Practical Project Risk Management[1]

Multiplicative Risk Effects: A brief guide [2]

Purposes

1. Identify risk combinations that produce multiplicative (or partly multiplicative) effects.
2. Structure risk models e.g. cost or NPV risk models accordingly.

A Simplistic Example to Explain the Principle

Suppose that, in a building project, there is a risk that the price of bricks could double and another risk that twice as many bricks could be required than planned. If both of these risks occur, the cost of purchasing bricks would be 2 X 2 = 4 times the planned cost.

Risk combinations that produce multiplicative effects are not uncommon, but are often not identified. As a result, models constructed by summing risk effects can underestimate the overall level of risk involved.

A Simplified Software Development Example

A software cost estimate is built using a software size estimate (e.g. the number of software lines of code – SLOC), and a productivity estimate (e.g. SLOC per man-day). These estimates are multiplied and combined with an engineering labor rate to estimate the overall cost for the software team. When software development risks are identified, it becomes clear that:

Some risks affect the software size estimate: e.g. risk of emergent software requirements.
Some risks affect the productivity estimate: e.g. risk of staff turnover in software team.

Given the multiplicative way in which the base estimate is calculated it is illogical to sum the cost-related effects of these risks. Hence, the project's cost risk model structure should reflect that the combined effects of one group of risks will have a multiplicative effect with those of another group. Identifying this insight would typically flow from a top-down multicycle approach to developing the model (see *Top-down Multicycle Approach* guidance sheet).

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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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A large Scale & High-level Example: the Scottish Parliament Building

The original estimate for the Scottish Parliament building was approximately £40m. However, the scope of the building was underestimated (there were significant omissions), basic building and outfitting standards were assumed, whereas the eventual build leaned toward "gold plating" and the negative effects of a novel contracting strategy had yet to be experienced. As this project shows (final cost reported to be £431m), if you increase the scope of a building **and** upgrade its standards **and** use a controversial contracting strategy, the combined effect may be closer to being multiplicative than would be calculated on a sum of the parts basis.

Multiplicative effects in Risks to Benefits

In preparing a project business case, benefits risk should be taken into account. It is not uncommon to find multiplicative effects amongst the risks involved. As an example, if a prospective High Speed Railway is being considered, its benefits will include the revenue from ticket sales. This revenue might be estimated as:

Revenue = No. of trains per day x Occupancy (No. of passengers per train) x Mean Ticket Price

Risk may be associated with each of these factors. Given the formula involved it would thus be incorrect to sum these risks. However, simple multiplication would be incorrect since the factors are interdependent. For example, occupancy might be increased by reduced ticket prices. The overall effect is thus partly multiplicative rather than being simply multiplicative.

Compound Risks

Compound risks can be described as being risk combinations that have a more significant impact should the risks occur in conjunction. Risk combinations with multiplicative or partly multiplicative effects are compound risks. Systemic risks (see *Identifying High Risk Projects* guidance sheet) are another form of compound risk. The unidentified significance of compound risks can be a cause of underestimating the overall effect of project risk. One of the advantages of using a top-down multicycle approach when initiating a project risk management process is that insights into the nature of compound risks are more likely to be identified.

Common Faults

1. Failure to use a top-down multicycle approach when initiating a risk management process.
2. Default use of a sum of the parts structure when creating risk models. (This default is built into the cost risk analysis functions of a number of commercial project risk tools).

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.)