Chapter 3
Systemic Risks and Parametric Modeling

John K. Hollmann
Validation Estimating, LLC, USA

ABSTRACT

Predictability in cost and schedule outcomes is a key financial objective for capital project systems. The primary measure of predictability is accuracy; it measures how estimates differ from the final actual outcomes. Unfortunately, accuracy in funding estimates in the construction arena has been elusive. Despite over 50 years of research, most companies are unable to quantify risks realistically. The cause is simple; traditional risk quantification methods have no empirical basis. This chapter is about empirically-based parametric modeling of "systemic" risks. Systemic risks are attributes of a project system and they are the dominant driver of project uncertainty. There are a number of reliable methods to quantify project-specific risk "events" and conditions and escalation and exchange risks. While those are the topics of other chapters, this chapter describes how to integrate the parametric method with those. Working together, those risk quantification methods can realistically predict the "usual" project cost growth and schedule slip.

INTRODUCTION

Predictability in cost and schedule outcomes is a key financial objective for capital project management systems at most companies. The simplest and most common measure of predictability is accuracy which is a measure of how estimates of project cost or duration differ from the final actual outcomes. Unfortunately, the achievement of accuracy in small and large project funding estimates in the construction arena has been elusive. We have over 50 years of empirical project cost and schedule accuracy data and research at our disposal to learn from and yet most companies still lack basic understanding of accuracy reality and remain unable to quantify risks realistically. The cause of this failure to improve estimate accuracy results is simple; traditional risk quantification methods have no empirical basis−we fail to learn what history is teaching us.

DOI: 10.4018/978-1-5225-1790-0.ch003

This chapter is about empirically-based parametric modeling of systemic risks; this is the start to realistic risk quantification. It is the only empirically-valid method I know of. Beyond parametric modeling of systemic risks, there are a number of reliable methods to quantify project-specific risk events and conditions and escalation and exchange risks; while those are the topics of other chapters of this text, this chapter describes how to integrate the parametric method with those. Working together, those risk quantification methods can realistically predict the "usual" project cost growth (i.e., <50%) and schedule slip (i.e., <20%). Chapter 7 on *Complexity Risk and Modeling Disorder* describes how to extend the risk quantification model to projects where systemic risks combine with complexity and the stress of critical project-specific risks to tip them into disorderly or chaotic behavior and blowouts (i.e., >50% for cost growth and >20% for schedule slip).

PROJECT COST BEHAVIOR

So what is industry's experience with cost estimate accuracy? For large projects involving construction including process, utility, mining and infrastructure projects, accuracy (i.e., actual outcome/funding estimate) is well documented and dismal. In a meta-analysis of published accuracy research, I found that 10 percent of projects overrun their estimates by about 70 percent or more after normalization for scope change and price escalation (Hollmann, 2012). Actual cost growth outcomes have a wide and heavily skewed distribution while most owner and contractor risk analyses forecast vary narrow distributions for the same projects (based on my personal benchmarking). The average project overruns its sanctioned amount by about 20 to 25% while project teams are predicting no overrun at all. As stated, about 10% of projects (the 90% confidence level or p90) overrun by about 70% or more while project teams predict 25% overrun at the p90 level. The following statement summarizes the failure of our risk analysis:

Our Estimating's p90 = Reality's p50

It is perhaps then no surprise that savvy financiers assume our projects will overrun by about 25% on average (Finnerty, 2013). Companies are also aware that something is wrong; many fund their projects at the p80 level of our estimates, not because they are particularly risk averse, but because experienced managers, like financiers, sense there is something wrong with the risk analysis. This chapter lays out what that something is and how to correct it.

UNREALISTIC RISK QUANTIFICATION METHODS

Before describing empirically-valid risk quantification methods, I will describe the traditional risk quantification methods that empirical research shows do not work when significant systemic and/or complexity risks are present (the majority of large projects) (Juntima, 2004). The most common method is still "rules-of-thumb" where 5 to 15% contingency is allowed for with about 10% being the *de facto* standard; most projects do not apply probabilistic models. Rules-of-thumb work when the only risk or uncertainty is "variability" in practices or when the base estimate without contingency is over-estimated which is common for small projects. This method adds no value to investment decision making because it assumes every project alternative's risk profile is the same.

Related Content