Cost and schedule risk assessment

PMI Australia Conference 2014
Presented by Dr Stephen Grey
Broadleaf

Theme

A lot of quantitative risk assessment is unnecessarily cumbersome and soaks up effort without adding value to a project.

The approaches used often make it very hard to think clearly and realistically about a project.
Modelling

- Project
- Reality
- Belief
- Model

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Describing a model

- Assumptions
- Dependencies
- Sources of uncertainty

Cost
The requirement
Requirement

Inputs

$\Sigma$

Duration

Risk of exceeding target
Requirement

- Inputs
- Target
- Risk of exceeding target

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The candidates
Three methods

Risk events
- List risks
- Probability and impact (range of variation)
- Add them up

Line items
- Line items from estimate (summary)
- Range of variation in line item
- Add them up

Risk factors
- Cost or duration estimating relationships
- Uncertainty in inputs to relationships (ranges)
- Simulate the effect on the base case
Similarities

Relationships in the model \equiv Relationship in reality?

Is the link between inputs and reality easily understood?

Almost any attention to project risk will be beneficial

Some are more cost-effective than others
## Risk event model

<table>
<thead>
<tr>
<th>Risk</th>
<th>Probability</th>
<th>Impact</th>
<th>P x I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk 1</td>
<td>$P_1$</td>
<td></td>
<td>$P_1 \times I_1$</td>
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<tr>
<td>Risk 2</td>
<td>$P_2$</td>
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<td>$P_2 \times I_2$</td>
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<tr>
<td>Risk 3</td>
<td>$P_3$</td>
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<td>$P_3 \times I_3$</td>
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<td>Risk 4</td>
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<td>$P_4 \times I_4$</td>
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<tr>
<td>Risk n</td>
<td>$P_n$</td>
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<td>$P_n \times I_n$</td>
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<tr>
<td>Total</td>
<td></td>
<td></td>
<td>$\Sigma P_i \times I_i$</td>
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</tbody>
</table>

Monte Carlo simulation
Modelling based on risk events

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Monte Carlo simulation

Indirect inclusion of original cost and schedule relationships

Risk of exceeding target
# Line item modelling

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<thead>
<tr>
<th>WBS Item</th>
<th>Labour</th>
<th>Materials</th>
<th>Total</th>
<th>Contingency</th>
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Indirect inclusion of original cost and schedule relationships

Monte Carlo simulation

Risk of exceeding target

Target
Risk factors model

Cost estimating relationships (e.g. Cost = Quantity x Unit rate)

Simulated cost = Base estimate x (1 + ΔQuantity) x (1 + ΔRate)

<table>
<thead>
<tr>
<th>Project estimate summary</th>
<th>Labour</th>
<th>Facilities</th>
<th>Supervision</th>
<th>Materials</th>
<th>Sub-contracts</th>
<th>Services</th>
<th>Expenses</th>
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Uncertainty about quantities of concrete (m³)

Uncertainty about rates for cost of concrete ($/m³)
Risk factor modelling

Simulated cost = Base estimate x (1 + ΔQuantity) x (1 + ΔRate)

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Uncertainty about quantities of concrete (m³)

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Direct inclusion of original cost and schedule relationships

Simulated cost = Base estimate x (1 + ΔQuantity) x (1 + ΔRate)

Risk of exceeding target

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Making it work
Risk event

Variation in cost if the event occurs

Min = $2M Likely = $4M Max = $8M

Probability = 33%
Probability = 67%
No effect

Inputs

Outputs

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Risk event model
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Risk event model

Common factors, overlaps and interactions

Inputs

Outputs

Risk of exceeding target

Target
Line item range
Line item model
Line item model

Common dependencies and correlations

Risk of exceeding target

Target
Risk factor model

Cost drivers → Risk factors → Inputs → Outputs

∑ Cost drivers

Risk factor

Opt [-10%] → Likely → Pess [+15%]

Risk of exceeding target
Risk factor example (partial)

Small IT development project

- Overhead rates ($/month)
- Duration
- Software scale
- Team productivity
- Professional services rates
- Professional services $
- Number of users
- Installed license cost $
- Market rates for licenses

Design decision:
- Option 1
- Option 2
Risk factor example (partial)

Mineral processing plant construction

- Electrical & instrumentation
- Steel, mechanical & piping
- Concrete
- Earthworks
- Design decision
- Option 1
- Option 2
- Major equipment item cost $
Assessing input parameters
Describing a range

Common practice

1. Start in the middle and work out
   Anchoring bias

2. Explain reason for choosing numbers
   Confirmation bias
Describing a range

Good practice

1. Establish context
   • Assumptions
   • Sources of uncertainty
   • Pessimistic and optimistic scenarios

   Pre-empt confirmation

2. Start with the extremes and work in
   Break anchoring
Describing a range

Common practice

Assumptions
Sources of uncertainty
Scenarios

Outcome
Summary

Modelling using risk factors is generally simpler and more realistic than using structures based on risk events or line item ranging.

Context setting and methods to limit anchoring are required to get realistic assessments of uncertain values’ ranges.

It need not be hard work!
Contact

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If you would like further information about this topic please contact us.

For further information visit www.Broadleaf.com.au