

## Chapter 6

# Risk Based Contingency in Project Cost Estimates

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### ABSTRACT

*Project Cost estimation is carried out for making investment decisions. Cost estimation is carried out during different phases of the project. Contingency in cost estimation is an important factor before releasing final cost estimate for formal approval of the project by senior management. Major Petrochemical companies use risk-based contingency calculation instead of following a standard practice of adding a certain fixed percentage to the final project cost estimate. In this chapter, cost contingency calculation methodology has been elaborated by conducting case study of a sample project. The methodology described here uses famous tool of Monte Carlo for simulation. It is pragmatic approach to calculate required cost contingency in the project cost estimate, based upon the particular project risks as compared to simply following rule of adding fixed percentage of the estimate as cost contingency in overall project cost estimate.*

### INTRODUCTION

Cost estimation is carried out during different phases of the project. Initially, in the beginning of the project, project cost estimation accuracy is not very high but it keeps improving as the project progresses thru different phases in any given life cycle of the project. This is because uncertainties in the project decrease with every passing day. Contingency in cost estimation is an important factor before releasing final cost estimate for formal approval of the project by senior management. Effect of contingency is particularly profound for multi-billion dollar project as it is not wise to block a great sum of money for contingency only.

This chapter discusses application of risk-based contingency calculation instead of following a standard practice of adding a certain fixed percentage to the final project cost estimate. It plays an important role in decision making for sanctioning of the project. Contingency estimations based on fixed percentages determined by engineering practice or based on historical data don't take into account the unique risks associated with the particular project under discussion.

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## **DISCUSSION**

### **Mega Projects**

In petrochemical industry, the terminology of “Mega Projects” is used for major investments; these projects can be green-field or brown-field. It is hard to state one single definition of “Mega Project” as it varies from company to company. However, investments of significant Million Dollars are considered as Mega Projects. Words “Mega Projects” are used to differentiate these major investments from many other “Projects” which are significantly smaller in terms of their total cost and sometimes in overall project duration.

As every single project is unique, so are the risks associated with the project. Although there might be commonalities among the similar projects, yet uniqueness of the projects is still there because of the different circumstances faced by the projects at the time of their execution.

### **Project Risk Workshop**

As a standard practice, project risks are identified and qualitatively analyzed by conducting project risk workshops. Risk workshop is a team work where personnel from different disciplines and areas of expertise participate and impart their view about project challenges down the road. Most of the petrochemical companies follow a systematic and structured approach for risk identification, analysis and risk mitigations planning. This is very common to have this exercise under the umbrella called “Project Risk Workshop”. Usually person leading this activity is called “Risk Workshop Facilitator”.

Qualitative analysis of the risks is carried out in the workshop with all the participants while quantitative risk analysis is carried out by using simulation software. However data required for the quantitative Risk Analysis are gathered in the same workshop. Use of Monte Carlo simulation technique is very common and is used to develop the possible range of project cost estimates.

Estimation of possible project costs enables senior management to allocate a budget which provides desired level of confidence – which actually varies from project to project and is primarily linked with the nature of the project – brown-field or green-field. It is important to highlight that accuracy of the result depends upon the accuracy of the information gathered during risk identification and ranking processes of risk workshop(s).

### **Monte Carlo**

Monte Carlo is a very powerful and generally accepted simulation tool. This tool requires a specialized software but it is worth it. Monte Carlo creates a virtual population of projects that are just like the one under our analysis, down to its structure, estimate and project risks.

Monte Carlo iterates the project multiple times, creating often thousands of projects that could represent our sample project (Hulett, 2011). For each iteration, Monte Carlo selects at random a cost for each project element and calculates the total cost of the project for that iteration by summing these elements. Each of these iterations represents a possible project since it creates a different possible project every time by taking its costs from cost probability distributions specified by the analysis. The way Monte Carlo selects the costs at random for each cost element and for each iteration is to use the cumulative

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