(20)	23(35.4)	20(30.8)	247	3.8
25	Rush bidding	2(3.1)	12(18.5)	14(21.5)	21(32.3)	16(24.6)	232	3.5692
27	Undocumented change	1(1.5)	8(12.3)	33(50.8)	18(27.7)	5(7.7)	213	3.2769
26	Gaps between implementation and the specification	1(1.5)	25(38.5)	6(9.2)	23(35.4)	10(15.4)	221	3.2769

In table (4.8) risks associated with construction were divided into two groups according to weights. The high importance group contained the risks of design change, lower work quality and rush biding respectively. Considering the risk of design change incurred additional cost and consumed more time than budgeted. 83.1% of the respondents agreed it has highly significant risk(severity measure 4.0769) .The second high significant risk is lower work quality which weigh 3.8 severity .The severity show that the enterprise disturbed with the lower work quality, which means the enterprise do their best to not have an abortive works, to maintain a good reputation and to avoid more costs repeating the abortive works. Other important risk is the risk of Rush biding which sever weigh 3.5692. the enterprise suffer when biding suppliers to purchase construction materials which have great impact on objectives:(time ,quality and cost).According to the respondents: 56% indicated it has high risk, 21.5% show as

medium, 18.5% & 3.1% as low and not represented as risk respectively. Undocumented change orders and Gaps due to misunderstanding of drawings and specifications places with medium severity, this the little attention reflects paid to these issues. The researcher asked the selected project managers a bout those issue how can them judged as medium. They answered since both enterprises i.e the construction and the design are in one umbrella(MOD) it is not difficult to solve any problem when faces related to the issue .

4.2.7.2 Risk Allocation

Figure (4.8) shows the allocation of construction risks. Enterprise accepted the risk of undocumented change orders (70.8% and rush biding(67.7%);the company understand that the documentation of change order and bid for purchase of material is their job. Also Majority of the respondents (46.2%) of lower quality in presence of time constrains and (40%) of gaps between the implementation and the specification due to misunderstandings of drawings and specifications are shared both the enterprise and the owner. Allocating design changes risk category to the owner reflects a trend in which contractors are not very much concerned with changes in the work.

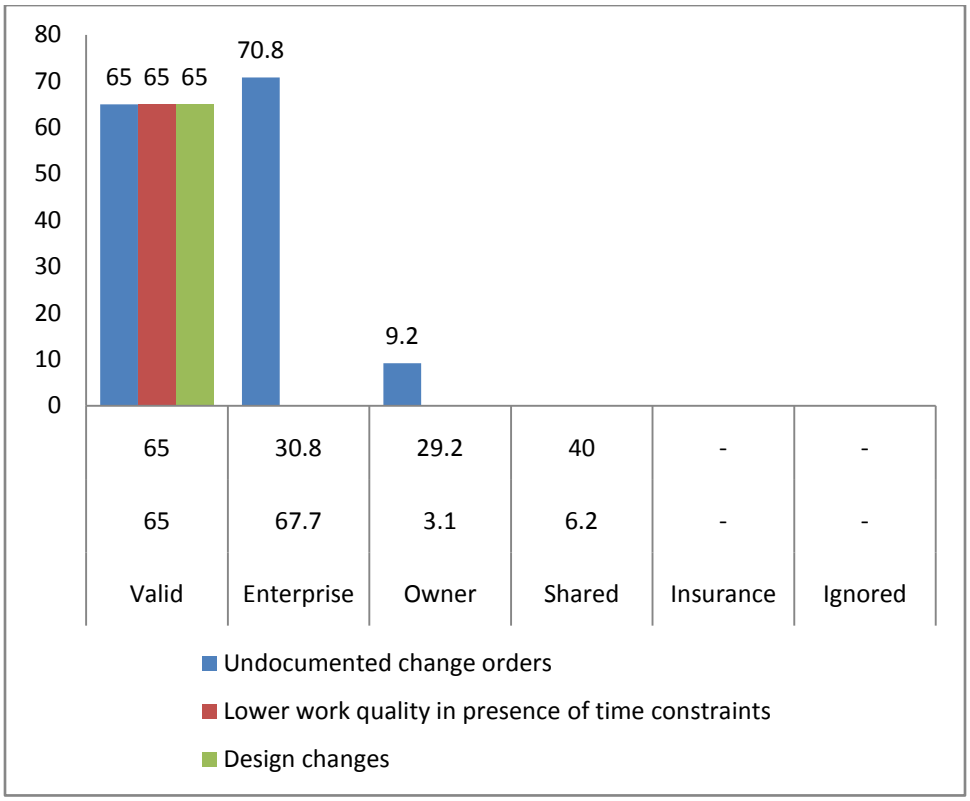


Fig.4.8 Technical risk allocation

4.2.9 Management group (Group 9) 4.2.9.1 Severity

Table 4.9 Management Group Risks Rank

No.	Management Group Risks	Severity Frequency (percentage)					Severity Weight	Severity Mean
		No risk	Low risk	Medium	High	V.high		
34	Poor resource management	1(1.5)	4(6.2)	14(21.5)	39(60)	7(10.8)	242	3.7231
37	Poor communication between parties	1(1.5)	25(38.5)	14(21.5)	23(35.4)	2(3.1)	195	3.7
33	Improper planning & budgeting	1(1.5)	7(10.5)	11(16.9)	38(58.5)	8(12.3)	240	3.6923
35	Information unavailability	1(1.5)	9(13.8)	8(12.3)	45(69.2)	2(3.1)	233	3.5846
31	Material shortage and theft	1(1.5)	9(13.8)	22(33.8)	20(30.8)	13(20)	230	3.5385
30	Shortage of skillful workers	1(1.5)	21(32.3)	9(13.8)	2(33.8)	12(18.5)	218	3.35
38	Internal management problem	1(1.5)	23(35.4)	19(29.2)	15(23.1)	7(10.8)	199	3.0615
32	Absence of team	1(1.5)	26(40)	18(27.7)	15(23.10)	5(7.7)	192	2.9538
36	Changes in management ways	1(1.5)	21(32.3)	30(46.2)	9(13.8)	4(6.2)	195	2.907

In management group factors ranks in table(4.9) above. The first significant factors based on severity shown poor management,, poor communication between involved

parties and Improper planning and budgeting which has 3.7231,3.7 and 3.6923 respectively.

The second significant risk based on respondents are information un availability, material shortage and theft, shortage of skilful workers and internal management problems which weigh severity ,3.5,3.5,3.3 and 3.06.From which information unavailability and material shortage and theft that can be able to influence on the objectives of the enterprise. The third significant type of management group risk are absence of team and changes in management which sever 2.95 and 2.907.

4.2.9.2 Risk Allocation

Figure (4.9) illustrates the respondents' allocation of management risks. The enterprise seemed to be ready to accept shortage of skillful workers(86%),improper planning and budgeting(84.65),absence of team (78.55%),poor resource management(67.7%),internal management problem(67.7%),changes in management ways(60%). Enterprise respondents decided to share poor communication risks with (70.8%). The type of risk that couldn't decided the enterprise is unavailability of information.

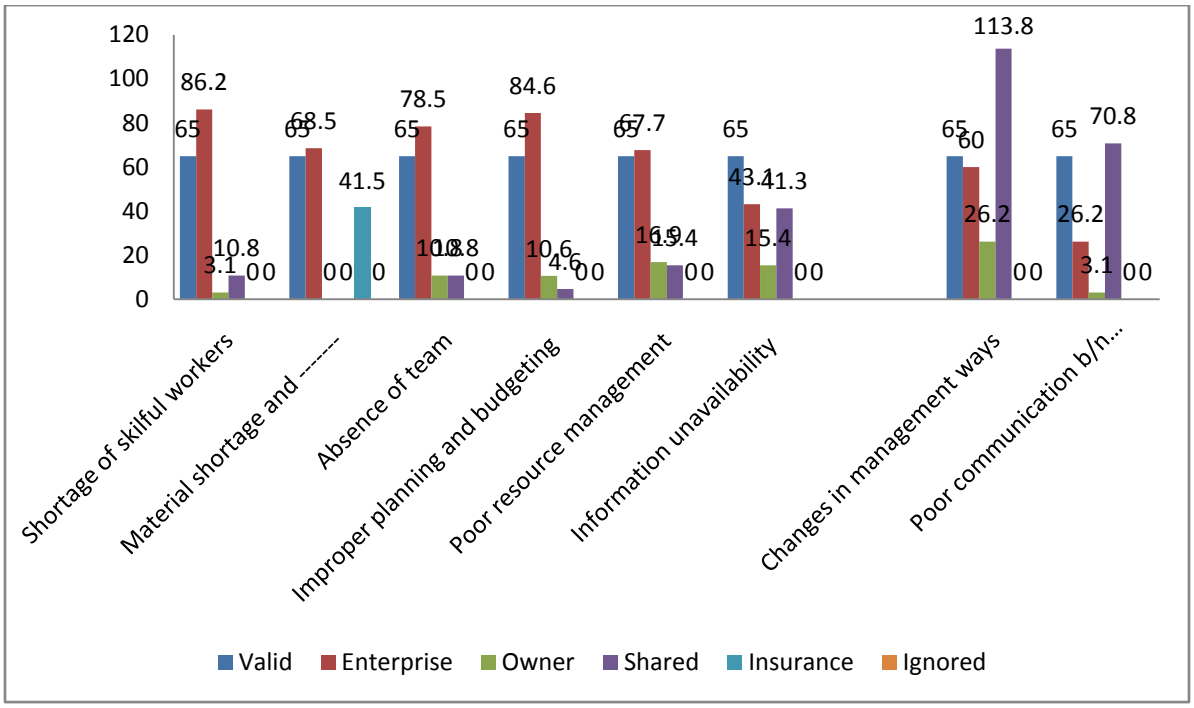


Fig 4.9 Management risk allocation

4.10 Overall risk significance and allocation

4.10.1 Significance risk

Table (4.10) shows all risk factors included in the score of closure with questionnaire ranked in descending order according to their weight of severity. The most and least important risk categories for the enterprise are shown in Table (4.11) which was developed based on the data in Table (4.10). The result shows that enterprise considered un managed cash flow ,defective design, design change ,increase of material change and inflation are to be the most important construction risks giving them a range between (260) and (270)), as shown in Table (4.11). The least important risk, from the enterprise respondents perspective is the risk of delaying dispute with a score of (165),) followed by the risk of difficult to get permit with a score of (168). The results show that enterprise considered (53%) of the risk factors as highly important risks , (42%) of them as medium risk and 5% as lowest risk. Most of the significant risks also highly influence on the objectives based on the probability matrix result(below table).But sometimes even though the risks categorize under medium risk but they indicated highly influence due to frequently happened. For example improper planning, increase labor cost and exchange rate fluctuation has higher matrix result respectively.

Table 4.10. Risk factors ranking

No.	Risk Factors	Weight	Severity (1-5)
20	Un managed cash flow	271	4.2.
36	Defective design	266	4.11
39	Design change	266	4.10
7	Increase of material cost	262	4.03
19	Inflation	260	4.0
18	Delayed payment	248	3.83
6	Health working environment for the workers	248	3.82
28	Lower work quality in presence of time constraints	247	3.8
12	Lack of consistency between bill of quantities, drawings and specifications	242	3.73

34	Poor resource management	242	3.72
2	Supplies of defective materials	241	3.71
33	Improper planning and budgeting	240	3.692
8	Not coordinated design	238	3.69
9	Inaccurate quantities	238	3.66
16	In adequate forecast about market demand	238	3.65
20	Exchange rate fluctuation	234	3.6
35	Information unavailability (include uncertainty	233	**3.58**
25	Rush bidding	230	3.53
31	Material shortage and theft	230	3.54
30	Increase labor	227	3.49
11	Awarding the design to un qualified designers	222	3.369
10	Rush design	219	3.36
30	Shortage of skillful labor	218	3.35
27	Undocumented change orders	213	3.27
26	Gaps between the implementation and the specification	213	3.246
3	Varied labor and equipment	210	3.23
5	Environmental impact of the project	206	3.16
1	Occurrence of accidents because of safety procedures	201	3.09
38	Internal management ways	199	3.06
37	Poor communication between involved parties	195	3.0
32	Absence of team	192	2.95
36	Change in management ways	189	2.907
4	Change in climate condition	180	2.76
15	High competition from other companies	179	2.75
22	Ambiguity of work legislation	170	2.62
21	Difficulty to get permit	168	2.6
16	Delayed disputes resolution	165	2.56

4.10.2 Risk Allocation

The criterion for a risk to be appropriated to a particular category (contractor, owner, shared, insurance, or ignored), was that it should get at least a (60%) response rate. Those that failed to get such response rate in favor of any category were listed as undecided. Allocation of risk factors included in the questionnaire, according to the enterprise respondents, is appeared in Table (4.10). Respondents have allocated 14 risks onto themselves, that means enterprise accepted (37%) of the risk factors, they have allocated 9 risks onto owners, which signifies that (24%) of the risk factors the owner (client) should handle, according to the enterprise employees. The respondents also considered 3 risks as shared risks, i.e. (7%) of the risk factors should be shared. On the other hand, they were undecided about 12 risks, that means the contractors failed to allocate (32%) of the risk factors. These results indicate that enterpris**e** clauses applied in enterprise ignore the majority of these risk factors.

Table 4.10.Risk allocation, enterprise'sperspective

Allocation	Risk Description
Contractor	Supplies of defective materials
	Increase of labor cost
	High competition from other companies
	Improper planning and budgeting
	Internal management problem
	Unmanaged cash flow
	Undocumented change orders
	Shortage of skilful labor
	Inadequate forecast about market demand
	Rush biding
	Delayed deputies
	Absence of team

	Poor r resource management
	Material shortage
	Changes in management ways
Owner	Defective design (incorrect)
	Not coordinated design (structural, mechanical, electrical, etc.)
	Rush design
	Awarding the design to unqualified designers
	Delayed payments on contract
	Increase of material cost
	Design changes
	Difficulty to get permit
Shared	Poor communication between involved parties
	Legal disputes during the construction phase among the parties of the contract
	Ambiguity of work legislation
Undecided	Occurrence of accidents because of poor safety procedures
	Environmental factors
	Gaps between the Implementation and the specifications due to misunderstanding of
	drawings and specifications
	Lack of consistency between bill of quantities, drawings and specifications
	Undefined scope of working
	High competition in bids
	Inaccurate project program
	Inflation
	Exchange rate fluctuation
	Monopolizing of materials due to closure and other unexpected political conditions

	Difficulty to get permits
	Ambiguity of work legislations
	Lower work quality in presence of time constraints

4.2.11 Risk management actions

4.2.11.1 Preventive actions

According to the survey results (Figure 4.11), enterprise usually depend on subjective judgment to produce a proper program is the most effective risk preventive actions. Judgment or subjective probability uses the experience gained from similar projects undertaken in the past by the decision maker to decide on the likelihood of risk exposure and the outcomes. These findings are supported by Kartam (2001). Judgment and experience gained from previous contracts may become the most valuable information source for the use when there is limited time for preparing the project program. Construction, however, is subjected to a dynamic environment, that is why risk managers must constantly strive to improve their estimates. Even with near perfect estimates, decision making about risk is a difficult task. Thus depending only on experience and subjective judgment may not be enough, and updated project information should be obtained and applied. Consequently, enterprise considered getting updated project information and add risk premiums to time estimation at the project planning stage to be effective risk preventive method. Yet, this result was expected since taking into consideration such risks' premiums would increase the priced bid and would consequently decrease the probability of gaining the bid due to the highly competitive construction market.

Make more accurate time estimation through quantitative risk analyses techniques such as Primavera Monte Carlo program was not considered to be an effective preventive method for reducing the effects of risk. This tends to support Kartam (2001) that the approach of risk analysis is largely based on the use of checklists by managers, who try to think of all possible risks. Insufficient knowledge and experience of analysis techniques and the difficulty of finding the probability distribution for risk in practice

could be the main two reasons for such result. Referring to similar projects to for accurate program was recommended by the practitioners to be an effective preventive method. The percentage above the column is effectiveness proportion for each method.

4.2.11.3Mitigative actions

Figure (4.11) represents the six mitigative methods being proposed. The percentage above the column is effectiveness proportion for each method. The first mitigative method recommended by the respondents is close supervision to subordinates for minimizing abortive work, and the last recommended mitigative method is change the construction method.

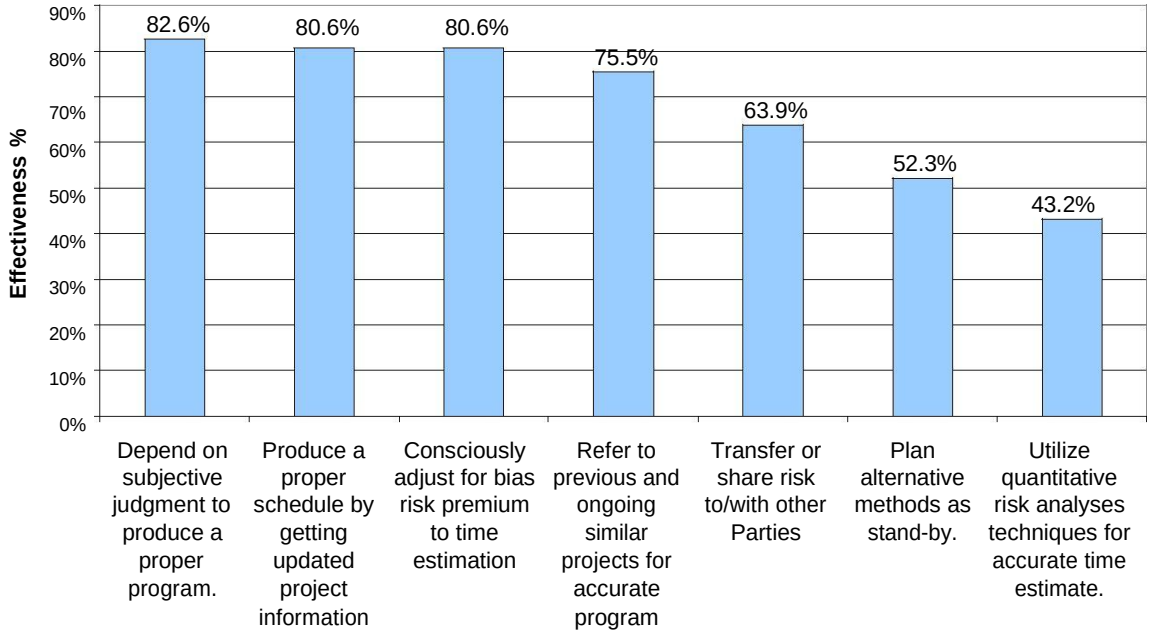


Figure 4.11. Preventive methods effectiveness, Respondents perspective

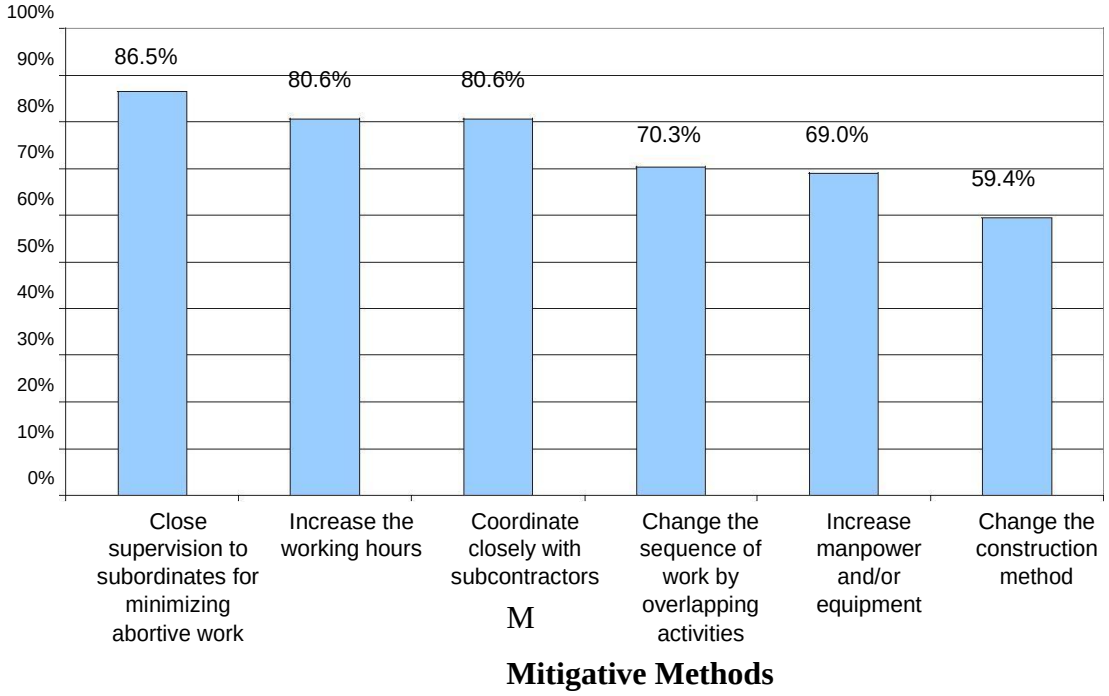
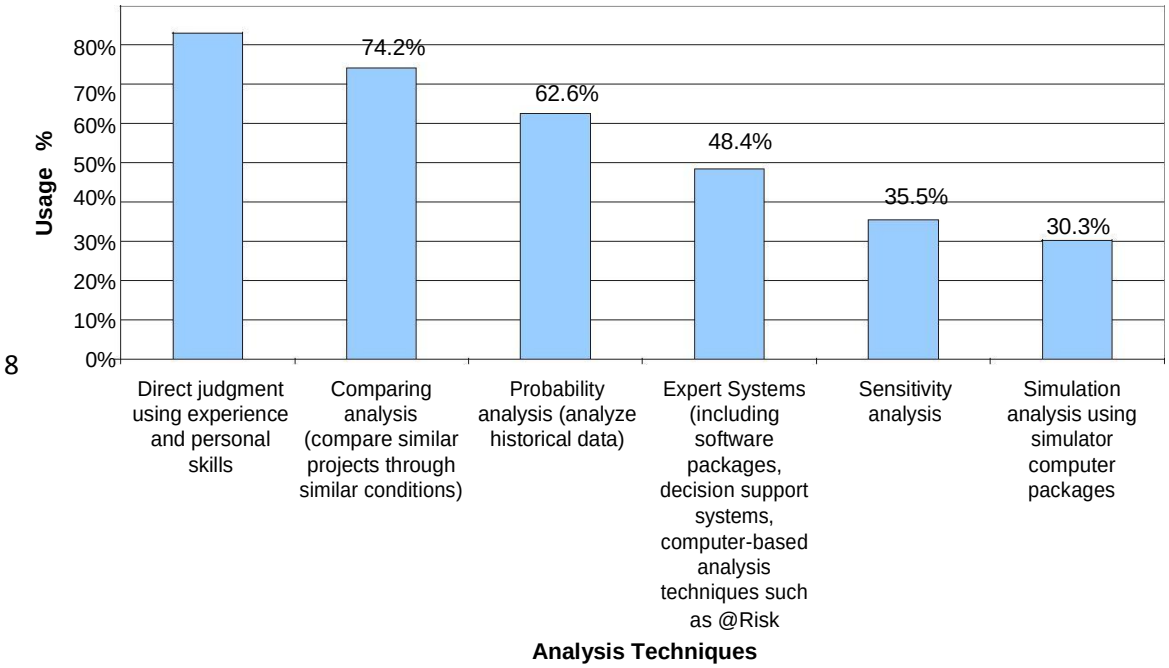


Figure 4.12. Mitigative methods effectiveness

Increase working hours and coordinate closely with subcontractors were the second most effective mitigative methods for minimizing the impacts of delay while Change the construction method was rarely used as a mitigative method. This could mean that the effort driven on site is one of the most important variables to project progress, since construction projects generally include many labor-intensive operations. In fact, as pointed out before, shortage of manpower in subcontractors' firms is one of the most serious risks to project delays. Therefore, increasing the work hours normally speeds up progress subject to the availability of materials and supervisors, physical constraints of the site, and construction sequences

4.2.12 Use of Risk analysis techniques

Figures (4.13) demonstrate the results gained. The first technique used was depend on the direct judgment and personal skills, the last was simulation analysis(30.3%). These results reflected the insufficient knowledge and experience of analysis techniques and the difficulty of applying them. Expert techniques are available such as at Risk system, which integrates with time schedules and spread sheets software, should be learned and applied to obtain a precise risk estimation.



8

Figure 4.13 Use of risk analysis techniques by enterprise

CHAPTER FIVE

SUMMARY OF FINDINGS,CONCLUSIONS,AND RECOMENDATIONS

The chapter refers the summary of the study findings, the conclusions of the result, include the recommendation that suggested based on the study and limitation of the study.

5.1 Summary of findings

In enterprise, past experience and discussions were the most commonly used techniques to identify potential risks. This finding corresponds with the research by Lyons and Skitmore (2004) that showed brainstorming and case based approach as the most popular risk identification tools. In fact, no time in the project was reserved for RM and respondents declared that potential risks were handled at the time of their occurrence. In other words, the members of the project team were not identifying risk in a structured way as described in the literature. They believed that their time was used more efficiently when they worked on the actual project instead of searching for problems. Only to a small extent were risks in the project identified by experience. The major tool such as checklist were not used.

Yet another finding from the interviews shows a differentiation between how risks are managed by individuals and in a team. Individuals and their organizations most often use manuals while groups use discussion as the most common technique to identify risks and problems. This statement is partially supported by Smith (2006) who found group meetings and discussions as the most relevant way to identify and manage risks.

In risk assessment of the RMP, the greatest differences can be discovered between the theory and how the industry actually works. As previously stated, the respondents were not familiar with any method used to analyze potential risks. Overall not many practitioners in the enterprise who work with residential projects use these structured methods. Lyons and Skitmore (2004) found that intuition, judgment and experience are the tools most often used

in risk analysis while structured methods like Monte Carlo or risk impact assessment are not used .

In response or control of risk the enterprise employees have no knowledge about any type of response. Most of them agreed to mitigate the risks through close supervision to subordinate, increase working hours and coordinate closely with sub contractor. It is clear that there is also lack of knowledge within this area. In the Lyons and Skitmore (2004) research, risk reduction was also the type of action most often chosen against risks.

The most significant and highly influence risks those faces in enterprise are :unmanaged cashflow,defectivedesign,designchange,increaseofmaterialcost,inflation,delayedpayment,health working environment ,lower quality due to lack of concistency and poor resource management.

The allocation technique of risk to take the responsibility is poor.32% of the risk factors not decided to whom allocated.

5.2 conclusions

In this study, identifying the risk factors faced by the enterprise is based on collecting information about construction risks, their consequences and corrective actions that may be done to prevent or mitigate the risk effects. Risk analysis techniques were investigated too. However, determination of severity and allocation of these risk factors was the main result of this research.

The focal point of this research is to explore the key risk factors and identify these factors that could be faced in Defense construction Enterprise . Analysis of these risk factors was carried out to measure their effects on building projects and to assign each risk factor on the party who is in the best position to handle such situations. A frame work was developed to rate construction risks by taking into account all the risks type in enterprise. Data for the study were collected through survey questionnaire with related interviews administered to respondents .The data were analyzed using significant level to calculate the mean and the weighted average. The result of weighted average indicated that risks management practice are not properly practiced in enterprise .Professionals in the enterprise know the techniques described concerning RM, but are not aware of it. The researcher confirmed that the

knowledge of RM and RMP is close to zero, even though the concept of risk management is becoming popular in organization. To manage the risk effectively and efficiently, the enterprise must understand risk responsibilities, risk event conditions, risk preference, and risk management capabilities.

5.3 Recommendations

- Enterprise should compute and consider risks by adding a risk premium to quotation and time estimation.
- Risks which scored the most significant should required attention to response or control in order to minimize their negative impact on the achievement of the enterprise.
- Enterprise should struggle to prevent financial failure by practicing a stern cash flow management and minimizing risk related with design..
- The company should learn how to share and shift different risks by hiring specialized staff or specialized sub-contractors.
- Moreover, Enterprise staffs should work on training their personnel to properly apply management principles. It is the duty of institutes to provide such training.
- Exchange rate fluctuation should be considered as a risk factor by owners and donors and they should offer a compensation mechanism if there was any damage due to this risk.
- The design process is the most important phase in the construction process. Design products should be at the highest level of quality, because of that it should have more focus by owners.
- Possible risks should be allocated contractually and clearly on each party (enterprise as contractor ,owner ,suppliers etc). That could be done by defining the potential risk factors and allocate them on the party which is in the best place to manage these risks.
- Satisfactory level of communications between parties should be maintained to convey needed information emphasizing documentation.
- Documentation works should be applied widely in the projects . In addition, contractors and owners are requested to keep computerized historical data of

finished projects. This may help in rights reservation and to be an information source for future comparison.

5.4 Limitation

The researcher excessively loaded with his regular duties of working in his respective undertaking, in line with post graduate studies that possess time limitation .Related specific materials and references in the area of construction risk management practice and shortage of time and finances were other limitation of the

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St. Mary's University
School of Graduate Studies
Master of Business Administration (MBA) Program Sample Questions (English Version)

Dear Respondents

First of all I would like to forward my heartfelt gratitude and respect to you for administering the questionnaire honestly and responsibility in advance.

The purpose of this question is to collect primary data for conducting a study on the topic, the assessment of risk management practice in DCE as a fulfillment to the completion of the masters Business Administration (MBA) program at St.Mary's University. In this regard you are kindly requested to provide reliable information that is to the best of your knowledge so that the findings from the study would meet the indeed purpose.

Finally, be assure that all information appearing here in will be kept strictly confidential and will exclusively be used for academic purpose only.

General instruction

- There is no need to write your name
- For the questionnaire checking in the box and table mark your response with "✓" mark.

Thank you for your Cooperation and timely response in advance.

PART 1 Personal Profile

Please use (✓) in the related box for your response.

a. **Gender** Male ☐ Female ☐

b. Educational background

1. MA/MSC ☐
2. BA/BSC ☐
3. Diploma ☐
4. Below Diploma ☐

c. Work Experience

1. Less than 5 years ☐
2. 5-10 years ☐
3. 10-15 years ☐
4. Above 15 years ☐

d. Job title

1. Top management ☐
2. Middle management ☐
3. Project manager ☐
4. Office manager ☐
5. Construction engineer ☐
6. Site engineer ☐
7. Project planning monitoring evaluation ☐
8. Others ☐

PART 2 A

Here attached the table which contains the risk factors, please sign (✓) the severity, probability and impact as you judge.

- Severing measure the degree of significance
- Probability show the likelihood of the frequency
- Allocation refers how the risk responsible to handle.

PART 2 A Risk Factors, Severity, likely hood (Probability) and Allocation

Risk Group	No	Factors	Severity					Probability					Allocation			
			Not Risk	Less Risk	Medium	High Risk	Very High	Very Low	Low	Medium	High	Very High	Enterprise	Owner/Client	Insurance	Ignore
Physical	1	Occurrence of accidents because of safety procedures														
	2	Supplies of defective material														
	3	Varied labor and equipment productivity														
Environmental	4	Change in climate condition														
	5	Environmental impact of the projects														
	6	Healthy working environment for the workers														
Design	7	Defective design (incorrect)														
	8	Not coordinated design (structural mechanical, electrical)														
	9	In accurate quantities														
	10	Rush design														
	11	Awarding the design to unqualified designers														
	12	Lack of consistency between bill of quantities, drawings and specifications														

Risk	No	Factor	Severity					Probability					Allocation			
			Not Risk	Less Risk	Medium	High	Very	Very Low	Low	Medium	High	Very High	Enterprise	Owner/Client	Insurance	Ignore
Market Risk	13	Increase of labour costs														
	14	Increase of material cost														
	15	High Competition from other companies														
	16	Inadequate forecast about market demand														
Financial	17	Inflation														
	18	Delayed payments on contract														
	19	Unmanaged cash flow														
	20	Exchange rate of fluctuation														

Group	No	Factors	Severity					Probability					Allocation			
			Not Risk	Less Risk	Medium	High Risk	Very High	Very Low	Low	Medium	High	Very High	Enterprise	Owner/Client	Insurance	Ignore
Legal Group risk	21	Difficulty to get permits														
	22	Ambiguity of work legislations														
	23	Legal disputes during the construction phase among the parties/ environment														
	24	Delayed disputes resolutions														
Technical Group Risk	25	Rush bidding														
	26	Gaps between the implementation and the specification due to misunderstanding of drawings & specifications														
	27	Undocumented change orders														
	28	Lower work quality in presence of time constraints.														
	29	Design change														

Group	No	Factors	Severity					Probability					Allocation			
			Not Risk	Less Risk	Medium	High Risk	Very High	Very Low	Low	Medium	High	Very High	Enterprise	Owner/Client	Insurance	Ignore
Management groups	30	Shortage of skilful workers														
	31	Material shortage and theft														
	32	Absence of team														
	33	Improper Planning and Budgeting														
	34	Pure Resource management														
	35	Information un availability (include uncertainty)														
	36	Changes in management ways														
	37	Poor communication between involved parties														
	38	Internal Management Problem														

Part 2 – B. Remedial Methods

2. In the table Shown below, Please determine the relative use of each preventive method in the table

Preventive Method		Never	Rarely	Sometimes	Often	Always
		1	2	3	4	5
1	Utilize Quantitative risk analyses techniques for accurate time estimate					
2	Depend on subjective judgment to produce a proper program					
3	Produce a proper schedule by getting updated project information					
4	Consciously adjust for bias risk premium to time estimation					
5	Transfer or share risk to/with other parties					
6	Refer to previous and ongoing similar projects for accurate program					

3. In the table shown below, please determine the relative use of each mitigate (reducing risk) method in the table.

Preventive Method		Never	Rarely	Sometimes	Often	Always
		1	2	3	4	5
1	Increase man power and/or equipment					
2	Increase the working hours					
3	Change the construction method					
4	Change the sequence of work by overlapping activities					
5	Co ordinate closely with sub contractors					
6	Close Supervision to subordinate for minimizing abortive work					