Practical Project Risk Management[1]

Three-point Estimates: A brief guide [2]

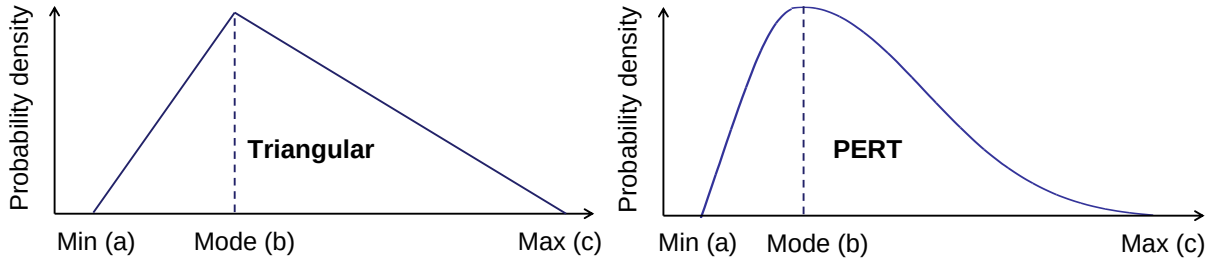
Purpose

Provide a simple means of modelling the magnitude and range of risk impacts or effects.

Three-point estimates are often made for the cost or schedule effects of project risk. However they may also be used in connection with other important variables. For example, on an aircraft development project, design-related risks might be assessed for weight modelling purposes. Three-point estimates are often used as inputs to quantitative risk analysis.

Probability Density Functions

Three-point estimates are used to create probability density functions (PDFs). Two of the most commonly used PDF shapes are the Triangular and the PERT (often called betaPERT).



Triangular

Mean (μ) = $(a + b + c) / 3$

St dev (σ) = $\sqrt{((a^2 + b^2 + c^2 - ab - ac - bc) / 18)}$

PERT

Mean (μ) = $(a + (4 \times b) + c) / 6$

St dev (σ) = $\sqrt{((\mu - a)(c - \mu) / 7)}$

A triangular distribution has a higher standard deviation than a PERT distribution with the same range. Moreover, whereas the standard deviation of a triangular distribution increases as its shape is skewed (i.e. as the mode comes closer to the Min or Max), the reverse is the case for a PERT distribution.

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[1] This series of articles is by Martin Hopkinson, author of the books "*The Project Risk Maturity Model"* and *"Net Present Value and Risk Modelling for Projects"* and contributing author for Association for Project Management (APM) guides such as *Directing Change* and *Sponsoring Change.* These articles are based on a set of short risk management guides previously available on his company website, now retired. See Martin's author profile at the end of this article.

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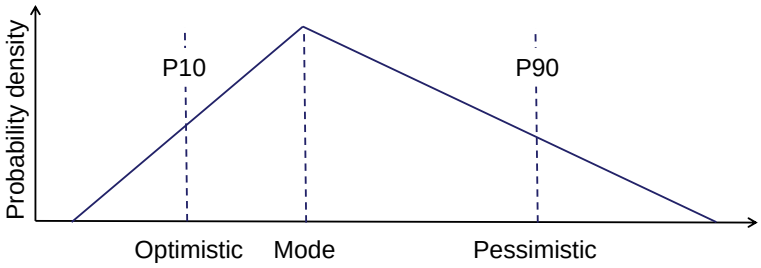
The triangular distribution's higher standard deviation may be argued as a reason for using it in preference to PERT as a means of compensating for the tendency for three point estimates to be unrealistically narrow. However, this thinking can lead to lazy estimating. It is more important to ensure that each three-point estimate is unbiased and has a realistic width (see recommended approach below).

Confidence-based Three-point Estimates

An alternative approach uses the optimistic and pessimistic points to represent confidence levels e.g. 10th percentile (P10) and 90th percentile (P90) values. Some estimators are more comfortable with this than estimating extremes.



The General Triangular distribution is a confidence-based three point estimates approach used to create PDFs. An optimistic P10 estimate represents a value for which there is only a 10% probability of the actual value being lower. Similarly there would only be a 10% probability of the actual value being higher than the P90 estimate. Note: the Triangular distribution formulae for μ and σ do not apply to the General Triangular distribution.

A Recommended Estimating Approach

Intuitive three-point estimates tend to be too narrow, often by a factor of more than two. The following approach helps to avoid typical cognition errors.

1. Identify and record all significant sources of uncertainty that are relevant to the estimate.
2. Make the pessimistic estimate taking into account how the relevant sources of uncertainty might combine to produce aggregate and/or compound effects.
3. Make the optimistic estimate taking into account how the effects of uncertainty might be beneficial and the outcome as good as is just plausible.
4. Make the mode estimate using planning data and insights gained from steps 2 and 3.
5. If the mode estimate is different to the project plan, consider adjusting the plan.

Common Faults

1. Failing to think through the effect of combined sources of uncertainty.
2. Starting with the mode estimate, thereby introducing anchoring bias that narrows the PDF.
3. Treating the planned (deterministic) estimate as being the mode by default, thereby transferring any planning bias directly through to the PDF.
4. Using project tools to produce generic estimates e.g. planned value +/- 10%.
5. Using over-detailed models that cause the quality of three-point estimates to be diluted.

About the Author

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Martin Hopkinson, recently retired as the Director of Risk Management Capability Limited in the UK, and has 30 years' experience as a project manager and project risk management consultant. His experience has been gained across a wide variety of industries and engineering disciplines and includes multibillion-pound projects and programmes. He was the lead author on Tools and Techniques for the Association for Project Management's (APM) guide to risk management (*The PRAM Guide*) and led the group that produced the APM guide *Prioritising Project Risks.*

Martin's first book, *The Project Risk Maturity Model*, concerns the risk management process. His contributions to Association for Project Management (APM) guides such as *Directing Change* and *Sponsoring Change* reflect his belief in the importance of project governance and business case development.

In his second book *Net Present Value and Risk Modelling for Projects* he brought these subjects together by showing how NPV and risk modelling techniques can be used to optimise projects and support project approval decisions. (To learn more about the book, click here.)