

**CEM-520-Construction Contracting**

**Assessment of Risks Management Perception and  
Practices of Construction Contractors in Saudi Arabia**

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## ABSTRACT

*The Thesis present and discuss the results of a study on the assessment of risks management insight and practice of construction contractors in Saudi Arabia toward construction risks. Focuses on risk allocation (both contractors view and as practiced); risk importance and risk effects on a construction project; and compares contractors' perception of allocating construction risks to the common practice of allocating these risks.*

*To achieve the study objectives of this thesis the researcher conducted a literature review of the subject, defined important risk parameters and categories related to construction risks, designed a questionnaire related to allocation of risks, importance and effects of these risks on a construction projects. The questionnaire was distributed to 82 construction contractors of grade one and higher as per the classification of the Chamber of Commerce, Eastern Province Chapter of Saudi Arabia.*

*Responses from 30 contractors were received, analyzed, summarized and reported. Analysis of the results indicated that the perception of construction contractors in Saudi Arabia in allocating surveyed risks is different from the common practice of allocating these risks. In practice, most of the risks are allocated to contractors and none to owners. Quality of work is the most important risk while adverse weather condition is the least important risk. The surveyed risks have the highest impact on the schedule of a project with a response frequency of 38.5% while the same risks affect the safety of the project least (only with a response frequency of 8.5%)*

## **INTRODUCTION**

The construction process is one of the most risky and challenging industries. It has an inherited risk in all of the processes starting from the conceptual phase of a project, engineering design, placing the bid and going through scheduling, material procurement, construction, changing orders and ending with the commissioning, final payment and closing-up of the project. 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 construction requires the application of different types of resources to see a finished facility such as a multi-story building, a processing plant, an airport or even a small room. These resources might include manpower, equipment and tools, money, time and basic construction materials. Each of these resources has some risks associated with it. For example, the risk of not completing the project as scheduled or on budget or any injuries or damage to the workforce and equipment means losses to the contractor as well as more losses and delays to the client. These resources, along with associated risks, should be identified and managed to minimize losses and increase profits. 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**

The complex characteristics of major construction projects, competitions and the tight economic situations have created the necessity for predicting the project risks and the need to improve management support, techniques, and tools for risk management.

There is a lack of an accepted method of risk assessment and management among professionals in the construction industry compared with the financial and health professions (Mulholland 1999). A 1992 worldwide survey reported that the majority of construction projects fail to achieve the objectives of the schedule (Cooper 1994). This study is to shed some light on the view 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.

## **PREVIOUS STUDIES**

There are no studies on the researcher domain, further there are a thesis was presented on Kuwait state.

## **OBJECTIVES**

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

Present the view 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. Also, compare the views of the typical local construction contractor towards allocation of construction risks to the common practice of allocating these risks.

## **RESEARCH SCOPE AND LIMITATIONS**

Although this research will be done in the Eastern Province of Saudi Arabia, the results and conclusions can be applied to the construction industry in other areas of Saudi Arabia because of the similarities of the rules, regulations and business environment. Moreover, most of the large construction contractors have offices in other areas of Saudi Arabia. Because of the above reasons and for the purpose of this study, the words Eastern Province of Saudi Arabia and Saudi Arabia will be used interchangeably. 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 Province 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.

## **LITERATURE REVIEW**

This part was summarizing the comprehensive literature review of the available work reported on the subject of risk management in the construction industry, and the allocation and importance of risks. 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. He is certain of the consequences and the outcome of that decision during that period of time. This type of confidence, of course, does not happen very often in a complex industry like construction industry. Because risk is inevitable in almost every decision we make, different definitions are given to the word risk. Webster New Collegiate Dictionary defines the word risk as: “the possibility of loss or injury .... The chance of loss or the perils to the subject matter...” In other words, 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. While some authors and most people consider risk and uncertainty as two similar and synonymous terms, risk and uncertainty are two different terms meaning completely different issues. Flanagan, R. (1999) states "There is a general consensus that a decision is made under risk when a decision maker can assess, either intuitively or rationally, the probability of a particular event occurring". In this section, risk and risk management is defined from the construction point of view. The following are some of these definitions:

1. Eriksson (1979) defines risk in construction as: "Exposure to possible economic loss or gain arising from involvement in the construction process."
2. Jaafari and Schub (1990) define risk as: "The presence of potential or actual construction that could stand in the way of project performance causing partial or complete failure either during construction and commissioning or at the time of utilization".
3. Albahar and Crandall (1990) define risk as: "the exposure to the chance of occurrence of events adversely or favorably affecting project objectives as a consequence of uncertainty".
4. Kähkönen and Huovlla (1999) define systematic project risk management as "advanced preparation and decision making for minimizing the consequences of possible adverse future events and, on the contrary, to maximize the benefits of positive future events".
5. International Risk Management Institute, Inc. IRMI (1984 and 1995 supplement) defines risk management as "the process of identifying and analyzing risk, determining the most appropriate techniques for handling those risks, implementing the techniques, and monitoring the results. It differs from the old approach to managing these risks, frequently called insurance management, in that it recognizes that there are alternative techniques for handling these risks, that insurance is frequently the most expensive of all the available techniques, and that insurance should be used only as a last resort"

The topic of risk management has been important ever since the early age of humans on earth. In Covello and Mumpower's (1985) article, and according to Grier (1981), the first signs of risk management dated back as far as 3200BC in the Tigris-Euphrates valley with a group of people called the Asipu. One of their functions was to act as risk consultants. Their procedure would be to identify the important dimensions of the problem, propose alternative solutions, and collect data on the likely outcome. Their data sources were signs from Gods. However, in my literature review I found that the actual term "risk analysis" first originated with Hertz (1964). He proposed simulation by utilizing the computer to derive the probability distribution of the rate of return of an investment project. Risk management is not new, nor does it employ black box magical techniques. Traditionally it has been applied instinctively, with risks remaining implicit and managed by judgment, and informed by experience (Mills, 2001). People tend to use their intuition, experience and judgment in making decisions in construction.

Zack (1996) states that, in the past, normal risks associated with construction contracts were primarily physical in nature. The risks of 13 underground conditions, availability and productivity of labor, the effect of weather, and the ability to obtain materials and equipment, or other onsite problems that prevented work from proceeding were fairly well known and predictable. Both owners and contractors knew these risks. According to Baker, Ponniah and Smith (1999), formal risk management in construction has become an integral process only in the past few decades. The reason for this is the rapid advancement of technology. Risk and the management of risk, therefore have become a specialized subject in itself.

Hayes *et al*, states that the construction industry is one of the most dynamic, risky and challenging businesses. However, the industry has a very poor reputation for managing risk, with many major projects failing to meet deadlines and cost targets. This is influenced greatly by variations in weather, productivity of labor and plant, and quality of material. All too often, risks are either ignored, or dealt with in a completely arbitrary way: simply adding 10 per cent contingency onto the estimated cost of a project is typical. According to Akintoye and MacLeod (1997), construction risk is generally perceived as events that influence project objectives of cost, time and quality. Analysis and management of risk in construction depend mainly on intuition, judgment and experience. Because of the lack of knowledge and doubt on the suitability of risk analysis procedures, formal and 14 systematic risk analysis and management procedures are rarely used in the construction industry. Bing *et al*. (1999), state that a systematic approach to risk management is not a widely-spread practice in the construction industry due to the complex nature and involvements of this industry.

## **WHY RISK ASSESSMENT/SYSTEMATIC RISK MANAGEMENT IS NEEDED**

To answer this question, we need to know the importance and benefits of systematic risk management in the construction industry. According to Godfrey, (1996), the systematic risk management program helps to:

- Identify, assess, and rank risks, 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, Mills, (2001) states that systematic risk management is "expecting the unexpected- it is a tool which helps control risks in construction projects". And it has the following advantages:
  - Questions the assumptions that most affect the success of your project;
  - Concentrates attention on actions to best control risks;
  - Assesses the cost benefit of such actions.

## **RISK MANAGEMENT PERCEPTIONS AND TRENDS IN CONSTRUCTION**

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. Strassman 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
- another study by the American Society of Civil Engineers (ASCE) was made in 1979 to identify risk and the allocation of each risk category.

In a risk identification and allocation survey of the top 100 large USA construction contractors by Kangary, R. (1995), respondents were asked to identify the importance of risks associated with construction from the owner's and the contractor's perspective. Also, they were asked to place these risks into three allocations. Allocated to the owner, construction contractor, or shared between the two parties. A similar survey conducted by ASCE in 1979 showed that contractors were less willing to assume risks that are related to contractual and legal problems in the form of risk sharing with the owner.

Construction contractor contingency can be thought of as a contractor's estimate of the extraordinary risks or losses they will encounter in the project. These would be risks not covered by bonds, insurance or by the contract and they are uncertain. For examples, unforeseen conditions and unclear scope issues that the contractor cannot get enough information about at the time of bidding. Modern estimating textbooks usually represent the contractor's contingency as a fixed percentage of the direct cost. Generally the percentage reported is around 5-10 % of the contract value. This percentage is greatly affected by external factors such as the market, competitions and on-hand projects. Smith, G. And Bohn, C., (1999) concluded from their investigation that contractors had no knowledge of formal modeling techniques published on risk models. Where



contingency was included in contracts, the construction managers used a percentage of the total cost approach based on their intuition and previous contract knowledge. Each party (owners, engineers and contractors) in a contractual relationship will perceive risks from their own perspective. For example, the owner, who is the ultimate beneficiary of the contract, may be considering the project from a production requirement perspective.

## **RISK CLASSIFICATIONS**

Jaafari and Schub (1990) classify risks as technical risks and technological risks. Technical risks are those related to the fundamental properties, processes and concepts such as failure of an earth dam embankment in operation due to the overestimating of the shear strength of the structure. Technological risks are those related to plant and manufacturing and construction processes, state of hardware and the like. Failure of a construction method to achieve its production level is an example of technological failure. 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.

Farquharson J.A (2000) classifies risk assessment analysis as qualitative (i.e., what-if/ checklist analysis) and quantitative analysis. The qualitative analysis is often sufficient for making good decisions about the allocation of resources for safety improvement which in turn results in reliability and cost saving. But project managers and contractors also “seek quantitative - direct- cost/ benefit information upon which to base their decisions, they increasingly turn their attention to the use of a more detailed analysis technique (quantitative risk assessment)”. For Farquharson, the process of risk analysis includes answering three questions:

1. What can go wrong?
2. How likely is it?
3. What are the impacts?

## **RISK ANALYSIS AND RISK MANAGEMENT**

In the construction industry, paying attention to risk is essential to ensure

completing the project on time, on budget and with a good quality end product. Few people would deny the importance of assessing the risks in construction, but few analyze the risks systematically other than by using intuition and experience. The management of risks in the construction industry is a central issue for the success or failure of any project. Is it enough to be aware of risks or should we try to quantify them, analyze them and manage them? Flanagan, R. (1999) defines a risk management program as “a system which aims to identify and quantify all risks to which the business or project is exposed so that a conscious decision can be taken on how to manage the risks”. He added that the risk management system must be practical, realistic and must be cost effective. Because of the complex nature of construction activities, processes, environment and organization, it involves high degree of risk. However, analysis and management of risk in the construction industry are not well developed. Almost all parties (designers, owners and contractors) involved in this industry approach risk analysis and management from individual intuition, judgment, and experience gained from previous contracts (Al-labtabi and Diekmann 1992). Assaf (1982) proposes a systematic approach for the management of pure risk. It includes:

- (1) Risk identification by 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.

Buchan (1994) proposes three steps, namely risk identification, analysis and response, and he implemented a 15-step sequence to account for risk management. He concludes that if these simple steps are followed then beneficial outcomes and a stable risk environment should be obtained. Bostwick (1987) adds a fourth step; risk response; to the above three steps. Nummedal *et al.* (1996), Eloff *et al.* (1993) and the British Standards BS 8444 (BSI, 1996) propose five steps to manage risks. These systematic five steps used for a comprehensive risk management procedure are:

- (1) Risk Identification
- (2) Risk Estimation
- (3) Risk Evaluation
- (4) Risk Response
- (5) Risk Monitoring

Baker *et. al* (1999) have suggested fitting these five steps in a simple circular procedure which, if maintained, will yield a controlled risk environment. The first two steps, namely risk identification and risk estimation, can come under the broader title of risk analysis. Risk analysis with risk evaluation can be grouped under risk assessment, with response and monitoring collectively entitled risk control.

They state “Systematic project risk management means advanced preparation and decision making for minimizing the consequences of possible adverse future events and, on the contrary, to maximize the benefits of positive future events”. According to this definition, project risk management is more related to 'planning' rather than 'management', which usually refers to on-line control of events. However, it is widely accepted that project risk management must be seen as a pro-active technique to identify potential risks, analyze them, do response planning and make necessary decisions. Risk analysis is an integral part of the risk management system or program. It gives an insight into what happens if the project does not proceed according to plan. There are many theories that can be utilized to analyze risks including a decision tree, decision tables, utility theory, game theory, simulations and an AHP model. But, no matter how good the analytical techniques, it is the application and interpretations of results by the professional that determines the success of the system. Ibbs and Crandall (1982) developed their risk decision model based on utility theory. Utility theory models are useful for modeling human value systems into a mathematical formulation. This decision modeling approach allows contractors to estimate the impact of their risk decision based on Bayesian probability analysis.

Smith (1999) uses a Monte Carlo simulation to generate the project cost cumulative density function. The construction Industry Institute's (1989) publication *on Management of Project Risks and Uncertainties* also describes a Monte Carlo technique to evaluate risks. Fuzzy mathematics has been used to estimate risk probabilities, which are difficult to measure using the traditional mathematics. Risks in construction are often discussed using terms such as good or bad and high and low. Fuzzy sets provide a convenient way to include a measurement of these types of variables. Boyer and Kangari (1989) suggest using fuzzy set theory in an expert system environment to evaluate risk based on perceived severity and sensitivity to project changes. Flanagan, R. (1999) suggests that clear thoughts should be applied to the best available data in a structured and systematic way to analyze risks in a project.

## **RISK RESPONSE**

Pundist has argued that there are four ways to deal with risk in the construction industry:

- 1- “*The umbrella approach*” where you account for every possible eventuality by adding a large premium to the price. This will increase the bidding price and eventually lead to few contracts.

2- "*The Ostrich approach*" where you bury your head in the sand and assume everything will be alright, and that somehow you will manage.

3- "*The intuitive approach*" where you only depend on intuition and gut feeling, ignoring any formal analysis.

4- "*The brute force approach*" where you focus on the uncontrollable risks and say that you can force them to be controlled, which of course they cannot be.

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 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 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 (Baker, Ponniah and Smith, 1999). Usually risks related to safety can be reduced. Reduction falls into three basic categories:

First, are the education and training programs that alert the staff to potential risks within the working environment, Loss prevention programs and safety alerts and training play major roles in preventing accidents and consequently reduce risks. Second, is the physical protection of people and equipments, continuous maintenance and updating of equipment and tools help prevent damages and losses and in turns reduce risks. Third, are the consistent company's systems and procedures? Clear procedures, good housekeeping, first aid and security procedures can lead to a better working environment, improved labor relations and increased productivity which in turn reduce risks.

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. For example, a general contractor might transfer risk to an incompetent sub contractor who can not handle the risk and this ends up in a more risky situation. Risk transfer can be in two ways (Thompson and Perry, 1992): (a) the property or activity responsible for the risk may be transferred to a sub contractor; or (b) may be retained, but the financial risk transferred through insurance. 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. There are other ways of eliminating risks like pre-contract negotiation or including exemption clauses in the contract, either to avoid risks or to avoid consequences of certain risks.

## RESEARCH METHODOLOGY

The research methodology will include the following essential six steps:

**Step one:** A comprehensive literature review of the available work reported on risk management in construction industries, allocation of risks and the importance of these risks. The review includes the recent literature on the subject that includes the past ten years.

**Step two:** Definition of important risk parameters and categories related to risk allocation, risk importance and effects of risks on typical projects.

**Step three:** Design of a questionnaire related to the allocation of risks, importance and effects of these risks on the construction industry and the local construction contractors. The questionnaire was mailed and E-mailed to the local construction contractors.

**Step four:** Data was collected and compiled.

**Step five:** Collected data was analyzed.

**Step six:** Results from the analyzed data were summarized and presented.

**Step seven:** Conclusion of the research, recommendations and suggestions for further studies were incorporated.

The questionnaire contains 31 short and straight-forward questions, and is designed in such way that completing it should not take more than 25-30 minutes considering the busy schedule of project managers/ project engineers completing the survey questionnaire. The questionnaire includes two sections; the first section will provide general information about the construction contractor like the size of the firm, how long the firm has been in business and background information about the individual completing the questionnaire. The second section includes the main questions about the assessment of construction risks. It starts with a 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 that risk on the project. In this survey, questions related to the allocation and importances of risks are similar to the questions Kartam (2001) used for the survey of risk and its management in the Kuwaiti construction industry. Kartam used 26 risk categories in his survey; 21 of them are similar to those used by Kangari (1995). In this survey, 25 risk categories will be used for risk assessments focusing on risk allocation, risk importance and risk effect on the project. Effect of these risk categories on the project were not surveyed neither by Kangari's nor by Kartam's questionnaires. Similarly, a comparison between contractor perception and

common practice of allocation construction risks was not done in the previous studies. At the end of the questionnaire the chance is given to the contractor to add and rate any additional risk category that he might think has any significance for future similar studies. Finally, full contact information of the surveyors is included at the end of the questionnaire for the applicants if they need any clarification or if they have any questions regarding the study.

## **SAMPLE SURVEY**

Selection of the sample for the survey from the big list of contractors in the construction industry plays a major role in making the research more effective and representative. By carefully considering the research theme from different angles and to avoid any possible conflict and discrepancies in the collected data, only construction contractors were selected. The sample survey was selected from the list obtained from the Chamber of Commerce, Eastern Province Chapter. Only medium to large construction 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 was calculated based on the following formula (Kish, 1995)

$$n^{\circ} = (p \cdot q) / v^2 \text{ ----- (1)}$$

$$n = n^{\circ} / [1 + (n^{\circ} / N)] \text{ ----- (2)}$$

Where:

$n^{\circ}$  = 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 considered from the list obtained from the Chamber of Commerce, Eastern Province consisted of construction contractors (Appendix II)

Applying the above formula, the sample size is:

$$n^{\circ} = (0.5 \cdot 0.5) / (0.1)^2 = 25$$

$$n = 25 / [1 + (25/82)] = 19.2$$

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

## DATA ANALYSIS

Data gathered from the questionnaire is analyzed and used to identify the respondents' allocation and importance of each type of risk categories and the effect of each risk on the project. The analyzed data is presented in a tabulated format and figures. Allocation of risks as practiced in construction industry in the area is compared with the view of local construction contractors for allocating the same risks. By carefully studying the results of the survey, a better understanding will be gained of the current situation in the construction industry from a local contractor's point of view. This also allows recommending the next approach for further studies of the subject.

<b>Risk Description</b>	<b>Risk Allocation (Practice)</b>	<b>Risk Allocation (Perception)</b>	<b>Risk Rank of Importance</b>	<b>Risk Effects</b>
Permits & regulation	Undecided	Undecided	18	Schedule
Site access	Contractor	Undecided	10	Schedule, safety
Scope limitation & work definition	Undecided	Owner	4	Budget, schedule
Labor, material & Equip. availability	Contractor	Contractor	4	Schedule, budget
Labor & equipment Productivity	Contractor	Contractor	17	Schedule, Budget
Defective design	Undecided	Undecided	12	Budget, Schedule
Changes in work	Undecided	Owner	13	Schedule, budget
Differing site condition	Contractor	Undecided	13	Schedule, budget
<b>Adverse weather Conditions</b>	<b>Contractor</b>	<b>Shared</b>	<b>Least important</b>	<b>Schedule, budget</b>
Acts of God	Shared	Shared	23	Budget, schedule
Defective materials	Contractor	Contractor	10	Quality, budget & Schedule
Changes in government Regulations	Contractor	Undecided	21	Budget, schedule
Labor disputes	Contractor	Contractor	23	Schedule
Safety/ Accidents	Contractor	Contractor	6	Safety
Inflation	Contractor	Undecided	13	Budget
Contractor competence	Contractor	Undecided	6	Budget, schedule & Quality
Change order Negotiations	Undecided	Shared	6	Budget, schedule
Third party delays	Contractor	Undecided	18	Schedule, budget
Coordination with Subcontractors	Contractor	Contractor	22	Schedule
Delayed dispute Resolutions	Contractor	Shared	13	Schedule, budget
Delayed payment on Contract	Undecided	Owner	2	Budget, schedule
<b>Quality of work</b>	<b>Contractor</b>	<b>Undecided</b>	<b>Most Important</b>	<b>Quality, budget</b>
Financial failure	Shared	Undecided	2	Budget, schedule
Actual quantities of work	Contractor	Undecided	18	Budget, schedule
Accuracy of project Program	Contractor	Undecided	6	Schedule, budget

## SCORING

The main section of the questionnaire on the importance of risk categories basically uses an ordinal scale. This ordinal scale does not offer in its qualitative 3 points scale, namely very important, important and less important, a direct quantitative comparison between its intervals. This scale will be transformed into an interval scale by assigning a weight to each interval as indicated in the questionnaire. This transformation will facilitate the required parametric statistics. No scoring is needed for other sections of the questionnaire. Scoring will be as follows:

- "Very important" equals 5 points
- "Important" equals 3 points
- "Less Important" equals 1 point

Importance Index of each risk category will be calculated as follows:

$$II_{R1} = 5x1 + 3x2 + 1x3 / (x1 + x2 + x)$$

Where:

$II_{R1}$ : importance Index (R1 denotes risk category 1 in this case)

X1: Number of respondents answering very important

X2: Number of respondents answering important

X3: Number of respondents answering less important

Microsoft Excel is used as software to perform weighting, ranking and to calculate the percentage of each risk category. Printouts of Excel tables are in Appendix V.

Frequencies and ratio calculation will be used for other sections of the questionnaire.

$$\text{Frequency (\%)} = n / N_T * 100$$

Where:

n = number of respondents (frequency)

$N_T$  = Total respondents

## 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).

Twenty five important risk categories were selected to compose the survey questionnaire. They have either direct or indirect effect on the project budget, schedule, safety and quality of the project and need to be carefully looked at in the assessments of risks management of construction projects. These categories are:



1. Permits and Regulations
2. Site Access
3. Scope Limitation and Work Definition
4. Labor, Material and Equipment Availability
5. Labor and Equipment Productivity
6. Defective Design
7. Changes in Work
8. Differing Site Condition
9. Adverse weather conditions
10. Acts of God
11. Defective material
12. Changes in government regulations
13. Labor dispute
14. Safety / Accidents
15. Inflation
16. Contractor competence
17. Change-order negotiations
18. Third party delays
19. Coordination with subcontractors
20. Delayed dispute resolution
21. Delayed payment on contract
22. Quality of work
23. Financial failure
24. Actual quantities of work
25. Accuracy of project program

## **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. 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 DISCUSSION**

The results of the questionnaire are discussed, summarized and presented in tabulated format as well as in charts. There were some problems encountered during the survey. The first problem was the low response rate. Second, was the slow delivery of the questionnaire to the contractors? Initially the questionnaire was sent to the contractors using the local snail mail service on March 1<sup>st</sup>, 2003 but it took 16 days to reach some of the contractors. Third, e-mails of the

contractors were not available. Fourth, since the questionnaire consisted of ten pages, it was difficult to fax to the contractors. At the start, the contractors were contacted by telephone to ensure they are in the construction industry and were interested to participate in the research. Then the questionnaire was sent to a total of 82 contractors by snail mail. The response rate was very low and only 2 responded even after a follow up phone calls. The e-mails of the 82 contractors were obtained through the Chamber of Commerce Eastern Province Branch and were confirmed by phone calls. The questionnaire was e-mailed to those contractors and followed up after 3 days by phone calls. The response rate of the emails was good and a total of 28 responded at this time.

The questionnaire was sent to a total of 82 contractors using both snail mail and email. A total of 30 replied in both. One contractor apologized and did not complete the questionnaire because the top management did not want to participate in the research. Also, another contractor did not complete the questionnaire and was dropped. So, only 28 of the total replies were considered in this study that makes the response rate of 34.15.

The list of contractors is attached in appendix IV.

## DESCRIPTION OF RESULTS

The results are presented in five main parts. The **first** part discusses the general background information of the respondents. The results of this section were obtained from the answers of section "A" of the questionnaire. The answers of section "B" of the questionnaire are discussed in the second, third and the fourth parts. The **second** part discusses risk allocation to each party; namely contractor, owner or shared. Allocation of risks from the viewpoint of the respondents (contractors) and the common practice of allocating these risks are discussed and compared in this section. The **third** part covers the importance of these risks. The **fourth** part talks about the effect of these risks on the project from different angles like budget, schedule, safety and quality. The **fifth** part outlines the answers to section "C" of the questionnaire. This section presents the general background information of the respondents to the questionnaire like company size, experience and individual completing the questionnaire. Respondents were spread all over the Eastern Province of the kingdom.

It was found that only 7.1% of the respondents, as a company, have less than 150 employees, and 92.9% have more than 150 employees. Regarding experience, most of them have been in the construction business for long time. Only 14.3% of the respondents have less than 10 years of experience; and 85.7% of them have experience of more than 10 years in the construction industry. Since it was requested in the questionnaire that it is highly recommended that a project manager or a project engineer completes the questionnaire for better results, it was found that all the questionnaires were completed either by a project manager or a project engineer.

This part represents the allocation of risk categories included in the questionnaire. There are 25 risk categories listed in section "B" of the questionnaire and the respondents were asked to best allocate these risks based on their perception to either the contractor, owner or shared between the two parties. For the same risk categories, the respondents were asked to allocate them based on the common practice in the area. The surveyed risks allocation from the contractors' opinion (perception) and as practiced, respectively. Based on the respondents' perception, two of the surveyed risks, namely labor and equipment productivity and labor disputes, are 100 % allocated to contractors. For site access, equal numbers of the respondents allocate this risk category to the owner, contractor and shared equally. In other words, 33% of the respondents allocate this risk to the owner, 33% of respondents allocate it to contractor, and 33% of the respondents think this risk should be shared. Also shows that 0% of the respondents (contractors) do not want any of the following risk categories to be allocated to them:

1. Defective design
2. Acts of God
3. Changes in government regulations
4. Change order negotiation,

The frequencies of the respondents in allocating each risk category as practiced in the construction industry in Saudi Arabia. It shows that six risk categories are fully allocated to contractors. These risk categories are:

1. Labor, material and equipment availability
2. Labor, material and equipment productivity
3. Labor disputes
4. Safety / accidents
5. Coordination with subcontractors
6. Accuracy of project program

This is a logical and anticipated result since the above categories are more under the control of contractors. From we can see that there are two risk categories: Labor and equipment productivity and labor disputes, are consistently and fully allocated to the contractor (both in practice and in the contractor's opinion). Also, we can see that no respondent allocated the following risk categories to the owner (both in practice and perception):

1. Safety / accidents
2. Coordination with subcontractors
3. Delayed dispute resolution
4. Quality of work.

The respondents' frequencies of risk allocation, both from contractor's perception and practice, will be appropriately allocated to each party (namely, contractor, owner or shared) if the frequency is more than 60%. In other words, for a risk

category to be fully appropriated, an allocation method, it requires at least a 60% response rate. If a risk category receives less than a 60% response rate for any party, it will be considered as an undecided allocation. In previous similar studies done by Kangary, R. (1995) in USA and by Kartam (2001) in Kuwait, they both assumed a response rate of 70% for a risk category to be fully appropriately allocated. I think a response rate of 70% is high to be considered as a majority. For this study, a 65% response rate is assumed for a risk category to be fully allocated to a construction party.

It can be concluded that the perception of the contractors in allocating the surveyed construction risks is different from the actual practice of allocation. In practice, not a single risk is allocated to the owner and the contractor assumes most of the risks while in the contractors' opinion, they want to allocate some risks that they think the owner has better control over, like delayed payment on contract, change in work and scope limitation, and work definition. Also, contractors want owners to share more risks with them. Also show that some risks are consistently allocated to the contractor or shared. Six risks are consistently (both in perception and practice) allocated to contractors. These risks are mainly related to labor and equipment. They are namely:

1. Labor, material and equipment availability
2. Labor and equipment productivity
3. Defective material
4. Labor dispute
5. Safety / Accidents
6. Coordination with subcontractor

Acts of God is consistently wanted to be shared by the two parties. Summarizing these results it shows that in contractors' perception, a total of three risks should be allocated to owners seven risks should be allocated to contractors, four risks to be shared by the two parties, and a total of eleven risks were undecided. In practice, no risks are allocated to owners, a total of seventeen risks are allocated to contractors, only two risks are shared, and four risks are undecided.

## **RISK ALLOCATION**

Contractors in their view want owners to assume 12% of the surveyed risks yet they do not decide on the allocation of 48% of the risks. Also, it shows that contractors want to retain 24% of the surveyed risks themselves and share 16% of the risks with owners. It shows that in practice, contractors assume 68% of the surveyed risks and owners do not assume any risk but they share 8% of the risks while 24% of the risks are undecided on the allocation. This is a very interesting result and might be attributed to the idea that contractors are better in managing these risks. Another factor is the high competition in the market and the slow economy in the recent few years. Quality of work is considered the most important risk and is ranked first on the top of the list. All the respondents (100%)

indicate that quality of work is the most important risk category. 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. Similarly, for delayed payments on contract and financial failure, 89% of the respondents believe they are very important risks. These two risk categories are very important for the contractor since any delayed payment or financial failure of any party of the contract will jeopardize the construction project. These risk categories are ranked second (tie). Acts of God and labor disputes are regarded as low important risks. Because neither the owner nor the contractor has much control over acts of God, it is considered a low important risk. Also, this is since the area is not known for force majeure conditions such as volcanic activity or earthquake that are considered examples of acts of God. And, since both parties (contractor and owner) have strong faith in God (all Muslims); this risk category is considered low. Labor dispute is also considered a low risk category (tie with acts of God) since labor disagreements are very minimal since the majority of the labor are foreigners and are controlled by strict rules of the contractor and government laws. Adverse weather condition is considered the least important risk category because the area is not known for adverse weather conditions like, hurricanes, heavy snow or rain. Also, the weather is pleasant and stable most of the time.

This part discusses the effect of the different risk categories on the budget, schedule, safety and quality of the project. It indicates that safety received the least input from respondents, except for safety / accident risk where 41% of the respondents think this risk category directly affects the safety of the project. No respondent thinks that scope limitation & work definition change in work and quality of work will affect the safety of the project. Surprisingly, only 10% of the respondents think that defective design affects the safety of the project. Only 15% of the respondents think that coordination with subcontractors will affect the budget of the project while 64% of the respondents think that changes in government regulations affect the budget of a project. 62% of the surveyed contractors think permits and regulations affect the schedule of a project, and only 54% of the respondents think that coordination with subcontractors affects the schedule of the project. Each risk category has an effect on a construction project in one or more of the listed project parameters (budget, schedule, safety and quality). The respondents' frequencies of risk effect will be appropriately assigned to one or more parameter if the frequency is more than 25%. In other words, for a risk category to be fully appropriated an effect on a project, it requires at least 25% response rate.

If a risk category receives less than 25% response rate for any parameter, it will not be considered as to affect the project in that parameter. Some of the surveyed risks have effects on a project in more than one aspect; for example a risk category might affect the budget, schedule and quality of a project. If a risk category has more effect on a project it will be ranked first. The responses on risk effects of all surveyed contractors in each risk category were analyzed to see the

relative frequency of each project parameter (budget, schedule, safety and quality) on a project. This was done to see the effect of the risk categories on each parameter and compare the consequences. Risks effect on budget, schedule, safety and quality of a project with relative frequency. The surveyed risks have more impact on the schedule of a project with a frequency of 38.5% while the same risks have the least effect on the safety of a project with a frequency of 8.5%. It can be seen that the surveyed risks have more effects on the schedule and budget of a project. In this section, the results of the survey concerning risk allocation (both in practice and contractor's opinion or perception), risk importance and risk effects are summarized for quick reference and easy comparison. Risk category is allocated to each party. Similarly, the importance of each risk category is assigned and ranked. Effects of each risk category on each parameter of the project are assigned if it weighs more than 25% since we have four parameters (budget, schedule, safety and quality). Some risk categories might affect more than one parameter of the construction project. In section "C" of the questionnaire, the respondents were asked to add and rate any additional risk categories that they think should be added to the list. Five contractors responded to that section and five categories were added; one each, these risks and the ratings are listed bellow.

## **CONCLUSION AND RECOMMENDATION**

Based on the results discussed in the previous chapter, the following conclusions were reached:

- 1- Risk assessment is a new concept to the construction contractors in Saudi Arabia. It is a relatively new concept to the construction industry world wide, based on the literature review.
- 2- The view of construction contractors in Saudi Arabia and the common practice of allocating the surveyed 25 risk categories are determined by this study. Similarly, the importance and effect of these risks are established. Risk allocations, risk importance and risk effects on construction projects are determined for the first time for the construction industry in this region of the world.
- 3- The perception of construction contractors in Saudi Arabia in allocating the surveyed risks is different from the common practice of allocating these risks. In practice, most of the risks are allocated to contractors and none to owners.
- 4- Quality of work is the most important risk while an adverse weather condition is the least important risk.
- 5- The surveyed risks have the highest impact on the schedule of a project with a response frequency of 38.5%, while the same risks affect the safety of the project least (only with a response frequency of 8.5%) Most of the risk categories affect

schedule and budget more than other project parameters.

6- Construction contractors in Saudi Arabia want owners to accept and share more risks with them. This can be attributed to two factors. First, owners have some control over some of the risks. For example, the Payment on contract, changes in work, and scope limitations and work definition. Second, because the high competition in the market and slow economy in the recent few years.

As a result of this research, the following recommendations can be made:

1. All construction contractors in the Eastern Province of Saudi Arabia are encouraged to consider the results revealed by this research to have a better understanding when dealing with risks in the construction industry in this part of the world.
2. All construction industries in the Eastern Province of Saudi Arabia are advised to consider trends of allocation, importance and effect of important risk categories to help them facilitate proper management of these risks based on the results of this research.
3. Although this research was done in the Eastern Province of Saudi Arabia, the results and conclusions can be applied to the construction industry in other areas of Saudi Arabia because of the similarities of rules, regulations and business environment. Moreover, most of the construction contractors have offices in other areas of Saudi Arabia.

## **SUGGESTIONS FOR FURTHER STUDIES**

Although this research discussed the most important aspects of assessments of risks management perception and practices of construction contractors in Saudi Arabia, some areas of this subject need further research. These studies might include:

- Similar study of assessments of risks management perception and practices of construction from the viewpoint of owners
- Research of development of a Knowledge Based Expert System to manage the common and re-occurring risks in the construction industry in the region incorporating the expertise of the project managers, project engineers and owners, such a system will help contractors and owners in the area
- Consider including the added risk categories in the next study

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## SURVEY QUESTIONNAIRES

### **A. General Background Information**

It is highly recommended that a project manager or a project engineer, if possible, completes this survey, for better results.

In this research, lump sum type of contract is assumed.

**Note:** Responses to questions and company, project and individual will remain anonymous.

1- Name of the Company / Establishment

\_\_\_\_\_

2- Number of Employees

10-50 51-100 101-150 More than 150

3- Gross net value (approximate in 1000 Saudi riyals)

\_\_\_\_\_

4-Individual completing the questionnaire:

Name: \_\_\_\_\_ (optional)

Organization: \_\_\_\_\_

Title: \_\_\_\_\_

Telephone #: \_\_\_\_\_, Fax \_\_\_\_\_

E-mail \_\_\_\_\_

5- How long has the company been in the construction industry?

1-5 Years 6-10 Years more than 10 Years

### **B- Risk Allocation. Importance & Risk Effects Questionnaire:**

The responses to each question are divided into three groups: risk allocation, risk importance and effect of that risk on the project. In risk allocation, two responses are requested. First, your opinion as a Project Manager/ Project Engineer. Second the normal practice of allocating these risks in your firm.

Please rate the following questions that you think most appropriate In a scale 1 to 10 where 10 being the highest and represents the most important risk factor and 1 represents the least important.

#### **1- Permits and regulations**

In YOUR opinion this risk is best allocated to Owner Contractor Shared

However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared

This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale 1-3)

This risk mostly affects Budget Schedule Safety Quality

**2-Site access**

In YOUR opinion this risk is best allocated to Owner Contractor Shared

However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared

This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)

This risk mostly affects Budget Schedule Safety Quality

**3- Scope limitation and work definition:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared

However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared

This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)

This risk mostly affects Budget Schedule Safety Quality

**4- Labor, Material and Equipment Availability:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared

However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared

This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)

This risk mostly affects Budget Schedule Safety Quality

**5- Labor and Equipment Productivity:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared

However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared

This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)

This risk mostly affects Budget Schedule Safety Quality

**6- Defective Design:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared

However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared

This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)

This risk mostly affects Budget Schedule Safety Quality

**7- Changes in Work:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared

However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared

This risk is very important scale (8-10) Important (scale 4-7) Less important (scale1-3)

this risk mostly affects Budget Schedule Safety Quality

**8- Differing Site Condition:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared

However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)  
this risk mostly affects Budget Schedule Safety Quality

**9- Adverse Weather Conditions:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)  
This risk mostly affects Budget Schedule Safety Quality

**10- Acts of God:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) important (scale 4-7) Less important (scale1-3)  
this risk mostly affects Budget Schedule Safety Quality

**11- Defective Material:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)  
This risk mostly affects Budget Schedule Safety Quality

**12- Changes in Government Regulations:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)  
This risk mostly affects Budget Schedule Safety Quality

**13- Labor Dispute:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)  
This risk mostly affects Budget Schedule Safety Quality

**14- Safety / Accidents:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)  
This risk mostly affects Budget Schedule Safety Quality

**15- Inflation:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)  
This risk mostly affects Budget, Schedule, and Safety Quality

**16- Contractor Competence:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)  
this risk mostly affects Budget Schedule Safety Quality

**17- Change-Order Negotiations:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)  
this risk mostly affects Budget Schedule Safety Quality

**18- Third Party Delays:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)  
this risk mostly affects Budget Schedule Safety Quality

**19- Coordination with Subcontractors:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)  
This risk mostly affects Budget Schedule Safety Quality

**20- Delayed Dispute Resolution:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale1-3)  
this risk mostly affects Budget Schedule Safety Quality

**21- Delayed Payment On Contract:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale13)  
this risk mostly affects Budget Schedule Safety Quality

**22- Quality of work:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared

This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale 1-3) this risk mostly affects Budget Schedule Safety Quality

**23- Financial failure:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale 1-3)  
This risk mostly affects Budget Schedule Safety Quality

**24- Actual quantities of work:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale 1-3)  
this risk mostly affects Budget Schedule Safety Quality

**25- Accuracy of project program:**

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to Owner Contractor Shared  
This risk is Very important scale (8-10) Important (scale 4-7) Less important (scale 1-3)  
this risk mostly affects Budget Schedule Safety Quality

**D-** Please, add and rate any additional risk category that you think should be added for the questionnaire:

**Risk category:** \_\_\_\_\_

In YOUR opinion this risk is best allocated to Owner Contractor Shared  
However, in PRACTICE this risk is mostly allocated to owner–contractor shared this risk is very important scale (8-10) Important (scale 4-7) Less important (scale 1-3) this risk mostly affects Budget Schedule Safety Quality.