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Risk Management in Construction Industry

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Abstract : Construction industry is highly risk prone, with complex and dynamic project environments which create an atmosphere of high uncertainty and risk. The industry is vulnerable to various technical, socio-political and business risks. The track record to cope with these risks has not been very good in construction industry. As a result, the people working in the industry bear various failures, such as failure of abiding by quality and operational requirements, cost overruns and uncertain delays in project completion. Risk management is a process which consists of identification of risks, assessment with qualitatively and quantitatively, responses with a suitable method for handling risks, and then controls the risks by monitoring. This paper covers the concepts of risk management and various risk analysis techniques to be used for the one stop solution for all types of hazards most likely to occur during any construction project lifecycle.

Keywords: *construction industry, Risk Management, Risk Analysis*

1. Introduction:
The development of infrastructure is one of the most important activities that can boost up the business of various industries, thereby increasing the gross domestic product (GDP) of the country. Construction projects are always unique and risks raises from a number of different sources. Risk is defined as any action or occurrence which will affect the achievement of project objectives. Risk management is a technique which is used in many other industries from, IT related to business, automobile, pharmaceutical industry, to the construction sector. Risks and uncertainties inherent in the construction industries are more than any other industries. Many industries have become more proactive about using risk management techniques in project. However, with respect to the construction industry, the same is not used commonly. Risk is an integral component of any project. Risk is present in all projects irrespective of their size or sector. No project is totally free from risks. If risks are not properly analyzed and strategies are not trained to deal with them, the project is likely to lead to failures.

1.1**Concept of Risk Analysis and Management:**

Risk management is a process which identifies the project risks, analyze them, and determine the actions to avert the threats on any project. All steps in the risk management process should be included to deal with risks, in order to implement the process of the project. Due to the nature of construction projects, risk management is a very important process. Risk associated with construction industry can be broadly categorized into:

1. Technical Risks: The risks associated with the Incomplete Design, Inadequate specification, inadequate site investigation, Change in scope, Construction procedures and insufficient resource availability etc. are termed as technical risks.

2. Construction Risks: These risks include Labor productivity, Labor disputes, Site condition, Equipment failures, Design changes, too high quality standard and new technology.

3. Physical Risks: The risks arising from the Damage to structure, Damage to equipment, Labor injuries, Equipment & material fire and theft etc. are known as physical risks.

4. Organizational Risks: The organizational risks consist of Contractual relations, Contractor's experience, Attitudes of participants, inexperienced work force and Communication.

5. Financial Risks: Increased material cost, Low market demand, Exchange rate fluctuation, Payment delays and improper estimation taxes etc. are related to financial risks.

6. Socio-Political Risks: Changes in laws and regulations, Pollution and safety rules, Bribery/Corruption, Language/Cultural barrier, Law & order, War and civil disorder and Requirement for permits and their approval.

7. Environmental Risks: Natural Disasters and Weather Implications.

2. Risk Management Process:
Risk management is the process which consists of identification, assessment, response and review.

2.1. Risk Identification:
Risk identification can be done by the following methods

a. Brainstorming: This is one of the most popular techniques. Generally, it is used for idea generation; it is also very useful for risk identification. All relevant persons associated with project gather at one place. There is one facilitator who is briefing about various aspects with the participants and then after note down the factors. Before closing it the facilitator review the factors eliminate the unnecessary ones.

b. Delphi Technique: This technique is similar to brainstorming but the participants in this do not know each other and they are not at the same place. They will identify the factors without consulting other participants. The facilitator like in brainstorming sums up the identified factors.

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c. Interview/Expert Opinion: Experts or personnel with Sufficient experience in a project can be a great help in avoiding/solving similar problems over and over again. All the participants or the relevant persons in the project can be interviewed for the identification of factors affecting risk.

d. Past Experience: Past experience from the same kind of project, the analogy can be formed for identification of the factors. When comparing the characteristics of projects will provide insight about the common factors.

e. Checklists: These are simple but very useful predetermined lists of factors that are possible for the project. The check list which contains a list of the risks identified in projects undertaken in the past and the responses to those risks provides a head start in risk identification.

2.2. Risk Assessment:

2.2.1. Quantitative methods:

a. Sensitivity Analysis: This is carried out to identify the uncertain project components which will have maximum impact on the outcome of the project. After a risk model is made a sensitivity analysis is carried out to check the sensitivity of different elements of the model on project outcome. To do these the values of one variable at a time is changed and the impact of these changes is then seen on the project.

b. Scenario Analysis: Scenario analysis gives the impact of different scenario of the project or impact of different risk if that occurs simultaneously. A fair decision can be made after this analysis, the option which will give lesser loss or hazards that option can be opted.

c. Probabilistic Analysis (Monte Carlo Simulation): A project simulation is done using a model to show the potential impact of different level of uncertainties on project objectives. Monte Carlo Simulation is generally used for this analysis. It can quantify the effect of uncertainties and risks on project budget and schedule. It simulates the full system many times, each time randomly choosing a value for each factor from its probability distribution. It uses three point estimates like most likely, worst case and best case duration for each task in time management.

d. Decision Trees: This analysis is carried out by decision tree diagram. Decision trees are very helpful to both

Formulate the problem and evaluate options. In this analysis
There are graphical models used to represent a project and can clearly reflect the effects of each decision taken in the project.

2.2.2. Qualitative methods:
Qualitative methods for risk assessment are based on descriptive scales, and are used for describing the likelihood and impact of a risk. These relatively simple techniques apply when quick assessment is required in small and medium size projects. Moreover, this method is often used in case of inadequate, limited or unavailable numerical data as well as limited resources of time and money. They are listed as follows:

a. Risk probability and impact assessment: By applying the method called risk probability and impact assessment, the likelihood of a specific risk to occur is evaluated. Furthermore, risk impact on a project's objectives is assessed regarding its positive effects for opportunities, as well as negative effects which result from threats. For the purpose of this assessment, probability and impact should be defined and tailored to a particular project. This means that clear definitions of scale should be drawn up and its scope depends on the project's nature, criteria and objectives. PMI (Project Management Institute) identifies exemplary range of probability from 'very unlikely' to 'almost certain'; however, corresponding numerical assessment is admissible. The impact scale varies from 'very low' to 'very high'.

b. Probability/impact risk rating matrix: Probability and impact, which were assessed in the previous step, are used as a basis for quantitative analysis. For this reason findings from the assessment are prioritized by using various methods of calculation which can be found in the literature. Westland computes the priority score as the average of the probability and impact. The range of priority score, the rating and color are assigned to indicate the importance of each risk. Threats with high impact and likelihood are identified as high-risk and may require immediate response, while low priority score threats can be monitored with action being taken only if, or when, needed.

c. Risk categorization and Risk Urgency Assessment: Risk categorization is a way of systematizing project threats

According to their sources, in order to identify areas of the project that are most exposed to those risks. Tools which
Can be used in this method are work break down structure (WBS) or risk breakdown structure (RBS), and their role is to develop effective risk response. WBS breaks down large activities into small, manageable units and creates linked, hierarchical series of independent activities. RBS categorizes risks and shows their dependencies. The role of the second method, Risk Urgency Assessment, is to prioritize risks according to how quick response they require.

2.3. Risk response:
This third step of the RMP indicates what action should be taken towards the identified risks and threats. The response strategy and approach chosen depend on the kind of risks concerned.

a. Risk Avoidance: Risk can be warded off by removing the cause of the risk of executing the project in a different direction while still aiming to accomplish project objectives. Change project management plan to eliminate a threat, to isolate project objectives from the risk's impact, or to relax the project objective that is exposed to loss, such as extending schedule or reducing the scope.

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b. Risk Transfer: Transferring risk involves finding some other party who is willing to accept responsibility for its management, and who will bear the liability of the risk should it occur. Transferring a threat does not eliminate it; the threat still exists however it is owned and managed by another party. Transferring risk can be an effective way to deal with financial risk exposure. The aim is to ensure that the risk is owned and managed by the party best able to deal with it effectively.

c. Risk Mitigation/Reduction: Risk mitigation reduces the probability and/or impact of an adverse risk event to an acceptable threshold. Taking early action to reduce the probability and/or impact of a risk is often more effective than attempting to repair the damage after the risk has passed.

d. Risk Exploit: This strategy seeks to eliminate the uncertainty associated with a particular upside risk by creating the opportunity definitely happens. Eliminate the
Uncertainty associated with a particular upside risk. An opportunity is defined as a risk event that if it occurs will have a positive effect on achievement of project objectives.

e. Risk Share: Allocate risk ownership of an opportunity to another party who is best able to maximize its probability of occurrence and increase the potential benefits if it does happen. Transferring threats and sharing opportunities are similar in that a third party is used, those to whom the threats are transferred take on the liability and those to whom opportunities are allocated should also be allowed to share in the potential benefits.

f. Risk Enhance: This response aims to alter the "size" of the positive risk. The opportunity is enhanced by increasing its probability and/or impact, thereby maximizing the benefits gained from the project. Seeking to facilitate or strengthen the cause of the opportunity, and proactively targeting and reinforcing its trigger conditions.

g. Risk Acceptance: Ultimately it is not possible to eliminate all threats or take advantage of all opportunities. We can document them and at least provide awareness that these exist and have been identified. This strategy is adopted when it is not possible to respond to the risk by the other strategies, or a response is not justified by the grandness of the risk. When the project manager and the project team decide to accept a risk, they are agreeing to address the risk if and when it happens.

h. Contingency Plan: This involves the use of a fallback plan if a risk occurs. Contingencies can also be in the form of sometime kept in reserve to deal with unknown risks or in the form of costs to deal with unknown risks.

2.4. Risk review:
It is the final step of the process. After we have implemented response actions, we must track and record their effectiveness and any changes to the project risk profile. Did the response actions have a positive or negative
Effect on achieving project objectives? Responses taken in risks should also be documented for future reference and project plans.

3. Conclusion:
Risk is perceived as a negative term, even though in theory
It can have two dimensions. Professionals in the construction industries are using techniques described in the literature concerning RM, but are not aware of it. Risks are being managed every day in the industry, but not in such a structured way as the literature describes. As also other researchers confirmed, the knowledge of RM and RMP is close to zero, even though the concept of risk management is becoming more popular in the construction sector. Risk management is a technique that should be applied within an industry to achieve the goals of the industry. Hence, it is necessary to spread awareness and create interest amongst people to use risk management techniques in the industries.

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