Chapter 4
The Case for Truly Integrated Cost and Schedule Risk Analysis

Colin H. Cropley
Risk Integration Management Pty Ltd, Australia

ABSTRACT

Time and cost outcomes of large and complex projects are forecast poorly across all sectors. Over recent years, Monte Carlo (MC) simulation has increasingly been adopted to forecast project time and cost outcomes more realistically. It is recognised that the simultaneous analysis of time and cost impacts makes sense as a modelling objective, due to the well-known relationship of time and money in projects. But most MC practitioners advocate the use of Schedule Risk Analysis (SRA) feeding into Cost Risk Analysis (CRA) because they believe it is too hard to perform Integrated Cost & Schedule Risk Analysis (IRA) realistically. This chapter elaborates an IRA methodology that produces realistic forecasts without relying on questionable assumptions and enables identification and ranking of all sources of cost uncertainty for risk optimisation as part of the process. It also describes an extension of IRA methodology to include assessment of the assets produced by the project as well as the project itself, thus enabling the analysis of business risks as well as project risks.

INTRODUCTION

This chapter sets out the problem of poor forecasting of project outcomes, some of the frequently cited causes of this and how they affect outcomes. It discusses the elements of uncertainty to be included in realistic forecasting before describing the Integrated Cost & Schedule Risk Analysis (IRA) process in some detail. Barriers to producing realistic forecasts are described and ways of overcoming them discussed.

IRA methodology is compared with the conventional approach of "Serial Schedule Risk Analysis (SRA) to Cost Risk Analysis (CRA)" or "SRA2CRA". The SRA2CRA methodology and its pros and cons are discussed, along with likely explanations for the adoption of the SRA2CRA approach. These reasons are critically examined and challenged. Recent developments in IRA methodology and software are discussed.

Various alternate Monte Carlo (MC) simulation approaches are used at different stages of the project lifecycle and these are reviewed, from initial conception of the project through feasibility studies,

DOI: 10.4018/978-1-5225-1790-0.ch004

financial closure, project execution, asset startup to operations and finally to asset closure and remediation. References are made to Recommended Practices (RPs) of the Association for the Advancement of Cost Engineering International (AACEI), relating the use of IRA and other risk-based methodologies to applicable RPs.

The chapter ends by describing the extension of IRA to encompass the whole life-cycle of the project and the assets produced, noting that many projects have failed, not because of project execution, but due to the lack of viability of the delivered assets. This extension of IRA forecasts probabilistic returns on investment. It includes operation and maintenance of the asset, encompassing uncertainties and risk events in operational costs and revenues, interruptions to production and uncertainties in asset closure costs and timing and is only possible when time and cost uncertainty are modelled simultaneously.

This chapter argues the case for integrating estimate and schedule in simultaneous MC modelling when both schedule and estimate are available, highlighting the benefits of optimising risk and producing realistic forecasts of time and cost outcomes and contingencies.

The author has previously written extensively on this subject and some of the material contained herein has been published on the RIMPL website (Risk Integration Management, 2014), but this chapter draws some of those elements together into an overall coherent discussion for the first time. This chapter is not an academic review of the literature relating to Quantitative Risk Analysis (QRA) methodologies. Rather it is a description of the experiences of the RIMPL team in developing and using their IRA methodology on real projects, their encounters with competing QRA methodologies and their analyses of the merits of the respective methodologies.

BACKGROUND

The author became involved in Schedule Risk Analysis in the early 2000s, seeing it as a different window into project planning and enabling assessment of the likelihood of the project finishing by the planned finish date. As he gained experience, he saw the need for integrating risk events into schedule risk modelling and led a group that developed a risk management database to identify, manage and map risk events into the SRA model. Once risk events were being incorporated, cost impacts of some risks were recognised as requiring modelling as well as schedule impacts. In late 2006 it became clear that the only way to deal effectively with both cost and time impacts was to analyse cost and time uncertainties and risk events in the one model. This followed an engagement to conduct separate SRA and CRA analyses for a $3 billion mining project. No satisfactory solution to the problem of integrating the SRA analysis with the CRA analysis was found and certain major sovereign risks were excluded from analysis.

By 2008, the author's group had developed a workable methodology and supporting risk management database software to work with the then leading MC SRA tool Pertmaster Risk Expert to offer IRA consulting services to clients.

In the same period, Pertmaster was bought by Primavera Systems, Inc. (PSI) and was renamed as Primavera Risk Analysis (PRA). In 2009, Oracle Corporation bought PSI, but was not interested in further developing PRA. PRA has remained much as it was in 2008, still one of the best MC simulation tools with superior planning and graphics capabilities, but increasingly competing against some more modern products with better simulation speed.

The author's group continued developing and refining the group's software to improve modelling realism and to measure and rank probabilistic impacts better. In addition, the group developed software