



# Risk SIG Workshop: The Role of Quantitative Risk Analysis

Harpreet Gill  
& David  
Hillson

The role of quantitative risk analysis techniques in the overall project risk management process is a contentious issue. Many risk practitioners are not convinced that quantitative analysis adds any further value to the process, and prefer to focus on qualitative aspects. Others feel that to ignore quantitative analysis is to lose a significant opportunity to understand the effect of uncertainty on project objectives. With this in mind, the APM Risk SIG held a workshop in April to debate the issues involved.

The objectives of the workshop were to seek consensus on when and how to use quantitative analysis, and to identify the strengths and weaknesses of quantitative approaches. The workshop was attended by over 30 SIG members with a wide range of experience and differing views on the subject to be discussed.

In order to bring some structure, the workshop split into four groups, each debating one of four specific areas. These were as follows:

- What quantitative methods other than Monte Carlo simulation are available, and when should they be used?
- When in the project lifecycle should quantitative risk analysis be used, and what for?

- Which types of projects might benefit most from quantitative risk analysis?
- How can managers ensure that the results from quantitative analysis are used?

In addition, each group was asked to consider the relative strengths and weaknesses of the techniques. The conclusions from the four groups are summarised below.

## Different quantitative methods

Monte Carlo simulation is probably the best known and possibly the most widely used quantitative technique. The group did, however, identify a number of other quantitative methods that can be used, including probability-impact tables and grids, Project Evaluation Review Technique (PERT), Expected Value, algorithmic methods, decision trees, influence diagrams, system dynamics, and Multiple Estimate Regression Analysis (MERA).

Most of these techniques are described further in the APM's *Project Risk Analysis & Management (PRAM) Guide*, and are reasonably well known to risk practitioners. However, defining when each technique might be most appropriate is less straightforward. When deciding which technique to use, the key consideration should be identification of the questions which need to be answered. The technique best suited to addressing these key questions should then be selected, bearing in mind the need for availability of adequate input data to support the analysis.

## The project lifecycle

Few would disagree that risk assessment and management should begin as soon as the project is conceived. This requires implementation of a formal risk process with the use of both qualitative and quantitative methods at appropriate points in the project lifecycle. But the specific value of quantitative techniques throughout the project lifecycle varies according to the particular phase. A generic lifecycle is described in the table below, indicating the extent to which quantitative methods might be appropriate or applicable. Although terms to describe a project lifecycle may vary, the broad outline of the various phases should be clear.

The table (Figure 1) is concerned specifically with indicating when and where quantitative risk analysis should be used. This is not to say, however, that qualitative methods should not be used as well.

## Types of project

It would be useful to produce a set of criteria to define the types of project that should have qualitative risk analysis carried out. One obvious driving factor is whether the customer requires that such a risk

## TIME

### Project inception

Little hard data may be available, therefore qualitative methods might be more appropriate than quantitative.

### Feasibility

A quantitative risk analysis could be carried out for the feasibility study, although this may not be appropriate if the project is small either in budget or timescale. Both qualitative and quantitative analysis can be used to support decisions during option selection and help to highlight risks in the business case.

### Definition

A full quantitative analysis can be used to set appropriate and robust contingency levels and define the base programme prior to project sanction.

### Design

A quantitative analysis at this stage should be included in the tender.

### Development/ Construction/ Manufacture

Risk analysis should be carried out at defined and regular points throughout this phase. This ensures that the status of risks are continually assessed and monitored and that new risks are identified and their impact understood and managed.

### Commissioning/ Operation/ Decommissioning

It is probably too late to use quantitative methods at this point in the project lifecycle, as many of the risks will already have been taken and the opportunity to influence the project has largely passed.

Figure 1  
When to use  
quantitative  
risk analysis



analysis be carried out, but are there any generic criteria to define the projects best suited to quantitative risk analysis?

The projects that would benefit most from a quantitative approach tend to be large, complex, critical, sensitive, or innovative projects, or projects with tight timescales or budgets, or high-risk projects, as identified by an initial qualitative risk analysis.

It is notable that these criteria are mostly subjective. The perceived degree of project size, complexity, sensitivity, etc will vary from one organisation to another. Therefore it is up to each organisation to define the circumstances under which quantitative risk analysis must be carried out. In other words, it is probably not possible to define generic criteria suitable for use by all organisations, although some guidelines can be set.

The following points also need to be considered:

- The project budget must be sufficient to cover the cost of the analysis.
- The organisational culture must be receptive to quantitative techniques.
- The data necessary to support the analysis must be available.
- There must be a commitment to using the results of the analysis.

### Integration issues

Performing a quantitative risk analysis is only going to be useful if the results are understood and acted upon. To ensure that this happens, it is important firstly to understand why the analysis is being carried out, then communicate the results, and finally incorporate the results into the project plan.

When agreeing the objectives for conducting an analysis, the following questions need to be considered:

- Why are we doing this analysis?
- Which decisions do we wish to support?
- Which questions do we wish to answer?

Before the results are communicated, consideration must be given to the target audience, identifying their questions and ensuring that answers can be supplied with supporting evidence. The information must be at the appropriate level – ie the right information given to the right people at the right time.

Unless the decision-makers and users of the results are experts in the quantitative techniques being used, the results must be interpreted and pre-digested to make them accessible and usable. Care must be taken to ensure that the data is presented in a format that will be readily assimilated and understood.

The results of quantitative analysis can be used in several ways. Initially they can focus attention on areas with high criticality/cruciality, thus supporting decisions in areas such as changes in resource levels, renegotiating milestones, etc. Secondly the data can be used to set budgets, project team targets, and contingency levels. The results should also be incorporated into the project plan, for example to reset durations to expected values, and to include explicit activities in the project plan for key risk impacts and planned mitigations. Lastly, the results are useful for targeting contingency to areas of highest risk in the project.

### Strengths and weaknesses

As with any technique, quantitative risk analysis has many strengths and weaknesses, including the following:

#### Strengths

- Permits 'what-if analysis', to test effectiveness of proposed actions
- Reveals aggregate effect of risks on project
- Allows a non-deterministic approach
- Provides an auditable basis to support decisions
- Reveals impact of individual risks on the whole project
- Helps to set contingency levels, milestones and budget
- Supports decision making under conditions of uncertainty
- Provides a consistent approach
- Can profile a portfolio of projects

#### Weaknesses

- Inputs are often subjective
- Needs training
- Open to abuse and manipulation
- Often expensive and time-consuming to implement
- Viewed as a specialist function
- Output needs interpretation
- Cannot identify risks
- May focus on numbers too early without taking a broader view
- Can be used cosmetically, without definition or purpose

### Conclusions

Despite the expertise of participants, the results of the Risk SIG workshop were far from conclusive, suggesting that there is no unambiguous set of criteria for determining when to use quantitative modelling techniques. A number of factors such as size, sensitivity, complexity and inherent 'riskiness' of a project must be balanced with more pragmatic issues, such as the relative cost to the project in terms of budget and time and whether there is a real commitment to making use of the results.

The main objective of the workshop was to reach consensus on 'when and how to use quantitative analysis'. The discussion and debate was broad and wide-ranging, and can be summed up in two words: 'It depends'! Overall, the workshop attendees agreed that quantitative techniques are powerful tools, making an important contribution to the risk process, but they must be used appropriately and with care if the full benefits are to be realised. ■

#### About the Authors

Harpreet Gill MAPM APMP is a Senior Consultant with PMP Services Limited, and has undertaken a range of project management training and consultancy assignments in the UK and abroad. Dr David Hillson FAPM APMP is Manager of Consultancy for PMP Services Limited, and chairs the APM Risk SIG. Harpreet and David can be contacted at PMP Services Limited, Tel: 01494 479650 or by email: [OneStop@pmp.uk.com](mailto:OneStop@pmp.uk.com)