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Prioritising Project Risks

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1 Introduction

Project risk management addresses the implications of uncertainty for the project team, the sponsoring organisation, the users of the project's deliverables and other project stakeholders. The aim of this guide is to improve risk prioritisation by offering a choice of techniques ranging from simple to complex. Efficient prioritisation selects the simplest technique that will be suitable in the circumstances, but making the choice requires a clear understanding of why risks are being prioritised and what we mean by a risk.

Prioritisation is an important part of any risk process because it focuses attention on what matters most. However, 'what matters most' is variable in the sense that it depends on context. It varies from one stakeholder to another, and it changes during the course of the project, from one stage to another. For example, the most important impacts on the project sponsor at feasibility stage, before the project has been sanctioned, are not necessarily those that the project manager will regard as most important during project start-up. Additionally, the range of responses available to the project sponsor at feasibility stage will be typically much wider than those available to the project manager once the project has begun.

This variability of 'what matters most' raises questions in prioritisation, such as:

1. Where does the project team need to pay most attention to understanding risks in more detail?
2. What are the most important risks from the project sponsor's perspective?
3. How can the team identify those risks that should be prioritised for the implementation of risk responses?
4. How can quantitative risk models be used to identify key risks?
5. How can risks be prioritised if probability and impact cannot be reliably estimated?
6. Which risks threaten the feasibility of the project?

The third question above identifies an important distinction between prioritising risks and prioritising responses. This distinction is explored further in Section 3.

Prioritisation of risks is commonly associated with the assessment of probability and impact and the ranking of risks within a probability–impact matrix (PIM), so that risks with high impact and high probability assume the greatest importance. The familiarity of this technique leads us to assume that it is simple and effective, but probability and impact are not always easy to define or estimate. Nor are they always the most important attributes to consider.

Attempts to prioritise risks often raise another important question: what do we mean by risk? We know that uncertainty lies at the heart of risk. We also know that project risk can be complex, with many risk events and other sources of uncertainty contributing to the overall project risk. In this guide we have started from the concept of overall project risk. The APM *Project Risk Analysis and Management [PRAM] Guide* (2nd edition, 2004) describes project risk as resulting from 'an accumulation of a number of individual risk events, together with other sources of uncertainty to the project as a whole, such as variability and ambiguity'.

Types of risk that contribute towards overall project risk include:

- uncertainty concerning an event which, should it occur, would have an effect on the project objectives (event risks);
- uncertainty concerning the eventual value of an important project variable, including those that affect duration, cost and resource requirements (variability risks);
- uncertainty concerning the combined effect of multiple interdependent factors (systemic risks);
- uncertainty concerning the underlying understanding of the project (ambiguity risks).

Any of these types of risk can have a positive or negative impact on the project outcome. The project team may need to use the project risk management process to address either some or all of these types of uncertainty.

This guide also includes the concept of composite risks. These may comprise combinations of any or all of the risk types listed above. When using a multi-pass top-down approach to risk management, such as that recommended by the *PRAM Guide*, dealing with composite risks is an important part of the process, particularly during earlier passes. Composite risks might also be produced as a synthesis of contributory risks where it makes sense to do so, e.g. where an overarching response may be effective. The levels to which risk has been decomposed will, of course, affect prioritisation results. In addition, some techniques (including all of those related to quantitative modelling) cannot be expected to produce reliable prioritisation of risks unless risks have been understood within a coherent structure developed from a top-down perspective.

Finally, the scope of this guide also includes project strategy risks. Typically, these involve uncertainty about the fundamental role of the parties involved, the project objectives or factors that are critical to project success. Project strategy risks have the potential to change the purpose of a project or to fundamentally affect the way in which it is delivered.

Whatever scope is selected, the following are important aspects of risk prioritisation, often missing in common practice:

- risks should be understood before prioritising can begin;
- interrelationships between risks should be recognised, particularly in complex projects;
- risk management should begin in the earliest stages of a project;
- prioritisation, and the tools chosen to prioritise, should be part of a coherent process framework to analyse and manage risk in the project.

Section 2 addresses how we understand and describe risk. The purposes of risk prioritisation are explored in more detail in Section 3, and a selection of techniques to assist in prioritisation is presented in Section 4. The techniques selected in this guide are not intended to be exhaustive, and there may be other equally valid techniques available to projects. The techniques presented here have been chosen because they fulfil one or more of the following criteria:

- they are in common use;
- they are generally applicable;
- they give robust and reliable results;
- they are independent of proprietary tools.

Each of the techniques will be appropriate in some circumstances and not in others. The aim should be to select the simplest approach that will be suitable for the purpose of effective risk management. It is important to recognise in early passes of the prioritisation phase of the risk management process that there are sources of uncertainty that may require further analysis using more time-consuming and complex techniques. It is equally important to recognise where this is not necessary and avoid wasting time and resources on analysis of uncertainties that are of relatively low importance in terms of their effect on project objectives. These choices will almost certainly be more appropriate and effective if they are part of a coherent process framework.

It is important to recognise that there are significant differences of opinion about these choices, arising from different framing assumptions about the nature and scope of risk management. This guide attempts to clarify these differences and their effect on the choice of prioritisation technique.

2

Understanding and describing risks

Clear understanding of risks is an essential prerequisite for prioritising them; one cannot justify prioritising risks that have not been adequately understood. Risk descriptions are a vital tool for generating such understanding. A feature of good risk descriptions is that they include the information required both to make realistic estimates and to evaluate the relative importance of risks. Table 2.1 describes a number of risk attributes that might be taken into account when prioritising risks.

Of course not all the attributes shown in Table 2.1 will necessarily be relevant to risk prioritisation in any particular project or in any situation. But where these attributes are relevant they should be included in risk descriptions or related information such as descriptions of risk responses.

Table 2.1 Attributes that may be relevant to risk prioritisation

Risk attribute	Description
Probability	The probability that a risk will occur (note that risks that are not event risks may have a probability of 100%)
Impact	The consequence(s) or potential range of consequences of a risk should it occur
Impact – single dimension	Impact estimated in the dimension relevant to the context in which risk is being assessed (e.g. time or cost)
Variability	Uncertainty of outcome (typically evaluated as range or standard deviation)
Urgency	The nearness in time by which responses to a risk must be implemented in order for them to be effective
Proximity	The nearness in time at which a risk is expected or predicted to occur
Propinquity	The acuteness of a risk as perceived by either an individual or group
Controllability	The degree to which the risk's owner (or owning organisation) is able to control the risk's outcome

Risk attribute	Description
Response effectiveness	The degree to which current risk responses can be expected to influence a risk's outcome
Manageability	A function of controllability and response effectiveness
Relatedness	The degree to which causal relationships may correlate a risk's outcome with the outcome of other risks
Ownership ambiguity	The degree to which responsibility (either individual and/or organisational) for a risk's ownership lacks clarity

Given the importance of risk descriptions and the direct link to prioritisation, this guide describes a number of structured approaches that can be used to describe risks. Each of these structures differentiates between causal relationships that can be described in terms of facts and causal relationships characterised by uncertainty.

A commonly used simple structured risk description has three essential components: cause, risk and effect (see Figure 2.1). A *cause* is a certain event or set of circumstances that exists in the present, and that gives rise to one or more risks. A *risk* is an uncertain event or set of circumstances that might occur

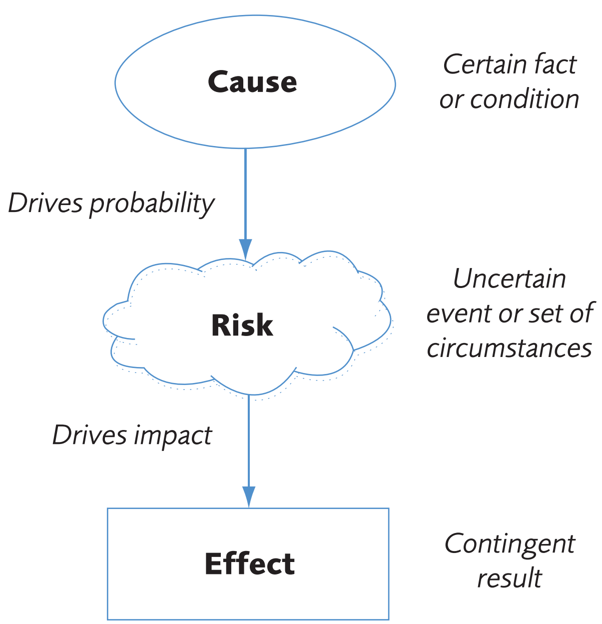

Figure 2.1 Simple cause–risk–effect model

in the future, and if it does occur it will affect achievement of one or more of the project's objectives. An *effect* is what would happen to achievement of the objectives when a risk occurs, and is also a future event, contingent on occurrence of the risk.

Use of a simple cause–risk–effect structure can be reflected in a three-part risk description (also known as 'risk metalanguage'), e.g. 'Because of <cause>, <risk> may occur, which would lead to <effect>.' The following example illustrates this format.

Example 1. Preferred electrical installation contractor unavailable. *Because the project's preferred supplier for electrical installation has a full order book, an alternative supplier may be required. This would lead to increased costs of 10% for the work involved.*

Two key parameters of risks are often used in prioritisation, namely *probability* and *impact*. Probability is a function of the cause–risk relationship, and the risk–effect relationship results in impact on objectives. The simple description of a risk using the cause–risk–effect framework therefore leads naturally to a prioritisation method based on probability and impact, and the standard probability–impact matrix (PIM) is an expression of that approach.

However, the cause–risk–effect model is a simplification that can be improved upon by expansion. Most projects have risks that are more complex than this, so it is a simplification that may not support effective risk prioritisation. There are several ways in which this model might be refined.

Firstly, the simple cause–risk–effect structure can be adapted, as in Figure 2.2. This recognises that some risks concern variability of effect rather than whether or not an effect will occur. All variability risks are of this nature, as are many ambiguity risks. In some cases, the risk impact could be either positive or negative relative to value assumed for a baseline. As with most risks, good descriptions of these risks require a sound understanding of relevant facts.

Examples 2 and 3 are risk descriptions based on the structure illustrated in Figure 2.2.

Example 2 (variability risk). Effect of exchange rates on costs of a foreign contract. *The supplier has provided a fixed price in foreign currency for the delivery of gas turbines. For planning purposes, the project budget has been set at the current exchange rate. However, uncertainty in future exchange rates will drive actual costs that may be either higher or lower than this baseline.*

Example 3 (ambiguity risk). Immature software specification. *The signal processing software specification is immature. It is uncertain how well aligned it is to the overall system specification. A detailed review can be expected to produce changes. An increase in software resource requirements can be expected, although these could range from three person-months to five person-years.*

4

Prioritisation techniques

This section describes a variety of risk management techniques. Some are high-level techniques designed to deal with risks identified primarily from a top-down perspective. These are often of greatest value in the earliest phases of a project. Others become more applicable as project information becomes increasingly detailed. Anyone wishing to prioritise risks should aim to choose the simplest techniques that are appropriate given the data available, while avoiding the trap of choosing techniques that are simplistic.

The techniques have been divided into three groups. Section 4.1 includes techniques that focus exclusively on the risk attributes of probability and impact. By comparing the combination of these attributes on a risk-by-risk basis, these techniques are designed to prioritise risks within the context of a list of risks or a risk register. Section 4.2 includes techniques that also adopt a risk-by-risk prioritisation approach. However, they use a variety of methods to broaden the perspective of risk prioritisation with a fuller range of risk attributes from among those listed in Table 2.1. Section 4.3 includes techniques that can be used to prioritise risks quantitatively within a model that represents the combined effects of risks to levels up to and including the analysis of overall project risk. This section also illustrates how risk prioritisation can be used to choose how and where to focus attention during successive iterations of a best-practice risk management process.

Each risk prioritisation technique is described under the following headings:

- purpose and applicability;
- description;
- examples;
- references (where appropriate).

4.1 PRIORITISING RISKS USING PROBABILITY AND IMPACT

4.1.1 Probability–impact picture

Purpose and applicability

The probability–impact picture (PIP) offers a flexible format for depicting independent event risks, variability risks and ambiguity risks. When event risks are involved, it allows specification of a range for the probability of occurrence, and a range for the impact should the risk event occur. The former recognises the often highly subjective nature of probability estimates. The latter recognises that the size of impact, should an event occur, is usually uncertain. The PIP allows the relative sizing of event risks in a more transparent manner than the probability–impact matrix (see Section 4.1.2), by showing the uncertainty about probability and impact estimates for each risk. But most important, it facilitates comparison of variability and ambiguity risks as well as event risks.

Description

1. Select an impact dimension and units in which the impact is to be specified.
2. For each risk, estimate the range for the probability of some level of impact occurring by specifying a pessimistic and optimistic probability of occurrence. Call these P_p and P_o. For variability or ambiguity (ever-present) risks, such as weather or market conditions or no design as yet, or no contract as yet, or no agreed specification as yet, set $P_p = P_o = 1$.
3. For each risk, estimate the range of possible impacts assuming the risk occurs by specifying a pessimistic and optimistic size of impact. Call these I_p and I_o.
4. For each risk, plot on a probability–impact graph the rectangle (I_oP_o, I_oP_p, I_pP_o, I_pP_p). This denotes the range of possible combinations of probability of occurrence and impact.
5. Various simple prioritising rules might be applied to the PIP. For example, attend first to risks with: the highest absolute value of I_p, then P_p values for risks with similar values of I_p; the highest absolute I_pP_p values; or the risks with the largest rectangles (I_oP_o, I_oP_p, I_pP_o, I_pP_p).

Example 1

There are three possible sources of delay to a project: (a) weather, (b) suppliers and (c) equipment. Associated risks and estimates of probability and impact are shown in Table 4.1, and plotted in Figure 4.1.

A simplification would be to plot the centre points of rectangles for risks (a), (b) and (c) in Figure 4.1 onto a PIM. However, this clearly ignores important information about the uncertainty present. In Figure 4.1, the relative importance of each risk is more equivocal, and risks with a probability of 1 have a role to play. This highlights the different nature of each, and the desirability of influencing each in different ways for different reasons.

Table 4.1 Probability and impact ranges for the estimates made for three risks

Risk	Event probability		Impact (days lost)	
	Pessimistic P_p	Optimistic P_o	Pessimistic I_p	Optimistic I_o
(a) Weather	1	1	12	2
(b) Late arrival of supplies	0.2	0.0	8	0
(c) Equipment failure	0.7	0.5	8	6

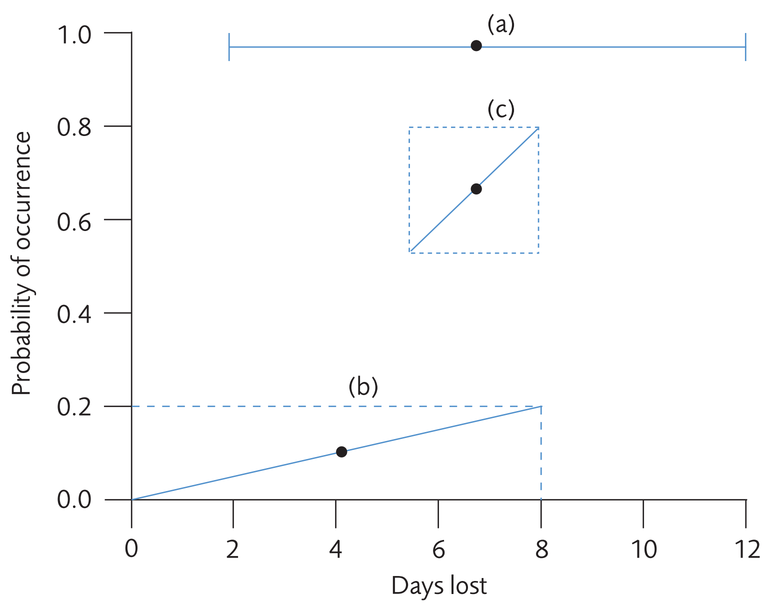

Figure 4.1 Mapping of three risks onto a probability–impact picture (PIP)

Example 2

This example illustrates the following four ways in which the core PIP technique shown in Example 1 can be extended if appropriate:

- the introduction of an explicit opportunity side to the impact dimension, beyond the good weather aspects of the weather risk in Example 1 – this

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