Chapter 8 | overview

Because every project is a unique endeavour, every project contains uncertainties. For project success those uncertainties that can endanger a project need to be managed. Those uncertainties that matter are called risks. In contrast to the common use of the word 'risk', which has a negative connotation, in projects a risk can either be a threat or an opportunity. Although most people have some idea of what risk management entails, clear language and processes are sometimes difficult to understand and/or apply in practice. This is also clearly related to human factors, subjectivity and interpretation.

The chapter discusses the why, the what and the how of risks and risk management. With tips and tricks provided throughout the chapter, readers will be able to apply risk management in their own projects.

Chapter 8 | outline

Chapter 8
Project risk management

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8.1 | Why risk management?

Why is risk management crucial for managing projects? The most important reason is related to the essence of projects. As discussed in Chapter 1, a project is by definition unique and therefore it comes with many uncertainties. Those uncertainties that matter are referred to as risks and risk management is about managing those uncertainties that can harm the project outcome. In that sense risk management contributes to increasing the overall value of the project to its stakeholders amongst others by maintaining better control of the project.

Hence risk management is strongly related to uncertainties. A clear trend is an increasing complexity in society in general with its related uncertainties (see Chapter 7). This trend also clearly touches the performance of projects, as can be seen from the huge variety in increasingly complex projects with a higher risk profile. Often risks are not very well evaluated upfront and/or they are underestimated. This is one of the main reasons for having (so-called) unsuccessful projects. As a consequence the reputation of projects is not very good. On top of the intrinsic complexity of projects, the highly complex projects often span multiple years or even decades (especially if one also includes the operating phase), and they will be subjected to changes in the environment. This clearly increases the risk profile of the projects.

Although this book is dedicated to engineering projects, it is important to realise that project risk management can steal a page from other areas where risks play a role. Although they seem different, there are often many parallels to be taken from these fields. Below a few examples will be discussed.

The first example is the financial business: most people know that risk management plays or should play a dominant role. Typically, high risks come with high value and low risks with lower value. Therefore a balance needs to be made to optimise risk and value. In order to do so, the risk profile of financial transactions or a financial portfolio is investigated. Due to the quantitative character of the financial business, one will find a larger focus on quantitative risk management. On the other hand, engineering projects more often deal with risk management in a qualitative way.

Another example stems from human healthcare. Although the terminologies of risk management and human health do not seem to match, while one is more rational than the other, it is common practice to analyse the balance between healthcare costs and impact on life expectancy. If a doctor would request a full body scan for every headache or cough, healthcare costs would be unmanageable. The trend in the human healthcare industry is therefore towards risk screening studies on specific populations. Known examples are breast cancer and heart and vascular diseases. In the risk screening approach, doctors also use standard criteria that balance between accepting the risks versus further diagnosis.

The third well-known example is from the process industry: for all large plants and clearly also for nuclear power plants extensive risk assessments are performed. Society needs to know that these plants are safe. Still, everybody realises that they cannot be 100 % harmless. We all accept that with a certain very small chance a large disaster can happen. Clearly, these risk assessments are used to minimise the risks for something going wrong at some very low level. The same holds for the safety of a country like The Netherlands with respect to flooding. All dikes and other water protection devices are assessed for their risk: the chance that a dike breaks through and the effect thereof. Still we all accept the risk of our city flooding once every 1000 years (more or less consciously).

So basically, risk management is very present in our own day-to-day lives. We take risks by riding to work on our bikes, jumping on trampolines, climbing mountains, etc. Simply avoiding every risk makes normal life impossible and therefore we (subconsciously) continuously assess situations, determine the risks and decide on the action required. This is why we have cars with seatbelts, install antivirus programmes on our PCs and insure our homes against fire. Luckily, realising this might help us approach risks in a project environment in a more natural way.

8.2 | What is risk management?

What is a risk?

For risk there are many different views and interpretations, but current definitions more and more iterate towards each other. The PMBOK (Project Management Body Of Knowledge) provided the following definition of a project risk:

> *'...an uncertain event or condition that, if it occurs, has a positive or a negative effect on at least one project objective such as time, cost, scope or quality. A risk may have one or more causes and, if it occurs, one or more impacts.'*

The above definition is rather concise, but it still contains all necessary aspects that are discussed below.

- Positive and negative effect – The formal definition of a risk in most dictionaries is related to something negative. Therefore, risk management is often seen as a method to prevent events with negative effects from occurring. If you are managing a project by only focusing on the uncertainties with negative effects, the value of the project can only be maintained or decreased. On the other hand, if a risk is seen as an uncertainty that can both have negative effects (threats) but also positive effects (opportunities), managing risks can lead to increased

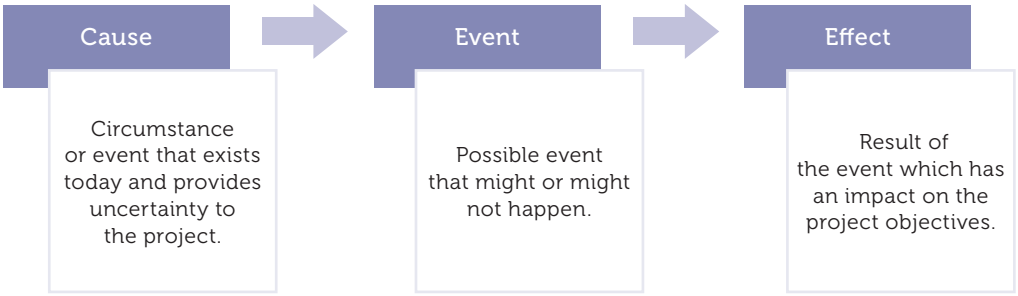

Figure 8.1: Cause-Event-Effect structure of a risk

value. Clearly upside and downside risks must be distinguished. This can be done by just calling them upside and downside risks; in practice this is sometimes done by calling them threats and opportunities.

- Cause – event – effect – The definition refers to an event (or condition) with a related effect (or impact). The cause is something that exists today that gives rise to uncertainty of an event happening that has an effect in its turn. This meta-language proves to be very beneficial in risk management, as can be seen from the fact that this meta-language is seen as a best practice in larger industries (see Figure 8.1).
- Objective (or value driver) – Every project is undertaken with a certain objective in mind. This is also often formulated as to create value. The value is then represented by value drivers (see Chapter 6). For managing the project in general it is important to have the objective in mind, but also for risk management it is important to be clear on what this objective exactly is. The reason for that is that only those risks that have an effect on the project objectives (value drivers) need to be taken into account. Or put differently: risks are those uncertainties that matter for a project. There are many more other uncertainties, but as long as they do not influence the objectives or value drivers of a project they do not need to be on the radar of the project lead. The main objectives or value drivers of projects are:
  - Sustainable development (Health, Security, Safety, Environment, Reputation)
  - Scope
  - Time
  - Cost
  - Quality

The objectives or value drivers are used again to rank the impact of a risk in order to better understand the importance of a project risk, see Paragraph 8.4.2.

Risk or issue

In practice, risks and issues are often confused. Theoretically, the difference is clear: a risk can or cannot happen and an issue is already there. It is described above that a risk has a chance of occurring, which means that it might or might not take place, with the chance of occurring being anywhere between 0 % and 100 %. An issue however, is something that is going to happen or has happened already. It therefore has a 100 % chance of taking place. The main reason for

the fact that risks and issues are confused is that they both endanger the project outcomes. To some extent our brains, apparently, are tempted to throw the two on one pile. Another reason why they are sometimes interchanged is the fact that the chance of occurring feels different to different individuals. For some people a 80 % chance of occurrence is almost already a certainty so that the related risk really 'feels' like an issue.
Common project management methods introduce risk registers for filing the project risks and issue registers for the issues.

Risk or hazard
The difference between a hazard and a risk is more than just a word game. In short, a hazard is the possibility of causing harm (the cause), while a risk is the event (with a probability) of harm occurring. Thus a hazard requires exposure before it becomes a risk. For instance, a car has a chance of becoming involved in car accidents where the other cars – or driving in general – can be seen as hazards.

International standards
Throughout the industry, the perceived importance of risk management has continuously increased over the years. This trend has led to the development of several, (very similar) standards on project risk management. The better known ones are described below.
The International Standard ISO31000 provides principles and generic guidelines on risk management. It is not specific to any industry or sector. This standard consists of two parts: an overview of all risk management aspects in ISO31000 and guidance on 31 different risk identification techniques in ISO31010.

The Project Management Institute (PMI) is a not-for-profit membership association for the project management profession. They provide globally recognised standards and certification programmes, academic and market research programmes, communities of practice and professional development opportunities. Part of their standards is grouped in the PMBOK guide (Project Management Body of Knowledge). One of the chapters in this guide is about project risk management.

PRINCE (PRojects IN Controlled Environments) was originally developed for ICT projects in the United Kingdom. Later on it was updated to PRINCE2 so it could be used outside the ICT industry as well. PRINCE2 is a set of project management methods that are based on principles like phased development, the steering group and management by exception. Risk management is one of the seven themes of PRINCE2.

8.3 | How to method

While the previous two paragraphs were dedicated to the why and the what, it is time to find out how risks should be managed. This is explained in this paragraph using a five-step process similar to the ones used in industry standards (e.g. PRINCE2). The risk management process is shown in Figure 8.2. The five steps are discussed in the subsequent paragraphs.

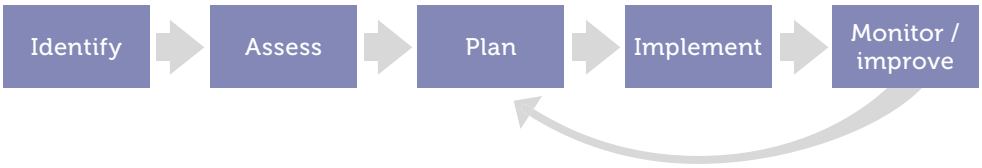

Figure 8.2: Risk management process

8.3.1 Identify

The first step in risk management is the identification of the risks present. In line with the definition of risk it is important to use the meta-language to describe each risk:

As a result of **<definite cause>**, an **<uncertain event>** may occur, which would lead to an **<effect on the project objectives or value driver(s)>**.

It is important to realise that there might also be more causes for one risk or a chain of causes and also that there might be multiple effects. For a good formulation of a risk obviously it is important to be complete, but on the other hand the descriptions should also not be too detailed nor over-complete. In the latter case one would lose focus on the real essence of a risk. The cause(s), the event (the risk) and the effect(s) can also be given in different columns in a risk register.

The ISO31010 refers to many different identification techniques, including HAZOP (HAZard and OPerability study), Delphi and interviews. The most common techniques in projects are brainstorming sessions, lessons learnt and the use of checklists. The different methods can be used alongside each other.

For brainstorming it is important to realise that it relies heavily on people and how they interact. This means that for risk identification, it is best to sit together and brainstorm through possible risks. Preferably people are present across the range of interfaces in a project from the current up to the later phases (including operations). It is best to have a face-to-face brainstorm session for which several systems exist such as:

- interactive computer tools so people can work simultaneously
- using sticky notes so all participants can brainstorm simultaneously or
- writing down each risk one by one while the other participants listen.

The advantage of a brainstorm session (with the whole project team) is that people buy in to a project and its risks by collectively going through the risks. In the process of brainstorming, make sure:

- every participant has a voice, avoid rejecting risks in the identifying stage in order to keep ultimate creativity and openness of the whole group
- not only technical risks are dealt with and
- sufficient time is taken before moving on to assessment
- discussions of likelihood and impact are saved for the next phase (Assess)

Another option is to have an individual risk assessment session. This can be done as a preparation for the 'live' session to save time or to replace the 'live' session all together. The advantage is that you will have less group bias and the downside is that you will miss out on the opportunity to discuss and therefore people might interpret the same risk differently. Besides brainstorming sessions, a second option is to use lessons learnt from previous projects. Similar to the individual brainstorm process described above, it is used as preparation for a live session, the extraction of relevant lessons learnt from previous projects can be done upfront to serve as input into the brainstorm session.

A third option is to use checklists in which several risk categories are distinguished with the aim to having your risk inventory cover all relevant types of risks. One popular method is TECOPS which stands for: Technical, Economical, Commercial, Environmental, Political and Sustainable. The 'ECOPS' risks can be seen as 'non-technical risks' (NTRs) which is a relatively new term in engineering.

One might ask why it is necessary to come up with another definition for something that is already defined. This is related to the trend in recent years of the increasing social awareness of industrial projects, their impact on their environment as well as an increase in the amount of stakeholders involved (e.g. joint venture partners, different governmental bodies, NGOs, local residents, suppliers, contractors, shareholders, employees, customers). Therefore the focus of NTRs is on community-related issues, sensitive environments and a large amount of stakeholders. This means that NTRs are most applicable to those industries that have a significant impact on the environment, communities they operate in or having numerous stakeholders. Typical examples are energy production (such as wind turbines), infrastructure construction and oil and gas production.

Another checklist that can be used is the Work Breakdown Structure or schedule if available. Both can be used to go through each activity on the WBS or schedule to identify possible risks.

The Wind Farm – Risk identification examples

The project team has identified two risks related to the communities near the construction site. The risk formulation makes use of the meta-language.

Opportunity
As a result of the high human resource requirements for the maintenance of wind turbines, many local residents might become employed, which would lead to an increase in local support.

Threat
As a result of the wind farm being near shore, local residents might be against the project and start to protest, which would lead to significant schedule impact (e.g. delayed permitting) and a reputation impact on national level.

8.3.2 Assess

Now that a list of risks is available to the project, it is important to start analysing and ranking the risks. This is a quantitative step. The reason for this is that quantification enables objective prioritisation and gives an idea of how much implementation effort/costs mitigation would require. The best known method of quantification is to split up a risk into the product of likelihood of occurring times the size of the impact:

Risk = likelihood of occurring x size of impact

One can see that the application of the meta-language is beneficial for this step. It is because in risk phrasing the event (with a certain likelihood of occurring) and the effect are specifically separated. A graphical way to represent risks based on the likelihood and impact, is a risk assessment matrix (RAM), see Figure 8.3. The colour coding shows which risks are acceptable (white, gray, and pale blue), which might require mitigation (dark blue) or which ones will have to be mitigated (black). The consequence is typically seen as more important than the likelihood; this is the reason why a typical RAM is not symmetric but skewed towards effect. This is especially true for safety related risks.

The likelihood scales used in the RAM matrix depend on the industry, project size, duration etc. Some examples of likelihood scales are:

- Qualitative: 'Remote / rare / unlikely / possible / likely' (or sometimes the categories are numbered: 1 to 3, or 1 to 5)
- Quantitative: 0 - 5 % / 5 - 20 % / 20 - 50 % / 50 - 80 % / 80 - 100 % or 'Occurs in: 1 in 100 projects / 1 in 20 projects / 1 in 2 projects / 2 in 3 projects / every project)'
- Mixed: 'Never heard of in the industry / happened in the industry / happened in the company / happened in the past year at the company / frequently occurred last year at the company'

	Likelihood				
Impact rating	remote	rare	unlikely	possible	likely
1					
2					
3					
4					
5					
6					

Figure 8.3: Example Risk Assessment Matrix (RAM) (from ISO31010)

As the consequence should always be related to an objective or value driver (why else would one care about the risk), the impact rating for a risk is related to the main objective or value driver for that risk.

In the estimation efforts it is again important to recognise human behaviour. This results for example in bias and anchoring phenomena. Often people already have a gut feel, based on their own experience, what the final outcome of the risk assessment should be. This can result in (group) bias to the outcome in discussions. To reduce this effect, it helps to split the assessment into two phases; first assessing the likelihood for all the identified risks and second, identify their impact rating (while the likelihood is shielded off).

Secondly, anchoring is done subconsciously by people when they do not have sufficient knowledge of a specific area. It describes the human tendency to use the first piece of information offered (the 'anchor') as the reference point. An example: Asking a group of workshop participants to estimate the mean time between pump failures. If the question is asked 'more or less than a year' versus 'more or less than 10 years', the typical estimate after the first phrase will be significantly lower compared to the second one.

8.3.3 Plan

The next step after identification and assessment is to plan the response. At this level it should be decided who owns the risk, what will be the risk response strategy and when these responses should be executed. Since it is unsure whether a specific risk really is going to happen, it is important to decide deliberately whether or not to respond to a risk and how.
The risk owner is typically the person (or organisation) who is best situated to deal with the risk. This is not necessarily the person who executes all the actions. Note that in the end the project manager is always accountable for all risks and in that sense she owns all risks.
Once a risk is identified and assessed a risk response strategy should be chosen for dealing with the risk. In general, there are multiple strategies possible for dealing with risks. These strategies are different for upside and downside risks (opportunities and threats); they are listed in Table 8.1.

Depending on the chosen risk management strategy, the new situation is not necessarily risk-free. The first possible consequence of the risk response is that the risk likelihood or consequence has been reduced, but not brought down to zero. This means there still is – what is called – a residual risk.

A second result from a planned response could be a so-called secondary risk. This risk was not present before, but rather it is a result of the chosen risk management strategy. These risks should be included into the risk register as well (see Paragraph 8.3.1).

While discussing on risk planning, it is important to mention both the residual and secondary risks, to make sure that the planned actions have the desired effect on either the consequence and/or likelihood. The residual risk and secondary risk outcomes allow for assessing whether spending time and money is worth the effort or whether the strategy should be adjusted.

8.3.4 Implement

This step is fairly straightforward. Just like with other action lists of the project, the risk responses should be actively managed to get things done. For large risk responses it might be worthwhile to plan them in the project schedule. The risk coordinator is the one managing this. Not all

Table 8.1: Strategies for dealing with risks

Upside risk response strategy	
Realise	Ensure that the risk will definitely occur
Enhance	Increase impact and/or likelihood
Share	Find another party to improve management of the risk (by realising enhancement)
Accept	No action is taken although it is possible to develop contingency plans (either in actions or a reserve in time/money/resources)
Downside risk management strategy	
Avoid	End risk exposure
Reduce	Reduce probability and/or impact on objectives to an acceptable level. Also known as risk mitigation.
Transfer	Find another party to deal with the risk
Accept	No action is taken although it is possible to develop contingency plans (either in actions or a reservation in time/money/resources)

organisations have a risk coordinator, in which case the project manager takes on this role. Depending on the duration of the project phase and the size/complexity of the project, regular risk meetings should be organised to track progress, but also to check whether new risks popped up.

8.3.5 Monitor / improve

After implementation of the risk responses, risks should be monitored to ensure that the responses lead to the expected results. If this is not the case, responses should be adjusted. Just like with the implementation step, regular meetings are required to update the register as the project develops. This step is crucial for risk management and often forgotten in practice. One should realise that it is not enough to make an inventory of the risks and define the risks response strategies: the most important aspect is to make sure that the chosen approach works.

8.3.6 Reporting

One step not mentioned above, but which is definitely required, is the reporting step. Although for large projects it can be beneficial to also do this within the team, reporting is typically done to the management of the organisation that owns the project. Perhaps in addition to or instead of talking your audience through parts of the risk the register itself, a visual reporting method, can bring across the message much more effectively.

The visualisation is done by placing the titles of the risks that require reporting on the RAM matrix. Next to the title, the trend and status are indicated using symbols in different colours, see Figure 8.4.

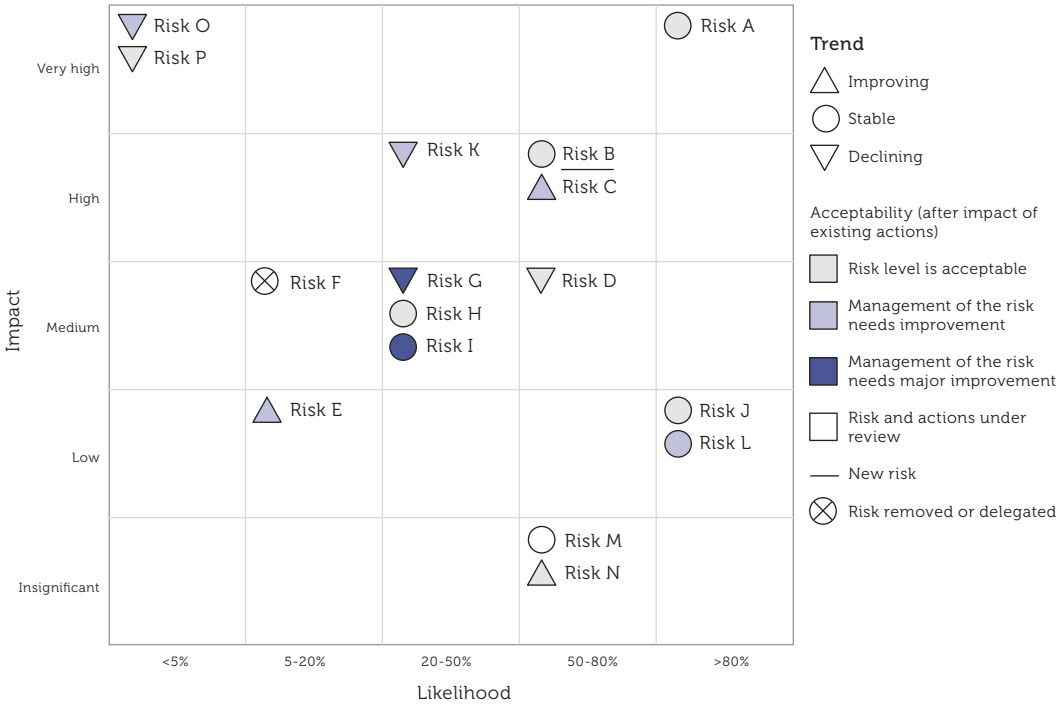

Figure 8.4: Example of visual risk reporting

8.4 | Risks and range estimates

As stated before, risks are uncertainties that have an influence on the project objectives (or value drivers). In other words: risks determine what the ultimate outcome of those project objectives is. The more risks, the more uncertainties will present themselves around the project objectives such as the costs and timing of a project. This means that risks drive the ranges of potential project outcomes, also of costs and timing. Since a project is uncertain by definition, it means that there is no such thing as THE project costs or THE planning. A project promise to a sponsor or client should be made in terms of a range ('The project can be finalised between 1 September and 1 October') or in terms of the chance of realising a certain cost or deadline ('There is a 50 % chance that the project will be ready by 15 September').

Because of the intrinsic uncertainty of a project, all project promises should be ranges (theoretically). In practice, quite some managers do not like this, since they are used to make one promise to their management to bring in a certain project at a specific date. Of course this is understandable, but one should always realise that this deadline might not be met (in case some risks fired that are causing delays). This clearly shows the importance of communicating the risk profile of your project, since this depicts the possibility of delay or cost overrun. For apparent reasons, this is also one of the main reasons for clearly communicating the risk profile of a project at important decision moments in the project (see also Chapter 2).

There are two major elements that drive the range estimates in projects:

1. The variability in many project parameters. Examples are: the price of raw material or goods, the sickness leave rate of the project members, the amount of time to be spent on finishing details, the percentage of scrapped material, etc. This can be seen as 'known unknowns'. One knows there is uncertainty in the estimations, but not how much.
2. Risks – A risk can or cannot fire. If it fires it has an influence on one project outcome, if it does not it does not have any influence (except for precaution measures, contingencies).

It is clear how variability influences the ranges: if we need 10 to 11 kg of steel at a price of €10 - 12 euro per kilogram costs will be €100 - 132. For risks this is less straightforward: if there is a risk something might happen with a likelihood of 10% which will cost €100,000, what is the effect on the project budget. If nothing is done, there is a chance of 10% that there will be a budget overrun of €100,000. If we budget for the €100,000, there is a 90% chance that we will not need it, whereas we might have spent it on other things (perhaps even on 'gold-plating'). If we budget for the expected value of the risk (€10,000), this will never work. If the risk fires we will have too little money, if it does not we lose €10,000.

A solution is to work with a contingency budget. The latter can be used for risks that have fired. Sometimes, managers have problems in giving out contingency budget, but it should be clear that these budgets can only be used when risks have actually fired. If a project manager has spent the whole contingency budget but is unable to show that risks have actually fired, she will have something to explain to the project steering comittee. Thus the contingency budget covers the difference between the minimum and the maximum range estimate of the budget.
The range estimates can be calculated by means of probabilistic calculations. One needs to realise that in practice, people often are 'scared' by this term alone: people do not really understand it and sometimes they will try to argue it away.

For parameters that have a variability, all relevant costs and parameters are estimated as ranges. An example of this is shown in Figure 8.5. On the horizontal axis the parameter to be estimated is given. On the vertical axis the probability density is stated: for every cost level or timing a certain

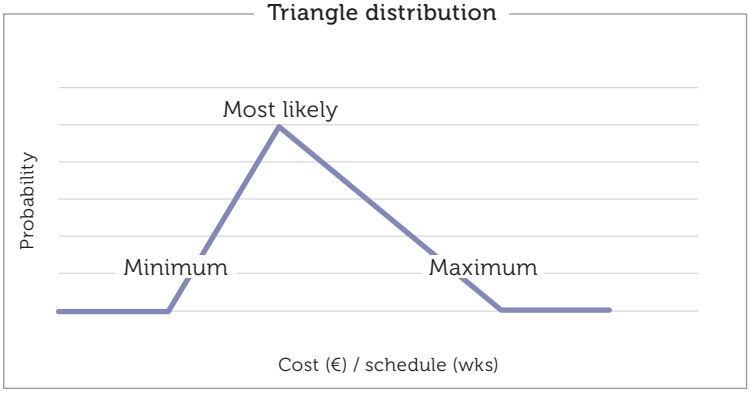

Figure 8.5: Example range estimate of one parameter

amount of realisation possibilities exists. The peek is the 'most likely' value which simply means the highest chance this budget or schedule is realised. The example distribution is triangular, but you could use any distribution you like: normal distribution, uniform distribution, etc. These estimations can also be done per task in the project schedule (facilitated by computer packages like 'Primavera' or 'Crystal Ball').

The next step is to add all these estimations together, which clearly needs to be done with a computer. One well-known method is the Monte Carlo method. Let us take an example for a Monte Carlo analysis of a budget or project schedule. This method draws one value from all distributions for all parameters. After the draw the method calculates one final possible budget or schedule based on these draws. For each draw all risks and their effects are taken into account: if there is a risk of 10 % of something that takes 1 month longer, in 10 % of the draws this additional 1 month is encapsulated in the final schedule for that occasion (and in 90 % of the draws this month is not appearing…). After that this is repeated several hundreds of times (typically 500 - 1000 times). It means that now hundreds of possible budgets or schedules are calculated. These can be plotted in a probability distribution, see Figure 8.6a, or a cumulative distribution, see Figure 8.6.b.

Figures tell us that there is a huge spread in potential schedules (or budgets): there is the – in practice very unlikely – possibility of a schedule of 1 week all the way down to the possibility of the project lasting 16 weeks. The most likely outcome is 5 weeks: this is simply the highest value in Figure 8.6.a. Typically, these kinds of distributions are asymmetrical (skewed). This is to be expected because at some point it is very hard (or impossible) to finish the project in less than the minimum amount of weeks, whereas it can be delayed almost indefinitely. The asymmetry is caused by the risks, especially the low chance-high impact ones. The cumulative plot (8.6.b) confirms there is a 50 % chance that the project will take 5.5 weeks or less (this is the 'median'). Likewise, it can be seen there is only a 10 % chance that the project takes 2.5 weeks or less, and a 90 % chance that the project is completed within 10 weeks.
The strength of this Monte Carlo approach is that the deterministic (point) estimate on budget and schedule now turns into probabilistic versions. This really improves expectation management, but it also allows for sensitivity analysis and enables the quantification of the impact of various risk management strategies. Having this quantitative impact of risks on costs and schedule also provides a solid basis to communicate with stakeholders such as joint venture partners or internal management.

8.5 | Getting started

Now it is time to turn the plan into practice. In this paragraph guidance for day-to-day-work in the field of risk management is given.

8.5.1 Risk management plan

The first step in sound project risk management is to consider what the risk management strategy is and how it can be formalised. This is laid down in a risk management plan which could typically be part of the project strategy/implementation plan for smaller projects or a separate document for large projects. A risks management plan typically contains:

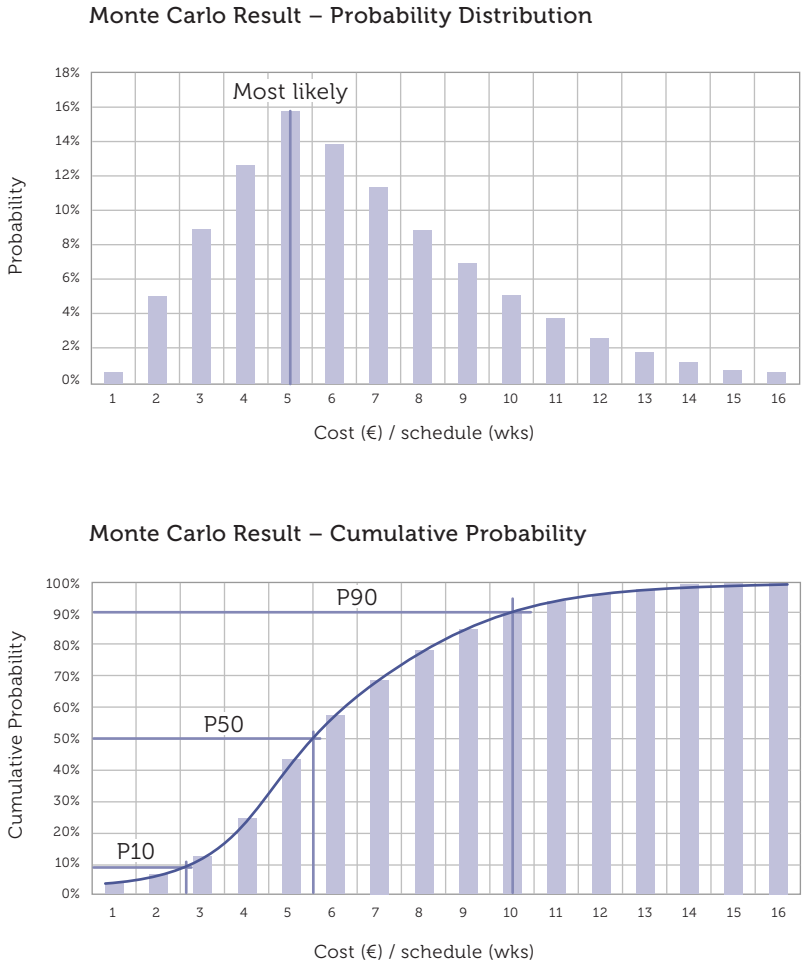

Figure 8.6 a and b: Example probability distribution (a) and cumulative distribution (b) as a result of Monte Carlo analysis

- Roles and responsibilities
- How the risk management process will take place
- When the 5 steps discussed earlier will be executed (identification, assessment, planning, implementing, monitoring and improving)
- RAM matrix and impact scales for cost, schedule, reputation etc.

8.5.2 Roles and responsibilities in risk management

In risk management there are three formal roles that should be defined.

- Project manager – ensures resources are in place, understands the top risks, signs off on the risk responses and in the end is accountable for all risks
- Risk coordinator – does a frequent review of the risk register with the team, monitors and develops responses, communicates to management and project team, owns the risk register. The coordinator reports to the project manager
- Risk owner – part of the project team (typically owns the consequence of the risk), communicates with coordinators about status.

A role is not the same as an individual so it is possible that there is one person with multiple roles. It is crucial to realise that the risks that could cause the project to step outside the triple constraints need to be signed off by more senior managers. Besides that, the role of the risk coordinator is mostly only introduced for (very) large projects; typically a project manager takes on that role as well.

8.5.3 How and when: risk workshops

It is crucial for risk management to invite the right stakeholders to brainstorm (identify) and assess the risks especially within the project team in a risk workshop. An integrated process is recommended with relevant parties like the project owner/customer, (sub) contractor(s), partners, etc. This improves risk understanding and increases ownership throughout the larger team. As with any other meeting, a workshop consumes time and energy from people and thus justifies preparing thoroughly to generate the most value. In order to be well prepared:

- Make sure you invite the right attendees (also consider future project phases, e.g. construction, operations)
- Make sure all project objectives (or value drivers) of the project are represented
- Consider what can be done in advance (e.g. offline brainstorming by all participants, gathering lessons learnt, checklists etc.)
- Depending on the number of participants, ensure a facilitator and scribe are present
- Be clear what the aim of the meeting is and which of the steps are going to be discussed; identify, assess and/or plan
- Decide whether to include HSE in risk assessment or make it part of a separate session. Both have pros (integration, single register, having people already there) and cons (smaller audience, safety discussions can eat away time from other topics).

A few tips for having an effective risk workshop are:

- Ensure alignment among participants on the risk assessment matrix and its interpretation (both likelihood and impact scales). This prevents discussions during assessment later on.
- Use the meta-language which really helps identify good quality risks. This also helps in assessing the risks later on for probability and impact.
- Assess the likelihood by thinking in percentages starting with 'is it more than or less than 50 % likelihood' after which the scale to determine whether the risk is 'Very High' to 'Very Low' can be used, not the other way around.
- If one of the team members has experience with a certain risk that actually happened in the past, she is more likely to rate the probability higher than those who have not. It is therefore important to recognise that any assessment will be based on a common agreement between perceptions (this is called the Delphi method). Try to prevent wasting too much time on the assessment as it is nothing but a means to prioritise the risks, not to manage them.

As stakeholders change regularly, the advice is to have a focused meeting or workshop on a regular basis, but at least in every project phase.

8.5.4 Risk register

The most important way of handling risks is to keep track of them in a risk register in which all the risks, including the risk status and planned responses are laid down. The register lists for each risk the following information:

- Risk ID
- Risk title
- Upside or downside risk (Threat or opportunity)
- TECOPS identification (or likewise categorisation)
- Cause
- Event
- Effect
- Risk rating before risk response
  - Likelihood rating
  - Impact rating
  - Risk (multiplication of the two)
- Planned response (including timing)
- Residual risk rating after response
  - Likelihood rating
  - Impact rating
  - Risk (multiplication of the two)

The most obvious tool to use is a simple spreadsheet which lists individual risks on the rows and the information listed above in the columns.
Although a spreadsheet function is fit for purpose for small to large projects, a shared database (online) has a number of advantages. Some enable history tracking so you know when each change was made. A second advantage is the ability to work with multiple users on this database and sometimes even cross platform (including mobile devices). Thirdly it can automatically track how actively the risk register is kept up to date.
To give the project stakeholder an indication of how actively risk management is being applied, some key performance indicators (KPIs) can be defined and tracked. The easy and obvious ones are:

- % of risks completely described (meta language, assessed, owner)
- % of risks added, changed, closed last month
- ratio of opportunities versus threats

Just like with project to-do-lists, the risk register should be kept up to date at regular intervals to enable progress monitoring and timely intervention. Frequency depends on the kind of project. Since the amount of uncertainty decreases by definition during the project lifecycle, the risks and risk descriptions too will become more precise during the project. In line with good front-end development (see Chapter 7): the earlier the risks are on the radar screen, the better the potential for dealing with them in an efficient way. For an effective risk register regular updating is key.

The Wind Farm – Risk register examples

The project team previously came up with two risks related to the comminities.
The table below shows how these risks are worked out in the register.

Risk ID	1	2
Risk title	**Local employment**	**Local protest**
Threat or opportunity	**Opportunity**	**Threat**
TECOPS category	Organisation + sustainable development	Sustainable development
Cause	High human resource requirements for the maintanance of these wind turbines	The Wind Farm being near shore
Effect	Many local residents might become employed	Local residents might be against the project and start to protest
Consequence	An increase in local support	Significant schedule impact (e.g. delayed permitting) and a reputation impact on national level
Before response		
Likelihood rating	3 (20 % – 50 %)	4 (50 % – 80 %)
Consequence rating	4 (10 % – 20 % impact on NPV)	5 (> 20 % impact on NPV)
Risk (multiplication of the two)	12	20
Risk owner	Project manager	Sustainable development lead
Planned response (incl. timing)	(Enhance) plan for high local employment strategy (e.g. local advertisement)	(Reduce) organise frequent meetings with communities and develop win-win development options
Residual risk		
Likelihood rating	5	3
Consequence rating	4	5
Risk (multiplication of the two)	20	15

By now it should be clear to the reader that risk management can and should be applied for every single project as it can easily be made fit for purpose. The steps explained basically all have to be taken but fit for purpose for risk management means to select the right tools, involve the right amount of stakeholders and spend an appropriate amount of time on e.g. workshops and keeping the register evergreen. This could mean for example that risk workshops for small projects are held in the framework of a regular project meeting.

8.6 | People are key

The techniques, tools and framework discussed should not be seen as all there is to risk management. After all, threats and opportunities are managed by people and not by processes and spreadsheets. Recognising this strengthens the risk management in a project, but this needs some understanding of the psychology of people and influencing skills.

Throughout the chapter the reader is shown that the risk management process is no 'hard science' but rather a subjective process in which human assessment of situations and future expectations play the key role. Still, a key element of risk management is at least prioritisation or even quantification of risks. This means that we have to realise that both the prioritised and quantified risks hold subjectivity in them. Different people will judge the danger of risks (or potential of opportunities) in different ways. Day-to-day examples are: some people do not ride a motorcycle because they think it is too dangerous, whereas others love the thrill. Some project members just seem to see problems (and risks) everywhere, whereas others are always (very) optimistic. Both types of personalities might be allergic to the other type: 'Why can't you stop finding roadblocks everywhere? Let's just do it.' versus 'Last time we also faced last-minute troubles, don't you remember? So let's now work out this risk a bit more. You never seem to listen to my warnings!' For a good (risk management) team both attitudes are necessary and both types perfectly complement each other. You need the other that you are so allergic for….

The attitude towards risks is described best by Hillson & Murray-Webster: 'Risk attitude is the chosen response of an individual or group to uncertainty that matters, driven by perception. Understanding risk attitude is a critical success factor that promotes effective decision-making in risky situations.' (Hillson & Murray-Webster, 2007).

As the risk attitude is a continuum ranging from extreme levels of discomfort up to extreme levels of comfort to risk, there is an infinite amount of risk attitudes. In Figure 8.7 this continuum is illustrated. The continuum is divided into roughly four groups: risk averse, risk tolerant, risk seeking and risk neutral attitudes. Risk averse persons will typically (try to) avoid risks, whereas on the other hand risk seeking people will actively seek out risks. There is a large group in the middle that balances between those extreme attitudes. The attitude might also depend on the situation. The risk neutral persons tend to be more averse in the short term, while they might be more risk seeking in the long term.

Perception has a significant impact on risk management; both the likelihood as well as the impact of risks are based on perceptions. Because perception is influenced by many factors (e.g. previous experience, risk attitude, current emotional state), the resulting process and actions from risk management depend on the individuals and the group and interaction between them.

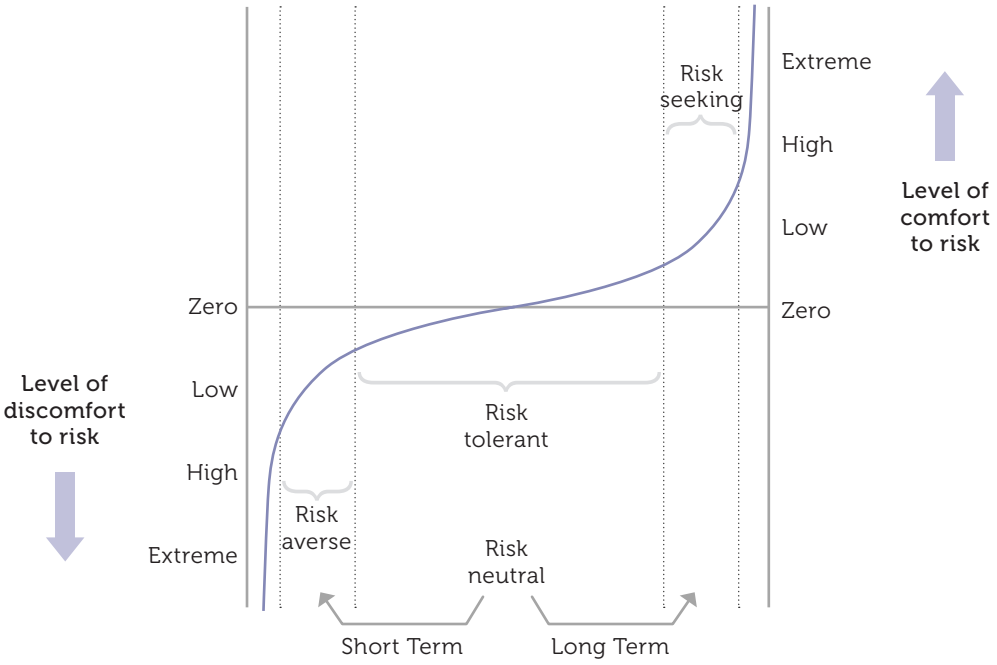

Figure 8.7: Risk attitude spectrum (adapted from Hillson & Murray-Webster, 2007)

Realising this is important. Nevertheless, influencing it can be a challenge the more so because personal believes are at stake.

Already quite some ideas for influencing or dealing with these aspects were given. An example is the use of several techniques (e.g. TECOPS) to ensure multiple categories of risks are identified instead of merely the technical part (a common pitfall). During assessment, the separate discussion of likelihood from impact gives more focus on the distinct items and thus reduces risk bias in groups.

Paragraph 8.4 confirms risks determine probabilistic schedules and cost estimates, instead of deterministic ones. Communicating in ranges to stakeholders gives much more information about the project: not only is it clear what the ball-park figures of the project are, but one also understands the effects of the uncertainties in the project. This does not change the fact that there will always be people who are not interested in ranges and probabilities, but who simply want to have single numbers: 'Just give me the budget'. We now know this is too simple and that we need to try to bring the richer picture across.

8.7 | Finally: the case for risk management

At the beginning of this chapter we asked the question as to why risk management is being applied. Although the case for risk management seems clear, convincing your stakeholders of the usefulness of applying effective risk management proves to be difficult in daily practice. For this reason below some research conclusions are given that support the application of risk management:

- 'Projects tend to suffer unexpected outcomes... and organisations must learn to accept that as part of reality, and be ready to prepare for them....' (Raz, 2002)
- '...even low-uncertainty projects usually come with failure and delays, and their success is not guaranteed.... In fact, previous studies have shown that high-risk projects are not less successful than low-risk projects' (Raz, 2002)
- '...risk management is more helpful in avoiding time and budget overruns than in helping achieve better outcomes in performance and product specifications' (Raz, 2002)
- A study from 2009 among 21 companies and 42 project managers, shows that out of 26 different project success factors such as trust, market, teambuilding and leadership, risk management was highest ranked by the project managers, even above SHE compliance (Safety, health and environment). (Arkesteijn, 2009)
- Another study from 2010 on 67 projects focused on the impact on so-called value improvement practices (VIPs). When asked about the benefit to the project, risk management was rated as a top 3 item together with teambuilding and constructability review. (Bosch-Rekveldt, The influence of project front end management and project complexity on project success, 2010)
- '... it is not about applying risk management with a 'tick the box' mentality, but rather it is about truly investing efforts ... One means to improve risk management is to have the right people incorporated in the project team... A thorough risk identification session, including the appointing of risk owners, should be followed by serious risk monitoring in order to take the appropriate measures and achieve the project goals' (Bosch-Rekveldt, Managing project complexity, 2011)