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Analysis, Perception and Aspects of Risk Management in the Construction Sector of Pakistan

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Abstract
Management of risk is very significant in the construction sector of Pakistan. Firstly, risk and uncertainty are defined and described in detail. Risk management and risk management process is also defined, described and explained. This risk and risk management provided necessary details and background for this study. A questionnaire survey was conducted for collection of data and information about risk management in Pakistan. Interviews were also conducted for the deeper investigation, study and analysis of the particular specific aspects of risk management in construction sector of Pakistan. Data analysis was done on the basis of data, information, ideas and views regarding risk management from the results of questionnaire survey and interviews. In data analysis, we discussed the aspects of risk management, documentation analysis, research trustworthiness, contracting types and the role of collaborative relationships such as relational contracting and joint risk management. This analysis and discussion provided the important concepts of better and effective risk management.
Keywords: Construction Project, Risk Management, Questionnaire Survey, Interview, Analysis.

1. INTRODUCTION

Risk management is very important for the success of construction projects. Risk management plays significant role in the accomplishment and completion of constructions projects in Pakistan. Risk management is defined as a systemic process used to identify, analyze and manage the risks during construction project. Risk management is a process involving various steps such as risk categorization , risk identification, risk analysis and risk response. Effective risk management is required for managing and controlling risks for the successful completion of the project. The four ways to counter risks effectively in the construction projects are risk elimination, risk reduction, risk retention and risk transfer. The overall objective of risk management is to decrease the negative events and to increase the positive events for the success of the construction project.

A combination of occurring of probable unforeseen events affecting the project and project objectives is called risk. Risk is also defined as the chance of occurring of probable event affecting the project. The term risk is very closely related to the term uncertainty. Risk refers to the negative events, but uncertainty includes both negative and positive events. There are various sources and approaches for defining and describing risk and uncertainty. The risk types or components are static risk, dynamic risk and uncertainty. Uncertainty also includes aleatory risk and epistemic risk. There are three categories of risk considering the sources of risks and these categories are internal factors related, external factors related and force majeure risks. Generally, pure risk and speculative risks are the two main kinds of risks.

Questionnaire survey is a suitable method for collection of data and information. Questionnaires were prepared and distributed among respondents for collection of data about risk management. For the deeper investigation of specific phenomenon and aspects, interviews were conducted. Results from questionnaire survey and interviews provided the necessary data about risk management for the analysis. The data was analyzed about the risk management, risk perception, documentation, research trustworthiness, design-build projects and collaborative relationships.

2. THEORETICAL FRAMEWORK

The definitions and descriptions of risks and risk management methods are described and explained regarding the risk management in construction sector of Pakistan. The definitions and descriptions provided the background and scene for collection and analysis of data. Previous researches are used in different contexts as a reference for the analysis of same results. The risk perceptions and risk management practices in construction sector are described and explained.

3. METHODOLOGY

The qualitative method is used in this study for the description analysis of data. The sources of data and influences and opinions from the researcher played an important role in this study and in the description and analysis of data and results. We used questionnaire survey and also conducted interviews for the collection of qualitative data. Then the qualitative data was described and analyzed by qualitative methods.

4. LITERATURE REVIEW

Construction sector is a complex sector involving wide number of stakeholders and many linkages with other sectors like finance, manufacturing, energy, labor etc (Hillebrandt 1985). A number of researchers addressed the construction sector's contribution in country's economy showing the strong linkages between construction sector and other economy sectors. In research literature, many methodologies for the risk analysis were proposed for analysis of risks in construction projects. A risk ranking methodology allowed an efficient and effective allocation of resources for dealing with project risks (Baccarini and Archer 2001). A judgmental risk analysis method was developed which is effective in uncertain situations and conditions in the projects (Oztas and Okmen 2005). A fuzzy system method was proposed for determining potential changes occurring during the construction project (Motawa et al. 2006).

The linkage concept was firstly defined by Hirschman in his work "The Strategy of Economic Development" (Hirschman 1958). The importance of unbalanced growth among supporting economy sectors as contrast with balanced growth of all related economic sectors (Lean 2001). The importance of construction industry stems from linkages with other economy sectors (World Bank 1984). The construction sector generates high multiplier effects through forward and backward linkages with other economy sectors (Park 1989). The construction sector and other economy sectors are not statically interdependent (Bon 1988; Bon 1992). A comparative analysis between different sectors emphasized on construction sector (Strout 1958). Ball addressed the construction sector's overall employment effects (Ball 1965; Ball 1981). The important role of construction sector in the country's economy is shown by direct, total and strong linkage indicators (Fox 1976; Bon and Pietroforte 1993, 1995).

4.1 Risk and Uncertainty

Theoretical overview and definition pinpointing is presented in this study because there are various risk and uncertainty definitions. The definition of project risk can be given by the following equation;

$$Pr = P(E) + I(E)$$

Where,

P_r = Project Risk,

P (E) = Probability of events, I (E) = Impact of events

Risk is also defined as the chances of occurring of probable event affecting the project. The matter of project risk is both individual and philosophical. Different approaches and sources for defining and describing uncertainty and risk are as shown in the figure below.

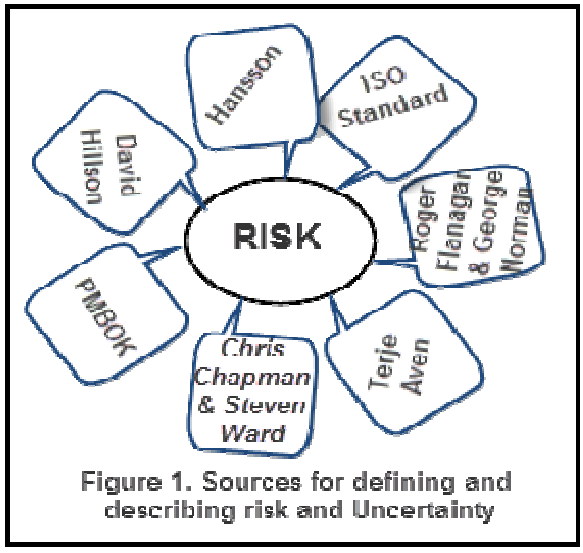


Figure 1. Sources for defining and describing risk and Uncertainty

It's impossible to predict the future accurately, so uncertainty is a part of daily life. We can define and structure the uncertainty level and the handling of uncertainty. The term risk is very close to the term uncertainty, but the term risk is often used for negative outcomes or negative uncertainties. The term uncertainty is more appropriate and suitable for the works to be done, so there is a trend of using the term uncertainty (Ward and Chapman 2003). It is needed to focus clearly on the opportunities or upside effects. It is better to focus less on the historical events, circumstances and conditions. It is better to focus and concentrate more on sources of uncertainties leading to negative risks or positive opportunities. Uncertainty management is about everything which matters for completion of objectives and success of the project, not just related to uncertainties faced and specific objectives. It also includes the perception of uncertainties and risks in a project. It is suggested to replace risk management and to use uncertainty management for wider view and perspective (Ward and Chapman 2003).

The realization of where and why uncertainty have important role in project is important. But the term risk is used more in both theory and practical work.

According to Project Management Institute, the risk definition should consider and include both positive and negative events and their effects on the project (PMBOK 2000). This definition is fine in theory but it not works in practical field. Opportunities or positive events are often neglected in practical usage. According to PMI, risk also includes positive events or upside effects, but in practice the positive events are neglected and focus is on the negative or downside effects.

Uncertainty and risk are described in theoretical sense and can be addressed as epistemic. An epistemic or aleatory risk can be regarded as random and estimated with probabilities and consequences of possible outcomes, but still random outcomes. These outcomes of epistemic risk are unpredictable and random, even everything is done in right way and in the right system. This approach can be given by equation as follows;

$$Re = P(O)$$

Where,

Re = Epistemic Risk,

P(O)= Probability of possible outcomes

Epistemic risk is often related to lack of essential knowledge about related matters, usage of improper methods and techniques and lack of information for identification and assessment of risks. An epistemic uncertainty or risk is an unknown event with unknown and random possible consequences or outcomes (Hillson 2004). The uncertainty term leads to both risks (negative events) as well as opportunities (positive events). This manner of regarding and describing risk is found in decision theory (Hansson 1994).and also found in the book named Risk Management in Construction (Flanagan and Norman 1993). Uncertainty has to deal with uncertain outcomes and is related to performance of the system, so uncertainty can be an epistemic uncertainty (Aven 2003). Logical framework of risk management process showing risk types or components is shown in the figure below.

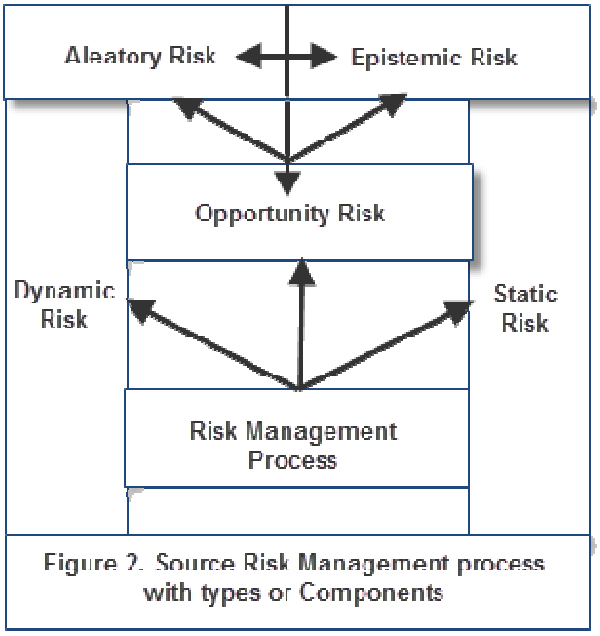


Figure 2. Source Risk Management process with types or Components

Uncertainties and risks are dealt with and handled everyday on the project. A static risk includes just losses or negative events, while a dynamic risk also includes the positive events where there is chance of gaining something (Flanagan and Norman 1993). Both static and dynamic risks depend on the project type and concrete project related facts and they are sorted according to their effects. The aleatory and epistemic risks have a theoretical perspective in addressing uncertainty and risk. They show the difference between uncertainty and risk, so they are very important during early stages of the project. Both aleatory risk and epistemic uncertainty affects the project outcomes and need different management approaches to deal with them, so the project managers should be well aware of both aleatory risk and epistemic uncertainty. The relationship between uncertainty, risk and opportunity are shown in the table below.

Table 1 Relationship between Uncertainty, Risk and Opportunity

S. No	Terms	Definitions and Examples
1	Uncertainty	Uncertainty is the term having two possible outcomes like an opportunity or a risk. Example: positive opportunity or negative risk.
2	Opportunity	Opportunity is the uncertainty with positive impacts or effects. Example: ground pollution where and when you have effective solution for dealing with this problem.
3	Epistemic uncertainty and risk	Epistemic uncertainty and risk is the lack of knowledge and information about possible consequences or outcomes. Example: when acquisitioning land, lack of knowledge and information about ground situation like ground pollution.
4	Aleatory risk	Aleatory risk is a random risk having known possible outcomes but unknown probability and unknown level of impacts and consequences. Example: known risk of ground pollution, but uncertain and unknown impacts and consequences of ground pollution risk.
5	Dynamic risk	Dynamic risk is a risk having both negative and positive outcomes. Examples: weather, fluctuation of material prices etc.
6	Static risk	Static risk is also known as pure risk and it is only related to negative outcomes and losses. Examples: damage, injuries etc.

We used uncertainty for both possibilities of opportunities with positive impacts and risks with negative impacts. In our study, the definition of risk concentrates on uncertainty's negative consequences or outcomes. Risk is described as something which happens and which is not foreseen in contract or project description. This happens due to lack of information and knowledge of the involved parties. These risks can be aleatory or epistemic, static or dynamic and any uncertain event which happens during the construction project. It makes the project's procedure go different from the normal or standard one. This definition of risk agrees to the questionnaire survey carried out in UK by (Akintoye and MacLeod 1997). They observed that the contractor's perception of risks is associated with the project's objectives with respect to time, cost and quality.

The uncertain conditions or events can effect or have impact on one or more objectives of the project and are known as project risks. There are one or more causes of a risk and if not dealt with properly can also have consequences. A combination of occurring event's probability and its impacts on the project objectives is known as project risk (International Standard IEC 2001). The risk concept was discussed in detail and a general concept of uncertainty was suggested (Ward and Chapman 2003). A questionnaire survey showed that the most of the project's parties perceived risk as a negative event (Akintoye and MacLeod 1997). In different project stages or phases, different kinds or types of risks occur. In some cases, the risks are inherited from the previous phase or phases of the project. Several approaches are used for classification of project risks and the sources of project risks (Leung et al. 1998; Tah and Carr 2000; Baloi and Price 2003; Li et al. 2005). The sources of risks are categorized into three categories as shown in the table below.

Table 2 Three Categories of Sources of Risks

Sr. No.	Risk Category	Risk Examples
1	**Internal factors related**	Management, relationships, construction and design risks.
2	**External factors related**	Economic, financial, legal and political risks.
3	**Force majeure risks**	Earthquake, floods, riot and war risks.

Risk is identified as the measurement of losses and the measurement of probable outcomes of decision (Byrne and Cadman 1984). There are two components of risk, which can be represented by the equation below;

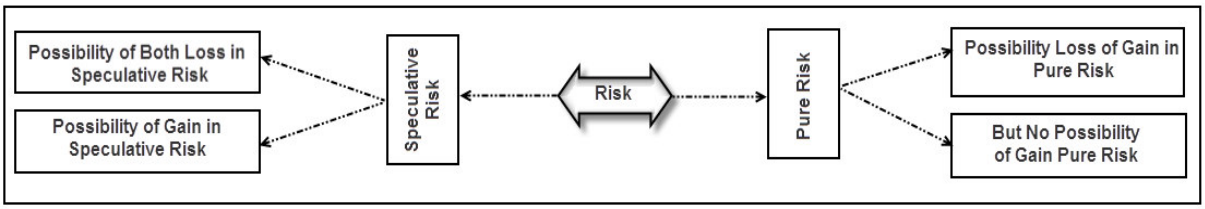
$$Cr = P + M$$

Where,

Cr = Components of risk,
P = Probability component,
M = Magnitude

The probability component is equally measured in each ways, but the magnitude component is measured and expressed in various ways such as the physical damage and economic loss. Risk is the exposure to the possible financial or economic loss. Opportunity is the positive risk leading to financial or economic gain.

Risks are referred as actual and probable uncertainties influencing the objectives and success of construction project. The chance of occurrence of adverse or favorable events influencing the success and objectives of construction project is also known as risk. There are two types of risk as follows:



5. RISK MANAGEMENT

A systematic process used to identify, analyze and manage the risks during a construction project is known as risk management (PMBOK 1998). Most of the construction companies in Pakistan's construction sector are facing this important issue of risk management. The risk management is new issue and there is very less practical experience in this field, which leads to inadequate estimates, poorly defined objectives and adversarial relationships. In risk management, we look at the various risk perspectives and then determine how to deal with these risks. In risk management, sources of risks are identified, their impacts are determined and suitable management responses are developed (Uher 2003).

New emergent risk are often assessed and controlled in the changing construction industry's environment. So the risk management is a cyclic process, not linear process. It is important to assess risks at and during every stage of the construction project. A cross-disciplinary team supported by open and clear consultation and communication among and between project-related parties for the effective risk management.

5.1 Risk management process

Risk management is defined as a cyclic process composed of risk identification; risk analysis; risk response and risk control (Gehner 2003). Mostly the subjective or objective estimations of risk probability and risk magnitude or impact are used for assessment and quantification of risk. Risk response and decision is based on risk tendency and risk tolerance of the people. Risk measures are according to the risk responses which are avoidance, reduction, transfer and acceptance.

A risk management process is divided systematically into four steps which are as follows.

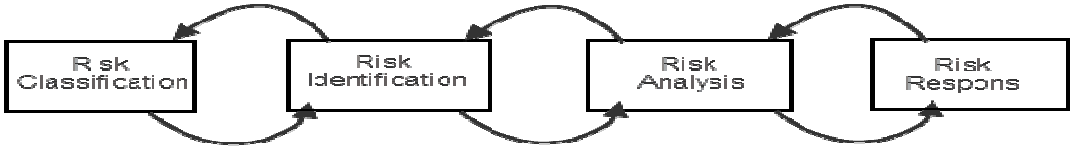


Figure 3. Foure steps of risk management process

The effective risk management helps to identify the kinds of risks to be faced and also helps to manage these risks during the different stages of construction project. Nowadays, some techniques are developed to control the potential risks and their impacts (Schuyler 2001; Baker and Reid 2005). Risk management process controls the risk level and mitigates the negative effects. Risk management is a systemic process for identification, evaluation and response to encountered risks in the construction project (Nummedal et al. 1996).

There are four different ways to counter risks in the construction projects; these four ways are as follows.

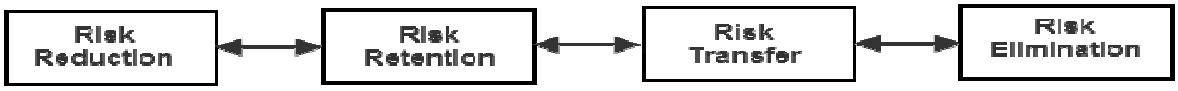


Figure 4. Source Four ways to counter risks

Details about these methods are given by following authors (Kelly 1996; Thompson and Perry 1992; Carter and Doherty 1974). Risks are assessed in risk analysis which is an important part of risk management process. Risk management is a critical project management practice used for ensuring the successful completion of the construction project (Turner 1999; Chapman 1997; Royer 2000). Primary causes of failure of construction project are the unmanaged or unmitigated risks, so risk management is very important concern in construction projects.

The overall objective of risk management process is to decrease the negative risk events and to increase the positive opportunities. Risk management process in the project consists of risk identification, risk assessment and risk response (PMBOK, 1998). This can be given by Moore state machine. Moore state machine is basically digital design mechanism but here it can be used for excellent representation of risk management process. The steps in risk management can be considered as states and on every sign 1 bit, next state is accomplished. The diagram is as follows;

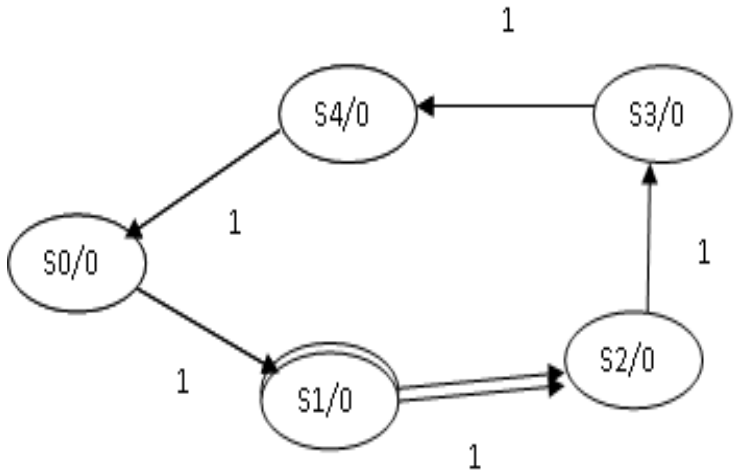


Figure # 5 Risk Management in Moore State Diagram

According to this diagram;
S0 = Risk,
S1 = Risk Identification,
S2 = Risk Assessment,
S3 = Risk Response,
S4 =Risk Management
So, from this diagram, if state S0 is 1, means if there is risk, then it passes it to S1 which is risk identification. It will remain on S1 till S1 gets 1 because 0 means risk has not been identified yet. Similarly, after seeing 1 from S1, it goes to S2 which is actually risk assessment. It will be 0 till risk assessment is being done then after having 1 bit it will move to S3.S3 is Risk response. It will remain as 0 till response to risk is being done and 1 will be shown after the completion of response. Then there is final stage S4 which is risk management. It will remain as 0, if risk is managed, if is not then 1 is sent to S0 and the process is repeated.
In risk identification process, the potential or probable risks are identified. In risk assessment process, the evaluation and ranking of identified risks is done. In risk response process, the way and process of dealing with the risks is identified for the mitigation of risks. Many surveys were conducted in the construction industry about the risk management process (Akintoye and MacLeod 1997; Uher and Toakley 1999; Lyons and Skitmore 2004). These surveys showed the following results as below.

- Most usable methods in risk identification are brainstorming and checklists.
- Most usable methods in risk assessment are intuition, experience and subjective judgment.
- Most usable methods in risk response are avoidance, transfer and reduction.

6. QUESTIONNAIRE SURVEY

An adequate method of collecting data and information for descriptive studies is the questionnaire survey (Robson 2002). A questionnaire survey was carried out to analyze the risk management in the projects. The seven main steps for effective questionnaire survey are listed below (Atkin 2006).

1. To determine the specific requirements and general purpose.
2. To develop the suitable questions and sub-questions to be inquired.
3. To construct the questionnaire in a easier way for the respondents to answer.
4. To determine the sample and population to be asked.
5. To check, pilot and reformulate the questionnaire.
6. To make required adjustments and finalize the questionnaire.
7. To conduct the questionnaire survey.

Total 80 questionnaires were distributed among respondents from different categories. 61 respondents replied to the questionnaires. The percentage of completed and received questionnaires was 76.25 percent. The detail of questionnaire distribution and respondents is given below in the table.

Table 3. Questionnaires and Respondents Detail

Sr. No.	Characteristic Detail	Contractor	Owner	Professional Consultant	Total
1	Questionnaires sent	37	28	15	80
2	Questionnaires received	26	21	14	61
3	Response percentage (%)	70.27	75.00	93.33	76.25
4	University or professional education of respondents (%)	51.35	57.14	100.00	62.50
5	Professional experience of more than 10 years (%)	89.18	75.00	53.33	77.50
6	Age of more than 40 years (%)	94.59	60.71	53.33	75.00

7. RISK PERCEPTION IN CONSTRUCTION SECTOR

The attitudes and beliefs of a person make the basis of risk perception (individual judgment). Probabilities, consequences and mathematical models cannot be included in risk perception. According to a questionnaire survey in UK, the time, cost and quality objectives of the construction project are closely related to the risk perception (Akintoye and MacLeod 1997). The occurrence of unforeseen thing or event adversely affecting the success and completion of the project can be included in risk perception. The conclusion sought after results in construction projects cannot be given by traditional methods of risk management (Tah and Carr 2001).

Lyons and Skitmore compared and used four surveys about risk perception and risk management from various researches between 1994 and 2001 by authors (Akintoye and MacLeod 1997; Baker and Ponniah and Smith 1999; Raz and Michael 2001; Uher and Toakley 1999; Lyons and Skitmore 2004). Compared and analyzed these surveys in their research in 2002 at Queensland engineering construction industry, and they made some conclusions about development and usage of risk perception and management in construction sector (Lyons and Skitmore 2004). These conclusions are given as below:

- Risk assessment and identification risks are used often.
- The most often used risk identification technique is brainstorming.
- The most often used risk assessment techniques are judgment, intuition, finding from survey and experience.
- The most frequently used risk assessment methods are qualitative methods.
- There are different risk assessment techniques for different cases.
- Planning and execution stages risk management is more important than the conceptual and final stages.
- Risk analysis is mostly carried out by groups of project teams.

These conclusions were from a survey which covered managers, owners, contractors, property developers and consultants and the response rate was 22 percent. Mills emphasized the importance of early systematic approach of risk management by designers and developers in construction process (Mills 2001). The usage of systematic risk management methods in construction sector is low due to various reasons given as below:

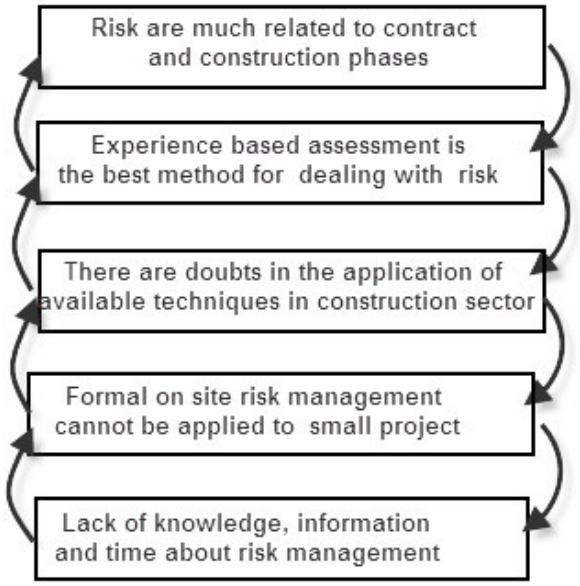


Figure 6.Reasons for Low Usage of Systematic Risk Management Methods

Risk perception and identification relied on knowledge, judgments and experience and is traditionally don't by

brainstorming, checklists, surveys or interviews (Akintoye and MacLeod 1997; Al-Tabtabai and Diekmann 1992; Chapman 2001).

8. INTERVIEWS

Interviews are suitable to collect data and to deeply investigate the particular and specific phenomenon (Robson 2002). Structured, semi-structured and unstructured interviews are the three techniques of interviews (Robson 2002). The freedom level of the interviewee and interviewer is the difference between these techniques. The predetermined questions are unchangeable and they follow a specific order during interview in structured interviews. The predetermined questions do not follow a specific order including addition of new questions and skipping of irrelevant questions in semi-structured interviews. The interviewer talks freely with the interviewee regarding field of interest in unstructured interviews.

Total, 3 interviews were conducted based on the questionnaire survey results. These interviews were conducted for the deeper analysis of the practices of risk management. The interviewees from the contractor side were site managers, from the owner side were project managers and from the consultant side were designers and engineers.

9. RESULTS FROM THE INTERVIEWS

The interviews responses are sorted and present in this study. The responses are sorted group-wise like clients, contractors etc. There is analysis of the results in the end of each section. Project managers working on the construction site or close to the sites were the client representatives in this study. In some cases, the client representatives were the consultants.

9.1 Risk Identification

In this section, the questions were focused on what, by whom and how it is done regarding risk identification. The questions were reformulated frequently during interviews. Questions like “are there any special hard events”, “what makes you worried” and “what keeps you awake during this project” were also formulated.

In some projects, the clients put the responsibility of risk management on the contractors. The clients for controlling their project relied on general construction documents. One client talking about a systematic approach and said: “There are requirements in the management system for managing project risks, but we have stated that it’s the responsibility of the contractors. This is a new working way and it is very rarely applied”. Another client also stated the same thing about handling project risks: “We require the contractors to have management systems for quality and environment, but we don’t have our system for handling risks. We are working on developing such system for handling project risks”.

In one case, the contractor and the client both were represented by a construction company. Risk analysis was carried out and the component affecting subcontractor was forwarded for management and control. In most documents supplied by clients, there were no special plans for specific areas or parts of risk analysis and risk management. A client talked about the way of controlling construction companies and said: “We cannot demand or make demand to the contractor for special risk management plan; it is their responsibility to manage risks”. Another client stated: “In new construction projects we have risk identification plans, but for refurbishment projects we don’t have any particular risk identification and management plans. This idea made me think that I go back to my organization and suggest them to work in this direction”. In one project, the client responded that due to lack of time no risk identification and analysis carried out, he said; “We haven’t carried out risk identification and risk assessments due to shortage of time”.

There were three events negatively affecting the project, these were not pointed out to the contractor by client. So there were no actions for managing and controlling these events. Lack of control in the design coordination was another risk leading to the production problems, and this was not managed and controlled. In other project, a client depended on his own experience and knowledge and said; “I make my own checklist for the possible wrong things and it will be followed during the project. As every project is different and have different requirements, so I don’t follow any template and I will depend on my own document”.

In short, client has different approach toward a problem and is more dependent on contractor. This situation can simply be given with following equation;

$$Tcl \propto \frac{1}{Tcn}$$

Where,

T_{cl} = Thinking of Client,

T_{cn} = Thinking of contractor

As work is regulated according to law, so client handles the risks related to the working environment. A demand for risk management for working environment is putted forward on behalf of client to the contractor. So risks related to working environment are dealt with separately. The handling of these risks is special due to legal requirements on working environment.

9.2 Risk Assessment

This section is risk assessment and it depends on the responses from first section of risk identification. The focus of questions is on how, by whom and in what way the identified risk are assessed. Less than 50 % clients agreed that the risks can be assessed theoretically. Mostly risk assessment is not systemic process depending on responses of the interviews. This observation can be shown mathematically as follows;

$$P(Ra) < 0.5$$

Where,

P (Ra) = Probability of risk assessment

A respondent stated; "The overall risk assessment is automatically done, even it is not in specific documents or forms. However it is needed to be done in systematic way". The risk assessment results are related to the responses of risk identification section.

9.3 Risk Response

To find out more about risk response of clients, the question are more focused on which risks got responses, who makes decision, who is responsible for risk control and what kind of responses. There are also some risk response questions which are not related to other stages of risk management.

Clients think that it's the contractor's responsibility to find solutions to risks and to control the risks, so clients are careful for their risk response demands on the contractor. In 30 % projects, the demands of risk control are through meetings and the contractor's quality supervision plan. In most projects, the clients rely on construction documents and put their demands in these documents. Some clients use timetables and schedule to control the projects by just setting time and deadlines and the rest is in the hands of the contractor to control risks and complete the time objectives. One project manager stated; "I managed the project through tight and exact timetables, the deadline was important to us for delivering the project component or whole project". One client talked about controlling the contractor and the project and stated; "Mostly we have good construction document saying what to do and that's all. Companies are good in their matters, but people working on the construction site are more important. To have good relationship with these working people is more important than the company which employed these people".

10. DATA ANALYSIS

After the collection of completed questionnaires, the data from the questionnaires was analyzed by converting questions into variable form. There are three different forms of data analysis named as qualitative, quantitative and structural analysis (Fellows and Liu 2003). Means, frequencies, rankings and distributions were obtained using customized tables and descriptive statistics and graphs were made for the illustration of statistical data.

The analysis of qualitative data from the interviews was carried out to determine the meaning and for deeper analysis (Fellows and Liu 2003). The analysis was done to find the patterns and to understand the respondent's views, opinions, ideas and perceptions about the study field. The analysis was done easily because most of the questions were structured and ordered specifically.

11. ASPECTS OF RISK MANAGEMENT

Risk management process is concerned with risk planning, identification, analysis, management, response, monitoring and mitigation in a project. According to AS/NZS, risk management includes the processes and structures directed towards realization of potential opportunities and management of adverse effects. Risk management is defined as an organized method of analysis, recognizing and handling of risks for success and completion of objectives in construction projects. Risk management is an integral part of projects and its significance and importance is growing, so many methods and techniques are developed to manage and handle the probable risks and their impacts. The feedback from practitioners was obtained on the aspects of risk management as follows:

- Risk management usage frequency
- Individuals and companies perception of risk tolerance
- Limiting factors of risk management implementation
- Phase by phase usage of risk management
- Implemented risk management methods and techniques
- Historical risk data analysis

12. DOCUMENTATION ANALYSIS

There are gaps between the risk management systems and the policies of the companies. These risk management systems cannot be applied on site because they are considered too extensive. So the site managers use their poor documentation, knowledge and experience to manage risks. Mostly the results from surveys and interviews are different as compared to the words in documentation. Instead of using a risk management system to predict probable future risks and control them, the history and experience is used to manage and control risks.

13. RESEARCH TRUSTWORTHINESS

Reliability, validity and generalization are considered for establishment of trustworthiness (Robson 2002). Reliability is related to achieving same results when following and repeating the same procedures and study. Validity refers to accuracy of the results. Generalization refers to the application of results to the other cases and situations.

Reliability was ensured through the documentation of all research steps. Validity of study was facilitated by usage of triangulation involving observer triangulation, methodological triangulation, theory triangulation and data triangulation (Robson 2002). In this study, three triangulations were used. Observer triangulation was achieved by cooperating with other researchers and involvement of consultants and advisors in interviews. Methodological triangulation was achieved by use different methods such as interviews and questionnaire survey. Data triangulation was achieved by usage of various project actors and numerous data sources. Generalization was facilitated by the application of most of the results of this study for other situations and cases.

14. DESIGN-BUILD PROJECTS

The responsibility of design and construction is on the contractor in design-build contracts. These design-build contracts are attractive for clients because responsibility of both design and construction is on the contractor and the clients set their demands in the documentation. Mathematically, relations of profit of design build projects are shown by following equation;

$$DBp > DBBp$$

Where,

DBp = Design built project's profit margin, DBBp = Design bid built project's profit margin

The DB project's profit margin is higher than the DBB's profit margin (Ernzen and Schexnayder 2000). There is better performance of DB projects regarding cost, schedule, construction and delivery. The risk is allocated more to the contractor in DB projects. If contractor uses cheaper and low quality solutions for decreasing his costs, then the quality of project is lower (Gransberg and Molenaar 2004). The structure risk analysis should be applied earlier in the construction project because the competence requirements are higher in DB projects (Hakansson et al. 2007). In Pakistan, the contractors prefer DB contracts instead of DBB contracts (Simu 2006). The contractors include insurance for extra risks in DB projects and increase their cost price of the projects.

15. COLLABORATIVE RELATIONSHIPS

In construction projects, opportunistic and adversarial behavior is very common because the focus is on economic results and short-term relationship (Cox and Thompson 1997; Zaghloul and Hartman 2003). Relational contracting and joint risk management are two important concepts focusing on effective risk management through better risk allocation and contractual relationships.

15.1 Relational Contracting

Relational contracting (RC) focuses on the recognizing and importance of relationships between contract parties in construction projects for successful implementation of project. Mutual benefits and profit scenarios are RC through cooperative relationship (Rahman and Kumaraswamy 2002). The partnering creates effective collaboration among project parties and is based on RC principles. The relationships in partnership projects are more stable than other projects (Drexler and Larson 2000). The concept of partnering is formed on the components of problem solving structures, continuous improvement and common goals. The effective collaboration of RC leads to better quality, lower costs and fewer disputes. NLC, Paragon construction (pvt) limited and Habib Rafiq (pvt) limited are the three construction companies of Pakistan and they worked actively in partnering projects. The better relationships and RC leads to reduction of costs lower contingency funds and effective process of risk allocation and management (Zaghloul and Hartman 2003). The partnering in construction projects results in sharing and transfer of experience and knowledge among and between project actors.

15.2 Joint Risk Management

The better risk allocation in procurement stage through contract cannot guarantee that conflicts and disputes will not occur during the construction project. The nature, impact and extent of risks can change during the project and there is also possibility that new risks can appear. Joint risk management is needed to counter and manage these changed and new risks. Joint risk management (JRM) refers to the working together for controlling and mitigating changed and new unforeseen risks in the construction project at post contract stages. The results of a questionnaire survey of Hong Kong construction sector indicated high motivation towards JRM and recommended JRM for mitigating risks (Rahman and Kumaraswamy 2002).

16. CONCLUSION

The risk and risk management were defined, described and explained for the better idea and background for the research study about risk management. The questionnaire survey was conducted for the data collection of risk

management aspects in construction sector of Pakistan. The interviews were also conducted for deeper and specific analysis studies of the risk management perspectives. The questionnaire survey and interviews provided the suitable data, views and ideas for the research analysis of risk management and risk management perceptions and perspectives. The data and results from questionnaire survey and interviews were analyzed and provided us the aspects of risk management, documentation analysis, research trustworthiness, design-build projects and collaborative relationships like relational contracting and joint risk management. The risk management is done by site managers using their poor documentation, knowledge and experience. Mostly the results from the questionnaire survey and interviews are different from the documentation. For trustworthiness of research, the aspects of generalization, reliability and validity are considered. In the construction sector of Pakistan, the design-build projects are mostly preferred as compared to DBB projects. Collaborative relationship concepts of relational contracting and joint risk management are very important for better risk allocation and effective risk management.

17. RECOMMENDATION

It is recommended that the risk management should be given more importance in the construction projects in Pakistan. The chances of positive events of uncertainties should be increased and chances of occurring of negative events of uncertainties known as risks should be decreased. The risks should be managed, controlled and mitigated effectively. The documentation should be more in accordance with the results from questionnaire surveys and interviews. There should be proper risk allocation in between group actors or parties involved in the construction project. Risk perception, good relationships in between parties and better relational contracting should be effectively considered. The joint risk management is recommended for the effective risk management, risk control and risk mitigation.

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