

Project Planning – Advice for Schedule Risk Analysis

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“The Commanding General is well aware that the forecasts are no good. However, he needs them for planning purposes” Anon – anecdote attributed to Kenneth Arrow (Nobel Laureate)

This article looks at the way in which plans can be made to reflect the realities of project life more closely by using quantitative risk management. A number of specialist tools based upon Monte Carlo analysis are marketed for this purpose. Their purpose is to enable the risk analyst to predict the probability of the project achieving a particular milestone by any given date or to any given budget.

A conventional planning tool accepts only one value for the duration of each activity and the quantity of each resource type that is required for its completion. The implicit assumption is that both estimation and execution are perfect. A programme risk analysis tool allows the planner to replace these fixed values with probability distributions. Typically each of these distributions is defined by a mathematical shape and a three point estimate; minimum (optimistic), most likely and maximum (pessimistic).

The use of probability distributions recognises that estimates are never perfect and that the content of activities sometimes changes. Discrete risks and conditional paths can also be added to a Monte Carlo model. In contrast, the conventional plan assumes that one activity will always follow another like night follows day. This all goes to provide a better-informed view of the plan and its sensitivities as compared to the simple critical path.

A Monte Carlo analysis therefore has significant potential for providing a more realistic idea of how the components of a plan will work with each other in practice. There is also a wide choice of software on the market that will enable such analysis to be done efficiently. However, as with the basic planning packages, the very capability of this software can easily seduce people into thinking that they are obtaining accuracy that is not really there. As ever, the problem lies in the input data.

If it is difficult to estimate the expected duration and resource for an activity, how much more difficult must it be to estimate the variance and shapes of their probability distributions? In the academic literature on this subject, you can find esoteric arguments on the relative merits of various mathematical shapes. However, my own view, based on long experience and a specific trial, is that the biggest problem lies in the under-estimation of variances. The three point estimates tend to be too narrow.

When people are asked to estimate the variance of activity outcome, there seem to be several factors that conspire to produce undue optimism. Kenneth Arrow noted that people tend to overestimate the amount of information that is actually available to them. Implicit in their estimates are assumptions that go unrecorded and turn out not to be fulfilled. For example, a three-point estimate for the development of a piece of software code may be rendered implausible by the re-allocation of a particular engineer. Another possible cause is that people are just not sufficiently adept at probabilistic estimates (a fact that has kept bookmakers in

business for centuries). Finally, it has been well established by academics working in the field of risk estimating psychology that by breaking problems into components people underestimate the co-variance of risks. By focussing on each activity, it is easy to forget the influence that conflicting priorities have in practice.

To help improve the estimation of input data for a project risk model, here is a checklist to bear in mind.

1. Is there a risk register following a process of risk identification and analysis? Are specific risks included in the model in addition to the basic programme of activities?
2. Are there any performance metrics collected from previous projects that can be used to aid the estimates? If such data is only available from smaller projects, do the estimates reflect the communication inefficiencies that result from the use of a larger team?
3. Is every “most likely” point amongst the three point estimates the same as the base estimate? If so, the estimates may be questionable. Project managers are an instinctively positive breed and base estimates are often biased towards the optimistic.
4. Normally much more information is available for activities that will take place nearer the start. Is this reflected in the model? On a long project it should be normal to see wider activity variances in the later phases.
5. What experience do the estimators have of making three point estimates? Are they personally accountable for the outcome?
6. Does the risk register contain information about secondary risks? Is the impact of secondary risks included in the programme risk analysis?
7. The input data will be based on a number of assumptions. Have the assumptions been understood by the people who will use the results?

A further modelling problem arises from risk co-covariance. Some simulation tools treat each activity as an independent entity. Real life doesn't operate in this fashion. Experience tells us that if one activity takes longer than expected, then others are quite likely to do so as well. This is most likely to affect tasks that are similar, but to some extent, it may pervade the entire programme. A number of tools cope with this issue by allowing correlation between activities that over-rides the random nature of Monte Carlo selections to whatever degree is specified. However, use of this feature needs careful understanding for it to be applied properly.

Problems with the quality of input data can cause Monte Carlo analysis to produce dangerously misleading results if put into the wrong hands. The worst style of programme risk analysis uses a Monte Carlo simulation run with 3 point estimates generated as a function (e.g. plus or minus 10%) around the base estimates taken directly from a large plan. Unfortunately, this is precisely the quickest way of using the software available.

However, in an environment of open and honest communication, and by taking steps to maximise the quality of input data, programme risk analysis can make substantial steps towards bridging the gap between the ideal and reality. To make best use of this opportunity, project managers need to be aware of the potential pitfalls and learn to be more discriminating about the way in which data is gathered and the tools are used. As with other planning software, being able to operate the tool is only part of the real skill.

Notes

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For the paper from which the first two articles in this series were drawn, see “Project Plans and Planning – the ideal vs. the reality”. This can be downloaded from the Risk Horizons web site at Riskhorizons.co.uk.

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