

## PRACTICAL APPROACH TO THE RISK ANALYSIS OF CONSTRUCTION PROJECTS

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**A construction risk assessment is the calculated process of identifying project specific threats on a jobsite, then analysing and evaluating each risk factor to determine the likelihood, impact, and repercussions of each of those variables.**

**That assessment creates awareness surrounding the risks/hazards identified, assess current risk prevention measures that are in-place to determine if they are sufficient or if further action needs to be taken, ensuring that any legal requirements or contract requirements are being met regarding risk and also deciding if additional controls need to be implemented or if changes need to be made to construction risk management strategy.**

**Keywords: risk analysis, risk evaluation, construction projects, project management, construction management, practical approach**

### Introduction

In comparison to many other industries, construction projects are more likely to face a higher level of risk due to their unique characteristics, such as extended timelines, complex processes, unpredictable environments, significant financial investments, and dynamic organizational structures. Therefore, it is crucial to prioritize effective identification and management of risks for the success of any construction project. In addition to pinpointing potential risks, it is important to carefully determine the most appropriate party to bear each specific risk. Simply transferring all risks to the contractor in most situations is unlikely to result in the optimal solution and does little to promote a collaborative working environment. The risk identification and management process should prioritize the best interests of the project, with the project manager being responsible for ensuring adherence to this objective.

The literature indicates that risk management in construction projects suffers from shortcomings that hinder its effectiveness as a project management function, ultimately impacting the performance of projects. For an extended period, risk management in construction projects has been approached in a reductionist manner, leading to subpar outcomes and constraining the overall quality of project management. (Theodore S. 1990 ; Cooper D. et al. 2005; Chapman C. 2003, Araújo Lima, 2020, Gurtu A, 2021, Hegde J., 2021, Pan Y., 2021).

Managing risk is an integral part of good management, and fundamental to achieving good business and project outcomes and the effective procurement of goods and services (Bolles D. 2007, A Budreviciute A., 2020, Munir M., 2020). It is something many managers do already in one form or another, whether it be sensitivity analysis of a financial projection, scenario planning for a project appraisal, assessing the contingency allowance in a cost estimate, negotiating contract conditions or developing contingency plans (Lock D. 2003 ; Cole G.A. 1990).

Practical procedures of companies, institutions of government agencies, covering risk issues based on professional literature are available to interested and involved stakeholders (AS/NZS 4360 2004 ; IEC 62198 2001 ; OGC 2002 ; TBC 2001 ; Fewings P. 2013).

Risk analysis from practical point of view can be defined as a structured process, part of project planning, and project risk management, that enables a project manager to identify, plan and manage risks to eliminate them or reduce them to an acceptable level (PMI 2003; CIOB 2014).

- Risk analysis processes should include:
- Risk identification
- Risk estimation and evaluation
- Risk response planning

### Materials and Methods

Procedure of risk identification is done through workshops, consultation with specialists, familiarization with the project, etc. As a result of the above activities, a list of potential risks is created (commonly known as a risk register).

In Procedure of assessment/evaluation each potential risk listed in the risk register is evaluated (estimated) to determine:

the probability of occurrence of this risk - from a practical point of view, it is sufficient to assume that this probability may be low, medium or high;

the effect, should this risk occur - from a practical point of view, it is sufficient to assume that the effect can be estimated as low, medium or high.

The combination of a high probability of occurrence along with a high effect allows such a risk to be categorized as high, while the combination of a low probability of occurrence along with a low effect allows such a risk to be categorized as low.

Each item in the risk register should be subject to such a qualification, and this qualification in turn should help guide risk management and assist in allocating provisions in the budget for each item in the risk register.

Once weights have been assigned to individual risk register items, the client and the project team can make individual decisions thoughtfully, rather than intuitively, and consequently manage reserve amounts proactively.

These procedures should allow for continuous monitoring of risks at each stage of the construction project under way, allowing for appropriate risk management, if possible within the limits of the reserve amounts set.

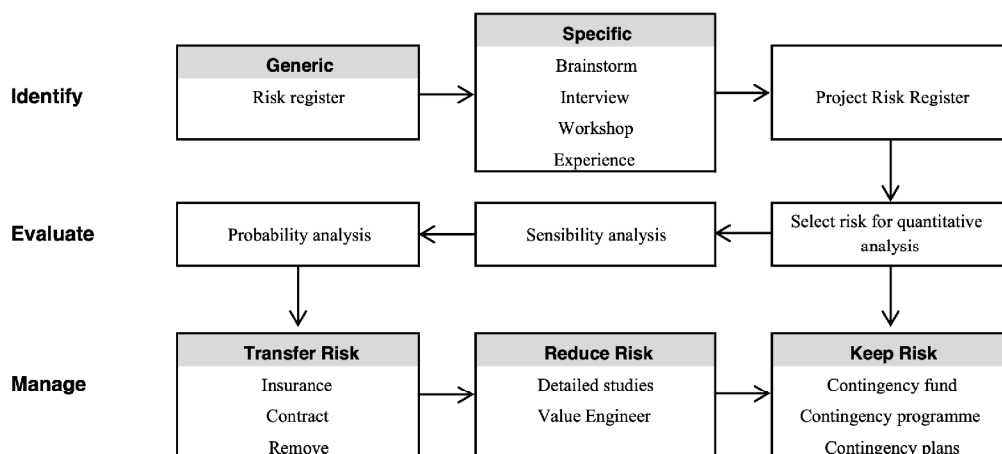


Fig. 1. Project Management Approach to the risk analysis

Project managers should address risk issues in their monthly reports in a way that allows them to identify potential risks, and the proposed form can help the team implementing the construction project to clearly understand the issues and possible consequences, e.g., legal consequences of signed contracts, as well as support effective risk management of a given investment project.

STAGE:							
Risk Ref	Description of Risk	Previous Month's Status	Current Status of Risk	Risk Response	Outline Management Plan	Programme / Timing	Champions Initials

Fig. 2. Example of a risk register and management plan

When using the risk registers, values of occurrence and consequence are assessed using high, medium and low (H, M, L) values. Other forms of assessments include very high, high, medium, low and very low scoring or using numerical values (e.g. a ranking of 1–10, with 10 signifying a very high probability/impact risk and identifying a risk of almost negligible impact/probability).

		H	M	L
%Probability (K) Cost	From	From	Up to	
	60-100	10-60	10	
H	50+	A1	A2	B1
M	20-50	A3	A4	C1
L	0-30	B2	C2	C3

Fig. 3. Importance assessment matrix for risk register

The value of the cost range needs be determined and will be different for different size of projects, and should to be determined jointly - the essence of the impact depending on the situation - a joint discussion. Similarly, the time factor (delays in the implementation of the project) can be addressed.

The risk assessment process should provide a framework for implementing a structured and strategic approach to:

- identifying potential risks to the project in the first place;
- management actions and plans developed in response to the risks;
- analysis that is carried out to adequately address additional costs and delays resulting from a given risk factor.

The objectives of this process based on the professional project management experience should normally leading to:

- more comprehensive identification of risks;
- creation of coherent management strategies;

- formulation of more realistic plans and programs;
- identification of reserves (cost and time) as a function of identified risks;
- faster response to risks when they occur;
- provides an audit trail for decisions made;
- increased team awareness of risk management;
- increased team understanding of the project.

Key milestones for risk management activities and their timelines are presented in figure 4:

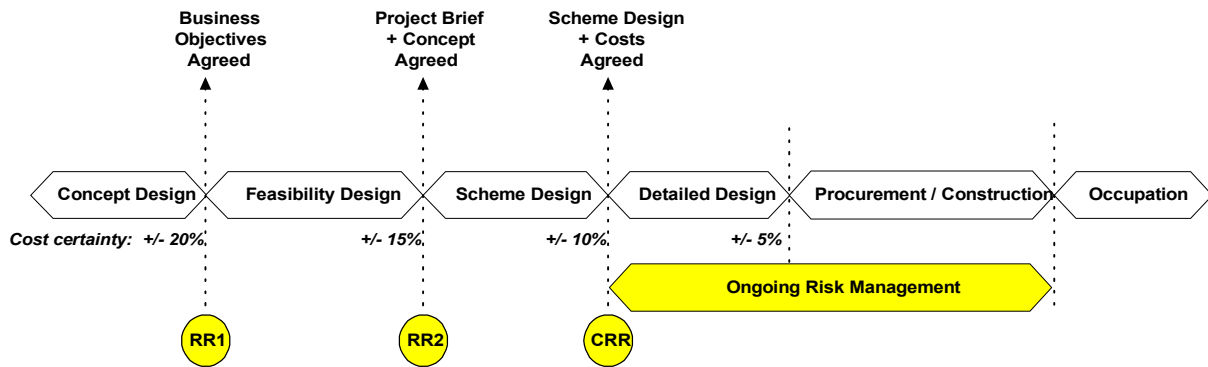


Fig. 4. Key milestones for risk management activities

Risk Register 1 (RR1):

- At conceptual design stage;
- Creation of strategic project risk register with outline management strategy (RR1);
- Ongoing update up to feasibility study.

Risk register 2 (RR2):

- During the Feasibility Phase;
- Further development of the risk register (RR1);
- Conducting high-level cost analysis;
- Ongoing development during the initial stages of scheme design.

Contingency Risk Register (ARR):

- Establish risk-based contingencies;
- Development of cost/risk profiles for use in ongoing project development.

Ongoing risk management activities at Detailed Design stages through :

- Brief meeting with client to establish key risk management objectives.
- Structured programme of workshops performed in a distraction free environment.
- Identification of key risk factors.
- Risks estimated using brainstorming for the project, good collaboration.
- Risk assessment with prioritisation.
- Qualitative analysis: categorisation of risks according to likelihood of occurrence and outline of cost impact.
  - Transfer of probability and impact information to cost specialists for quantitative analysis.
  - Development of risk management action plans.
  - Update at regular intervals e.g. monthly.
  - Clear risk management objectives from the outset.
  - Validation of the analysis programme from the contracting authority's management level through to lower-level units.

- A structured and properly timed workshop programme.
- Adequate reporting technology to store, especially information obtained during the workshops and meetings held.
- Creation of appropriate reports to keep the team informed of risk status and progress.
- Adequate resources to carry out this process.
- Appropriate information pack for each workshop/meeting.

Table. 1

**Typical Agenda for a Risk Register meeting**

<i>1.0 Meeting and introduction</i>
- <i>Introduction</i>
- <i>Administration</i>
- <i>Agenda</i>
- <i>Time frame</i>
<i>2.0 Introduction to risk management</i>
- <i>Concept and practice</i>
- <i>Application to the project in question</i>
<i>3.0 Presentations (current status of the programme)</i>
- <i>Contracting authority team</i>
- <i>Project team</i>
- <i>Construction management team</i>
<i>4.0 Identification of overall objectives of the Contracting Authority and the project</i>
<i>5.0 Identification of risks</i>
- <i>Agreeing by means of e.g. brainstorming</i>
- <i>Itemised risk factors identified</i>
<i>6.0 Qualitative analysis</i>
- <i>Assessment of the importance of the identified risks (risk factors)</i>
- <i>Team assigns risk factors a significance rating (likelihood of occurrence and impact on overall cost or delay)</i>
<i>7.0 Risk management</i>
- <i>Agree responsibility / risk management expert</i>
- <i>Development of risk management action plans</i>
<i>8.0 Summary, future actions, programme</i>

Table 2

**Project risk assessment checklist as an important part of the assessment of the participants (CIOB 2014)**

1	Risk factor	Criteria
1	2	3
Project environment concerned risk factors	User organization	<i>Stable/competent</i> <i>Weak/unmotivated/untrained</i>
	User management	<i>Works as a team</i> <i>Fractions and conflicts</i>
	Joint venture	<i>Customer's sole contractor</i> <i>Involved third party</i>
	Public visibility	<i>Significant or none</i> <i>Significant and/or sensitive</i>
	Number of project sites	<i>2 or less</i> <i>3 or more</i>
	Impact on local environment	<i>High</i> <i>Low</i>

Continuation of Table 2

1	2	3
Project management concerned risk factory	Management involvement	<i>Active participation of the Executive</i>
		<i>Limited participation</i>
	User management experience	<i>High project experience</i>
		<i>Little project experience</i>
	User management involvement	<i>Active involvement</i>
		<i>Limited involvement</i>
	Project manager	<i>Experienced/full-time</i>
		<i>Unqualified/part-time</i>
	Project management	<i>Applied effective techniques techniques</i>
		<i>Ineffective or not used</i>
Contracting authority's experience	<i>Has prior experience</i>	
	<i>In the type of project in question</i>	
	<i>Is implementing for the first time</i>	
Project characteristics	Complexity	<i>Reasonably simple</i>
		<i>Pioneering/new areas</i>
	Technology	<i>Generally accepted methods and solutions</i>
		<i>Unproven or new</i>
	Effects of failure	<i>Minimal</i>
		<i>Significant</i>
	Degree of organizational change	<i>Minimal</i>
		<i>Meaningful</i>
	Scope	<i>Typical project or design phase</i>
		<i>Non-typical project or design phase</i>
	Basis	<i>First phase or follow-up</i>
		<i>Early phase tentative</i>
	User acceptance	<i>Project has strong support</i>
		<i>Controversy surrounding the project</i>
	Proposed lead time	<i>Reasonable time reserve</i>
		<i>Bounded/fast ascent</i>
Planned completion	<i>Flexible with allocations</i>	
	<i>Boundary deadline</i>	
Potential changes	<i>Stable industry/ Investor/ implementation</i>	
	<i>Dynamic industry/ Investor/ implementation</i>	
Working days (developer)	<i>Less than 1000</i>	
	<i>1000 or more</i>	
Cost-benefit analysis	<i>Recognized methods or not needed</i>	
	<i>Inappropriate approximations/methods</i>	
Hardware/software capabilities	<i>No or recognized methods of estimation</i>	
	<i>Unrecognized methods/no provisions</i>	
Project operation	User participation	<i>Active participation</i>
		<i>Limited participation</i>
	Project supervision	<i>Meets standards</i>
		<i>Substandard</i>
Project team	<i>Appropriate skills/experience</i>	
	<i>Little relevant experience</i>	
Project costs	Cost pricing	<i>Normal (i.e., time-based or cost-based)</i>
		<i>Lump sum pricing</i>
	Basis of cost estimate	<i>Detailed plan/proven method</i>
		<i>Inadequate plan/method</i>
Formal contract	<i>Non-standard form</i>	
	<i>Standard form</i>	
Other		

Further identification of risk factors and scoping of the risk management team is done in subsequent meetings/workshops.

For the emergency risk meeting agenda, an appropriate risk factor contingency plan is developed by:

- linking the cost and schedule plan to the risk
- establishing a contingency amount and time reserve

### Conclusion

1. Managing risk is an integral part of good management, and fundamental to achieving good business and project outcomes and the effective procurement of goods and services.
2. Project managers should address risk issues in their reports in a way that allows them to identify potential risks, and the proposed form can help the team implementing the construction project to clearly understand the issues and possible consequences.
3. The value of the cost range needs to be determined and will be different for different size of projects, and should to be determined jointly.

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## **ПРАКТИЧНИЙ ПІДХІД ДО АНАЛІЗУ РИЗИКІВ БУДІВЕЛЬНИХ ПРОЕКТІВ**

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Оцінка будівельних ризиків — це розрахований процес визначення конкретних загроз проекту на будівельному майданчику, а потім аналіз і оцінка кожного фактора ризику для визначення ймовірності, впливу та наслідків кожної з цих змінних. У літературі зазначено, що управління ризиками в будівельних проектах має недоліки, які перешкоджають його ефективності як функції управління проектами, що в кінцевому підсумку впливає на ефективність проектів. Протягом тривалого періоду до управління ризиками в будівельних проектах підходили редуційно, що призводило до неадекватних результатів і обмежувало загальну якість управління проектами.

Ця оцінка створює обізнаність щодо виявлених ризиків/небезпек, оцінює поточні заходи запобігання ризикам, які діють, щоб визначити, чи є вони достатніми, або чи потрібно вжити подальших заходів, гарантуючи дотримання будь-яких правових вимог або вимог контракту щодо ризику та також вирішити, чи потрібно впроваджувати додаткові засоби контролю або чи потрібно вносити зміни до стратегії управління ризиками будівництва.

Управління ризиками має бути невід'ємною частиною ефективного менеджменту та має основоположне значення для досягнення хороших бізнес-результатів, а також ефективної закупівлі товарів і послуг. Керівники проектів повинні розглядати питання ризиків у своїх звітах таким чином, щоб вони могли ідентифікувати потенційні ризики, а запропонована форма може допомогти команді, яка реалізовує проект будівництва, чітко зрозуміти проблеми та можливі наслідки. Значення діапазону витрат необхідно визначити, воно буде різним для різних розмірів проектів і має визначатися спільно.

**Ключові слова:** аналіз ризиків, оцінка ризиків, будівельні проекти, управління проектами, управління будівництвом, практичний підхід