RISK ANALYSIS AND CONTINGENCY DETERMINATION USING RANGE ESTIMATING
INTRODUCTION

Scope

This Recommended Practice (RP) of AACE International describes the process known as range estimating, a methodology to determine the probability of a cost overrun (or profit underrun) for any level of estimate and determine the required contingency needed in the estimate to achieve any desired level of confidence. The process uses range estimating and Monte Carlo analysis techniques (as defined in RP 10S-90). The RP provides the necessary guidelines for properly applying range estimating and Monte Carlo analysis to determine probabilities and contingency in a reliable manner using any of a number of commercially available risk analysis software packages.

The RP does not recommend any particular software. Rather it describes the factors that the analyst must consider when using risk analysis software for probability and contingency determination.

Purpose

This RP is intended to provide guidelines (i.e., not a standard) for risk analysis using range estimating that most practitioners would consider to be a good practice that can be relied on and that they would recommend be considered for use where applicable.

This RP is also intended to improve communication as to what the practice called “range estimating” is. Many of the methods found in industry that are being called this are not in accordance with this RP. Practitioners should always make sure that when someone uses the term “range estimating”, that they are talking about the same practice recommended here.

Background

This RP is new. It is based upon the successful efforts of many companies to evaluate project risk and contingency using the range estimating techniques originally developed by Michael W. Curran[1,2,3]. Users should be aware that the principles outlined in this RP must be rigorously followed in order to achieve the desired results. Failure to follow the RP’s recommendations will likely lead to significant misstatements of risk and opportunities and of the amount of required contingency. In the great majority of cases, contingency and bottom line uncertainty are understated when the RP’s recommendations are not followed.

It is AACE’s recommended practice that whenever the term “risk” is used, that the term’s meaning be clearly defined for the purposes at hand. In range estimating practice as described in this RP, risk means "an undesirable potential outcome and/or its probability of occurrence", i.e. "downside uncertainty (a.k.a. threats)." Opportunity, on the other hand is "a desirable potential outcome and/or its probability of occurrence", i.e, "upside uncertainty." The range estimating process for risk analysis quantifies the impact of uncertainty, i.e. "risks + opportunities".
RECOMMENDED PRACTICE

Range Estimating

Range estimating is a risk analysis technology that combines Monte Carlo sampling, a focus on the few critical items, and heuristics (rules of thumb) to rank critical risks and opportunities. This approach is used to establish the range of the total project estimate and to define how contingency should be allocated among the critical items (RP 10S-90). It must be understood that total project estimate does not necessarily mean a cost estimate. The range estimating technique is equally applicable to profitability analyses (e.g., return on investment, projected earnings, earnings per share). It is also applicable to schedule-risk applications provided that the ranges determined for the critical schedule tasks do not result in a change in the critical path.

It must also be noted that the process applies to estimates that are based on a defined scope. Should scope changes be needed, or scope creep develops and results in significant changes in scope, the estimate upon which the range estimate is applied must be revised to reflect such scope changes.

An exception to this rule occurs when scope changes or modifications are anticipated and when the estimate includes a line item to cover such scope changes. In no event should contingency ever be treated as a source of funds to cover scope changes.

Identifying the Critical Items

The key to performing a project risk analysis using range estimating is to properly identify those items that can have a critical effect on the project outcome and in applying ranges to those items and only to those items. It is human nature to assume, for example, that a very large item in a cost estimate is critical simply because of its magnitude. That is not the case. An item is critical only if it can change enough to have a significant effect on the bottom line. The effect need not be negative (unfavorable). What matters is its degree, either in the negative or the positive direction.

Curran\(^2\) has demonstrated that in virtually all project estimates the uncertainty is concentrated in a select number of critical items -- typically 20 or less. Very few things are really important. This is called variously the Law of the Significant Few and the Insignificant Many or the 80/20 Rule. Others refer to it as Pareto’s Law after the noted Italian sociologist and economist, Vilfredo Pareto. On rare occasions there may be more than 20 critical items or less than 10. If this occurs, the risk analyst should carefully reexamine the items to be certain that the critical ones have been properly identified.

A critical item is one whose actual value can vary from its target, either favorably or unfavorably, by such a magnitude that the bottom line cost (or profit) of the project would change by an amount greater than its critical variance. The bottom line’s critical variance is determined from the following table:

<table>
<thead>
<tr>
<th>Bottom Line Critical Variances</th>
<th>Conceptual Estimates (AACE Classes 3, 4, 5)</th>
<th>Detailed Estimates (AACE Classes 1, 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Δ</td>
<td>± 0.5%</td>
<td>± 0.2%</td>
</tr>
<tr>
<td>Profit Δ</td>
<td>± 5.0%</td>
<td>± 2.0%</td>
</tr>
</tbody>
</table>

Table 1 – Bottom Line Critical Variances

Critical items are those which can cause changes greater than the above Δs (critical variances), either in the negative or positive direction.