Lucidus Consulting

Quality checking project management related quantitative risk models – 20 questions to ask

Here are 20 questions that can be asked in order to quality-check a quantitative risk model. These questions can be asked of yourself, if you are the risk manager or risk champion, or of the risk analyst if you are using either an internal specialist to carry out the task or the work has been sub-contracted to a third party. You should not necessarily expect to answer each question with an 'unreserved yes' however if a question is answered 'no' or with a 'qualified yes' then you should consider what the implications might be on the quality of the analysis and then make the decision whether to proceed or not.

1. **Is the risk analyst suitably experienced in using the modelling software?** Quantitative modelling software can be very easy to use; however to create appropriate risk models requires considerable expertise and experience. Inexperience can lead to the creation of inappropriate or incorrect models and should therefore be avoided. Note a model can appear to 'work' properly but may not truly represent the project's situation or the agreed risk assessments and will therefore give rise to spurious and incorrect output data.

2. **Is there a 'transparent' link between the risk register and the risk model?** It should be clear how and which discrete risk events have been modelled. Failing to maintain this link is quite common in quantitative risk models and can lead to both mistrust of the outputs and inappropriate or incorrect models. Using a simple risk-mapping template can help to avoid this.

3. **Are very low probability very high impact risk events included in the model?** If not how are they dealt with? The inclusion, or not, of these risks is often a key point for discussion. It may be appropriate to deal with very low probability very high impact risks as part of a sensitivity analysis, for example by varying the probability (and/or impact) and repeating the analysis so that the effect of the risk can be better understood. This can also challenge the correctness of the probability and impacts in the original assessment. It may be appropriate to omit these types of risks from the model completely; any omissions need to be understood and the method for dealing with these risks documented.

4. **What other risk events have been (deliberately) left out?** Risks not included in the risk model should be listed and reasons for exclusion understood. Omitting risks is not necessarily a bad thing however the rationale for doing so needs to be thoroughly documented. For example, certain risks (such as a change in legislation) may be excluded from the risk model for a project, and be borne at organisational level instead.

5. **When mapping discrete risk events to activities in the schedule does the impact reflect the impact on the activity or activities or the overall critical path?** In schedule risk analysis the impact must be on the activity duration not the critical path. In order to do this schedule-related risk will need to be assessed with this in mind. Using assessments from a more general qualitative assessment of risk events, as typically carried out in a risk workshop, will be insufficient.

6. **How has normal estimating variability or general uncertainty been dealt with?** All estimates will vary due to things like experience of staff or productivity. This variability can be modelled using three-point estimates placed on the base activity or base cost item.

7. **How are risky variables (not risk events or estimating variability) included in the model e.g. learning curves, exchange rates or commodity prices?** Most modelling tools permit the modelling of risky variables however it can be quite difficult for non-experts to achieve a realistic representation of what might happen.

8. **Has the existence of in-built contingency been understood and then explicitly removed or accounted for in the modelling input?** This particularly applies to estimating variability as failure to do this will lead to 'double counting' resulting in an incorrect and invalid set of outputs.

9. **Where probabilistic branching and conditional branching have been used to model risk events, or risk responses, are they used appropriately and can their inclusion be traced back to the risk register?** In addition when modelling risk events has the approach taken into account whether the impact of risk events are cumulative or mutually exclusive. And when modelling responses do they really reflect valid alternative courses of action.

10. **Have opportunities (upside risks) been modelled explicitly rather than included in estimating variability?** Modelling opportunities can require more detailed thinking and as a result some practitioners chose the easy option of modelling positive impacts via estimating variability by decreasing the minimum duration. Caution should be taken when modelling opportunities to ensure that minimum values for durations or costs are not violated.

11. **Have suitable distributions been used to reflect the nature of the risk event or estimating variability being modelled?** Where a modified triangular (Trigen) distribution has been used then the inputted percentage values used (at either end of the distribution) must be defendable. Likewise where other distributions, in particular, uniform and normal are used then there must be a clear rationale for doing so.

12. **Have heuristics and other biasing influences been taken into account when preparing range estimates and judgements of probability?** There should be clear traceability of where estimates and probabilities have been adjusted to take into account observed biases. An example might be where there is a view that over-confidence or the effects of the anchoring bias might have restricted the minimum and maximum values of a range estimate, so a modified triangular (Trigen) distribution is used to counter this.

13. **Is the 'model' used to perform the analysis overly complicated?** Ideally a model should contain no more than 200 elements (schedule activities or cost items); most models will contain around 100 elements. Overly complex models can result in analysis that is too complex to understand and action. If detail is necessary in a particular area of the project then you should consider a sub-analysis with the results of that sub-analysis used in the high-level model.

14. **Have pre and post-response models been created that adequately reflect all planned responses including contingent plans, fallbacks or plan Bs?** It is important to consider the effect of risk responses on overall risk exposure (defined as project risk by APM). By doing this the value of particular risk responses can be determined. It is also important that ALL responses are included and not just the first response. The use of conditional branching can assist in this where the conditional branch can represents either the initial risk response or a contingent plan.

15. **Has all available 'real' data been used; including readily available statistical data? Where required data is not generally available has an effort been made to find it?** This can be more subjective and relates to the effort that has been undertaken to find or derive relevant data. Sometimes there is far more data available in an organisation than is immediately apparent (such as weather and wave height data for offshore oil & gas projects) and effort must be made to source this.

16. **Has correlation been used and have logical correlation groups been established?** There should be clear justification of why a particular correlation coefficient has been used. Many practitioners suggest using correlation coefficients of between 0.7 and 0.8. This can be further enhanced by considering the following explanation of what differing coefficients effectively mean: Very Weak - 0.6 Weak - 0.7 Medium - 0.8 Strong - 0.9 Very Strong - 0.95 Total Dependence - 1.0. Correlation groups need to be identified and a rationale provided. Correlation coefficients and correlation groups can also be used to help deal with the law of averages.

> ***Law of Averages*** *(sometimes incorrectly called the Central Limit Theorem) – a phenomenon that suggests that if you add lots of independent variables together in a model such as Monte Carlo analysis then the extremes will cancel each other out. This applies to both schedule and cost risk analysis where it can lead to a very narrow output distribution i.e. the difference between the P10 and P90 is inappropriately small. Using correlation in an appropriate manner will help to eliminate this effect. Avoiding excessive detail can also reduce the effect.*

17. **For schedule risk analysis is there evidence that the potential consequences of merge/nodal bias has been understood?** In particular this is where all planned and potential responses (contingent plans) need to be considered and questions asked about what would happen if a series of parallel activities were not all 100% completed on time.

> ***Merge/Nodal Bias*** *– in schedule risk analysis this is important, as it is a key reason why as a result of Monte Carlo simulation, the dates calculated by deterministic project scheduling are vastly exceeded. In many cases this is an unfair reflection of what would really happen in a project. The phenomenon occurs when two or more (sets of) activities occur in parallel and each has a logical link between its finish date and the following activities. Using conditional branching can help eliminate this effect or alternatively appropriately increasing the modelling detail.*

18. **For cost risk analysis is the derived estimating accuracy (ratio between P10 and P50; and P90 and P50) reasonable/realistic for the current stage of the project?** It is unlikely that an early life cycle estimate of cost (or time) for a complex project will be very accurate; and it shouldn't be. Therefore if a cost analysis produces an accuracy figure of +/- 5% for a complex project before any significant design or planning has taken place then the quality of the model needs to be fundamentally questioned. Remember that the only purpose of the model is to provide useful information to decision-makers in the project team. If the project team do not believe the results, this indicates either that the original risk assessments need to be reviewed, or that the model is not representing the original risk assessments correctly, or that the project team's expectations need to be reviewed. Either way, the model results and expectations need to be aligned for the model to be of use.

19. **Are the limitations of the model and data understood when attempting to model the desired project situation?** Where assumptions or simplifications have been made these should be stated. Sometimes parts of the project are omitted from an analysis that are considered non-critical or where there is little apparent sensitivity. Where this happens there needs to be a good understanding of why, and a check that the assumption of non-criticality or sensitivity is safe.

20. **Do the results of the analysis feel right?** If for any reason you are uncomfortable with results of the analysis then do not ignore this 'gut instinct' and try to understand why this is and do whatever is needed to rectify it. Do the results of the analysis fall within the bounds of any recent (benchmarking) experience and can the results of the analysis be verified either internally or externally? If your organisation is a member of an external benchmarking group then it should be referred to; if not it sometimes helps to check what others, including other organisations, are achieving for similar projects

Peter Simon
peter@luciidusconsulting.com
www.luciidusconsulting.com