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**Assessments of Risk Management
Perception & Practice of Construction Contractors in
Saudi Arabia**

BY

Ali Abdullah Al Salman

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DR. SADI ASSAF

PREPARED BY

AHMED AL NEHMI

MAHMOUD HAMWDA

AIMAN YOUSEF HAWARI

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INTRODUCTION

The construction process is one of the most risky and challenging industries. Risk in construction cannot be eliminated but can be managed once taken. It can be controlled, minimized, transferred or shared. For risk management, there is no single universal and systematic approach that can be followed to manage and control all risks associated with every construction project

The construction industry in Saudi Arabia is exposed to similar risks as in other parts of the world and also risks associated with the unique characteristics of the region and the local practices.

PROBLEM STATEMENT

This study is to shed some light on the perception and attitude of the typical construction contractor in the Eastern Province of Saudi Arabia towards construction risks. It is mainly concerned with the allocation of risks, risk importance and their effects on the project as well as the improvements of the understanding by local contractors of risks related to the construction industry.

RESEARCH OBJECTIVES

The objective is to investigate the assessments and management of construction risks. In particular, the research will:

1. Present the perception and attitude of the typical construction contractor in the Eastern Province of Saudi Arabia towards construction risks. It is mainly concerned with the allocation of risks, risk importance and their effects on the project.
2. Compare the perception of the typical local construction contractor towards allocation of construction risks to the common practice of allocating these risks.

RESEARCH SCOPE AND LIMITATIONS

This research will be limited to:

- A. Medium to large construction contractors (Grades 1 or higher) per the classification of the Chamber of Commerce, Saudi Arabia Eastern Branch.
- B. Limited to the construction contractors in the Eastern Province of Saudi Arabia.
- C. Limited to general contractors lump sum type of construction contracts.

SIGNIFICANCE OF THIS STUDY

This study will shed some light on assessing the risk management practices of construction contractors. It will also help the local contractors identify the best approach to dealing with these risks.

Also, this study will shed some light on this issue of assessing the risk management practice in this region to help contractors minimize losses and clients to save the extra costs of their projects by better understanding how these risks are allocated and dealt with.

LITERATURE REVIEW

Definition of Risk / Risk Management

The concept of risk can be applied to almost every decision-making action we take ranging from zero risk to full risk. For any decision we make. It should be based on three broad elements. These elements are:

- Certainty
- Risk
- Uncertainty

Certainty exists only when the decision —maker can specify exactly what will happen during the period of time covered by the decision.

Risk could be defined as a situation in which there is a lack of information / data or previous experience to that particular situation being considered by the decision-maker at that time.

WHY RISK ASSESSMENT/SYSTEMATIC RISK MANAGEMENT IS NEEDED?

According to Godfrey, (1996), the systematic risk management program helps to:

- Identify, assess, and make the risks explicit.
- Focus on the major risks of the project.
- Make informed decisions on the provision for adversity.
- Minimize potential damage should the worst happen.
- Control the uncertain aspects of construction projects.

- Clarify and formalize the company's role and the roles of others in the risk management processes.
- Identify the opportunities to enhance project performance.

RISK MANAGEMENT PERCEPTIONS AND TRENDS IN CONSTRUCTION

Importance of Risks and Risks Allocation

Several studies have been conducted to identify the risk categories and to allocate the party/ies responsible for each category, whether it is the owner, contractor or shared between the two parties. Sfrassman and Wells (1988) have identified several risk factors associated with construction. From a client's perspective, these risks are:

- 1- Costs will escalate unpredictably
- 2- Structure will be faulty and need frequent repairs
- 3 -The project will simply be abandoned and partially paid for but incomplete and useless.

Similarly, from a contractor's point of view the risk factors are:

1. Fears of inclement weather
2. Delays in site availability
3. Unforeseen subsoil conditions
4. Inadequate detail drawings
5. Late material deliveries
6. Unanticipated price changes
7. Faulty subcontracting
8. Unproductive labor and strikes

Table 2. 1: Risk Importance

Level of importance	Risk Description
Most important	Safety Quality of work Defective design Labor and equipment productivity (tie) Contractor competence /delayed payment
Least important	Change in government regulations Acts of God Defective engineering (Tie) Permits and ordinances/ inflation

Source: Kangari (1995)

Al Bahar and Crrandal (1990) propose classification of risks that classifies the potential risks according to their nature and potential consequences. Their classification scheme is composed of six categories. They are:

- (1) Acts of God
- (2) Physical
- (3) Financial and economics
- (4) Political and environmental
- (5) Design
- (6) Construction related risks.

RISK ANALYSIS AND RISK MANAGEMENT

Assaf (1982) proposes a systematic approach for the management of pure risk, It includes:

- (1) Risk identification by either financial statements, flow chart, questionnaire and checklist; or a combination of them.
- (2) Analysis of risk treatment alternatives by either risk control, avoidance, retention or risk transfer.
- (3) Risk administration by either the contractor agency or an outside agency.

Perry and Haynes (1985) have suggested a simple and systematic approach for construction management, which consists of three stages:

- (1) Risk Identification
- (2) Risk Analysis
- (3) Risk Response.

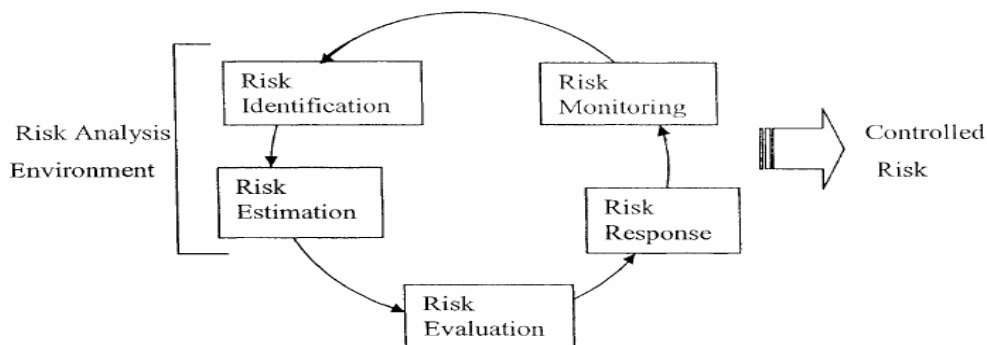


Figure 2. 3: Systematic Risk Management Steps

RISK RESPONSE

Responses to risks in construction can take any of the four approaches: risk retention, risk reduction, risk transfer and risk elimination! Avoidance (Raftery, 1997).

Risk Retention

Risk retention is sometimes called risk absorption. Not all risks can be transferred, but even if they can be transferred it may be more economical to retain them. Risks that produce small and repetitive losses that can be best controlled should be retained.

Risk Reduction

Risk reduction is sometimes called risk control. It may be argued that reducing risks is a part of risk retention because the risks have to be retained before they can be reduced.

Risk Transfer

Transferring risk does not reduce the severity of the source of risk. It only shifts the risk to another party to deal with it. In some cases, risk transfer can significantly increase risk because sometimes the party to whom it is being transferred may not be capable of handling the risk.

Risk Avoidance

Risk avoidance is sometimes called risk elimination. A contractor not bidding on a project or an owner deciding not to proceed with the project are simple examples of risk avoidance.

Research Methodology

Step one: Comprehensive literature review of available work on the risk management in construction industry.

Step two: Definitions of important risk parameters and categories related to risk allocation, risk importance, risk and effects of risk.

Step three: Design of Questionnaire then send it to the construction contractors.

Step four: Data was collected and compiled.

Step five: Collected data was analyzed.

Step six: Results were summarized and presented.

Step seven: Conclusion and recommendations for further studies were incorporated.

Design of Questionnaire

The questionnaire is contains 31 short and straight forward questions, it should not take more than 25-30 minutes to be completed.

The questionnaire includes two sections .the first section will provide general information about the construction contractor. The second section includes the main questions about the assessment of construction risks. It starts with brief description to help the applicants better understand the components of each question before answering this part of the questionnaire. The responses to each question are divided into four groups: risk allocation (both perception and common practice), risk importance and effect of risk on the project

At the end of the questionnaire the chance is given to the contractor to add and rate any additional risk category.

Finally, full contact information of the surveyors is included at the end of the questionnaire if they need any clarification.

Sample survey

The sample survey was selected from the list of construction contractors obtained from the chamber of commerce, eastern province chapter. Only medium to large contractors working in the eastern province of Saudi Arabia (Grades 1 or higher) per the classification of the chamber of commerce were included in the survey.

Sample size

The sample size that would represent the population for the survey calculated based on the following formula:

$$n_0 = (p \cdot q) / v^2$$

$$n = n_0 / \{1 + (n_0 / N)\}$$

Where: n_0 : first estimate of sample size

p :the proportion of the characteristic being measured in the target population .

$$q = 1 - p.$$

v :the maximum percentage of standard error allowed .

N : the population size.

n :the sample size.

For the purpose of getting the maximum sample size ,the values of(p) and (q) were taken as 0.5 for both .the maximum standard error allowed (v)in this study was taken as 10%.the total population was 82 construction contractors.

By applying the above formula, the sample size is:

$$n_0 = (0.5 \cdot 0.5) / (0.1)^2 = 25 \quad n = 25 / [1 + (25 / 82)] = 19.2$$

The maximum response rate was $(19.2 / 82) \cdot 100 = 23.4\%$. However the local actual response rate was $(28 / 82) \cdot 100 = 34.15\%$, which exceeded the minimum requirements.

Scoring:

Very important (equals 5 points).

Important (equals 3 points).

Less important (equals 1 point)

Each category will be calculated as follows:

$$!!R1 = \frac{5x1 + 3x2 + 1x3}{x1 + x2 + x3}$$

!!R1: importance index (R1 risk category 1)

X1: Number of respondents answering very important

X2: Number of respondents answering important

X3: Number of respondents answering less important

RISK CATEGORIES ALLOCATION, IMPORTANCE AND EFFECTS

The risk categories used to formulate the survey questionnaire is explained and detailed. Basically, three areas are investigated by this survey.

First, risk allocation (both from the Saudi contractors' point of view and as practiced) to either the owner, the contractor or shared by the two parties.

Second, the importance of each risk category to the contractor and the construction project.

Third, the effect of each risk category on the construction project (mainly on the budget, schedule, safety, and the quality of the project).

RISK CATEGORIES

Twenty five important risk categories were selected to compose the survey Questionnaire. These categories are:

Permits and Regulations

There are some local, national and international laws and regulations that govern the different aspects of the project. These regulations might include obtaining construction permits from the local municipality or the local authority and policies that control the development of the area such as safety.

Site Access

This risk category refers to the right of way and access to the project site. This is an important category especially if the project is in a remote or undeveloped area, or where access is limited to small trucks Also, when the project is located in a very congested area or access to other facilities.

Scope Limitation and Work Definition

Scope limits might not be clearly outlined and the work might not be well defined depending on the nature of the contract but this happens more in complex projects. Also, when there are subcontractors or multiple contractors for the different phases of the project.

Labor, Material and Equipment Availability

Certain jobs may require specific skilled expertise and for special material and equipment that might not be available or scarce in the local market and take a long time to procure.

Labor and Equipment Productivity

Like the previous risk category, certain jobs involving the productivity of labors and equipment might be affected because of the complexity of the job or the nature of the work.

Defective Design

It is impractical to make a 100% error free design especially in major and complex construction projects. This will be a major risk category if the defect is significant and requires major modifications and re-working especially in a lump sum type of contract.

Changes in Work

It could be change in work procedures, methodology or change of plans and scope of work. These changes might lead to change orders.

Differing Site Condition

Differing site conditions is required extra efforts and may necessitate special equipment and tools for excavation or de-watering.

Adverse weather conditions

The contractor might be forced to alter his work schedule due to adverse weather conditions such as high temperature, high humidity, flood or high wind.

Acts of God

They include things that could happen beyond the control of human and might affect the construction projects like hurricanes, earthquakes, volcanic rupture and other natural phenomena.

Defective material

This is an important risk category especially in the Saudi Arabian market where material standardization is not common and the local market is full of all kinds of material grades including substandard materials. This risk category becomes more important for lump sum and lump sum turn key contracts if the specifications were not well defined.

Changes in government regulations

Local authorities and government have specific codes and regulations that might be changed or revised from time to time. These regulations must be adhered to by contractors and owners of construction projects.

Labor dispute

This is more likely to happen in large companies where the work forces are multinationals with different backgrounds or where the relationships between management and workforce are tense.

Safety / Accidents

This risk category is inherited in the construction industry but can be minimized by following safety rules and the use of safety equipment such as goggles, safety hats and shoes. Another way of mitigation is by insurance.

Inflation

This risk category mainly depends on the economic conditions of the country. As the inflation rate increases, this risk becomes more important.

Contractor competence

This risk category is mainly related to the capability, skills, experience and proficiency of the contractor's organization including management and labor. This is important in performing major and complex construction projects.

Change-order negotiations

Change orders are the most undesirable risk category to deal with if not negotiated and managed properly and are generally un-welcomed by all parties.

Third party delays

Delays from these parties could affect the schedule and consequently the budget of the project and they need to be carefully considered in the assessments risk management programs for construction projects.

Coordination with subcontractors

Coordination with subcontractors and material suppliers is an important task especially in a multi-player environment like big construction projects and could be risky if not kept smooth, in a timely manner and continuous.

Delayed dispute resolution

This risk category is an important one especially if the dispute is major and deferred without resolution. Subcontractors or could be internally within each party organization. Disputes should be resolved immediately to eliminate any future consequences.

Delayed payment on contract

Delayed payments will influence the financial situation of the contractor, especially if the due payment is substantial and/or delayed for long time.

Quality of work

Quality of work would reflect the reputation of the contractor and might either rank him on the top of contractors or force him out of the market.

Financial failure

Financial failure of any party (contractor or owner) will significantly impact the project schedule and consequently the budget. in Saudi Arabia some new contractors to the construction market face financial difficulties in executing large projects and eventually file for bankruptcy.

Actual quantities of work

This could be a major risk category if the scope of work is not well defined and the actual quantities can not be measured. Actual quantities of work are important for progress reports and payments.

Accuracy of project program

This risk category mainly deals with the project program of the construction project.

RISK IMPORTANCE

Although risk importance varies from one project to another depending on the nature of the construction project, owner, contractor, type of contractual agreement and other factors, the questionnaire will elicit a general assessment of the importance of each risk category from the Saudi contractors' viewpoints and the general practice in the Eastern Province of Saudi Arabia.

RISK EFFECTS

All of the above risk categories will have potential effects on one or more of the project parameters namely budget, schedule, safety and quality, If these risks are not correctly assessed and managed, they will greatly impact the construction project.

RESULTS

Results are presented in five main parts:

- Part I: discusses the General Back Ground Information.
- Part II: discusses risk allocation to contractor, owner or shared. Allocation of risks from the viewpoint of the contractors and as common practice.
- Part III: discusses the importance of these risks.
- Part IV: discusses the effect of these risks on the project from different angles like budget, schedule, safety, and quality.
- Part V: Outlines the answers to section C of the questionnaire, which cover the added risk categories by contractors.

RESPONSE OF QUESTIONNAIRE

The questionnaire was sent to a total of 82 contractors. A total of 30 replies were received. Top management of two contractors did not want to participate in the research. So, only 28 of the total replies were considered in this study.

PART I: GENERAL BACKGROUND:

All contractors information like company size and experience of respondents were summarized in the following tables:

Table 5. 1: Number of Employees

Number of Employees	Number of respondents (Frequency)	Percent (%)
10 – 50	0	0
51 – 100	0	0
101 – 150	2	7.1
More than 150	26	92.9
Total respondents (N)	28	100

Table 5. 2: Experience of Respondents

Experience (years)	Number of respondents (Frequency)	Percent (%)
1 – 5	0	0
6 – 10	4	14.3
More than 10	24	85.7
Total Respondents	28	100

PART 2: RISK ALLOCATION

Table 5. 3: Allocation from Contractor's Opinion (Perception)

Risks Description	Risk Allocation (CONTRACTOR'S OPINION)		
	Owner	Contractor	Shared
Permits & regulations	44%	33%	22%
Site access	33%	33%	33%
Scope limitation & work definition	67%	11%	22%
Labor, material& Equip. availability	11%	89%	0%
Labor & equipment Productivity	0%	100%	0%
Defective design	36%	0%	44%
Changes in work	67%	22%	11%
Differing site condition	33%	44%	22%
Adverse weather conditions	11%	22%	67%
Acts of God	22%	0%	78%
Defective materials	11%	67%	22%
Changes in government regulations	44%	0%	56%
Labor disputes	0%	100%	0%
Safety/ Accidents	0%	67%	33%
Inflation	33%	11%	56%
Contractor competence	22%	56%	22%
Change order negotiations	11%	0%	89%
Third party delays	33%	22%	44%
Coordination with subcontractors	0%	78%	22%
Delayed dispute resolutions	0%	11%	89%
Delayed payment on contract	78%	22%	0%
Quality of work	0%	63%	38%
Financial failure	56%	11%	33%
Actual quantities of work	22%	33%	44%
Accuracy of project program	11%	33%	56%

Table 5. 4: Risk Allocation (Practice)

Risk Description	Risk Allocation(practice)		
	Owner	Contractor	Shared
Permits & regulations	33%	56%	11%
Site access	0%	89%	11%
Scope limitation & work definition	22%	56%	22%
Labor, material& Equip. availability	0%	100%	0%
Labor & equipment Productivity	0%	100%	0%
Defective design	0%	44%	56%
Changes in work	22%	44%	33%
Differing site condition	0%	78%	22%
Adverse weather conditions	0%	89%	11%
Acts of God	11%	22%	67%
Defective materials	11%	89%	0%
Changes in government regulations	11%	67%	22%
Labor disputes	0%	100%	0%
Safety/ Accidents	0%	100%	0%
Inflation	11%	67%	22%
Contractor competence	0%	78%	22%
Change order negotiations	0%	44%	56%
Third party delays	0%	78%	22%
Coordination with subcontractors	0%	100%	0%
Delayed dispute resolutions	0%	67%	33%
Delayed payment on contract	33%	44%	22%
Quality of work	0%	89%	11%
Financial failure	0%	33%	67%
Actual quantities of work	0%	78%	22%
Accuracy of project program	0%	100%	0%

Table 5. 5: Risk Allocation Practice Vs. Perception

Risk Description	<u>Risk Allocation</u> (practice)			<u>Risk Allocation</u> (contractor's opinion)		
	Owner	Contractor	Shared	Owner	Contractor	Shared
Permits & regulations	33%	56%	11%	44%	33%	22%
Site access	0%	89%	11%	33%	33%	33%
Scope limitation & work definition	22%	56%	22%	67%	11%	22%
Labor, material& Equip. availability	0%	100%	0%	11%	89%	0%
Labor & equipment Productivity	0%	100%	0%	0%	100%	0%
Defective design	0%	44%	56%	56%	0%	44%
Changes in work	22%	44%	33%	67%	22%	11%
Differing site condition	0%	78%	22%	33%	44%	22%
Adverse weather conditions	0%	89%	11%	11%	22%	67%
Acts of God	11%	22%	67%	22%	0%	78%
Defective materials	11%	89%	0%	11%	67%	22%
Changes in government regulations	11%	67%	22%	44%	0%	56%
Labor disputes	0%	100%	0%	0%	100%	0%
Safety/ Accidents	0%	100%	0%	0%	67%	33%
Inflation	11%	67%	22%	33%	11%	56%
Contractor competence	0%	78%	22%	22%	56%	22%
Change order negotiations	0%	44%	56%	11%	0%	89%
Third party delays	0%	78%	22%	33%	22%	44%
Coordination with subcontractors	0%	100%	0%	0%	78%	22%
Delayed dispute resolutions	0%	67%	33%	0%	11%	89%
Delayed payment on contract	33%	44%	22%	78%	22%	0%
Quality of work	0%	89%	11%	0%	63%	38%
Financial failure	0%	33%	67%	56%	11%	33%
Actual quantities of work	0%	78%	22%	22%	33%	44%
Accuracy of Project Program	0%	100%	0%	11%	33%	56%

Table 5. 8: Summary of Risks Allocation - Perception Vs. Practice

	RISK ALLOCATION			
	Owner	Contractor	Shared	Undecided
Perception	3	6	4	12
Practice	0	17	2	6

In practice, not a single risk is allocated to the owner and the contractor assumes most of the risks while in the contractor's opinion, they want to allocate some risks that they think the owner has better control cover. Also, contractors want owners to share more risks with them.

This result might be attributed to the idea that contractors are better in managing these risks. Another factor is the high competition in market and slow economy.

PART 3: RISK IMPORTANCE

Table 5. 9: Risk Importance

<u>Risk Description</u>	<u>Very Important</u>	<u>Important</u>	<u>Less Important</u>
Permits & regulation	44%	44%	11%
Site access	67%	22%	11%
Scope limitation & work definition	78%	22%	0%
Labor, material & Equip. availability	78%	22%	0%
Labor & equipment Productivity	63%	38%	0%
Defective design	75%	25%	0%
Changes in work	44%	56%	0%
Differing site condition	56%	33%	11%
Adverse weather conditions	22%	44%	33%
Acts of God	33%	33%	33%
Defective materials	56%	44%	0%
Changes in government regulations	33%	56%	11%
Labor disputes	11%	78%	11%
Safety/ Accidents	67%	33%	0%
Inflation	56%	33%	11%
Contractor competence	67%	33%	0%
Change order negotiations	67%	33%	0%
Third party delays	33%	67%	0%
Coordination with subcontractors	38%	63%	0%
Delayed dispute resolutions	56%	33%	11%
Delayed payment on contract	89%	11%	0%
Quality of work	100%	0%	0%
Financial failure	89%	11%	0%
Actual quantities of work	33%	67%	0%
Accuracy of project program	67%	33%	0%

Quality of work is ranked first 1 (the most important). This is anticipated because this is what matters most to the owner and this is what the contractor is paid for, to deliver quality project in accordance with the contract documents and specifications.

Table 5. 10: Risk Importance Level

Risk Description	Rank	Weighted Importance	Importance Level
Quality of work	1	140	Most important
Delayed payment on contract	2	134	
Financial failure	2	134	
Scope limitation & work definition	4	128	
Labor, material & Equip. availability	4	128	
Safety/ Accidents	6	121	
Contractor competence	6	121	
Change order negotiations	6	121	
Accuracy of project program	6	121	
Site access	10	115	
Defective materials	10	115	
Defective design	12	112	
Changes in work	13	109	
Differing site condition	13	109	
Inflation	13	109	
Delayed dispute resolutions	13	109	
Labor & equipment Productivity	17	106	
Permits & regulation	18	103	
Third party delays	18	103	
Actual quantities of work	18	103	
Changes in government regulations	21	96	
Coordination with subcontractors	22	93	
Acts of God	23	84	
Labor disputes	23	84	
Adverse weather conditions	25	78	Least important

PART 4: RISK EFFECTS

The risk effect will be appropriately assigned to one or more parameter if the frequency is more than 25%.

Table 5. 11: Risk Effects

Risk Description	Risk effects			
	Budget	Schedule	Safety	Quality
Permits & regulation	23%	62%	15%	0%
Site access	23%	38%	31%	8%
Scope limitation & work definition	57%	36%	0%	7%
Labor, material& Equip. availability	32%	47%	11%	11%
Labor & equipment Productivity	38%	44%	0%	19%
Defective design	38%	29%	10%	24%
Changes in work	29%	53%	0%	18%
Differing site condition	29%	47%	12%	12%
Adverse weather conditions	33%	44%	11%	11%
Acts of God	40%	35%	15%	10%
Defective materials	26%	26%	16%	32%
Changes in government regulations	64%	29%	0%	7%
Labor disputes	18%	41%	18%	24%
Safety/ Accidents	24%	24%	41%	12%
Inflation	75%	17%	0%	8%
Contractor competence	29%	29%	14%	29%
Change order negotiations	56%	38%	0%	6%
Third party delays	29%	53%	0%	18%
Coordination with subcontractors	15%	54%	8%	23%
Delayed dispute resolutions	38%	50%	0%	13%
Delayed payment on contract	56%	31%	0%	13%
Quality of work	31%	19%	0%	50%
Financial failure	50%	43%	0%	7%
Actual quantities of work	57%	29%	0%	14%
Accuracy of project program	28%	50%	6%	17%

Table 5. 13: Risks Effect on Four Project Parameters

Risk Effect (1)	Frequency (2)	Relative Frequency (%) (2) / sum *100
Budget	467	36.8 %
Schedule	488	38.5 %
Safety	109	8.5 %
Quality	206	16.2 %
SUM	1269	100 %

PART 5: ADDED RISK CATEGORIES

Table 5. 15: Added Risk Categories by Respondents

Risk Category	Allocation		Importance	Effect
	Perception	Practice		
Pre commissioning/ commissioning	Contractor	Contractor	Very important	Budget/schedule
Knowledge of owner /representative	Owner	Contractor	Very important	Budget/schedule/qua lity
Proper budgeting	Owner	Owner	Very important	Budget/schedule/qua lity
Cooperation of owner/decision maker	Owner	Contractor	Very important	Budget
Extension of schedule	Shared	Contractor	Very important	Schedule

CONCLUSION

Risk assessment is a new concept to the construction industry in SAUDI ARABIA and relatively new world wide. Saudi Arabia contractors' perception in allocating the surveyed risks is different from the common practice. In practice most of the risks are allocated to contractors none to owners. Quality of work is the most important risk while an adverse weather condition is the least important risk.

The surveyed risks have the highest impact on the project schedule while affect minor on the safety of the project. In other words, most of risk categories affect schedule and budget more than other project parameters.

Saudi Arabia construction contractors want owners to accept and share more risk with them. This can attributed to tow factors:

- Owners have some control over some of the risks.
- The high competition in the market and slow economy in the recent few years.

RECOMMENDATIONS

All construction contractors in Saudi Arabia are encouraged to have a better understanding when dealing with risks, in order to help them facilitate proper management of these risks based on the results of this research.

Although this study was done in EP of Saudi Arabia, the results can be applied to other areas of Saudi Arabia because of the similarities of rules, regulations and business environment.