

Managing Murphy

essentials of project risk management

Applicable regardless of your preferred
methodology – PMBOK®, PRINCE2 or Agile.

by Dr Jim Young PMP FNZIM

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Jim Young
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Foreword

Risk management is one of today's hottest topics. Most industries are now highly competitive and the project management mantra is faster, cheaper, better. With these pressures come risk.

Good risk management or poor risk management can mean the difference between project success and project failure. Good risk management allows us to respond proactively to risk and also allows us to react better to those risks that do occur.

Experience has shown that risk management must be of critical concern to all project managers, as unmanaged or unmitigated risks are a primary cause of project failure. Unfortunately, many managers and project managers believe risk management to be too difficult, too time consuming, or too complicated to perform. However, such concerns are unfounded and there is no doubt that successful risk management will greatly add to the probability of project success.

This book is a welcome and timely addition to the literature on risk management and will be of particular interest to those involved in project management. The author demystifies the topic and describes a standard framework for integrating risk management into the management of our projects.

Phillip Meyer FNZIM

Chairman

New Zealand Institute of Management

Preface

“Great deeds are usually wrought at great risk.”

Herodotus

Herodotus, an ancient Greek historian, has been referred to as “The Father of Lies” due to his tendency to report fanciful information. However, the above quote, at least, is perfectly true – significant accomplishments are rarely possible without taking risks. The “no free lunches” mantra applies. Those who desire a reward need to be willing to expose themselves to risk. In fact, a no-risk project would not be worth pursuing, although of course there are no projects that are free of risk. It’s said that there are only two certainties in life – death and taxes. However, there is a third – project risk. Projects are unavoidably risky and this book explains how we should manage that risk to improve the likelihood of project success.

Historically, New Zealanders haven’t always given risk the respect it deserves, evidenced today for example by our road carnage. I understand that violence, car accidents and suicide are now the leading causes of adolescent deaths. Evidently death rates increase dramatically during the “risk-taking” years from 14 to 24, especially for males. One theory for Kiwi’s relaxed attitude to risk is that many of our ancestors, Maori and Pakeha, must have been hopelessly optimistic to sail huge distances to carve out a life in a strange and hostile land. One wonders how many of those early explorers never found land and perished at sea. So perhaps it’s part of our genetic heritage to focus on the upside and ignore the possibility that something could go wrong. The “she’ll be right” attitude often prevails.

Nevertheless, in the last few years many New Zealanders and New Zealand organisations have become more risk-aware, and several more risk-averse, waiting for our economy to turn around. Although, rather than waiting, some organisations are taking this opportunity to further differentiate themselves by investing in new products and services, and by expanding their reach further into

existing markets and penetrating new markets, examples of which are Fulton Hogan's and Fletcher Building's recent forays into new business in Australia and United States. Yet many of our organisations have become more conservative. Management effort has been diverted to survival mode. This attitude has put project managers under the spot light. We are now expected to produce more efficiently and cost-effectively, while short-handed and with reduced budgets. If this situation seems familiar, then this book is definitely for you.

The devastation caused Christchurch and my experience with the practical application of project risk management prompted me to write this book. My research suggested:

- Project risk management in New Zealand at least is poorly understood and even more poorly applied, although this is likely to be a more universal deficiency. The “she’ll be right” attitude prevails.
- Projects worldwide are becoming more risky, largely as a consequence of exponential technological advances, an obsession with speed, worldwide credit woes and the global recession. Uncertainty is the new norm.
- Existing publications give insufficient attention to several important aspects of contemporary project risk management including its full integration with the project management process, treatment of assumptions and opportunities, transfer of risk, ‘groupthink’ and other stakeholder risks, understandable quantitative risk analysis, and risk management maturity.

This book aims to describe the practical application of the project management process, rectify the above mentioned issues, and provide persuasive arguments in favour of project risk management.

The book introduces a sound approach to risk management aimed at keeping us, our team and our organisation at the forefront of risk management, thus contributing to the success of all three. This approach to risk management is not

intended to promote uniformity across our organisations. Application needs to consider the varying needs of our specific organisations, including their goals, culture, values, context, structure, functions, products, services and so on.

Risk is ubiquitous. Our very lives are calculated risks, although the chances are we don't consciously perform risk management in a very deliberate way on a daily basis. When we drive to work, we assume a calculated risk that we will arrive safely. When we eat in a restaurant, we assume a risk that the food has been safely prepared. The key is that we control or could control these risks by driving defensively or choosing a clean restaurant.

You're also taking a risk reading this book. You're investing your time to find out more about project risk management – and I thank you for that – but it is time you can't regain once spent. Furthermore, in the meantime you may forego other opportunities. However, you will, I'm confident, reach the end of this book and realise that you've learnt more about managing risk than you knew before. You will have taken a risk and benefited from doing so, particularly if you then apply what you have learned. Of course, as the author, I would maintain that the greater risk for you is not to read this book at all.

While usually on a bigger scale than reading a book, projects are also investments with risk, which we undertake to reap some reward – perhaps profit or at least add value in some way. We need to be confident that the rewards justify the costs and the associated risks. Intelligent risk taking is a fundamental precept of enterprise, where no risk taking means no innovation, no competitive advantage and no shareholder value. And some failure is acceptable.

Risk is a four-letter word that can cause big problems. A risk is something in the future that may or may not occur and the future is inherently uncertain. Risks do not yet exist as problems, and they may never become problems. They are possible future problems. Projects are particularly susceptible to risk because each project is unique at least in some measure. Many projects are without precedence. The elements of project uniqueness can vary. A state-of-the-art research project will have more unique elements than a project to carry out the tenth installation of a heat pump. Uniqueness means that the past is an imperfect guide to the future. We can never be entirely sure what the future holds or whether previous lessons are entirely relevant to our current or next project. There is always a risk that

things will not go as planned – possibly better than we envisaged, or if we believe Murphy’s Law, probably worse.

While uniqueness or novelty can introduce risk into a project, some other significant contributors to project risk include complexity, change, assumptions, constraints, and not least of all stakeholders – those individuals or groups whose interests may be affected by the project and/or who might influence project success. Nevertheless, with proper project risk management, organisations can defeat or at least subdue the Murphy factor to realise the following generic benefits:

- Projects will cost less and take less time to complete.
- More projects will be completed on time and within budget.
- Risks will be identified earlier and overly risky projects will be eliminated sooner, releasing resources for other pursuits.
- Better project selection decisions will be made, thus increasing the total value of our organisation’s portfolio of projects.

The term risk management can mean many different things to different people. To some the phrase is exciting – it’s all about taking and managing risks. To others the phrase is a turn-off. It reeks of control and bureaucracy. However we look at it, in a world of uncertainty, risk is inevitable and probably desirable. If we had no uncertainty and therefore no risk, then life would be entirely predictable, unrewarding and boring, although the truly risk averse may appreciate that.

While the future is uncertain, it is certain there is something that as project managers we will be asked, and asked often, about our every project, “How much will it cost and how long will it take?”

This question is posed in the future tense. We are being asked to predict. Because the future is uncertain, the fundamental answer to this question is that an estimate is more accurately expressed, not as a single number, but as a range. To determine a reasonably accurate range for cost and schedule, uncertainty must be considered. Risk exists as a consequence of uncertainty. Risk is always relative to something – a standard, reference point or estimate. There is no absolute risk. Of course the expression exact estimate is an oxymoron, and a precise estimate to the nearest hour or dollar only raises stakeholders’ expectations about the degree of accuracy

possible, which leads to perceived failure when such unrealistic precision is not achieved. Estimates are expressed as ranges every day. For example, we might say that we'll arrive in 5 to 10 minutes. Ranges reflect our best knowledge of reality.

Estimates are typically comprised of two components – their base component and their risk component. Base estimates are the likely cost and time for the project if no significant risk occurs. Once the project base estimates are established, typically a list of risks is created of both opportunities and threats, and recorded in a risk register – sometimes called a risk log. Then effective risk assessment replaces vaguely defined contingency with explicitly defined risk events and assesses the probability or likelihood of their occurrence and the impact or consequences for the project should these risk events occur.

While risk management is required for every project, we should keep in mind that it is a scalable activity and our risk management efforts should be commensurate with the cost, size, novelty and complexity of our project if risk management is to add value. Simple and familiar projects may use only straightforward qualitative risk analysis. Larger more complex and novel projects usually justify and benefit from more robust quantitative risk analysis.

Despite best intentions, our organisations may suffer from “dead projects walking.” These are unacceptably risky projects that should never have been commissioned or should have been terminated as soon as their unacceptable risk characteristics became evident. However, sometimes macho-style senior management and project sponsors can be complicit in keeping such disasters going. Instead of commending project managers whose conscientious risk assessments recommend early closure, at best they view such project managers as pitifully inadequate; at worst they are replaced. We can recognise those who doubt the value of project risk management from their comments, such as:

- *“The negative attitude that risk-finding encourages will undermine the project team’s morale and motivation, and ultimately project success.”*
- *“There is not enough time to indulge in mere possibilities. It’s much more productive to get on with the real project work and react to actual problems if and when they arise.”*
- *“Projects and the environments in which they are undertaken continuously change, which very quickly makes a nonsense of any risk management plan.”*

- *“What do you mean you ‘think’ the project is low risk? That’s defeatist talk. You’ll need to be a whole lot more confident and convincing to ensure we get this project approved.”*
- *“Risk management simply drives out innovation, which project management is all about.”*

In fact, uncreative risk management is a contradiction. To be effective the risk management process must embody innovation and creative thinking in both risk identification and response.

Attitudes to project risk can vary widely from dangerously tolerant to dangerously intolerant. Part of the problem is that effective risk management is typically low profile and may therefore seem to be a thankless business since few issues then arise. Issues are actual problems. They are risks that have materialised. Arguably, the fewer issues that arise, the better our risk management has been – a key measure of risk management effectiveness. However, tackling an issue can be very high profile. Ask BP about oil spills and our New Zealand government about mining disasters and earthquakes.

A preliminary report tells us that BP and its partners made a series of cost-cutting decisions that ultimately contributed to the oil spill that ravaged the Gulf of Mexico. Hazardous and time-saving steps were without adequate consideration of the risks involved. Yet the oil spill already has a time-warp feel to it. The whole spill-cam experience, which lasted for 107 days, seems like ancient history partly because preliminary studies are showing far less environmental damage than first predicted. The joy of oil-gobbling bacteria has dulled our recollection of petroleum-drenched pelicans. Corporate obfuscation has also muddled the memory. But no doubt there will be gazillion-dollar settlements to come. To encourage an appropriate attitude to risk management, we need to more conscientiously recognise and reward the fire-preventers, rather than simply glorify the firefighters.

“Prevention is better than cure” is the most important risk management principle. This principle might be more meaningful if we relate it to our personal health. Most New Zealanders, men in particular, associate a medical health check with being ill. But for life-threatening illnesses, physical symptoms may only appear at an advanced stage. In fact, in a third of New Zealand cardiovascular disease cases, the first symptom is death. Given this sobering statistic, there are enormous

benefits in switching our focus from treatment to early detection, intervention and prevention. The same is true of project risk, where unfortunately the emphasis is also often on cure rather than on prevention, and sometimes also with fatal results.

This book argues that project risk management is not an optional activity. It is essential for the successful management of all projects. While formal project management has been practised for more than half a century, deliberate project risk management is not too common. For example, the accountant mentality might think that the decision to go through with a crime is based on the cost of getting caught, multiplied by the probability of getting caught, weighed up against the expected gain from committing the crime. In practice it seems unlikely that our criminals perform such calculations before deciding to visit that South Auckland dairy. The same could be said about going shopping or engaging in other risky activities such as base jumping and mountaineering. Why should our behaviour be any less risky with projects? Some suggest that our risky sports are a natural by-product of a risk-averse society in which such activities are the only legal route to express our biological instincts.

Project risk management is seldom done well. At best, most project risk management is a one-time subjective check of the plan by its author immediately prior to project execution, after which no further formal risk management occurs. After project implementation it's all crisis management. Yet in recent years the importance of project risk management has increased considerably due in large part to our rapidly changing world and thus the increasingly difficulty of predicting the future based on history. This exponential rate of local and global change is evidenced by:

- Our diminishing planning horizons, lead-times, and product life cycles.
- Our increasing obsession with speed, service, sustainability, creativity and innovation, driven by new technology and our customers' ever-challenging and changing expectations and their changing loyalties, which require that our organisations continually reinvent themselves, their products and services.
- Our burgeoning workloads – exacerbated by reduced staff numbers, more frequent staff changes, flattened hierarchies, marketplace competition, and fully impossible timeframes that have us move on before we have time to comprehend or even benefit from the last change.

- Our greater connectivity, cross-functional interdependencies and teamwork, geographically dispersed teams, growing use of contractors to complete our non-core work, and an increasing use of temporary workers.
- Continuous streams of more and more knowledge to be rapidly captured, understood, managed and shared. Apparently the amount of data being stored worldwide doubles every 18 months. It's sometimes called data deluge or cognitive overload.

Today's business environment is constantly changing. It is unpredictable, volatile and becoming more complex every day. By its very nature, it is fraught with risk. A common misconception about project risk management is that its purpose is to avoid such risk. In fact, the purpose of project risk management is simply to make project success more likely. No organisation can operate in a state of zero risk. Interestingly, some interpret our Health and Safety in Employment Act to mean do nothing unless it is entirely safe, which was never the intention of this legislation.

We also need to remember, while aspirations for doing better – returning to the top half of OECD standards of living, or achieving income equality with Australia – are fine, but aspirations are not projects.

Today we often have difficulty identifying where we might reasonably expect our business to go or wish to be in just four or five years, which is a concern when we are making decisions today about some expensive and longer-term investment project that may be destined to become another white elephant. Linton Army Camp is a local example of interest to me that fits this description. Although, presumably this closure project and relocation to RNZAF Base Ohakea will now be on the back burner. There are plenty of others. Let's hope that Greater Auckland doesn't become one such folly. And our big investment in ultra-fast broadband, a platform for economic growth, may have some risk, but essential surely.

Such uncertainty could understandably favour the selection of those projects that promise a quick and more assured return, and preferably a return within our CEO's term-of-office, a cynic might suggest. Or our project propositions might founder due to those very risk-averse CAVE, NIMBY, and BANANA stakeholder attitudes mentioned in multi-millionaire Mark Ellis's recent book.

There is also the NIMTOO (not in my term of office) decision, which might mean “a fine project for my successor.”

While project selection is clearly a risky business, we project managers are more concerned with managing risk within our project once the project proposition has been approved. We are responsible for the output (project deliverable), but we shouldn't have responsibility for the success of outcomes (project benefits) over which we have no control. Some other learning points that this book expands on about managing risks within our projects are:

- Applying a proven project management methodology is essential. Risk management is then integrated with this methodology.
- Risk management is an integral part of good project management and to be wholly effective also needs to be part of the culture of our entire organisation.
- Risk management is not an exact science and sometimes the precise figures used may create an impression of accuracy that simply cannot be.
- Risk management is an on-going process applied throughout the project life cycle. Also, the effectiveness and efficiency of the risk management process itself needs to be continually reviewed and improved.
- The concept of risk tolerance needs to be understood and practised. Not all individuals and organisations show the same tolerance towards risk. Attitudes range from risk averse to risk taker.
- We should be careful about rewarding firefighters at the expense of rewarding fire-preventers. The firefighting syndrome can be a cultural impediment to proper risk management.
- Risk management should create value. It is a scalable activity. The benefits of project risk management should exceed the costs of doing so.
- The risk management process needs to be tailored to meet the unique needs of our organisation and must be responsive to environmental changes.

While risk management has always been important, it has gained much more traction in our current economic climate. Organisations, both private and public, are becoming more watchful and want to properly understand the risks that they're taking when planning new growth strategies, operational improvements, or other business and technology initiatives.

It is also important for our organisations to recognise that risk management is central to their ability to survive and thrive. They need to understand their risk tolerance levels and manage within those. Generally, those private enterprise organisations that are able to manage risk more effectively than their competitors do, have an edge in the marketplace. And non-profit and public entities will operate with greater effectiveness and efficiency.

One of the few certainties about projects is that they all involve risk, which needs to be planned for and managed in a rational and methodical manner. This book aims to demystify this discipline and show readers how to deal with project risk in a systematic manner. The chapters that follow are concerned with identifying, analysing, and responding to project risk, which requires we maximise positive risk events and minimise negative risk events to the betterment of our projects.

I trust you find the book useful and good luck in your efforts to subdue Murphy. Or perhaps I should wish you good luck and the wisdom to know how to manage it. It was Louis Pasteur who told us, “Chance favours the prepared mind.”

Finally, I wrote this book during the most significant natural disaster in the history of modern New Zealand. It served as a constant reminder. The earthquakes and some 7,000 aftershocks to date have turned many people’s plans on their heads. Gone is the business, the job, the house and in some cases, the breadwinner. I’m sure we all look forward to the resurrection of a stronger, safer and better Christchurch, to paraphrase the words of Mayor Bob Parker whose calm manner and commonsense advice has done much to soothe rattled nerves. The disaster has left an indelible mark on the collective Kiwi psyche. It would be interesting to zoom forward 30 years to see what our future Christchurch will look like. The CBD rebuild, replication, relocation or perhaps abandonment will be the country’s biggest project. Meanwhile there are some 6,000 houses to be demolished. Yet, by the time things settle we may also have lost the bulk of our unreinforced masonry buildings across the country, and along with them, a lot of our built heritage. This, despite the fact that the single largest contributor to the toll, the CTV building, belongs to the modern era.

Quake fixit czar, Roger Sutton, is likely to have a short honeymoon. He has a big job. Dresden took over 50 years to put right after Allied bombing. It took four years to clear the rubble at Hirsohima. Normalcy for Christchurch will doubtlessly

return – slowly, fitfully, but eventually resoundingly. Frustration levels are certain to rise, but rebuilding is an amazing chance for renewal. The City Council awaits the building consents tsunami.

We can learn positive lessons from such terrible disasters. Imagine the devastation in Christchurch if the Government had not introduced building standards after the Napier earthquake. Many people still think that when the ‘big one’ hits, building standards will make little difference, but this fatalism is not supported by the data. Building standards make all the difference. It is significant that no commercial building compliant with current Canterbury standards collapsed in the earthquake. And that is despite the fact that Canterbury building standards were lower than Wellington’s, because we ‘knew’ it wouldn’t happen there.

Somewhat overshadowed by the tragedies of the Pike River mining disaster and the earthquakes in Christchurch, the Rugby World Cup project provides us with an opportunity to focus on something much more positive and uplifting, although this too will have its hiccups on and off the field. May the best team win – this time surely! Our national mood is much synched to All Black fortunes.

In Memoriam – Rita Mulcahy, PMP

One of the world’s top authorities and very popular project risk management author, Rita lost her battle with cancer on 15 May 2010.

Introduction

One of the few certainties about projects is that they will involve risk and because of this, those risks need to be planned for and managed in a rational and methodical manner. Thus, when it comes to successful project management, we need to understand risk and how to manage it to the advantage of our project. In the planning, implementation and completion of any project, big or small, an understanding of risk management and its practical application is now essential.

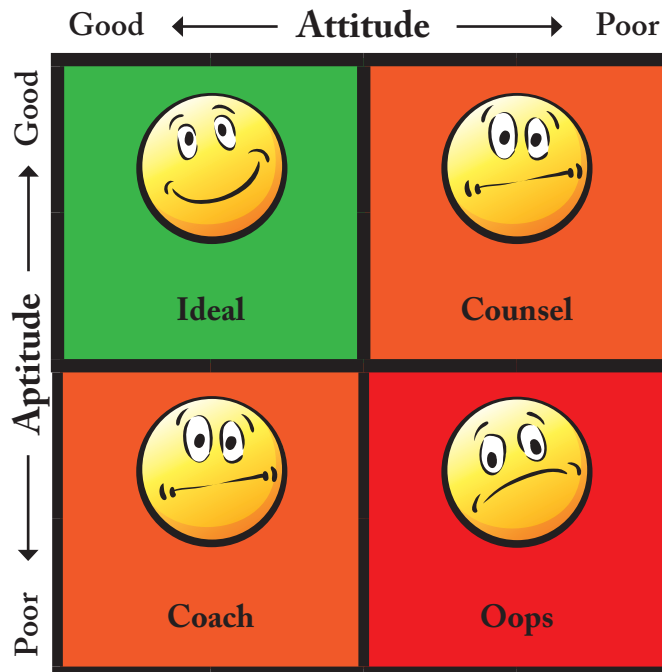
An important objective of this book is to provide you with a comprehensive guide to project risk management. The book aims to demystify the subject, although every discipline has its jargon. In our society to be illiterate is bad and nobody admits to it, but to be innumerate is readily admitted and seemingly very forgivable. In this book some mathematics is unavoidable, although the book is written for project managers, not mathematicians.

The book describes a generic risk management methodology that is cost-effective, systematic, easy to apply, and readily adaptable to any project regardless of its size, novelty, complexity, and type of project management approach used – PMBOK, PRINCE2, Agile and so on, not surprisingly all of which endorse the same risk management principles and employ similar straightforward processes, tools and techniques. The last thing we need is a tedious process. In fact, terminology is the only real difference among the various project risk management methodologies and possibly this difference is simply in an attempt to distinguish each from the other for mainly commercial reasons.

This book not only addresses the “how”, but also the “why” of project risk management, since the greater challenge is usually persuading people they should do it. In my experience project risk management is something that is talked about

a lot but rarely done. Accordingly, the benefits of project risk management are the focus of this first chapter. Effective project risk management is probably more about attitude (will) than it is about aptitude (skill), although both are important. If we can't persuade our project people of the need to properly manage risk, then it's pointless they should learn how to do it. See Figure 1.1.

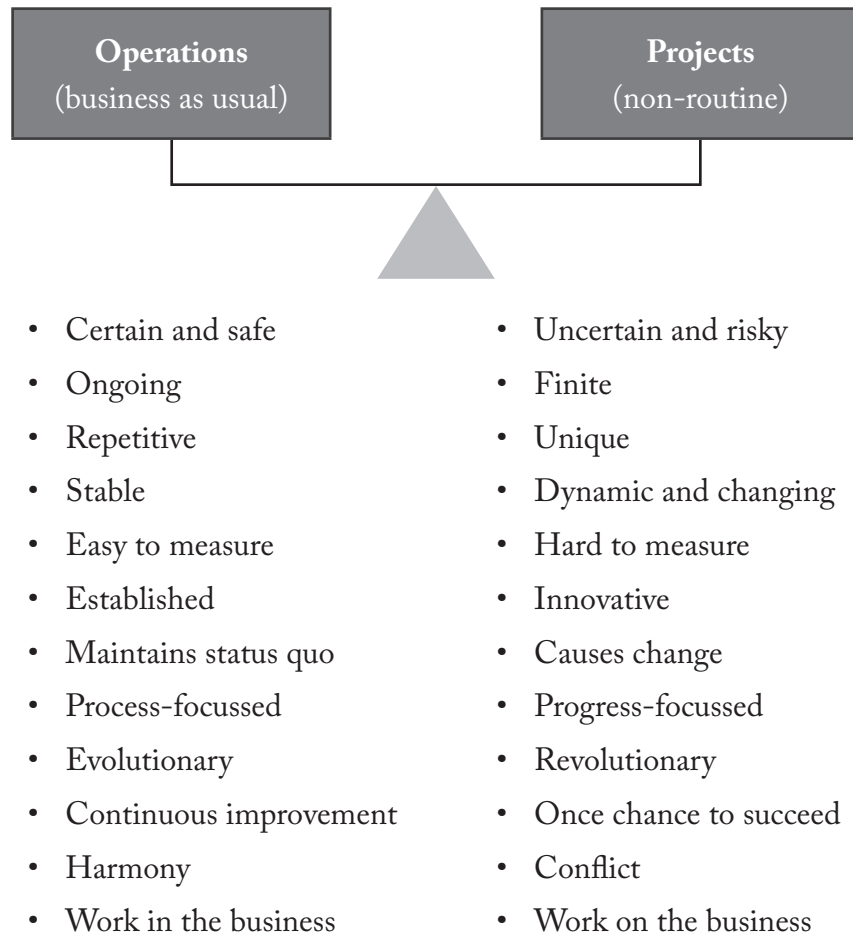
Figure 1.1 – Performance matrix



Projects are essential to the success of all organisations. There's no progress without projects, which can be risky ventures and more risky than repetitive operational activities. The distinguishing characteristics of each are summarised at Figure 1.2. Risks arise for many reasons. Some risks are internal or inherent to our project and some are external to our project, and both types of risks can considerably influence our project's success. Risk is a somewhat abstract concept and as such is a little difficult to clearly define, yet taking and managing risk is the essence of an organisation's survival and growth, particularly in a competitive environment. Risks are justified by the benefits that come as a result of taking them. Risk management might therefore be described as the process of optimising

the relationship between risk and reward. A certain amount of risk-taking is inevitable if our country, organisations and projects are to achieve worthwhile goals.

Figure 1.2 – Types of work



Project risk management is not a new concept. Official recognition of risk as a special concern of project management came in the late 1980s when the US-based Project Management Institute (PMI) first included risk management as part of its core Project Management Body of Knowledge (PMBOK). Since then a solid understanding of risk and its management has become a required item for

every project management methodology and in every project manager's toolbox. This growing importance of risk management is in part the consequence of our increasingly chaotic business environment. Also, with our current recession and political pressure for improved corporate governance, demand for better risk management is on the rise. Risk management is now recognised as an essential component of government, business and project success, since it focuses on addressing uncertainties in a proactive fashion.

The nature of project risk management continues to evolve. For some years now the project management profession has accepted that risk management is an essential, proactive and integral part of a project's entire life cycle, not simply a one-time, optional, tack-on activity. Also, it's now widely acknowledged that project risk management offers significant benefits to all organisations – established and new, large and small, public, private, and not-for-profit. Our major project management authorities, including the US-based Project Management Institute (PMI) and the UK-based PRINCE2 methodology owners, now advocate that project risk management be applied to both threats and opportunities. In adopting this inclusive definition we are consistent with the current trend in international best-practice risk management. We now use the same risk process to handle both threats and opportunities alongside each other, giving perhaps double the benefits from a single investment. Formerly, risks were regarded as only bad things – uncertain events with a negative impact on project objectives and/or benefits, and the perceived positives were simply the basis for project justification. Interestingly, other than for project management, risk is still widely regarded as wholly negative.

Perhaps no single event in recent history piqued worldwide interest in risk management more than the Y2K challenge. We recognised that when calendar dates changed after 1999, there was a danger of catastrophic computer failures. Also, in recent years phenomenal innovative software developments have particularly stimulated interest in risk management. Some of this software has helped us with risk management. For example, statistical simulation software has brought us the power of Monte Carlo risk analysis.

This book examines the origins of project risk, provides insights on why and how to manage it and prescribes a simple and structured framework for effective project risk management. The methodology supports the notion that not all risk is

bad, that in fact with risks we also encounter opportunities, although as Murphy's Law recognises, negative risk or threats seem more likely. Optimists may feel their project is exempt Murphy's Law, but experience tells us that Murphy visits every project, and while risk is a four-letter word, denial or the "she'll be right attitude" is possibly the biggest enemy to successful project management.

Managing project risk is essentially about increasing the probability and impact of positive events, and decreasing the probability and impact of negative events in our projects. Project risk management has also been described as the process of optimising the relationship between risk and reward. It's important that we aren't so risk averse that no risks are taken, because without risk there is no reward, innovation or progress. Thus, our fundamental objectives with contemporary project risk management are twofold:

- To increase the probability and impact of positive events or opportunities.
- To decrease the probability and impact of negative events or threats.

Opportunities are often the reciprocal of threats. For example, should a particular threat have a 70% probability of occurring we could reason that the risk's opportunity is then 30%. If an item of equipment has a 70% chance of late delivery, it therefore has a 30% chance of early delivery. Some refer to positive risk or upside risk as in a poker game in which some players also win money.

Risk is to projects what gravity is to the world around us. Risk is inherent in the process of managing projects. As with gravity, risk can be both beneficial and detrimental to our projects. Skateboarders use gravity to help propel themselves along. They also understand that the same gravity can cause them harm should they fall. Like skateboarders, project managers realise that risk exists, and it can have both good and bad consequences for their projects.

The 2010 Haitian 7.1 magnitude earthquake disaster killed about 230,000 people, some two million were left homeless, and many still remain destitute without shelter, healthcare or sufficient food. Apparently two years prior to this, a team of geophysicists, led by Eric Calais of Purdue University, predicted that the fault that produced this Haitian earthquake was at extremely high risk of doing exactly what it did – evidently a 50% chance within two years. They urged the Haitian government to strengthen critical buildings, including hospitals and schools. Failure to do so contributed to the toll.

Yet, sometimes it seems that people who advocate diet and exercise are kooks, and heart surgeons are heroes. For example, a fire alarm seems like a small investment compared to the possible consequences of a house fire. Yet our very professional Fire Service tells us that less than 60% of our New Zealand households have made this modest investment and of those installed, some 50% of the batteries are flat. Similarly, projects die every day, often the victims of risk neglect and malpractice.

Perhaps a percentage of the money raised for relief efforts, such as the Haiti earthquake, should be set aside to put right damage caused by future earthquakes? Of course a better answer might be to build quakeproof buildings in the first instance – a proactive approach that New Zealand attempts to follow quite conscientiously. I mention earthquakes as an example to remind us that anticipation is essential for effective risk management.

Brian Tucker, an earth scientist who leads GeoHazards International, suggested that 10 per cent of the money going to help the Haiti rebuild programme should be dedicated to mitigating the destruction in earthquakes. But he knows from many years of sounding warnings that most people are complacent about catastrophes that are yet to happen and after they happen it's too late to worry about them. Although of course the people of Haiti might prefer to eat than invest in quakeproofing their buildings. It is a very poor country.

About 403 million people live in cities that face significant seismic hazards, according to a recent study by seismologist Roger Bilham of the University of Colorado. One of those cities is Wellington, New Zealand's capital, where we're probably better prepared than most. However, in many of these vulnerable cities, people are effectively stacked on top of each other in buildings designed as if earthquakes don't happen. It's not the tremor that kills, but the buildings routinely constructed on the cheap, using faulty designs and, in some cities overseen by corrupt inspectors. The difference between life and death is often a matter of how much sand went into the cement mix or how much steel went into a supporting column. Earthquakes might be acts of God, but their lethality is often a function of masonry. Bilham tells us that in recent earthquakes, "buildings have been weapons of mass destruction."

Then seven weeks after the Haiti earthquake, an 8.8 magnitude earthquake hit Chile. This was far stronger than the one that struck Haiti – yet the destruction

and death toll in Haiti was much higher. In the Chilean earthquake some 550 people were killed and about NZ\$40 billion of damage occurred. The main reason for the relatively better outcome is simple – many Chilean homes and offices are built to ride out quakes, their steel skeletons designed to sway with seismic waves rather than resist them. In Haiti, by contrast, there was simply no building code.

However, many Chileans complained that scores of deaths could have been avoided had their government responded faster to the earthquake, which set off a roaring tsunami a few hours later that killed several who survived the quake. According to one survivor, Manuel Parra, “Those who ran up the hill survived and those that didn’t are no longer here.” In this instance risk prevention was not too bad, but the contingency plan was absent. The human and economic cost could have been a lot worse if Chile didn’t have a building code.

In contrast, here at home, on 4 September 2010, Christchurch suffered a major earthquake, of the same strength and at the same depth as the one that killed an estimated 230,000 in Haiti earlier in the year. However, although both quakes were near population centres, our local quake caused no deaths and had much less collateral impact since it occurred at night and because steps had been taken beforehand. The newer buildings in Christchurch had good quake designs, unlike Haiti where there were no quake designs. In fact, this was the first time in modern history a 7-plus quake had hit an urban centre with no deaths.

Most homes in New Zealand are generally timber-framed and will flex and absorb quake energy, and new commercial buildings are constructed with isolating foundations. Yet there have been some New Zealanders who have previously caviled at the earthquake standards now imposed on our buildings, claiming they are excessive and bureaucratic, that the standards are being set too high, and that they can force unnecessary expense, renovation and demolition, particularly in areas not known for earthquakes. Surely our recent experiences should silence these critics. Risk has been managed through building codes, resilient infrastructure, earthquake insurance and individual precautions.

On that occasion our rigorous building codes undoubtedly paid off in lives saved. Victoria University’s Professor Martha Savage has pointed to New Zealand’s building code as the key factor in the difference in outcome between the Christchurch quake and that in Haiti. It’s all too easy to become blasé about the risks of living in the Shakey Isles. We should be grateful to live in a country that can afford earthquake precautions and the repair costs.

At first we anticipated that Christchurch would be back to normal or even better within two or three years. However, there was a lot to put right. According to Tony Marryatt, Christchurch City Council Chief Executive, this included 100km of sewer pipes, 18km of water mains, 45km of roads and 161 parks that needed repair, at an estimate of more than \$500m. There was also repair work to do on buildings. But, on 22 February 2011 Christchurch suffered another, and even more, destructive quake. The central city is currently in ruins after a magnitude 6.3 quake, just five months after what now seems like the dress rehearsal or practice run. However, this latest quake has caused the carnage that Christchurch thought it had missed. The city was just learning to relax again and now it resembles a battle zone. The Government has declared a national emergency, help is here from many countries, and the death toll has climbed to 181. It might have been less on the Richter scale than the 4 September quake, but was significantly shallower and closer to the city, resulting in much worse impact.

This will now be a multibillion-dollar repair job, perhaps \$18 billion or more (about the same size as our national debt or the cost to put right our leaky homes). Our ECQ fund will be exhausted. There are already some 400,000 claims. It's an insurance nightmare. Thankfully, this is New Zealand and not Haiti, so there will be rebuilding. Although, as our PM John Key reminds us, "In the end buildings are just buildings, roads are just roads, but people are irreplaceable." Mr Key has (again) consummately combined uplift with realism. He is at his best in awful times.

In New Zealand, earthquakes are unavoidable. However, this latest event again demonstrates the value of quake-proofing to minimise damage and contingency planning. These risk management strategies are investments, not a cost.

That is the beauty of living somewhere like New Zealand – unlike Haiti or Pakistan where cities stay largely as earthquakes leave them, and where the governments cannot afford to provide electricity, let alone give aid to people whose home has suffered damage. Many such places have no power or clean water all the time. In fact, now, Haiti faces widespread cholera.

Although this book is not intended to explore earthquakes, having mentioned Christchurch's problems, on 11 March 2011 Japan suffered an extremely devastating 8.9 magnitude quake and tsunami with the possibility of some 15,000

deaths, multiple nuclear power stations meltdowns and the release of dangerous levels of radiation, to be the world's worst nuclear crisis since Chernobyl in 1986. And in New Zealand, fears have been raised that our mutton birds, which migrate through Japanese waters, will be glowing with radioactivity when they return here! Although, I notice that world media and Fukushima alarmists proclaim its a nuclear and ecological disaster much worse than Chernobyl. Seems improbable. Incidentally, their heavy reliance on nuclear energy seems ironic given their experience of being the first human targets of atomic warfare in 1945. Fortunately, New Zealand can't afford and doesn't yet need nuclear power, although thousands could die if our hydro dams burst. The main difference being that people die faster in a dam burst. However, in due course we will probably need nuclear power if we are to avoid burning fossil fuels or building more dams. The alternative being we relearn how to shoe horses and milk cows by hand, although I read that a thorium reactor from China might be a better solution.

The Japanese death toll seems likely to exceed 15,000 and coastal towns look like mangled debris. Actuaries will be reflecting on their risk assessments and are perhaps wondering if the Japanese quake was triggered by the Christchurch quake. Anyway, it was great to see that a Kiwi urban search and rescue team left for Japan immediately.

Some may argue that these examples are national-level Force Majeure situations and therefore not particularly relevant to projects. Force Majeure occurrences include earthquakes, meteorites, volcanoes, floods, civil unrest, terrorism and such like – all beyond our control as project managers. Nevertheless, these recent disasters provide a graphic illustration about the need to be prepared – the essence of risk response planning.

Project management is about managing risks in projects, which was never intended to deal with disasters for which organisations should have business continuity and disaster-recovery plans. Also, some contend, outside the scope of project risk management are everyday risks that can occur on any project, such as, "We may lose a team member during the project" or "The client may wish to change the project scope." We have standard operating procedures and project processes to address these routine matters. They do not usually need to be recorded in our risk register, although if unsure, better to record it.

At organisational level our CEO and senior managers would typically consider risk and risk management, but not so closely at project level. Ideally, they shouldn't be worrying about a project's risks, unless something comes up on the project that has such big impact that it affects business continuity. At our level, as project managers, we manage project risk. In fact, the application of project management is risk management. Programme managers manage programme risk, and CEOs and senior managers manage portfolio and strategic risk. CEOs mainly think about risks to things like profitability, reputation and market position. They are constantly looking ahead, trying to predict the unpredictable.

We each manage the risks to our assigned goals. Nevertheless, before a possible project becomes an actual project and is formally assigned a project manager, the proposition should have been subjected to some strategic risk scrutiny, otherwise it may be another Titanic on its way to disaster, while some hapless project manager is doing their best to straighten the deck chairs, as the saying goes. As you probably know, the "unsinkable" Titanic, with some 2,000 passengers and crew, and lifeboat capacity for about 1,000, struck an iceberg on its maiden voyage on the night 14 April 1912. Over 1,500 people lost their lives. It was the 9/11 of its time. While the Titanic came to grief, ironically, the 1997 film project by the same name was six months' late, massively over budget and finished with a bloated 194-minute running time, yet was an amazing commercial success and won eleven Academy Awards. A project is underway to convert the film into 3D in time for the 100th anniversary of ship's sinking. No risk – it will be another blockbuster.

Once a project is approved, the project manager then checks primarily for tactical or project risk, the management of which is the project manager's responsibility and the focus of this book. It's about looking ahead or forecasting and typically looking further ahead and spending more time doing so than anyone else on the project team.

A witty and perceptive former prime minister of New Zealand, David Lange, compared forecasting risk to driving a car forward by looking only in the rear vision mirror. It's a hazardous business, yet what has happened previously, history, is still our best predictor of the future, especially when we're thinking about what risks our project might hold. I would like to add to this metaphor by saying that we're also driving in rush-hour traffic with road-enraged, fist-shaking lunatics in

four-wheel-drives. And we have a cracked rear vision mirror and dirty windows, with a back seat full of kids who keep asking when we will we get there. This is real-world project management and the voices we hear are likely to be key project stakeholders whose expectations of spot-on-time arrival are in jeopardy.

A precise estimate to the nearest hour or dollar only raises stakeholders' expectations about the degree of accuracy possible. This can lead to perceived failure when such unrealistic exactitudes are not achieved. They may not understand that an exact estimate is an oxymoron, whereas we know that our raw estimate has about an equal chance of being too much as it has of being too little. This is reality in the uncertain world of project risk management where Murphy's Law reigns supreme.

Estimating is difficult but it needs to be done in order to assess a proposed project's acceptability and provide a baseline against which to gauge project management performance. Estimates also serve as a useful target for the project manager, although estimate accuracy generally improves as the project proceeds when previously unknown and unknowable factors become evident. Unfortunately, we can't predict the future with much accuracy and life is a chancy thing. Also, project scope changes. Such changes are due to external factors, client indecision, new technology, incorrect assumptions, poor original planning, and in compensation for changes to other parameters, such as budget cuts.

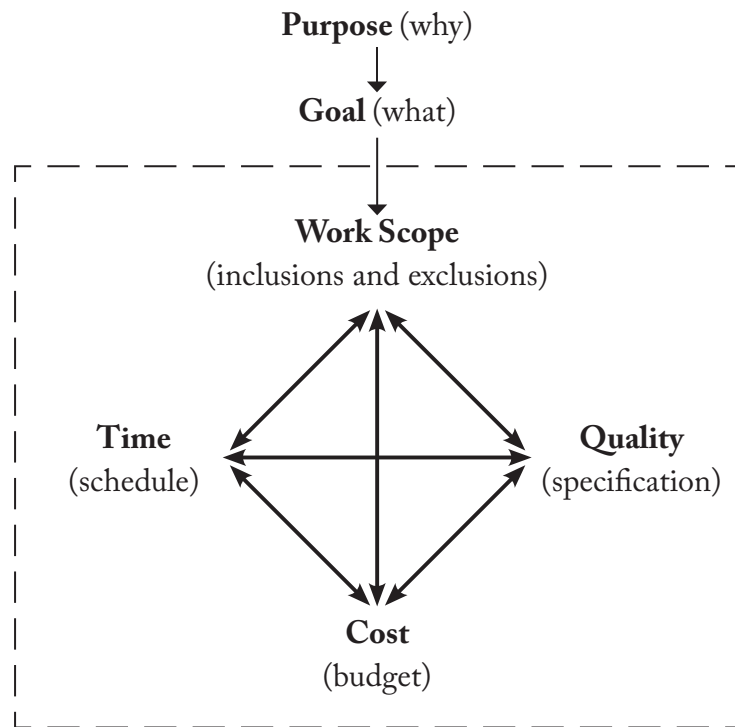
Risk is part of everything. It's a pervasive reality that arises because we live in a world of uncertainty. There's always some level of risk in our projects, regardless of what our pristine Gantt chart proudly pinned to the wall might seem to imply. Although Gantt, named after its inventor Henry Gantt, is sometimes considered to be an acronym **God Alone kNowS The Truth**. Projects, like life, possess their fair share of risk or sometimes more than their fair share. Yet, the zero-risk project, if one existed, would not be worth pursuing.

Risk is particularly prevalent in projects due to the uncertainty associated with such unique and often pioneering endeavours. Project risks arise from uncertainty, but not all uncertainty means risk. In the project management profession, uncertainty only matters if it affects us achieving our project objectives. It is this link with objectives that makes risk particularly relevant to projects. See Figure 1.3. In contrast, operational, business-as-usual, routine work generally has had all or most risk squeezed out of it as part of continuous improvement practices. Such

repetitive work usually has little uncertainty, holds few surprises, and the output is readily predictable and usually of a consistent quality. However, a project gives us just one opportunity to get it right, and given that we project managers are perishable items who are often deemed to be as good as our last project, a proactive or preventative risk management approach is preferable to a reactive approach, although effective project risk management usually requires both a fence at the top of the cliff and an ambulance at the bottom.

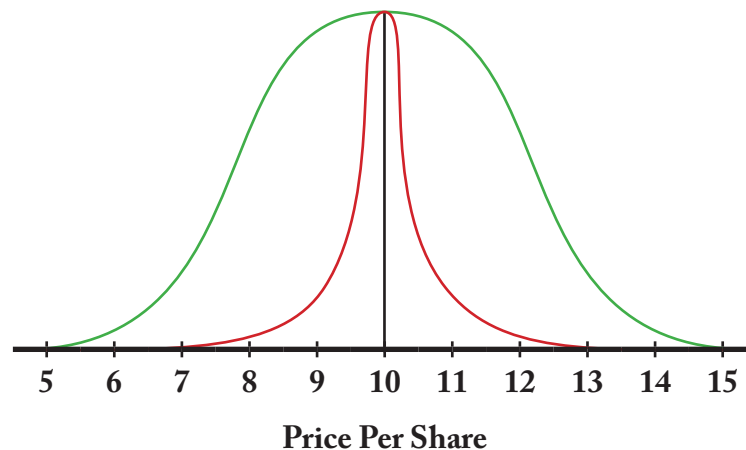
Uncertainty might be described as a measure of likely deviation from what we expect or desire. It's a measure of variability. Consider the market performance of two shares. Share X's price might average \$10 during the year, with a lowest price of \$7 and a highest price of \$13 per share. Share Y's price also averages \$10, but varies over the same period from \$5 to \$15. From an investment viewpoint X is the safer proposition. It has less variability and thus less risk than Y. These are both examples of normal or bell-shaped probability distribution curves, but one shows greater uncertainty. See Figure 1.4.

Figure 1.3 – Project objectives



If these were two projects, the average or mean duration would be the same, but the range (statistical variance or standard deviation) of expected durations is different. The value of such frequency distributions in predicting results is embedded in PERT (programme evaluation and review technique) a formula developed by the US Navy in 1957 and first employed during the Polaris Missile programme. It's a method of estimating the cost or duration of a project or project task, or material requirements that are subject to uncertainty. The PERT formula is the basis for @Risk and other risk assessment software used in project risk management, and is considered further later in this book.

Figure 1.4 – Probability distributions



To appreciate the range of risk possible in our projects, we can picture a continuum ranging from total certainty to total uncertainty. With total certainty there's no risk, since there is no variability. With total uncertainty, everything is unknown, and as a consequence risk is extremely high. All projects fall somewhere between these extremes.

Risk is a pervasive reality in project management, and projects are particularly susceptible to risk because each project is unique at least in some measure, which means that the past is an imperfect guide to the future. We are never completely sure what the future holds and it's only at the end of the project that we know for sure that we have a disaster or hopefully something much better. Up until then it's often guesstimates and assumptions, which we need to continuously review

and update as reality unfolds and as things go bump in the night. There are always plenty of risks lurking in assumptions. Also, project requirements and parameters, or the environment in which the project occurs, is never considerate enough to stand still while we plan the work and work the plan. Projects are dynamic things and any business case, project plan or budget estimate is simply a best guess and a baseline for change and improvement.

But is project risk management worth it? Some project managers skip the risk management process, perhaps because they're unsure how to do it or more likely they aren't convinced of the need for it. Also, the sponsor or other influential stakeholders may want the project to start immediately, without the project manager and team becoming preoccupied with potential problems, thus wasting time and money, and procrastinating over things that have no certainty of happening that can be dealt with when and if they arise. Yet, an important added value of effective project risk management is ultimately less cost and/or more profit, achieved by:

- The reduction or elimination of project threats, such as not employing an unsatisfactory contractor.
- The exploitation of opportunities, such as the addition of an extra product feature that disproportionately increases product sales and profits.

An appropriate and mature risk culture enhances an organisation's ability to successfully undertake innovative and complex projects. Increased predictability, openness about and control of project risks, reduces costs, stress, firefighting and overtime, which is otherwise needed to resolve unanticipated problems. Some further potential benefits of effective risk management are:

- fewer project issues
- more opportunities realised
- overly risky projects terminated early
- more realistic project estimates and plans
- more project benefits realised
- improved reputations for all involved.

The added value of project risk management will also depend on the nature of the project. The riskier the venture, the greater is likely to be the added value of risk management. A somewhat notorious New Zealand Police project (INCIS)

undertaken by IBM in the 1990s provides a useful acronym for some key constituents of high project risk.

INCIS wasn't just a new mega-project for the project team and organisation, but new for our country and possibly new for our world. If each of these risk factors is present in our project, and each factor had the potential to reduce the chances of project success to say 80%, then the compounding effect of these risks might mean that we have only a 33% likelihood of success ($0.8 \times 0.8 \times 0.8 \times 0.8 \times 0.8$).

- I** – Imprecision (unclear parameters)
- N** – Novelty (unique endeavour)
- C** – Complexity (many diverse components to coordinate)
- I** – Inexperience (lack of relevant knowledge and skills)
- S** – Size, scope or scale (big job)

These five items aren't the only risk factors in projects. In fact, size alone does not create more risk, usually just bigger ones. Novelty is most certainly a very influential factor, since risk is lowest when we revisit familiar ground. Also, complex projects often involve significant levels of uncertainty. When the business problem or opportunity is unclear, it is difficult to identify stakeholders and define business benefits, and establish project boundaries and estimates. Some other important risk factors include the organisation's level of risk management maturity, senior management support for the project, project priority, project intensity and duration, location, assumptions and the three As of project team human resource productivity – attitude, aptitude and availability.

Project duration is a risk factor insomuch as the longer the project's lifespan, the greater is the project's exposure to changes and risks, especially those arising from outside our project and also from outside our organisation. Such changes include inflation, market conditions, competitors' activities, cost increases, resource shortages, political uncertainty, earthquakes and changing weather patterns – all

or at least some of which are likely to occur concurrently.

In one form or another, we have practised project risk management for millennia, yet today, project risk management is a much greater challenge and necessity, mostly because the future is becoming less and less predictable as we suffer or benefit from unprecedented rates of change – ironically mostly due to projects, which of course upset the status quo in the name of progress. I'm reminded that several years ago when I occasionally facilitated strategic planning sessions, the planning horizon was measured in decades, while today it's hard to know where anything might be in a mere three to five years. Although, our government is obliged to look at least some ten years into the future. No doubt they need to update their predictions frequently to accommodate the change reality.

This uncertainty particularly challenges decisions about long-term projects and probably favours those projects that promise a quick return before everything changes too much, at least within our current CEO's tenure in order they might justify their sometimes obscene salaries the cynic would suggest. Interestingly, our Treasury experts have recently published a 40-year fiscal projection, although none of them are likely to still be in office by then. They too must surely recognise the increasing importance of risk management due to our rapidly changing and interconnected world and thus the difficulty of predicting or projecting the future based on history. Exponential change is the new norm, current global recession aside, evidenced by:

- Diminishing planning horizons, minimal lead-times and shortening product life cycles. We want it today even with its faults. Version 2 may later sort out these deficiencies. Has time now exceeded quality as the top project parameter? If we wait until it's perfect it may be too late for the market. But, given current rates of obsolescence, perhaps the product doesn't need to last too long!
- An increasing obsession with speed, service, sustainability, creativity and innovation, driven by new technology and customers' ever-challenging expectations and changing loyalties that require organisations to continually reinvent themselves, their products and services. There's also an amazing proliferation of products – varieties of toilet paper, toothbrushes, milk and bread come to mind.
- Burgeoning workloads, exacerbated through reduced staffing, staff changes,

flattening hierarchies, increasing global competition, and impossible timeframes that seem to have us move on before we can fully comprehend or benefit from the last change.

- New products, which are likely to be obsolete before we leave the shop. This, I noticed very recently, seems especially so with razors. They're only good for this month's razor blades. I find this frustrating rather than exhilarating. Also, with the latest shaving innovation – Gillette's Fusion ProGlide evidently designed by a former NASA scientist – hitting the market, one thing hasn't changed, they remain ridiculously expensive.
- China has leapfrogged Japan to become the second-largest economy and its 9.5 per cent growth is a sharp contrast to most developed nations. As deflation eats away at iconic Japanese firms such as Sony, upstarts like South Korea's Samsung Electronics are booming. There is no competing with China as the United States sheds jobs, Europe unravels and Japan's deflation deepens, although India is zooming along at 7.7 per cent. The Anglo-American model of capitalism seems due for a shake up.

More and more project managers are becoming successful CEOs since experienced project managers have the requisite cross-functional credibility. They know about the loneliness of command, single-point responsibility, and are accustomed to leading teams over whom they have little or no authority. To get results they must rely on who they know, which is largely about corporate politics, something every prospective CEO needs to understand. Incidentally, the culmination of those earlier strategic planning sessions was typically an impressive looking glossy that was often consigned to the bottom drawer and had little influence on project selection. Strategic planning was likened to a corporate rain dance that we insisted on doing, yet it had no influence on the weather.

However, now we better recognise that any value-adding project must have strategic alignment. The project must contribute to the realisation of our organisation's vision, mission and goals, and it must also fit with our core values, which unlike goals, aren't usually prioritised and may not give us direction so much as enable us to assess the correctness or appropriateness of our projects and how we go about them. It's practised values, not published values, that help determine the culture of our organisations, and sorry to say, not all cultures favour risk management, which is usually a reflection of senior management's attitude

and actions that we may then emulate throughout our organisations as local best practice. We will not have very effective project risk management unless our senior management “talk the talk and walk the walk”, since bottom-up change is usually much harder to achieve.

There is no progress without projects and it seems likely that they will occupy more and more of our time given world-wide increasing demand for new products and services, temporarily slowed by our current global recession, which of course has had some organisations reaching for the project axe. Yet, our Reserve Bank governor recently told us (December 2010) that the recession is over. Perhaps he needs to share this good news with our thousands of newly unemployed. I’m a consultant and that’s now proving to be a euphemism for unemployed – hence the opportunity for this book-writing project. A local economist has described the current downturn as “a fluctuation about an inexorable growth trend” prefixed of course by “everything else being equal.” One certainty is that our new television or laptop is already obsolete. Products are proliferating and their life spans are shrinking. Projects are increasingly time-driven often in our anxiety to get to market first to satisfy our impatient customers. Such speed can further exacerbate project risk particularly when it affects deliverable quality. While we don’t condone perfectionism, lack of quality may mean:

- Rework, which is about redoing the same job because the original effort was unsatisfactory. Rework in turn causes missed deadlines and an overspent budget, which then causes business value to be delayed or reduced.
- Higher on-going maintenance and support costs for the final deliverable.
- Unhappy clients from whom there will be no repeat business.
- Reduced productivity due to poor morale resulting from unhappy clients and the need to continuously repair deliverables.

Project managers are usually under pressure to deliver, but we can’t do everything ourselves, although we still have to make sure everything is done. While we await the cloning solution, some organisations could well increase their interest in project risk management and its application. Our best project managers will then be able to succeed more often, and our organisations will come out of the current economic doldrums stronger than they were before.

Meanwhile, organisations and project managers should not be afraid to take on

challenges. For those who have turned around projects through effective risk management, their futures are assured. In every sector, the ability to manage risk is a much prized skill, so project managers should be ready to capitalise on the good as well as the bad projects. Effective project managers have the courage to push back against arbitrary budgets and overly optimistic deadlines to negotiate realistic win-win parameters for their projects.

But it's not just our competitors and internal factors we need worry about. More than ever, our projects are at the mercy of external factors beyond what competition might do, and mostly beyond our immediate control. Such factors include our local and global environment with increasing emphasis on sustainability, economics, financial markets, technology that usually sets the pace, politics, legislation, climate, earthquakes, social and cultural considerations – all subject to unpredictable change. Very occasionally these external factors might conspire to make our projects more successful than they deserve to be, but that's luck, which helps, but is not a sensible basis for responsible risk management.

Most practitioners recognise that project risk management is no longer just an optional extra and that it is now an essential and integral part of the entire project management process from project conception onward. A few other recent changes to our project risk management philosophy are:

- Not all risk is bad. Yes, risk can provide opportunities as well as threats to our project. Risk is, after all, uncertainty and a mere possibility. It's a bit like indulging in the stock market. If we buy shares, we take a risk. Our shares may go up in value as well as down. Variability is a two-sided thing, since variables may go both up and down. For example, team productivity, weather, and cost could be different either way than estimated. The point is – risk can be positive or negative. However, not everyone subscribes to this relatively new definition. They argue that opportunities exist only in the respect that they offset a larger body of potential negatives and a term such as positive risk or upside risk is simply an oxymoron reminiscent of George Orwell's 1984 politically correct redefinitions. However, this author accepts that risk is "uncertainty that matters" and is the consequence of exposure to uncertainty, which surely covers the possibilities of both negative variances (threats) and positive variances (opportunities). That is, risk is something that could happen, and if it does happen, may have a positive or negative impact

on our project. Could happen means a probability of less than 100%. If it has a probability of 100% it's a fact – a definite issue. But a risk must also have a probability above 0%. Including opportunity in the definition of risk is a natural consequence of recognising that projects are affected by uncertainty, some of which might be helpful.

- Ultimately, project success is about adding value by realising business case benefits – those that justified our project investment. Thus, we must not only address the impact of risk on our project's objectives, but also apply risk management to our anticipated project benefits, which often possess more uncertainty than do project scope, cost, time and quality parameters. Developing and maintaining the project business case is usually the project sponsor's responsibility. Project managers concern themselves with risks to project management success. We generally let the sponsor worry about the viability of the project deliverable as argued in the business case. The sponsor's responsibility intrudes into the project product life cycle, whereas our formal responsibility as project managers is usually confined to the project life cycle. Once the final deliverable is produced our attention is usually focused on our next project or on our other projects.
- Project risk management starts early. Coupled with the above point, we're generally proficient at dealing with risk after project approval and at least up until project implementation, but risk analysis also needs to be considered as part of the project selection process. An effective risk analysis at an early point can quickly weed out potential duds and help us avoid wrong projects. After all, it doesn't matter how efficiently we as project managers execute the wrong project, if it's still the wrong project. Again, project selection is not usually the project manager's decision.

Just a few more words about the project business case. It is the objective rationale for the project that considers both anticipated project benefits and costs, which might be immediate and longer term, direct (primary) and indirect (secondary), qualitative (hard to dollarise) and quantitative (easy to dollarise), and each with different risks and likelihoods of occurring – assured, probable, possible or unlikely. It's the project sponsor's job to undertake or arrange with a business analyst for this assessment. The sponsor owns the business case and is ultimately responsible for ensuring that project benefits are realised. The sponsor's interest in the project

must therefore extend into the operational life of the deliverable. Sometimes the prospective project manager is required to prepare the business case or assist with its preparation.

Developing a business case is not necessarily an easy job (particularly for longer-term projects) and is based on assumptions and predications that may be inaccurate. Also, a business case should be an ongoing assessment, reviewed and updated periodically throughout the life of the project. Changing circumstances might mean that the project is now not needed, is unlikely to achieve its purpose or add value, or has a negative profitability index (revenue/costs) and should be stopped and resources used elsewhere. This usually is a difficult admission for project sponsors and other advocates, but unless future benefits continue to exceed future costs (regardless of sunk costs) it's time to quit.

A sensible place to start this book is to define risk – but this is not so easy. To most of us risk seems like something bad, and my daughter's school dictionary confirms this notion, describing risk as "The possibility of incurring misfortune or loss." But, as I mentioned earlier, in recent years there's been a paradigm shift in the project risk management thinking. The somewhat conservative Project Management Institute (PMI), currently our foremost professional body in project management matters, now describes project risk as, "An uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives." We should be happy enough to go along with this definition, even if at first glance positive risk seems to be a peculiar expression, since to do otherwise might mean we get preoccupied with the bad things to the possible detriment of stakeholders' morale and motivation, and more importantly we might then miss out identifying and exploiting opportunities – the good things. We might say it's about getting the risk out of opportunities and exploiting the opportunities in risk.

To illustrate – say company A announces that it is most likely to launch its new project in a few weeks. It's rival, company B, is also undertaking a project to produce a similar product, and realises that every day they launch earlier than company A, the bigger will be their initial market share and profit. However, they also realise that every day they launch later than company A, the smaller will be their market share and profit. Thus, a positive outcome of this risk is that

if fear of late release causes company B to accelerate their schedule and complete their project even one week earlier than does company A, then risk management should provide a positive outcome for company B.

We must not conceal threats to our project's success just to keep project people temporarily happy, persuade contractors to sign up, or to protect the viability of our pet project. That sort of behaviour is crazy. Yet on the other hand, we don't want to be non-stop merchants of doom and gloom, and "white ant" our own projects. Sometimes risks become self-fulfilling prophecies and overstating risk might see our project idea or request dismissed before its feasibility is ever objectively assessed, or it might be that disproportionate amounts of resource are devoted unnecessarily to managing over-estimated risk.

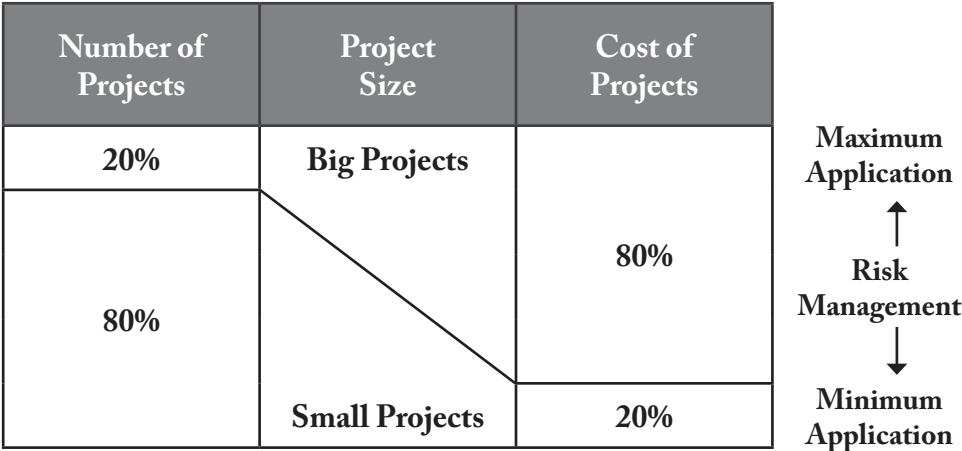
It's sometimes argued that risk finding encourages a negative and overly cautious attitude. Also, Parkinson's Law states that work expands to fit the time available. Relating this to projects, if we add extra time or money to counter or exploit risk, then naturally some project managers will fill out the extra time and spend the extra money regardless of risk. Conversely, neglecting risk management and having no contingency are common causes of project failure. It's a matter of balance.

We also need to recognise that the amount of time and effort we devote to risk management is largely a function of our project's scale, cost, duration, novelty, complexity and consequences should it fail. See Figure 1.5. These are principal factors that influence project risk. To which we might add inert sponsors and La La Land project parameters. Our organisations can minimise time and effort by applying risk management right from the start using a project selection process that quickly eliminates project propositions that are too risky, before there's any significant investment at stake. Also, one of our first actions as a project manager is to establish a risk register in which all stakeholders can document risks to the project. Project risk management, as with safety and quality, is everyone's concern and it starts as soon as possible and continues for the duration of the project life cycle.

A solid understanding of the risk management discipline and its application is most definitely a required competency for modern project managers. No seat-of-the-pants, ad hoc, shoot-from-the-hip, wait-until-it-happens approaches

should be tolerated. In essence, project management itself is risk management, and in some way all of our project management processes, tools and techniques help minimise uncertainty and enhance the likelihood of project success. In fact, a validated project management methodology is an essential prerequisite for effective project management. An effective methodology ensures that everything that needs to be done is done and in an appropriate sequence. However, many organisations approve more projects than they can deliver. Such organisations need to leave more projects behind at the beginning and fewer behind at the end. To remove the backlog we need to more conscientiously decline bad ideas, decline projects that can't be started soon, and decline projects that lack sufficient resources.

Figure 1.5 – Risk management application



Unfortunately, increasing uncertainty is the new norm. Worldwide credit woes, global recession and climate change all look like being with us for the foreseeable future. Yet somehow we adapt and projects forge ahead. We're gradually becoming more comfortable with the uncomfortable. We can't wait for the world to right itself, so we're adopting new models for project management that will make our projects more efficient, agile and flexible, better able to survive the present, and better positioned to thrive when and if, normalcy returns. All such new models recognise the great significance of risk and the vital need for its proper

management.

Agile (Scrum, Lean, Custom, Hybrid etc) software development projects welcome changing requirements, even late in development. Agile methodologies are ideally suited to those very uncertain projects where there are rapid changing or highly emergent requirements. Good ideas are welcomed at any point. There are no premature design freezes.

With Scrum for example, project progress is via a series of iterations called sprints where value is added progressively. Simplicity is emphasised, and at regular intervals, the team reflects on progress and identifies how to become more effective, although scope creep can sometimes proliferate and estimates may escalate. Then again some would maintain that Agile methodologies were developed to allow IT projects to indulge in scope gallop without guilt. Research suggests that software projects fail for a variety of reasons, but often they fail just because:

- Work took longer than expected.
- Requirements keep changing in an uncontrolled fashion.
- Things came up that nobody expected.

Often these causes would be valid, but I suspect that sometimes they are excuses to cover up an absence of basic planning and forethought. Perhaps Agile methodologies have become more popular because they compensate for the lack of foresight and longer-term planning that seems to be characteristic of many larger IT projects. The cynic would tell us that Agile is the answer for those IT projects, which they describe as, “Endeavours initiated by people who can’t describe what they want, constructed by people who can’t describe what they do, and delivered to people who can’t understand what was built or how to use it.”

Nevertheless, the incremental approach seems appropriate for high-tech pioneering projects in our rapidly changing project environment. The key characteristic being smaller steps, all of which we plan on a just-in-time basis, somewhat similar to PRINCE2 stages, rather than the more conservative model whereby we might attempt to prepare the plan for the entire project before any implementation. This latter approach usually means that the plan needs constant revision as we proceed, mostly due to future uncertainties, the more of which appear the further out we attempt to plan. The expressions sometimes applied to this iterative approach are progressive elaboration or the rolling wave strategy

whereby we define something broadly to start with and then in more and more detail as we proceed with the project.

Agile methods might best be described as focusing on adapting quickly to change, attempting to minimise risk by developing software in short time-boxes, and only building what we need, when we need it. Each iteration or sprint is a short project of its own, which means we don't have to invest a lot before we discover we have the wrong project or approach. In fact, while we would like some early successes to help ensure stakeholder buy-in, where practicable, it might be more sensible to tackle the most risky stuff first before there has been significant financial investment. Conventional models seem to believe that everything will stand still while we undertake our project, and we can work out everything we want to do before we start. But we then discover by the time we have started, requirements and other things have changed, and yet we might sometimes go ahead with the original plan anyway to the eventual dissatisfaction of all stakeholders.

Using Agile methods, each iteration is a miniature project of its own, and includes all the tasks necessary to release an increment of new functionality – planning, requirements analysis, design, coding, testing, or documentation. Thus, the argument goes, instead of finding out we have backed the wrong horse at the end of the race, Agile allows us to pull out or change horses early on to get a better result.

In an Agile risk-driven approach, the project team performs risk management activities before starting development work within an iteration. Agile risk management practices must address two issues:

- They must successfully integrate risk management activities into the iterative planning activities.
- They must adapt risk management practices so that the entire team can perform them quickly.

Typically Agile project risks include product managers' lack experience in creating user stories, product managers located remotely, team members not assigned full time, providing functionality competes with delivering high quality, software production unstable, etc.

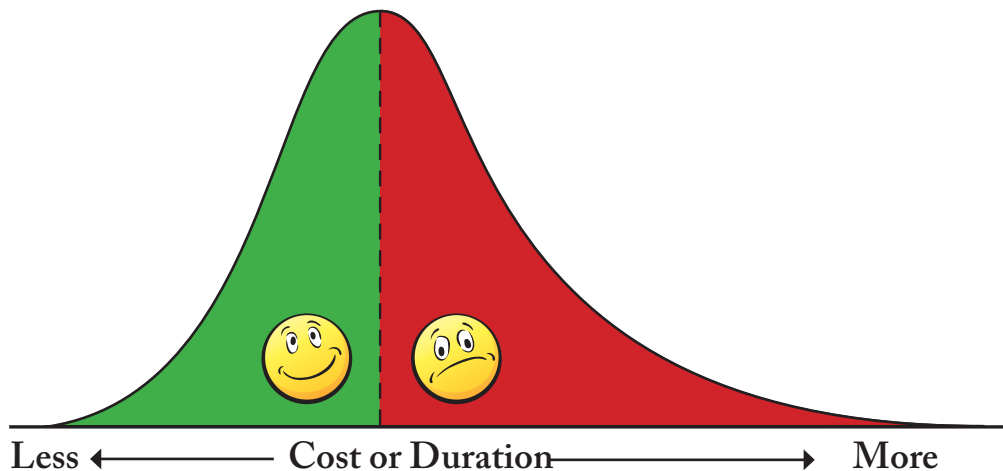
Also, we can apply Agile principles within a waterfall project setting. Clients

prefer a fixed or approximated budget up front. Deliverable groups can be set in a timebox to provide workable functionality for the client.

While there is a difference between Agile methods and traditional waterfall methods, this difference isn't so much as we might think. The traditional method results in a longer plan, but that plan is broken into smaller chunks and interim deliverables, not too unlike Agile sprints. With Agile, the argument goes, we manage risk as we undertake the sprints on a regular and short term basis. In practice there can be lots of backlogs piling up for the next sprint and causing the same level of uncertainty/risk that occurs in traditional waterfall project management.

Uncertainty means risk. Uncertainty also means that our estimates, on which our project selection decisions are largely based, are statistical probabilities, and variance, the difference between planned and actual, is inevitable, but hopefully within acceptable and predetermined limits of tolerance. In fact, risk is a measure of the extent to which a given result might deviate from what is expected or desired. Such deviation could be for better or worse, but generally for worse, since there is usually more that can accidentally go wrong with our projects than can go accidentally right, which is the essence of Murphy's Law, shown in the skewed frequency distribution at Figure 1.6.

Figure 1.6 – Uncertainty distribution



Similarly, it's been my experience that risk events are more likely to compound to cause a disaster than they are to compensate or negate each other. So if we expect random risk events to distribute themselves more or less evenly between good and bad luck, and impact each other for the betterment of our project, we're in for a sad surprise. It's possibly a manifestation of the Chaos Theory or the NIWA escape clause. The theory concerns the unpredictable interaction of events and NIWA are New Zealand's highly paid weather forecasters. In fact, our scientists have recently confessed that they cannot now keep up with extreme weather events linked to climate change. NIWA's attempts at three months-plus forecasting are no more exact than horse-racing tips. Forecasters blame their errors on La Nina of course.

Edward Murphy was an officer at Edwards Air Force Base, California, who in 1949 proclaimed that if a certain electrician was involved in the project, "Whatever can go wrong will." The story being that this electrician was inclined to wrong-wire equipment to cause fires, accidents and other problems. We have all experienced Murphy's Law. Has it ever started raining immediately after you washed the car? Also, we know if we don't have our driver licence with us that we have increased ten-fold the chances of being asked to produce it when for the first time in a decade we are stopped by the cops in a random roadside check. Well, as we know, projects are full of such happenings. There are several corollaries to Murphy's or Sod's Law that also seem very relevant to projects, and in particular:

- *Nothing is as easy as it looks.*
- *Everything takes longer.*
- *When we set out to do something, something else must be done first.*
- *Every solution breeds new problems.*
- *It's impossible to foolproof anything because fools are so ingenious.*
- *Nature always sides with the hidden flaw.*
- *Everything goes wrong at once.*
- *Parts that cannot be wrongly assembled will be.*
- *Variables won't and constants aren't.*

Given today's circumstances, Murphy might be regarded as an optimist (Murphy's wife's law!). There are of course several more such laws applicable to project

management. For example, Parkinson's Law also seems relevant – "Work expands to fill the time available." In our efforts to mitigate Murphy's Law by adding contingency time we might then invoke Parkinson's Law and unnecessarily prolong our project, or if we add more resources to complete the project on time, we might suffer Brooks' Law, which tells us that adding extra people to overcome schedule slippage will simply further slow down our project.

While Brooks was referring to knowledge workers and software development projects, I think his law has wider applicability. Interestingly, this slowing down, I've noticed, is often due to an excess or lack of items whose names all start with C – conflict, communication, coaching, congestion, cooperation, collaboration, coordination and control – the threat of which necessitates more management. Overheads then increase. We can see that project management isn't for the faint-hearted. They might be better to stay with business-as-usual where there's usually greater certainty and possibly greater promise of immediate job security.

So, why be a project manager with risk lurking behind every corner ready to devastate our creations? The answer is that the rewards are worth it, not only for our organisations and product users, but also for us project managers and team members who usually feel a great sense of accomplishment when a new product is deployed and we see people benefiting from its use often for years to come. Unlike the project itself, which has a finite life or should have, the deliverable that remains after project completion, is often a permanent or semi-permanent monument to our good risk management practices.

Our project leadership role is mainly one of risk management, whereby we preempt and remove obstacles to our project and team members' success, be they employees, contractors, consultants or suppliers, whenever they might join the team. We certainly don't hide risk, even from contractors. By enabling their success we help ensure project success and thus our own success.

There are no rewards without risk. Just ask our All Blacks, Lotto winners, Stephen Tindall, Michael Hill, Sam Morgan, John Key, Peter Jackson, Bob Jones, or any one of our many Kiwi achievers. A healthy regard for risk needs to be nurtured. Yet, some of our fine heroic and macho senior managers and inert project sponsors, readers of this book excused of course, can be complicit in keeping project disasters

going. Instead of commending those project managers who suggest terminating overly risky projects, at best they view these project managers as inept and at worst they replace them. I call these doomed endeavours “dead projects walking.” We know exactly where they’re going, but reputations, sunk costs, lack of courage and political considerations often dictate that these projects continue and thereby drain our resource pool and so deny more deserving project opportunities the chance of daylight. There can also be an adverse impact on business-as-usual if our organisation’s limited and shared resources are allocated to inappropriate projects. If we have such a sponsor, we can be assured that disaster has not left to chance!

While we would like to pull the plug early on overly risky projects, it’s sometimes only later in their life cycle that intolerable risk is identified. Nevertheless, if the project can’t or shouldn’t proceed or be satisfactorily recovered, it’s time to admit failure, cut our losses, and to re-assign those scarce resources. At least with growing attention hopefully now given by our project sponsors to post-project benefit tracking, it seems more likely that future business cases will be grounded in some greater reality and enable us to cull out overly risky project propositions before they are assigned to some unfortunate project manager. One warning sign of pending frustration and futility is when business cases for different projects identify identical benefits.

The benefits of project risk management apply to all organisations, whether big or small, old or new, public or private. The benefits should be of particular relevance to senior managers who sanction projects, to clients (owners) and customers (users) who will more likely get what they want, when they want it, and for a cost they can afford, and to we project managers who want to bring our projects in within budget, on time, and to the required level of performance.

The cost of project risk management will vary with each project, but some 5-10 percent of the project’s total cost is the suggested investment according to the Association for Project Management (APM). PRINCE2 suggests that 1-3 percent of the project budget might be spent on risk management prior to project execution, and 2-5 percent spent on risk control following implementation, which in total is 3-8 percent. Even accepting that PRINCE2 is primarily for government use, who are inclined to be risk-averse, these PRINCE2 percentages seem to be quite high for all except very risky projects.

No other project management authorities seem willing to commit to a figure or range, presumably because there are so many factors that influence a project's riskiness. We recognise that different organisations have, and need to have, different levels of risk tolerance. For example, a risk-averse organisation may not last long in a highly competitive environment, whereas risk-taking may not be appreciated in the more cautious government environment.

The benefits of risk management are mostly achieved as risk is addressed in our initial feasibility study, when the client (owner) and sponsor sanction the project, during tendering and post-tendering, at intervals during project execution, especially when changes are contemplated or occur, and during the early life of the new product as risk management continues into the operational phase when most benefits are realised. Importantly, risk management must continue beyond the start of project implementation where for many projects it prematurely stops.

There are good reasons to employ project risk management. If it is applied systematically and consistently across our organisation and its application undergoes continual improvement, then some of the resultant benefits are likely to be:

- Increased understanding of the project, which in turn leads to the formulation of more realistic project plans, particularly in terms of their cost and time estimates.
- Increased understanding of the risks in the project and their possible impact, which can lead to the minimisation of risks for a party, or the allocation of risks to the party best able to handle them.
- An independent view of project risks, which can help justify decisions and enable more efficient and effective management of the risks.
- Knowledge about the risks in the project, which allows assessment of contingencies that reflect the risk, and also discourages the acceptance of unsound projects.
- Contribution to the build-up of statistical information of historical risks that will assist in better management of future projects.
- Facilitation of greater and more rational risk-taking, thus increasing the benefits that can be gained from sensible risk-taking.

- Assistance in the distinction between good luck and good management, and bad luck and bad management.
- Better project selection decisions, which increase the value of our organisation's project portfolio, while eliminating projects with unacceptable levels of risk.
- Provides project team members and other stakeholders a forum for expressing concerns and opportunities, and for challenging or defending assumptions, all of which harbour risk.
- Understanding of how project risks can lead to the use of more suitable types of contracts, which might range from the firm-fixed-price variety to reimbursement agreements, in order to properly assign risk.
- Risk assessment, or allowing for uncertainty in estimates, helps us set and justify contingency levels with a preferred level of risk, which enable us to establish realistic estimates of time and cost.
- Improve product and service delivery, provide greater competitive advantage, ensure less firefighting and rework, and fewer unwelcome surprises. This focuses our attention on doing things properly the first time, which means more efficient use of our resources, and helps ensure that our projects cost less and take less time. As a consequence our morale, motivation, job satisfaction and even job security improve.
- Minimise management by crisis. When a significant risk event occurs, there is always a reactive response to it if the risk was not anticipated. Such reactions can be very disruptive, since time spent dealing with crises means less time available for normal management activities and prevention planning.
- Minimise surprises and problems. Identifying and planning for risks is the best way to avoid being surprised.
- Gain competitive advantage. Any well developed, documented, and implemented risk management process reduces the project schedule and cost impacts of risk events, thus improving the organisation's reputation and competitive advantage in the marketplace.
- Decreases project variances. One major problem in project management is maintaining project progress within often very tight variances from the baseline plan. Risk management is one of the principal ways of minimising these variances. If the risk is expected and an appropriate response is

implemented in a timely manner, then the project's planned track is more likely to be maintained.

- Increases the probability of success and exploitation of opportunities. Keeping the project to its planned schedule and budget enhances the probability that the project can be completed successfully.
- Increases profitability. Poor risk planning invariably leads to rework, scheduling problems and cost overruns, whereas good risk planning eliminates many such problems and often contributes directly to the bottom line, and to the improved morale and motivation of those involved.
- Contributes to project success, which is the realisation of business case benefits, recognises uncertainty and provides realistic forecasts of possible outcomes, and produces better business outcomes through more informed and realistic decision-making.
- Positively influences creative thinking and innovation. Offers better control, less overhead, less time wasting, and greater focus on benefits. Helps management to understand what is happening with the project and the challenges the project needs to overcome.
- A frequently overlooked aspect of project management, effective risk management can often result in significant improvements to the ultimate success of our projects. Risk management can also have a positive impact on selecting projects, determining the scope of projects, and developing realistic schedules and cost estimates. It helps project stakeholders understand the nature of the project, involves team members in defining strengths and weaknesses, and helps to better integrate the other project management knowledge areas (PMBOK) and processes.
- Having a sound project risk management methodology in place can only help in our bidding for work, which also helps our contractors and sub-contractors become more successful too.

We can describe project risk management as the art and science of identifying, analysing, and responding to risk throughout the life of the project and this is undertaken in the best interests of meeting project objectives.

As mentioned earlier, good project risk management often goes unnoticed, unlike

crisis management. With crisis management, there is an obvious danger to the success of the project. The crisis, in turn, receives the intense interest of the entire project team and other stakeholders. Resolving a crisis has much greater visibility (sometimes accompanied by more significant rewards) than the attention we get from successful risk management.

An example of this practice was the Chilean gold mine collapse in 2010, described by several of the miners involved as an accident waiting to happen. Evidently, little forethought was given to accident prevention or contingency preparations. When the dust settled some hours after the cave in, the miners began to climb the emergency escape ladder in a ventilation shaft that should have lead them safely to the surface. But they only got a third of the way. The frugal mine owners had never bothered to finish the ladder to the top. Nevertheless, their rescue was a very effective project. Those rescued and their rescuers were proclaimed national heroes, with fame and publication royalties assured. The mine owners are out of business and probably somewhat wiser about the value of risk prevention. In contrast our local Pike River mining accident was fatal for all 29 miners for which a Royal Commission of Inquiry is to get underway on the 11 July 2011 – the same day that this book goes to the printers if all goes according to schedule for these projects. If feasible, the recovery of these 29 bodies will be a particularly risky project. The disaster is reminiscent of the 1967 Strongman Mine explosion that killed 19 men.

Of course project management was never intended to deal with disasters, which are more appropriately managed through business continuity and disaster-recovery plans. These are outside the scope of project risk management.

In contrast, when risk management is effective, it results in fewer problems, and for the few problems that do occur, it enables their more expeditious resolution. It may therefore be difficult for outside observers to tell whether risk management or luck was responsible for the smooth development of a new product, but project teams will always know that their projects worked out better because of good risk management.

An excellent example of a recent large and very high profile project where risk was superbly managed was the royal wedding of Prince William and Catherine

Middleton. It would be fascinating to see the risk management plan that no doubt addressed risks such as inclement weather, traffic congestion, strike action, crowd control, and perhaps some less obvious risks such as cold feet (either bride or groom), bachelor/bachelorette night excesses, fashion faux pas, football hooligans and other terrorists disrupting the wedding, wedding guests upstaging the wedding party, etc, etc. There were some issues such as Samantha Cameron forgot her hat, Princess Eugenie's unflattering frock, and her sister's Wagnerian antler hat, but otherwise an incident-free occasion and example of effective project risk management.

Critical factors, several of them being of the soft variety, not listed in any particular order, which if present, help ensure individual and organisational project risk management success, are:

- Shared understanding of the principles of risk management and the language involved.
- A simple and scalable project management and risk management process.
- Proven user-friendly tools and techniques to implement all elements of the risk management process.
- Timely contribution from experienced, trained and skilled staff.
- Clear project risk management objectives.
- Sufficient resources to implement the process, especially risk responses.
- Buy-in from all who have a stake in the process and the project.
- A risk-aware organisational culture that recognises the existence of uncertainty in projects and is determined to address it proactively.

Risk management should be part of our organisation's culture. It should also create value not just cost, be tailored to the unique needs of our projects and organisation, be dynamic and responsive to environmental change, and be continually improved. We recognise that risk management is an "add in" rather than an "add on" to our project management methodology. Also, risk management is applied to all projects – those with a range of durations from days to years and budgets ranging from a few hundred dollars to millions of dollars.

Today's business environment is fast-paced, competitive and uncertain. Products

are proliferating and their life cycles are shortening. These characteristics emphasise the need for quick decision-making, yet often with incomplete information, which may mean frequent changes in project requirements. In these circumstances project teams need to be agile and particularly risk aware.

Over recent years our approach to risk management has much improved. There is that famous photograph taken in 1932 of New York construction workers lunching on a skyscraper crossbeam hundreds of feet above street level. They have no safety boots, hard hats, or harnesses, and are seemingly oblivious to risk. Attitudes towards risk have certainly changed for the better. Imagine today if people recreated that skyscraper scene. The police would be called to talk the people down and their employer would be spending considerable time in court if not jail.

In summary, why do we manage project risk? We do so to avoid rework, improve the chances of project success, lower project costs, improve the project's priority, avoid chaos and firefighting, have fewer surprises, improve communications, reduce time needed, and avoid missing out work. If we don't get to grips with project risk management, our projects will quickly go pear-shaped. And to avoid projects in order to avoid risks, simply means missing out on opportunities. The answer is to manage the risk.

Good project risk management within our organisation is likely to have the following characteristics:

- Project risk management activities commence at the initiation of the project when risk management plans are developed, and then risk management continues throughout the entire project life cycle.
- Project risk management is not a discrete stand-alone process, but is closely integrated with all other project management functions. All project decisions will take risk into account.
- Implementation of project risk management is the responsibility of all project stakeholders, particularly project team members, and they participate actively in the process.

All projects face risk. This risk can be mitigated to some degree by taking the time to develop a project risk management process to help ensure threats have a

limited effect on our project, while maximising opportunities. A skilled project manager understands the potential effects that risks can have on their projects, and manages them accordingly. Yet, sometimes, even if management is receptive, we may have reasons for not addressing risk. For example, we are usually in competition with other projects for resources. In order to get these resources we need to complete our project – and thus keep our job – which means we cannot afford to admit potential problems. So we reason, like a wounded animal in the jungle, if we show our weakness, we are as good as dead. Yet, if our project is not competing for resources, we might ignore risk.

In the final analysis, most postmortems of project disasters conclude that their problems would have been avoided or much reduced if there had been an explicit early concern about identifying and resolving their risk. Frequently, these projects were swept along by a tide of unfounded optimistic, often by their enthusiastic sponsors particularly during the early phases of the project.

Experience has shown that risk management must be of critical concern to project managers since unmanaged or unmitigated risks are one of the primary causes of project failure, aside from simply foolish projects. If we anticipate problems and plan appropriate responses, we will not suffer those problems or be overly disrupted should those problems occur. If the unexpected then also happens, we will also be able to attend to this. Having mentioned that we must not be so pessimistic we cannot make progress, remember there is a balance between blithe optimism and morbid pessimism.

The purpose of this introductory chapter has been to set the scene, hopefully persuade you of the importance of project risk management, although you're probably already a believer, and provide you with some arguments in its support. And also whet your appetite for an explanation of the project risk management process, starting with discussion about risk management terminology and principles for effective project risk management.

Language and Principles

It can be frustrating, but every discipline has its peculiar terminology. However, there's no total agreement about project risk management terminology, evidenced by the different definitions given in the PMBOK, and with PRINCE2 and Agile methodologies. Nevertheless, the more common project risk management terms are defined at:

www.projectnet.co.uk/gloss/

www.pmforum.org/library/glossary/PMG_A00.htm

Also, a glossary of common project risk management terminology, mostly as advocated by PMI, is at the rear of this workbook – Appendix 2. Have a read through it when you get the chance, although there is no need to memorise these terms, but there are a few we should now consider.

But first a warning – we need to be careful when communicating particularly with our clients and external stakeholders (people or groups outside our organisation who have a stake or interest in our project), some of whom could find our use of specialised risk management terminology patronising or even alienating. It's seen as linguistic tribalism. Such language can be annoying and even intimidating if you're not in the tribe. The use of such language might also cement unfortunate stereotypes. Project managers are sometimes cited as serial offenders. While our project management colleagues may appreciate and even be impressed with our command of the jargon, gobbledegook and acronyms of our profession, some of our clients are not.

It's not surprising that misunderstandings and confusion among stakeholders can easily arise. In fact, stakeholders might not even be aware that they are called stakeholders. Because one of the keys to project success is managing stakeholders' expectations, terminology can be a major risk. We must be sure the recipient fully understands what information we are conveying, including all the message's nuances.

Too often risk practitioners use their own jargon and fail to communicate their message clearly. Risk specialists need to express their findings and advice in language that will be understood by those who need to hear it. This means not talking about risk registers, Monte Carlo simulation or probability-impact grids. Instead they must present risk results in terms of what matters to the people who receive the information. Senior management are interested in strategy, business value, and competitive advantage. Technical experts are more concerned with functionality and performance. Risk communication should not be an afterthought but should receive careful attention and planning. Poor communication is a top risk to successful project management.

What is a project?

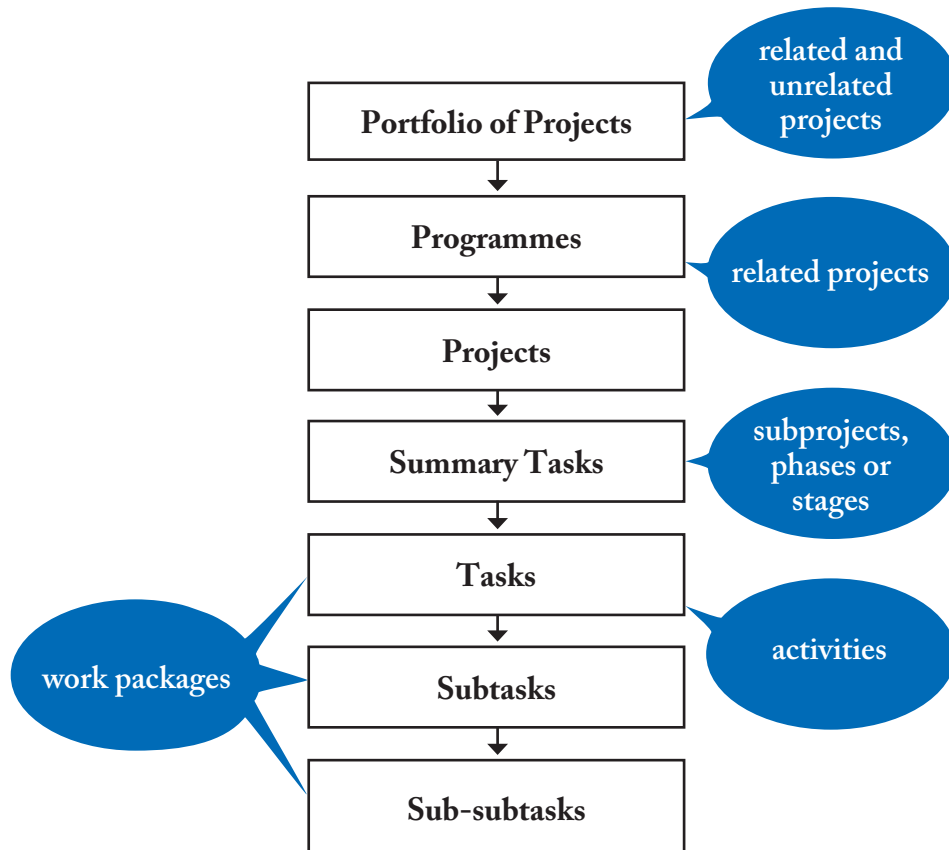
PMI describes a project as “a temporary endeavour undertaken to create a unique product, service, or result.” I like this definition because it reminds us that projects have or should have a completion date, although some projects take on a never-ending characteristic. Of course temporary doesn't necessarily mean short duration. The life span of some projects is measured in days or weeks, but others take months or years to complete. For example, the search and destroy project for bin Laden has taken some years to complete. Yet the deliverable or output (whatever product, service or result remains at project completion) could be permanent or semi-permanent. Also, unique is an appropriate word insofar as no two projects are precisely the same.

It is in large part this uniqueness that creates uncertainty and therefore risk, particularly for pioneering endeavours. On the other hand, operational work is repetitive and as such has had pretty much all its uncertainty squeezed out through continuous or continual improvement practices. For a project there is only some measure of real certainty at completion, although even then the

deliverable may not have a very certain life as predicted in the business case that justified the investment. Yes, it's always been difficult to predict the future, in fact more difficult today than ever before given our accelerating rates of change in every field, especially with technology. All we can be assured of is that our new technological purchase may be redundant before we walk out of the shop. In fact IT projects in particular are notoriously risky ventures, evidenced by the number that exceed their budgets and timeframes, let alone meet specified performance characteristics and stakeholders' expectations. In these circumstances it's little wonder that IT project managers might favour more flexible project management Agile methodologies such as Scrum whereby projects are completed in very short bursts before too much changes.

Project management

Figure 2.1 – Hierarchy of project work



While a project is an endeavour, project management is a process. The PMBOK describes project management as “the application of knowledge, skills, tools and techniques to project activities to meet the project requirements.” While definitions abound, I think project management is essentially about the leadership, planning, and control required to produce the project deliverable(s) within the parameters (objectives or constraints) of scope, cost, time, quality, and to the satisfaction of key stakeholders (clients and customers in particular), and it is in terms of these basic criteria that we might best assess the consequences of risk. The typical hierarchy of project work is shown at Figure 2.1. Summary task is an expression peculiar to MS Project – the world’s most popular project scheduling package.

Programme

In the hierarchy of project work, a programme is a collection of related projects managed in a controlled, balanced effort to realise benefits not available by managing each project independently. Essentially, programmes are composed of projects that work in tandem to create a consolidated deliverable that aligns with the strategic vision of the organisation, and programme management should centre mainly on three key themes:

- Benefits management.
- Stakeholder management.
- Programme governance.

The advantages of creating a programme can be considerable, and it is threats to the following potential benefits that should be of prime concern to the programme manager:

- Cooperative sharing of human and material resources, finance, tools, facilities and information across all projects in the programme, thus eliminating wasteful inter-project competition.
- Collective negotiation, shared procurement, and supplier management to achieve economies of scale and elimination of waste.
- Standardisation of risk management methodology (principles, processes, templates and terminology) across all projects in the programme and a common approach to project and stakeholder management.

- Scheduling of projects within the programme to make best use of resource availability and coordination of interdependent project activities, where for example, two or more project teams are to work on the one deliverable.

The programme manager is responsible for any risk that can affect the success of the programme deliverable(s) up to and including the programme business risk. Also, the programme manager is responsible for risks affecting the interdependencies between the projects that may compromise or enhance the programme. So the programme manager, in conjunction with the project managers, is responsible for identifying pertinent programme level risks that span across the related projects. Unfortunately, sometimes within a given programme there might be several risk lists – all uncoordinated. This problem highlights the need for enterprise risk management where there is a more obvious link between risks and our organisation's key performance measures, and where we can more readily escalate risks to the right level of management. In fact, risk management should be used across every facet of our organisation and at every level from grass roots project management to executive and governance levels.

A programme is not just a big project. A programme is a collection of integrated projects that together will deliver definite benefits. Programmes are therefore significantly riskier than projects due mainly to their complexity. For example, the impact of delay to an independent project might be only a minor risk, but a similar delay to a project within a programme might be a major risk due to the knock-on effect to the other related time-driven projects. The projects that comprise the programme need to be prioritised to ensure resources are allocated appropriately. Complexity is partly driven by team size. Small teams are usually collocated, whereas large teams are more likely to be spread around the organisation or several organisations or even countries. A useful practice is to have dependency owners attend the team meetings of the dependent project.

This book's focus is project risk management, accepting that the basic risk management framework is essentially the same in terms of principles and processes at portfolio, programme, project and task levels. In fact, it's sometimes hard to see clearly the difference between a programme and a project. A task too could be regarded as a smaller project. When we break projects down into smaller chunks, these chunks too are projects. However, the convention is to use different terms for different levels of work breakdown, and a lowest level of breakdown is usually referred to as a work package, which is a convenient size and measurable

work chunk (perhaps an activity, task or subtask) for delegation and contracting-out purposes. See Figure 2.1. We usually resist breaking work down further since this would be paramount to telling someone (who is usually more appropriately qualified than us) how to do their job. We can always ask them to chunk their work if necessary for more detailed estimating and risk management purposes.

Risk probability perceptions

There are many definitions of risk and we are as much slaves to our perceptions of a risk as to the risk itself. Ask yourself – what seems riskier, flying by Garuda Airlines from Jakarta to Bali or driving a VW from Wellington to Auckland? Statistically, flying is far safer than driving. But our knowledge of air accidents and the spread of these accidents in the media might give us a different perception. We grossly over-rate our odds of winning Lotto, and grossly under-estimate the risks of crossing the road. We feel certain of the outcomes of rugby games and elections, then act surprised when the All Blacks don't win the Rugby World Cup, although this time we will of course.

A rough calculation for turning betting odds into probabilities is simply to turn the numbers upside down. If the TAB offers \$1.80 on the All Blacks to win the Rugby World Cup, divide one by 1.80, and we get 0.555 or 56%, and that's the probability. However, past form suggests they have a 65% chance of winning each game in the quarterfinals. The likelihood of winning all three is the product of those chances: $65\% \times 65\% \times 65\%$, which comes to 27% only. On this basis the chances of Namibia winning the cup are 1/20,000 or 0.005%, although their real chance is a big fat zero.

Namibia's odds are better than winning Lotto, where for example the chances of winning Powerball, per line played, are only 0.0000026%, which is about the same as tossing 24 heads in a row. Perhaps Namibia is a better bet than Lotto. In comparison there's a 0.0017% likelihood of being murdered in New Zealand and a 1.6% likelihood of us emigrating. At present \$250 has been bet on Namibia, so our TAB stands to lose \$2.5m if the African nation wins. Incidentally, if we wish to maximise our Lotto chances, we shouldn't choose the numbers 1-2-3-4-5-6 since for some reason 2000 people choose these numbers each week. We would share the winnings 2000 ways, rather than the more typical two or three ways.

The chances of dying in an earthquake are phenomenally small, even in New Zealand and yet we worry about that much more than we worry about wearing seatbelts. What might be the chances of New Zealand suffering a severe financial crisis, a \$1.7 billion corporate bailout, a \$18 billion or more repair bill for two earthquakes that killed 181 people, the first combat casualty in a decade, and the Pike River tragedy that dwarfed Cave Creek in terms of loss of life, all within a few months of each other? The predicted likelihood of this combination would have been rather less than 100%. Yet this string of bad news leaves our personable Prime Minister, John Key, even more popular than he was on election night, whereas his hapless opponent remains least popular as he blunders on to his inevitable demise, personifying a dead project walking. Who could have predicted that? Likewise, we tend to judge our project managers on how well they handle a crisis, yet readily endorse the principle that prevention is better than cure.

Risk definitions

Given the ubiquity of risk in almost every human activity, it is surprising how little consensus there is about how to define the word.

The traditional definition of risk is that it is a potential problem that might delay a project, increase its cost, or otherwise harm the project. Some say that this negative focus on threats inevitably means that doom and gloom will prevail and opportunities will be missed. Thus, as mentioned earlier, a more contemporary definition is that in projects at least, risk is an uncertain event that has a positive or negative (upside or downside) effect on at least one of the project objectives.

Many individuals and organisations practise a reactive approach to project risk, which means waiting until the risk event happens and then figuring out what to do about it. Unfortunately, this approach may mean it is difficult to recover from the event. The much preferred proactive risk management process is to identify, assess, quantify and manage risk through planning in a timely and active manner so as to maximise the chances of the project's success. Nevertheless, there are a variety of definitions for project risk, although they all possess the basic "uncertainty" and "that matters" components. For example:

- "An uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives." (PMBOK)

- “An uncertain event or set of circumstances that, should it occur, will have an effect on the achievement of the project’s objectives.” (MoR)
- “Uncertainty of outcome, whether positive opportunity or negative threat.” (PRINCE2)
- “Loss multiplied by likelihood, where risk is the product of the expected consequences or impact (loss or gain) of the risk event should it occur and the probability (likelihood) that the event will occur.” (ISO/IEO)
- “The effect of uncertainty on objectives.” (ISO 31000: 2009)
- “A possible future issue that can be avoided or mitigated.” (CWS)
- “Any factor that might interfere with the successful completion of a project.” (www.ganttthead.com)

I rather like the PMI definition that mentions project objectives and the idea that risks can be either threats or opportunities. Interesting, the Chinese symbol for risk is a combination of danger (threat) and opportunity. Further to these I recently read that risk was, “The possibility and magnitude of future loss or gain.” I’m not sure of this definition since “possibility” usually means something is possible or not possible, whereas probability better reflects the continuum between absolute certainty and absolute impossibility that seems more appropriate when we describe the likelihood of risk.

The recently published ISO 31000 standard, based on AS/NZS 4360: 2004, now defines risk with emphasis on the risk effect rather than on the risk event. However, the process for managing risk in the new standard remains the same as in the old standard. “The effect of uncertainty on objectives” is a very simple definition that captures three main criteria for risk and risk management. First, for risk to be present there must be an objective. Second, the achievement of the objective possesses uncertainty. And third, the effect of this uncertainty can be positive or negative. However, this ISO 31000 definition may be oversimplified and somewhat confusing. Let’s see if it’s widely adopted.

Previously, we were inclined to define project risk as project management’s top four-letter word, but we now accept that the word risk is inherently neutral and can be good as well as bad. However, that said, most of our time is spent handling negative risks or threats, rather than positive risks or opportunities. There’s usually much more that can go accidentally wrong than will go accidentally right, which

of course is the basis for Murphy's famous law. Incidentally, some project sponsors ensure there is definitely more that can go wrong by aggressively over-selling the project proposition to secure funding based on minimal estimates and extravagant claims that will never be realised.

Some other definitions for project risk are:

- "A discrete occurrence that may affect the project for better or worse."
- "Uncertainty of outcome."
- "Something that might happen unexpectedly."
- "A measure of the ability to achieve project objectives."
- "The possibility of a surprisingly good or bad future event." (IRMI)

Incidentally, a risk isn't a hazard. An open manhole (oops – "personnel access point") is a hazard, whereas the potential for injury by someone falling into the hole is a risk. Also, electricity is a hazard. It has the potential to harm. But the risk of having electricity in our homes is very low providing all live components are properly insulated. So we need to be careful how we describe risks. Also, we should not confuse risk and uncertainty. Risk can only be defined in relation to objectives. Risk cannot exist in a vacuum. We need to define what is at risk. For example, if our project is to redevelop the Wellington botanical gardens, the possibility of rain in Wellington is not just an uncertainty – it is an uncertainty that matters. But if we are undertaking an IT project in India, the uncertainty about rain in the Wellington region is irrelevant. It does not matter. Thus, wherever objectives are defined, there will be risks to their successful achievement – some risks might even help us to achieve or exceed these objectives. Also, there can be confusion between causes, risks and effects:

- **Causes** are events or circumstances that give rise to uncertainty. Such a circumstance might be undertaking a project that we have never done before. In this instance, the cause is not uncertain since it is a fact. If we were implementing a project in a developing country, there may be a lack of skilled people. This situation may give rise to uncertainty. Causes themselves are not uncertain because they are facts. A cause is an existing condition that may give rise to risks.
- **Risks** are uncertainties, which, if they occur, would affect achievement of the project objectives, either negatively (threats) or positively (opportunities).

An example would be the possibility that stakeholders' expectations may be misunderstood or exchange rates may change. Such uncertainties should be managed proactively through the risk management process.

- **Effects** are positive or negative variations or deviations from project objectives. Such effects arise as a result of risks occurring. An example might be completing the project earlier than expected usually to the delight of our client. Effects will not occur unless risks happen. That the project might be over-spent is not in itself a risk, but an effect should a risk occur.

Thus a *risk cause* may result in a *risk event* that may have an effect on a *project objective*.

Also, risk is not a constraint. A constraint is something that will affect the scheduling of a task, whereas a risk is something that could happen to negatively or positively impact a task. That it could rain heavily while we are pouring the foundations is a risk. However, a constraint is that the concrete truck can only deliver on Saturdays. Nor is a risk a fact, requirement, problem or issue.

One way to separate risks from their causes and effects is to comprehensively structure a risk statement as per the following examples:

- “As a result of using the latest hardware (a definite requirement), unexpected system integration errors may occur (an uncertain risk), which would lead to overspending the project budget (an effect on the budget objective).”
- “Since our company has not attempted a project like this before (cause), we might misunderstand the client’s needs (risk), and our solution would be ineffective (effect).”

“Do you feel lucky? Well, do ya, punk?”

When I first noticed Richard Wiseman’s rather quirky book “The Luck Factor” I immediately thought of good old Inspector Harry Callahan (Clint Eastwood) – hence the heading. Wiseman maintains that luck can be predicted and controlled and claims that his publication is the consequence of ten years’ scientific research rather than mere anecdotal trivia. I first encountered Wiseman’s views when I saw his infamous “gorilla basketball” video on YouTube. Yet, now that we accept opportunity as a dimension of risk, his ideas on luck may have some relevance for us project risk managers.

Certainly when projects go wrong we are inclined to react “Why my projects?” and we are usually less inclined to question things when all goes right. However, Wiseman has researched the “go right” option and suggests that the following strategies could turn our projects into luck magnets:

- Capitalise on risk opportunities. Lucky project managers are skilled at recognising and responding to opportunities.
- Apply intuition. Lucky project managers seek facts first, but also listen to their positive gut feelings.
- Expect good luck. Lucky project managers are sure that their projects will succeed. This positive expectation becomes a self-fulfilling prophecy because it encourages perseverance and creates a motivating environment.
- Turn bad luck into good luck. Lucky project managers don’t dwell on ill fortune, rather they take control and recognise how things could have been worse.

In case we forget such strategies “push your luck” and “expect good luck” rubber wristbands are now available at US\$2.25 each and half that price if we purchase 100, which would presumably cater for a very large project team and some other anxious stakeholders or provide us with a lifetime’s supply of good luck. To keep us positively focussed, we give these wristbands a quick ping whenever bad thoughts arise. Wiseman also suggests we keep a project “luck log” that we update daily with things that go better than expected. He suggests that such a record will help grow our project team’s confidence. This approach reminds me of “The Secret”, a 2006 self-help or perhaps self-deception book written by Rhonda Byrne. Her book attracted plenty of controversy, but was a best seller. Rhonda is soon to publish “The Magic” some of which might be very useful when project disaster threatens, although I guess it would mean a fire sale for my book.

Frankly, while cultural views might vary, I would give the luck log and wristband a wide berth, unless perhaps our clients are impressed with such gimmickry. But I do recognise the power of positive thinking, providing this does not distract us from the serious business of anticipating and dealing with the bad luck or threats that lurk in our ever project. I believe that project risk managers need a proven methodology and a liberal sprinkling of scepticism, more so than lucky dust, happy logs, wristbands and wishful thinking. In fact, as a project sponsor or client any mention of such things by your project manager should be seen as a warning – a risk trigger no less.

Finally, while it is fair to say that luck, both good and bad, plays some part in every project, more than a century ago, Louis Pasteur said of his seemingly serendipitous discoveries, “Fortune favours the prepared mind,” which for us means, don’t neglect risk management planning. Similarly, when Seneca, a Roman philosopher, once said, “Luck is what happens when preparation meets opportunity,” I’m sure he was thinking of project risk management.

Risk management definitions

Risk management can be defined from either a purpose or process perspective:

- “To plan, identify, analyse, respond, and monitor and control risk on a project.” (PMBOK)
- “To manage a project’s exposure to risk.” (PRINCE2)
- “To reduce uncertainty and increase the chances of project success.” (APM)
- “To systematically increase the probability and consequence of positive events, and decrease the probability and consequence of events adverse to project objectives.” (ISO/IEC)
- “The art and science of identifying, analysing and responding to risk factors throughout the life of a project and in the best interests of its objectives.” (Max Wideman @ www.maxwideman.com)
- “Analysing and then acting appropriately on risk.”

In brief, risk management involves proactively determining what might go better or worse (opportunities and threats), identifying something to make the opportunities greater and the threats lesser, and implementing plans to achieve these results.

Sometimes different names are used for the project risk management steps described in this book. For example:

- Risk identification and risk quantification are sometimes referred to by the single expressions risk analysis or risk assessment.
- Risk response is sometimes referred to as response planning or risk mitigation.

Risk management can not be undertaken without reference to performance objectives. Setting a difficult to achieve tight budget for a project makes the project more risky by definition in that the chances of exceeding the budget are increased. Conversely, setting an easily achievable completion date makes the project less risky because the chances of exceeding the completion date will be reduced.

Issues

Sometimes the terms “issues” and “risks” are confused. A risk is a potential problem. An issue, in project management parlance, is a here and now problem. An issue is a risk that has happened and may not have been foreseen as a risk. Issues are often those happenings that go bump in the night. If the probability of a risk occurring is 100%, it’s no longer a risk, it’s an issue. For example, variance is an issue, not a risk. If a risk is not properly managed it will result in an issue. Uncertainty is the main difference. Issues are certainties. Risks are uncertainties.

Some authorities distinguish between issues and problems in that an issue cannot be addressed without escalation to the sponsor, whereas a problem can be directly addressed by the project manager.

To help the project manager track issues they are usually recorded in an issues register. Effective risk management will reduce the number of issues that we need to deal with. In fact, the fewer issues that arise, the more effective has been our risk management. A huge issues register and a small risk register speak for themselves. However, in practice, the usual order of priority for our attention is:

1. issues
2. threats
3. opportunities.

Reactive versus proactive

This tendency to focus on today’s problems or issues rather than tomorrow’s risks, results in issue management (reactive) rather than risk management (proactive). We need to implement risk management (fire prevention) or we will always

be managing issues (firefighting). We must maximise our time spent on risk management or we will always be stuck in the issue management business to the distraction of properly managing our project.

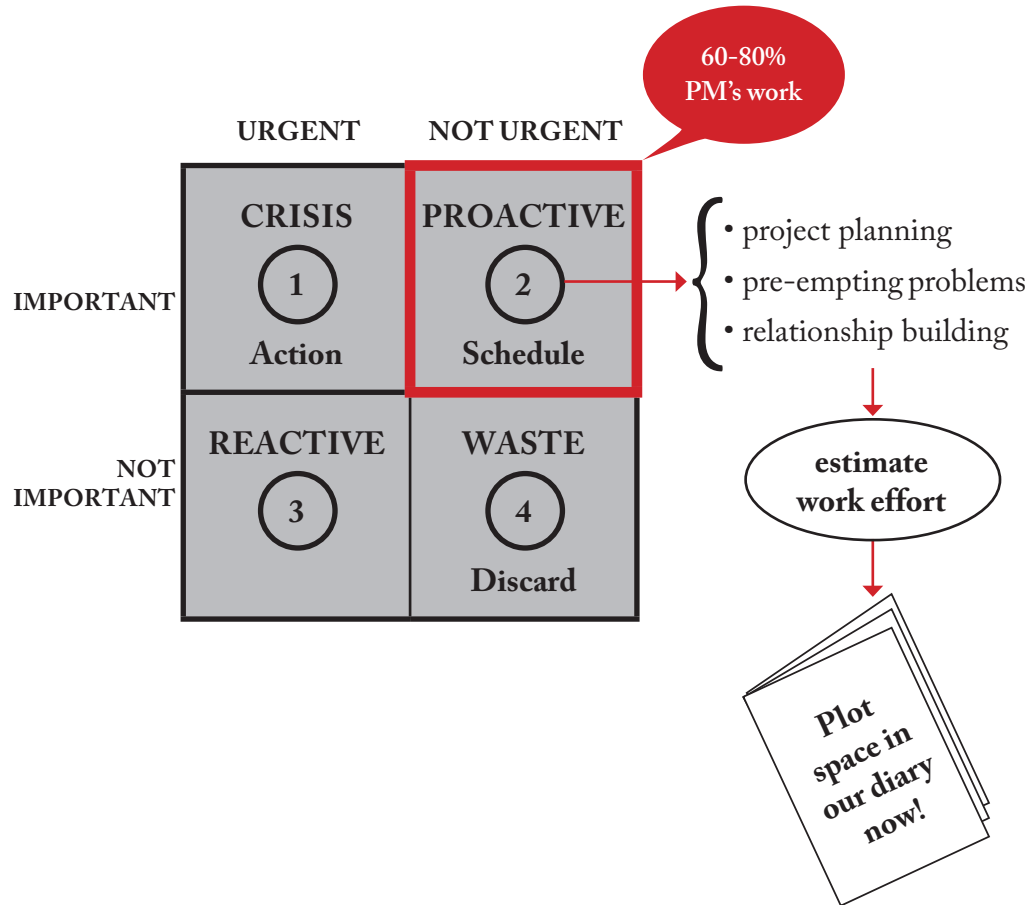
Interestingly, while proactive or preventative risk management is much preferred, it's the reactive variety that usually gets the headlines. All that diligent preventative work behind the scenes often gets little thanks, especially since some cynics would argue that the prevented risks would never have become issues anyway. And there's no way to know for certain. But what is certain is that it's usually much cheaper to prevent a problem than to put things right after the problem has occurred. This is the key principle underlying effective risk management, colloquially referred to as the fence at the top of the cliff rather than the ambulance at the bottom. For the truly risk averse, there might need to be a fence and an ambulance, but in reality the truly risk averse might never climb the hill (ie, avoid or cancel the project).

An example of the reactive variety is the rescue of trapped miners at the San Jose mine in Chile in 2010, where a giant rescue drill broke through to 33 trapped Chilean gold-miners, heralding an end to their 66-day ordeal and the creation of national heroes whose stories might be auctioned for small fortunes. Thankfully, this was a very successful rescue project, but one wonders if the mine's roof collapse was a predictable event? Certainly the mine's owners will ponder this question when the huge damage claims roll in. And, of course, more recently we here have suffered 29 deaths at our local Pike River coalmine.

The proactive emphasis for risk management is captured in Stephen Covey's time management matrix shown at Figure 2.2, where effective project managers spend some 60-80% of their time in Quadrant Two (important, but not urgent) pursuing the activities of planning, pre-empting problems and relationship-building, and thus avoiding or at least minimising their time spent in the crisis quadrant – Quadrant One (important and urgent). However, because Quadrant Two items do not present themselves as urgent they may be queue-jumped by Quadrant One items unless we schedule occasions for our Quadrant Two items. This means that effective risk management needs to be an integral part of project management, with regular reviews, and not an optional tack-on activity. As a minimum we need to establish a risk register and include risk as an agenda item

at every project meeting. The latter strategy helps normalise the practice.

Figure 2.2 – Stephen Covey's time management matrix



The important/urgent are issues – they have already happened so they need to be dealt with. Having dealt with them we must not be distracted into the not important/urgent stuff. We should use this time to deal with the important. If they are not managed, they too will become issues.

It's important that project risk management should not be so risk averse that no risks are taken, because without risk there is no innovation or entrepreneurship. Our organisations need to decide how much risk will be acceptable in pursuit of

organisational goals. This acceptable level of risk is sometimes referred to as the organisation's risk appetite, risk tolerance or risk threshold. The project team's job is to assess all project risks and take proactive steps to deal with them as appropriate within the boundaries established by management.

In summary, risks are significant uncertainties that might happen in the future. Issues are significant events that have already happened. Big issues will require plans to fix them. These plans will have assumptions and it's these we should also assess for risk.

Assumptions

Assumptions have been described as "the mother of all fuck ups." This very insightful piece of script comes from the 1995 movie, "Under Siege 2 – Dark Territory." History is full of disastrous assumptions. One that I particularly like is, "They can't hit us at this distance..." – an assumption, final estimate and last words of General John Sedgewick who was shot overlooking the parapets in 1864 during America's civil war.

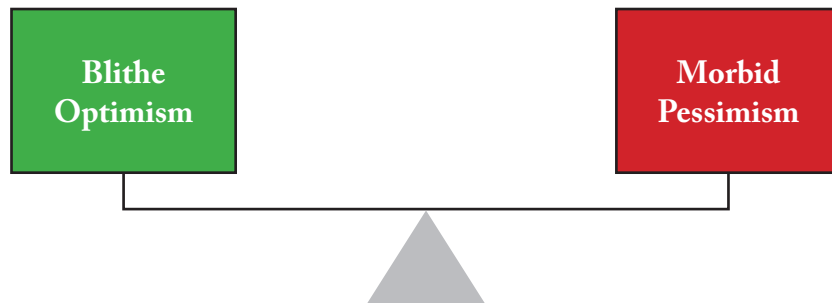
Project plans consist of facts and assumptions. If the plan is to be successful, then the assumptions will turn into facts. In contrast to risks, unmanaged assumptions are neither visible nor apparent as risks and so can be very dangerous to project health. They may be introduced by organisational culture and when unknowingly present in our project environment bring about incorrect perceptions and unrealistic optimism or pessimism. We seek a balanced attitude to risk as shown at Figure 2.3.

Assumptions are facts and factors that we consider to be true, real or certain, but without real proof. They are risks too, but hopefully modest ones. Assumptions should be reasonable assertions, but should be recorded, for which we may maintain an assumptions register. Assumptions need to be managed in much the same way as we manage risks, since they are a source of risk. The basic rules for assumptions are these:

- **Recognise** them, remembering they can masquerade as facts.
- **Document** and publish them together with their related estimates and plans to help ensure we all adhere to the same assumptions during our estimating and planning endeavours.

- **Validate** them frequently depending on their significance or impact should they prove to be wrong. They can be affected by changing circumstances. It is often good practice to transform them into risks. Assumptions need to be verified with our client and sponsor. How much does it matter if the assumption turns out to be wrong? Also, how stable is the assumption? How confident are we about them?

Figure 2.3 – Balanced attitude to risk



Every estimate and plan is unavoidably based on some assumptions because we do not know exactly what the future holds. So to proceed with project planning we need to make some educated guesses, such as for example, “the exchange rate AUS-NZ will be 0.8 in eight months’ time.” Of course we don’t make assumptions when the facts are available, and any assumptions we do make need to be reasonable and recorded along with the associated estimates and plans. The chances are that if an assumption proves to be wrong, some re-estimating and re-planning will then be needed.

When we assume, we are reasonably confident that something will happen or will not happen without having prior proof. Two examples of reasonable assumptions for planning purposes are:

- “During the project there will be no more than three days’ loss of productivity due to poor weather.”
- “Petrol prices will not change by more than 10% over the period of the project.”

However, would it be reasonable to assume, “All my communications will be clear and unambiguous, be received in a timely manner, and understood exactly as I intended” – yeah right. What about “We assume there will not be a snowstorm in Auckland during our project.” Is this a reasonable assumption to log or is it a given that we need not log? We should not log trivia or the obvious, and nor should we log motherhood statements such as “Project resources will be available to carry out the project.”

Incidentally, assumptions aren’t usually identified through brainstorming. Typically we may need to make assumptions when facts are unavailable while we are planning, problem solving and decision-making. In this context they are quite legitimate. We recognise as we go that we don’t know everything and in order to continue our planning, we need to make reasonable assumptions. We then document them where everyone can see them and we all then adhere to the same assumptions. A flipchart page, on the wall in our project planning room, can be a suitable place to record our assumptions. However, some assumptions may be risks of serious consequence. Assumptions can blind us to threats and opportunities and influence our reasoning and attitudes. Assumptions are a major cause of groupthink and therefore need to be objectively reviewed periodically. The groupthink phenomenon is explained later in the book.

Assumptions are larval risks that might best be transferred to our risk register if we assess they would be intolerable if proven wrong. What’s tolerable depends on our risk appetite. At www.projectperfect.com.au/info_assumptions.php there is a suggestion that we should analyse and prioritise each project planning assumption in terms of:

- **Confidence.** How sure are we that our assumption is true?
- **Lead-time.** How long before we can prove or disprove our assumption?
- **Impact.** What consequence or how much rework is needed if our assumption is wrong?

Another idea is that significant assumptions be given a monitoring metric. For example, “It is assumed that the project sponsor will be readily available to assess change requests” the more precise metric for which might be, “Change requests will be resolved within 48 hours of their submission.” If delay exceeds

48 hours, a response strategy is implemented (delay project, assume authority, by-pass sponsor, etc) preferably with the sponsor's prior approval of course. The assumption register should be communicated to all key stakeholders.

When planning a project some items need to be treated as absolutes so that we can proceed. This is where we make effective use of assumptions, or according to PMI, "factors that for planning purposes are considered to be true, real or certain without proof or demonstration." Practically every project management document is built on assumptions – often unstated. Such assumptions may be categorised:

- **Unwarranted and implicit.** These assumptions are undocumented and are taken on faith. These are dangerous assumptions.
- **Unwarranted and explicit.** These assumptions have no evidence, but are documented. These are not too dangerous since their validity can be assessed.
- **Warranted and implicit.** These assumptions have support, but lack documentation.
- **Warranted and explicit.** These assumptions pose least threat. We should attempt to move all assumptions into this category.

Most assumptions made in projects are optimistic. This means that they are likely to have a negative impact if they prove to be wrong. This optimism bias is our belief that the future will be much better than the past. Without this bias we would not undertake projects. In fact, our ancestors might never have ventured outside their caves. Perhaps mild depression encourages realism, yet optimists live longer!

To determine the extent to which assumptions matter we might ask the following questions:

- **Threats.** "If this assumption is false, then the effect on the project would be ..."
- **Opportunities.** "If this constraint could be removed or relaxed, then the effect on the project would be ..."

To identify assumptions, it can be useful to look for “wills and musts” contained in the project charter and plan. Also, expressions such as “for planning purposes” can help us uncover important assumptions. Analysing a simple statement such as, “management sees the success of this project as essential to our organisation’s future efforts”, can reveal several assumptions that might need clarification:

- “management” – exactly who and what level or levels does this refer to?
- “success” – what does management consider success to be exactly and who makes this assessment?
- “essential, future, efforts” – these too are imprecise expressions.

A very low probability risk might better be managed as an assumption. To get a feel for an assumption’s priority we might ask “If this assumption proves to be wrong, the impact on the project will be ...”

The Dominion Post

5 August 2010

“That’s the problem with Afghanistan – it’s designed for an ambush. Troops need to find the right balance between being carefree and ignoring the risk and getting over-preoccupied with it. If you play on it too much you can find that risk stops you doing anything.”

Colonel (retired) Richard Hall
NZ Provincial Reconstruction Team Afghanistan
2008-2009

Perhaps the best advice is that if in doubt convert the assumption into a risk statement and put it in the risk register to ensure its proper analysis, although most people tend to feel more comfortable and open about discussing assumptions rather than risks. Assumptions may increase or decrease risk.

Only by assumption identification, documentation, ownership and review will they add value to the project management process. And don’t make assumptions when the facts are available.

Project risk factors

Each project has a different capacity for uncertainty. High-risk projects, that is, typically pioneering endeavours, which are pursuing ambitious goals where it is accepted that the likelihood of failure is significant, will have a high capacity for uncertainty. Major uncertainties may be tolerated because the potential rewards justify the investment and because the consequences of failure can be endured. Such projects with a high capacity for uncertainty are a gamble, but one that the project stakeholders must understand and be prepared to sign up for. If lives are at stake or the consequences of failure are unpalatable, a project will likely possess a low capacity for uncertainty and warrant careful risk management.

Projects possess all sorts of risks, some of which might never have occurred before. While all projects have differences, basic risk factors common to most projects are listed at Figure 2.4. On occasions such factors can combine and compound to create higher levels of programme and project risk.

Figure 2.4 – Some key risk factors

Key Risk Factors	Brief Descriptions
Effort (person-hours)	Greater the project's total work effort, the greater the risk.
Duration	Longer the project's duration, the greater the risk.
Estimates	More inaccurate or severe our estimates of time and cost, the greater the risk.
Complexity	More complex our project, the greater the risk.
Novelty	More novel our project, the greater the risk.
Organisation support	Less supportive and stable our organisation, the greater the risk.
Project sponsor support	More passive, the greater the risk.

Key Risk Factors	Brief Descriptions
Resources	Fewer available, the greater the risk.
Technology	Less familiar, the greater the risk.
Dependencies between projects	More the reliance on other project outputs, the greater the risk (programme risk).
Scope and deliverables specifications	More vague and unstable these objectives, the greater the risk.
User requirements and involvement	More vaguely defined, incomplete and inaccurate the greater the risk. Less user involvement the greater the risk.
Project manager	Lesser our ability, availability, experience and commitment, the greater the risk.
Project team size	Greater the team size, the greater the risk.
Project team members	Lesser their ability, availability, experience, morale, co-location, cohesion and commitment, the greater the risk. Attrition level is also a factor.
Project methodology	Less mature and proven the methodology, the greater the risk.
Contractors and third-party dependencies	More contractors and subcontractors, and the lesser their competency, the greater the risk.
Stakeholders	More diverse and unrealistic their needs, the greater the risk.

The above factors aren't anywhere near an exhaustive list and aren't necessarily avoidable or even undesirable. There is a popular misconception that the bigger the project, the riskier it is. That is not necessarily true. Just because a project is

big or expensive, does not always make it more risky. However, complexity is of particular concern and is the consequence of factors such as:

- Number of disciplines, methods, approaches and other variables involved.
- Magnitude of political, legal, social, or environmental implications.
- Expected financial impact (positive or negative) on the project stakeholders.
- Extent to which stakeholders agree on the characteristics of the deliverables.
- Number of variations.
- Number and variety of interfaces between the project and other related organisational entities, which may be aggravated by cultural and linguistic differences.

While a complicated project is usually best managed through traditional decomposition, complexity is about interactions between project elements that can confound even the most experienced project managers.

“Fools ignore complexity. Pragmatists suffer it. Some can avoid it. Geniuses remove it.”

Alan Perlis
US Computer Scientist

Yet, project deliverables that don't somewhat push the risk envelope, probably aren't worth the development investment – unless perhaps our company is a market follower. Market leaders understand they must be prepared to run directly towards risk, instead of away from it, in order to put distance between themselves and their competitors. If a project has little or no risk, don't do it, might be sage advice. This suggestion recognises that risk and benefits typically go hand in hand. Depending on what level of risk is considered acceptable, there is a threshold where it becomes uneconomical to assume further uncertainty.

All projects share a range of inherent features that introduce uncertainty. Further to the above list, factors found in all projects, which to some degree make them inherently risky are:

- **Uniqueness.** Every project involves at least one or some elements that have not been done before, and there is of course uncertainty associated with these unique elements.

- **Complexity.** Projects are complex in a variety of ways, and are usually much more than a simple list of tasks to be performed. There are various kinds of complexities in projects, including political, technical, commercial, legal, and interface complexities, each of which bring risk into the project. Team size, team composition, problem/opportunity clarity, and requirements stability also determine complexity. Complexity frustration can also be attributed to stringent, inconsistent and changing regulatory requirements. Complexity mostly depends on product and task complexity. Complexity doesn't necessarily mean uncertainty. Some projects may be low in uncertainty but high in complexity. Programmes are typically more complex than projects, since there is a greater level of interconnection, interdependence, and interrelations. Software development is an inherently and increasingly complex undertaking with many uncertainties. A large number of such projects are abandoned before completion or are completed after compromising on quality, cost, budget or all three (*Standish Group, 2009*).
- **Pace.** The urgency and criticality of the endeavour also contribute to project risk. If less time is available we might for example be inclined to schedule more work to be completed concurrently or work longer hours, both of which can create further risk.
- **Assumptions and constraints.** Project planning involves making a range of guesses about the future, which usually include both assumptions (things we think will or will not happen) and constraints (things we are told to do or not do). Assumptions and constraints may turn out to be wrong, and it is also likely that some will remain hidden or undisclosed, so they are a source of uncertainty in our projects. Assumptions are often recorded in an assumptions register and may also be identified as risks. A constraint is an event or limitation that impacts our project. For example, we may only have access to a particular machine for a limited period. This is a constraint, not a risk, although it may create a scheduling risk.
- **People.** Projects involve team members, management, clients, customers, suppliers, consultants and subcontractors. All of these individuals and groups are unpredictable to some extent, and therefore introduce uncertainty into the projects that they support. Also, our social and political environment may not be stable, and then there are also cultural differences and individual

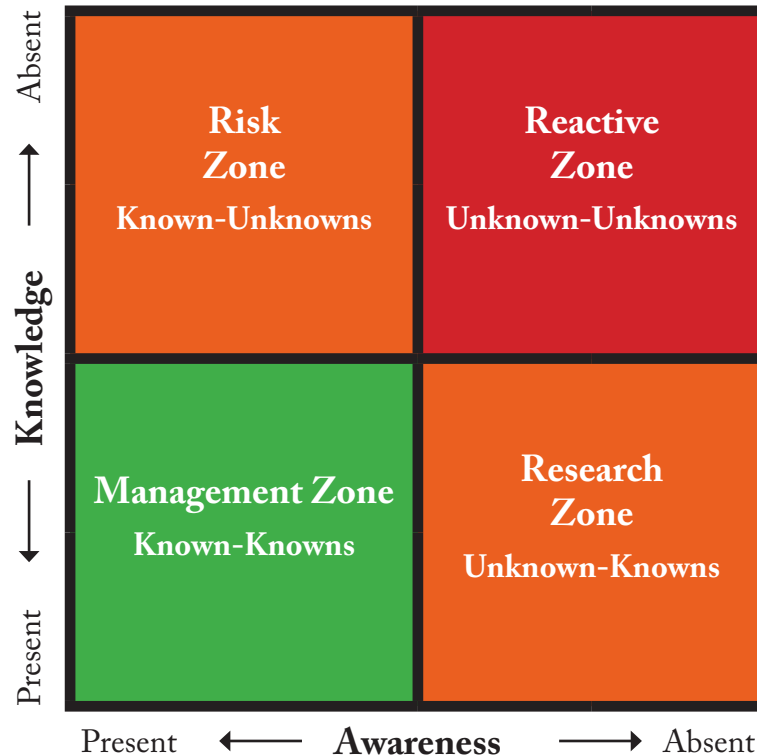
sensitivities too.

- **Change.** Every project is a change agent, moving from the known present into an unknown future, with all the uncertainty associated with such change. Also, while the project is being implemented, external change continues, which may either compromise or enhance project viability.
- **Stakeholders.** Stakeholders are a particular group of people who impose requirements, expectations and objectives on our project. Stakeholder requirements can be varying, overlapping and at times conflicting, leading to risks in project execution and acceptance of deliverables. One of the interesting similarities between stakeholder management and risk management is knowing what we know and equally importantly understanding what we don't or can't know. The greater challenge is to identify the things we don't know. This is important because what we don't know about key stakeholders may constitute a significant risk to the project or business, illustrated at Figure 2.5.

The characteristics and consequences of the four quadrants at Figure 2.5 are:

- **Management zone.** When we are aware of our knowledge, proactive management is possible. We know we know and we can take appropriate action.
- **Risk zone.** When we are aware that we don't know, we can assess the implications and invest effort as needed. This is where risk management works best.
- **Research zone.** We don't know we have access to knowledge that we could use if only we asked the right questions. This is zone of amnesia, inexperience and false assumptions. Research and experience can reduce the size of this zone. Brainstorming might unlock this knowledge.
- **Reactive zone.** We don't know we need to know. Particularly with people, there can be a multitude of issues, threats and opportunities that we are unaware of. This area defies management as we have no knowledge that we should do so.

Figure 2.5 – Knowledge-awareness grid



Effective stakeholder management is focused on moving all the key stakeholders into the management zone where we can take effective preventative action.

Risky characteristics are built into the nature of all projects and cannot be completely removed without considerably changing the project. For example, a project that was not unique, had no constraints, involved no people and did not introduce change would not be a project at all. Trying to remove all risky elements from a project would turn it into something else, but it would not be a project. It might be a routine, repetitive operational activity.

We've been undertaking projects for a long time. So why do many projects still fail? It is not necessarily due to lack of project management theory, tools and techniques, or even trained people. We have a good understanding of project concepts, project management processes are now well developed, and the people

working on projects are mostly professional, committed and capable. It seems that one of the major reasons for project failure is the occurrence of new and unforeseen and unforeseeable events that disrupt the smooth running of our project and often cause irrecoverable deviation from our original plan. This again emphasises the need to continue to apply risk management after project plan approval as execution realities are revealed.

Types of risks

There are a variety of ways to classify risk, but here are four basic categories or types of risk that we should recognise:

- **Business risk.** Business risk is the normal risk of doing business and carries with it the potential for both loss and gain. For example, suppose the customer decides to change the project scope. The change may involve a threat, because it might require expertise that our organisation does not possess. On the other hand, it might involve an opportunity because it could mean significantly more profit if the scope change can be accomplished efficiently. Business risk is the kind of risk an organisation should not only embrace but pursue. It is the type of risk we can manage to our advantage. It is a risk of loss or gain (eg, a product that can lose money or make money when sold). Business risk is sometimes referred to as external risk, which is typically beyond the project manager's control and is a risk to the project that arises from the external environment.
- **Pure risk.** Pure or insurable risk is the risk that is associated only with loss and has no opportunity for gain. This includes threats such as earthquakes, fires and floods. The organisation needs to avoid or at least greatly reduce the direct impact of this form of risk typically by passing the risk onto another party. This can be accomplished by purchasing insurance or by teaming with another party that has the expertise to do the risk management job.

Generally, we think of this pure risk in terms of catastrophic events, such as earthquakes, but in fact, this kind of risk occurs whenever an organisation attempts to do a job without having the requisite skills or expertise. These are situations where the solution is to team up with a company that has the skills and expertise to properly accomplish the required work.

- **Known risk.** Known risk includes those risks one should naturally be aware of (such as scheduling problems because of limited or over-committed resources) that must be identified and watched. Known risks are usually manageable, because we know they exist and we know what has to be done to avoid or deal with them. It is almost always possible to develop a strategy that will manage this type of risk. For example, if the known risk is that the schedule could be impacted because of a shortage of resources at a particular time, then the decision could be made to either hire additional resources, team with another company, outsource the work, or negotiate with the customer to delay work on that particular portion of the project.
- **Unknown risk.** Unknown risk is not so easy to deal with. By its very definition, it includes risks that we cannot anticipate or plan for, except perhaps by having a management reserve fund, which is a fund held against no specifically identified risks, but recognises that currently unknown risks will no doubt arise during our project. An unknown risk is, for example, a snowstorm that strikes in an area not usually susceptible to such weather phenomenon – say Fiji. The disease AIDS was an unknown risk before it afflicted millions of people.

Force Majeure describes risks that are so catastrophic that they are outside the scope of risk management. They usually require disaster recovery action. The following are some examples of Force Majeure risks:

- Forces of nature such as earthquakes, tsunamis, hurricanes, floods, volcanoes, meteorites, and unpredictable weather.
- External man-made forces such as government action, civil unrest, acts of war, terrorist acts, and social instability.

External forces are of particular concern when working on projects in third-world countries and countries with unstable governments or civil unrest. In fact, often the only significant projects in such countries are likely to be military operations, which are always risky.

Figure 2.6 – Some types of risk management

Types of Risk Management	Risk Description	Typical Performance Criteria
Project risk management	Any uncertainty that, if it occurs, would affect one or more project objectives.	Time, cost, quality, scope, and client satisfaction.
Business risk management	Any uncertainty that, if it occurs, would affect one or more business objectives.	Profitability, market share, competitiveness, internal rate of return (IRR), reputation, repeat work, and share price.
Safety risk management	Any uncertainty that, if it occurs, would affect one or more health and safety objectives.	Accident rate, lost days, insurance premiums, fines, and regulatory compliance.
Technical risk management	Any uncertainty that, if it occurs, would affect one or more technical objectives.	Performance, functionality, reliability, and maintainability.
Security risk management	Any uncertainty that, if it occurs, would affect one or more security objectives.	Information security, physical security, asset security, and personnel security.

Types of risk management

The project sponsor, or project director, is primarily concerned with business risk (project effectiveness or the business exposure inherent in undertaking the project), and the project manager is primarily concerned with project risks

(project efficiency). The project sponsor owns the business case that justifies the investment and has responsibility for keeping it up to date. Some types of risk management are briefly described at Figure 2.6.

Checklist of threats

At Figure 2.7 is a list of some threats or causes of negative risk that history has shown may threaten the success of our projects. Its purpose is to prompt thought. No such risk list is ever complete and the discovery of risk is ongoing, which means we don't file the risk list until project completion. Some more common culprits from my experience are printed in bold. Your experience may be different.

Figure 2.7 – Some example risks

Accelerated schedule	Contractor bankruptcy
Acts of God	Contractors' claims
Best case estimates	Corruption Cross-project dependencies
Blaming culture	Delayed approvals
Budget cuts	Denial of risk
Business-as-usual priorities	Dispersed team
Change in sponsor or key appointment	End-users not committed
Changing team membership	End-users not consulted
Competitors' activities	Excessive time spent planning
Complexity underestimated	Exchange rate changes
Complicated deliverables	Extended working hours
Confidentiality infringement	Failure to delegate
Hidden agendas	Feature creep or gallop
Hostile organisation culture	Fire
Inaccurate and/or late reporting	Frequent priority changes

Inadequate functional support
Inconsistent expectations
Inexperienced project manager
Insufficient authority
Insufficient planning

Insufficient resources

Intellectual property disputes

No substantive risk management method

No validated project management method

No written contracts

Non-compliance with regulations

Non-performing components

Novel project (pioneering endeavour)

Organisational changes

Other projects in the programme

Political interference

Poor communications – internal and external

Poor product specifications

Poor programme and/or project leadership

Poor teamwork

Theft of materials

Unclear specifications

Under-qualified people

Frequent scope changes

Funding delays

Groupthink Price increases

Procedures undocumented

Project benefits unclear

Project players unavailable when needed

Property damage

Resource consent delays

Rework

Risk impact wrongly assessed

Risk likelihood wrongly estimated

Risk responsibilities unclear

Risks not clearly defined

Roles and responsibilities unclear

Safety infringements

Site accidents

Staff turnover / unexpected departure

Stakeholder conflict

Stock deterioration

Subcontractors' poor performance

Terrorism and sabotage

Unreliable suppliers

Unstable requirements

Unstable work environment

Unexpected overtime
Uninterested sponsor
Unlawful activities
Unproved technology
Unproven contractor/
subcontractor
Unrealistic estimates
Unrealistic expectations
Unrealistic performance
standards

User needs unclear
Vague success criteria (not
measurable)
Vague work scope
Vandalism at project site
Variations proliferate
Wage/salary increases
Wrong assumptions

- If an above-mentioned risk happens **once**, that's **understandable**.
- If the same risk happens **twice**, that's **unlucky**.
- If the same risk happens **three times or more**, that's **unacceptable**.

Dr David Hillson

Remember too that risks are also opportunities.

Risk also depends on the type of project. For example, organisations face a lot of risk in commissioning a custom software product, where:

- Final costs greatly exceed the original budget.
- The implementation takes much longer than expected.
- The software meets the specifications, but isn't what the client really needed.
- The software is buggy, and fixes take a long time or just don't get done.
- We upgrade our system and the software doesn't work any more.
- The person who commissioned the software left that company and nobody left knows how it works.
- The software works fine, but it's a "black box" maintenance nightmare.

- We need a modification done, but the developers quote a ludicrous price.
- There is an enormous and complex contract document.
- There is considerable reliance on the advice of salespeople.
- We believe all we are told about progress and assume bugs will be ironed out once the project goes live.

Of course, the software developers can also face a lot of risks, such as:

- The client keeps changing their mind about scope.
- The client provides inaccurate information about their system, etc.
- The project is more complex than we thought.
- We don't get good access to the client's team and/or data.
- The client's project manager is replaced, and the new guy has no knowledge of the project.
- We underestimate the time it will take to produce the final product.
- The client doesn't pay or delays progress payments unreasonably.
- The contract is too rigid for us to deliver the best product for the client's needs.

We cannot complete our projects without people, who can be both our greatest asset and greatest liability. Significant threats associated with the people factor are:

- Lack of motivation resulting in low productivity, missed deadlines, rework and higher costs.
- Dishonesty resulting in inaccurate reports and estimates.
- Theft of real and intellectual property resulting in financial loss and legal issues.
- Sabotage resulting in unsatisfactory quality, missed deadlines, and strife with others in our team.
- Absenteeism resulting in missed deadlines and higher project costs.
- Lawsuits, harassment claims, and workers' compensation, resulting in missed deadlines and increased costs.
- Lack of documentation resulting in confusion and missed opportunities on future projects.

If our project team members are new or we haven't worked with them before, we might take time to interview them before assigning them to project tasks. We might also get a feel for their attitude to risk, which may need to be addressed. If we doubt that team members themselves could be a considerable risk, we might check out Richard Buchanan's book "The Enemy Within." We are reminded that people don't work for the project team; they are the team, and a team, like a chain, is often no stronger or better than its weakest link.

External risks

Risks to our project may be classed as external, organisational or project-specific risks. Sometimes external risks are referred to as business risks beyond the project manager's control. Organisational risks relate to the enterprise and external risks are those outside our organisation's direct control that influence project success. Such risks will be of particular concern to the organisation and project sponsor and could affect the business viability of the project. Some examples of external risks are:

- **Natural disaster.** A dormant volcano erupts, preventing the completion of a new ski resort that is delayed until after the next winter ski season. Earthquakes and tsunamis cause destruction, deaths and injury, causing a halt to most or all projects in the vicinity, except perhaps search and rescue and reconstruction endeavours.
- **International currency.** The exchange rate for \$500,000 worth of software being purchased overseas increases significantly between the time the cost is estimated, the budget is approved and the order is placed.
- **Environment.** The appropriate authorities require prolonged public consultations and submissions and a formal hearing before granting resource consent and a building permit for the construction of a wind turbine farm.
- **Illness.** A financial consultant who has spent several weeks auditing books suffers a serious illness and withdraws from the job.
- **Financial problems.** The company that has received an advanced partial payment for producing marketing brochures goes bankrupt before printing begins.
- **Broken contract.** Farmers who have given permission for access across their property for a pipeline to be laid or pylon to be erected withdraw their support when stock are injured after being spooked by a large truck.

- **Unforeseen physical conditions.** Excavating a building site, an underground stream is discovered or the site is deemed inappropriate.
- **Lack of commitment.** The main sponsor pulls out 12 months into the project.
- **Government action.** The US government for example brings an antitrust suit against Microsoft that prevents a major worldwide software release.
- **Historical/cultural issues.** During a site excavation, an ancient Maori burial ground is unearthed, causing indefinite delays as archaeologists and elders are called in for their various opinions.
- **Company organisation.** The client company is purchased by another company and the priority for our project is dramatically downgraded.
- **Political issues.** Political unrest, central or local government changes, financial instability, and contract misunderstandings due to language differences or corruption.
- **Accident.** The ship carrying hundreds of tonnes of steel sinks and loses all the material. Alternatively, the ship might have been transporting oil or secondhand Japanese cars for the local market.

When identifying external risks, the acronym 'PESTLEC' may help us identify relevant categories:

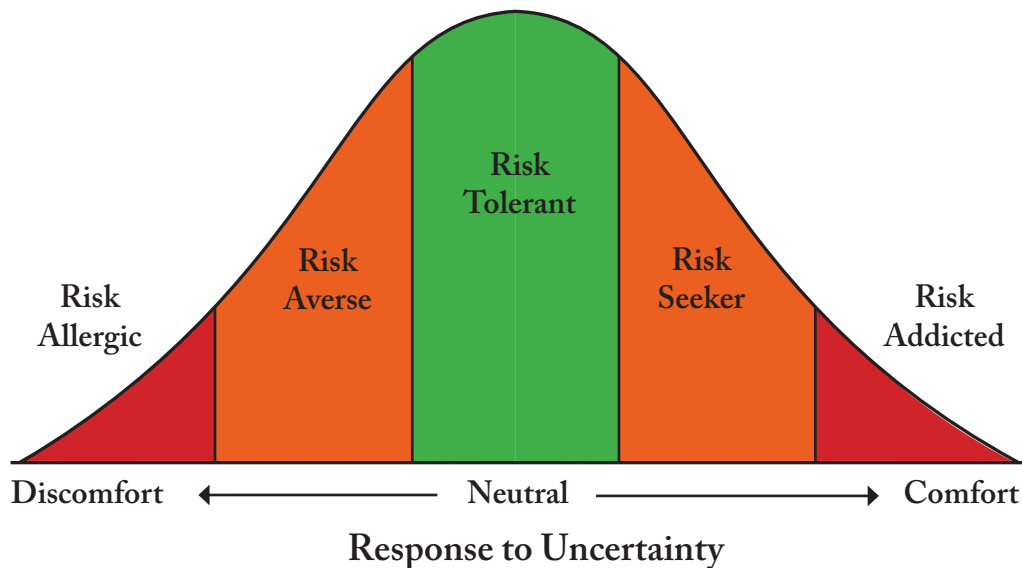
P	political risks
E	economic risks
S	social risks
T	technological risks
L	legal risks
E	environmental risks
C	competition

The competition component in this acronym would most likely be confined to private enterprise, although public utilities can also be run by private enterprise. A privately-run jail comes to mind.

Risk tolerance

Risk utility or risk tolerance is the amount of satisfaction or pleasure received from a potential payoff. Figure 2.8 (based on Hillson and Webster 2007) shows the basic difference between risk-averse, risk neutral, and risk-seeking preferences. The y-axis represents utility, or the amount of pleasure derived from taking a risk. The x-axis shows the amount of potential payoff, opportunity, or dollar value of the opportunity at stake. Utility rises at a decreasing rate for a risk-averse person. That is, when more payoff or money is at stake, a person or organisation that is risk-averse gains less satisfaction from the risk, or has lower tolerance for the risk. Those who are risk-seeking have a higher tolerance for risk, and their satisfaction increases when more payoff is at stake. A risk-seeking person prefers outcomes that are more uncertain and is often willing to pay a penalty to take risks. A risk-neutral person achieves a balance between risk and payoff.

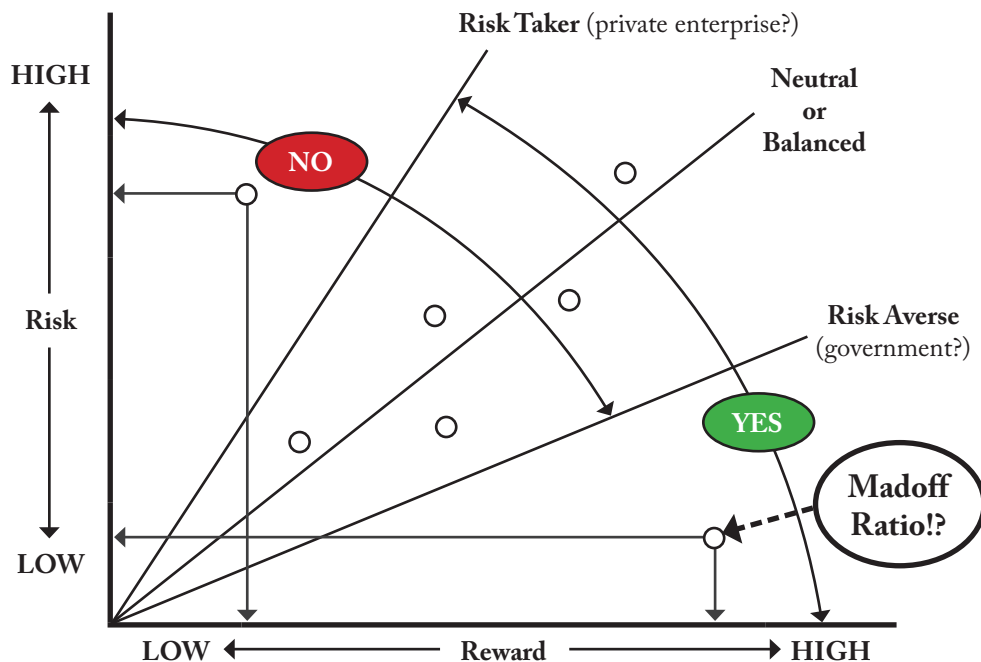
Figure 2.8 – Attitudes to risk



Risk tolerance is the willingness of some person or organisation to accept or avoid risk. Those with a low willingness to accept risk are risk avoiders. Those willing to take significant risks are risk takers. One measure of our risk tolerance is how much we are willing to lose if risk happens. The Madoff Ratio represents those most unlikely projects that promise enormous returns for minimal risk. See Figure 2.9.

Bernard Madoff, risk-taker extraordinary, was the operator of the largest Ponzi project in history. He is at present serving a life sentence together with other unsuccessful risk-takers. Yet, if we maintain a healthy scepticism, perhaps we can spot such risks. While acknowledging that hindsight is a wonderful thing, Madoff's clients should have been suspicious of stable, positive returns in both good markets and bad. Remember, if it sounds too good to be true it probably is!

Figure 2.9 – Risk versus reward



Each project may have a different capacity for uncertainty. Risk tolerance is a measure of how much uncertainty the project can tolerate. High-risk projects, that is, typically novel projects with ambitious goals where it is acceptable that the likelihood of failure is significant, will have a high capacity for uncertainty. Major uncertainties will be tolerated because the potential rewards justify them. And, equally important, the consequences of failure can be endured. A high-risk project with a high capacity for uncertainty is a gamble, but one that the project stakeholders must understand and be prepared to accept. Exploring for oil is an example of such a project, let alone drilling for it. Such offshore oil exploration projects are also targets for activists who add to this risk.

Generally, we expect the public sector to avoid higher risk (risk averse), but we recognise that the private sector often needs to take calculated risks to remain profitable and competitive. Not to say that government doesn't commission risky projects. For example, some years ago Wellington City Council created a beach at Oriental Bay by trucking in some 27,000 tonnes of sand. To my surprise the beach is still there. Usually the higher the potential rewards, the greater the risk we are willing to tolerate. Although the Council's 2011 foray into a waka-building project was rather disastrous.

One measure of an organisation's risk tolerance or risk appetite is financial discount rate or risk-adjusted rate of return (hurdle rate) used for project net present value (NPV) financial calculations and time to breakeven assessments. It's about risk-adjusted financial return, which is considered further in Chapter 7.

Many New Zealanders seem to be risk takers given the popularity of Lotto and our behaviour on the road where of course we are all better than average drivers. One theory mentioned earlier is that our ancestors, Maori and Pakeha, must have been hopelessly optimistic to sail huge distances to carve out life in a strange land. Little wonder our genetic heritage is the she'll be right attitude. The key attitudes to risk are described in the table at Figure 2.10. All categories can be risk aware.

Figure 2.10 – Risk attitudes

Risk Type	Definition
Risk averse	Willing to accept only a low likelihood of adverse outcomes, regardless of the level of potential benefit. Uncomfortable with uncertainty, desire to avoid or reduce threats and exploit opportunities to remove uncertainty. Would be unhappy with an uncertain outcome. Chicken Little investors, and perhaps those who might prefer we have people with red flags walking ahead of cars.
Risk taking, seeking or addicted	Sometimes referred to as risk prone, where we are willing to accept a relatively high likelihood of adverse outcomes in the expectation of a greater benefit. Comfortable with considerable uncertainty, no desire to avoid or reduce threats or to exploit opportunities to remove uncertainty. Would be happy with an uncertain outcome. Risk seekers might include sky divers, whitewater rafters and heli-skiers.
Risk tolerant or neutral	Tolerant of some uncertainty, no strong desire to respond to threats or opportunities in any way. Could tolerate an uncertain outcome if necessary. Risk accepters.

Personal risk tolerance

Are we personally risk averse, risk neutral or risk seeking? These three non-scientific quizzes might help us decide:

Quiz one

Consider we are given the choice between two investment scenarios, one with a guaranteed payoff and one without a guaranteed payoff. In the guaranteed scenario we receive \$50. In the uncertain scenario a coin is flipped to decide whether we receive \$100 or nothing. The expected payoff for both scenarios is \$50. We are:

- Risk averse if we accept a guaranteed payoff of less than \$50, rather than taking the gamble.
- Risk seeking if we will only accept a guaranteed payoff of more than \$50, rather than taking the gamble.
- Risk neutral if we are indifferent between the gamble and a certain \$50 payment.

Quiz two

Here is another assessment. Answer the following questions:

1. For me, which word seems the most appropriate expression associated with risk:
 - A. ☐ Loss?
 - B. ☐ Opportunity?
 - C. ☐ Uncertainty?
2. Given extra finance for my projects, would I:
 - A. ☐ Divide it among existing projects?
 - B. ☐ Finance new projects?
 - C. ☐ Divide half among existing projects and half for new projects?

3. Which one of these three project investment options, would I most prefer:
- A. ☐ 150% gain to 100% gain?
 - B. ☐ 400% gain to 100% loss?
 - C. ☐ 600% gain to 200% loss?
4. If a low-risk project returns were assured but modest, medium-risk project returns were probable but reasonable, and high risk project returns were possible, but significant, which risk portfolio would I prefer:
- A. ☐ 60% low-risk, 30% medium-risk, and 10% high-risk?
 - B. ☐ 30% low-risk, 40% medium-risk, and 30% high risk?
 - C. ☐ 10% low-risk, 40% medium-risk, and 50% high risk?

Circle and total your scores:

Question	A	B	C
1.	1	5	3
2.	1	5	3
3.	1	3	5
4.	1	3	5

Total Score	Description
4-8	Risk averse. Too much of my apparent caution may limit project and personal success.
9-15	Healthy curiosity. I have a sensible attitude to risk, which should help ensure my short-term and long-term project investment success. I am risk aware and risk neutral.
16-20	Risk-taker. Hey, risk should be managed, not embraced. I'm a gambler. Is my retirement plan Lotto?

Quiz three

Imagine that you're a contestant on a TV game show. You have just won \$10,000. The host offers you a choice. You can quit now and keep the \$10,000, or you can play again. If you play again, there is a 50% chance that you win again and wind up with \$20,000. However, if you play again and lose, you lose your \$10,000 and take home nothing. Which do you chose?

1. Keep the \$10,000.
2. Play again, with a 50% chance of \$20,000 and a 50% chance of nothing.
3. Content to go either way.

Once you have made your choice, read these assessments:

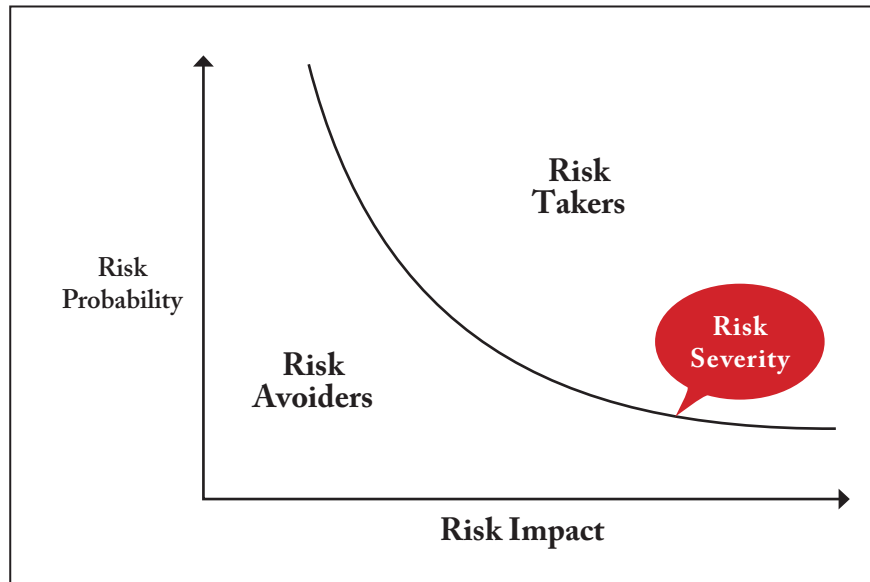
1. Prudent choice. You are risk averse.
2. Prefer risk. You are a risk taker.
3. Risk neutral. Taking a chance doesn't matter to you, so long as the expected values are the same.

Our personal tolerance for risk could be greater or lesser than our organisation's tolerance for risk, which could be a source of frustration for us. Generally, the higher the potential rewards, the greater the risks we are willing to take, but we may not be as concerned about our organisation's exposure to risk as we are about our personal exposure to risk. So an important question is, "What is our organisation's appetite for risk?" Alternatively, we might ask:

- "What is our appetite for our project's delay, cost overrun or possible failure?"
- "If we can't afford to mitigate our project's risk now, will we be able to resolve the problem later when it happens?"
- "What's our appetite for paying the price for not dealing with risk now?"

Another way to illustrate risk tolerance is based on risk probability and risk impact where the curve depicts our acceptance level for risk. The curve joins points of equal risk severity. The position of the curve might vary for each individual and organisation. See Figure 2.11.

Figure 2.11 – Risk curve



However, people often think differently about risk depending on the context or framing of the situation. Kahneman and Tversky who are regarded as trailblazers in this topic asked a group to imagine a disease that was expected to kill 600 people and one of the following programmes could be chosen to combat it:

- A. A health programme that will save 200 people.
- B. A health programme where there is a $\frac{1}{3}$ probability that 600 people will be saved and a $\frac{2}{3}$ probability that no one would be saved.

Given this choice, 72% chose A and 28% chose B. But when the same options were simply framed differently, a second group showed the opposite preference. In this round, the choices were:

- A. A health programme where 400 people die.
- B. A health programme where there is a $\frac{1}{3}$ chance that no one dies and a $\frac{2}{3}$ chance that 600 die.

Now only 22% of respondents chose A, while 78% chose B. The explanation is that people are apparently more risk averse when choices are expressed in terms of gains, and less risk averse, even risk seeking, when they are expressed in terms of losses. In other experiments, Kahneman and Tversky observed that people often have difficulty making sense of extreme probabilities. Highly unlikely risk events were either ignored (under insured) or overweighted (over insured).

Risk or risks

The distinction between the words risk and risks is significant. It's about risk ownership. When considering risk and projects, there are two levels of interest, typified by the respective responsibility and authority of the project manager and the project sponsor:

- The **project manager** is accountable for delivery within the project objectives, and therefore needs to be aware of any risks that could affect that delivery, either positively or negatively. Thus, our scope of interest as project managers is focused on specific sources of uncertainty **within** the project. These sources are likely to be particular future events or sets of circumstances or conditions which are uncertain to a greater or lesser extent, and which, if they occur, would have some degree of impact on the project's objectives. The project manager typically asks, "What are the risks in my project?" and these answers are usually recorded in a risk register. Such risks are sometimes referred to as internal risks or project risks. They come from the project itself and are risks that the project manager can control and is in the position to manage.
- The **project sponsor** on the other hand is interested in risk at a different and more strategic level. They are less interested in specific risks within the project, and more interested in the overall picture. Their question is, "How risky is this project?" and the answer does not usually come from a risk register. Instead of wanting to know about specific risks, the project sponsor is concerned about the **overall riskiness of the project**. This represents the organisation's exposure to the effects of uncertainty across the project as a whole. Sponsors have a particular interest in external risks. Whether or not the project benefits will be realised is usually their top concern. These benefits may be realised or not realised despite the risks within the project. Sponsors wish to be confident that the project will add value. Possibly the greatest business risk that an organisation can assume is the practice of engaging in unregulated and uncontrolled project selection, where for example project selection is based primarily on emotion rather than facts. Risk should always be a criterion for project selection and prioritisation. The sponsor's focus moves from cost minimisation during the project life cycle to a revenue or benefits generation focus on product launch.

Figure 2.12 – Project and product life cycles

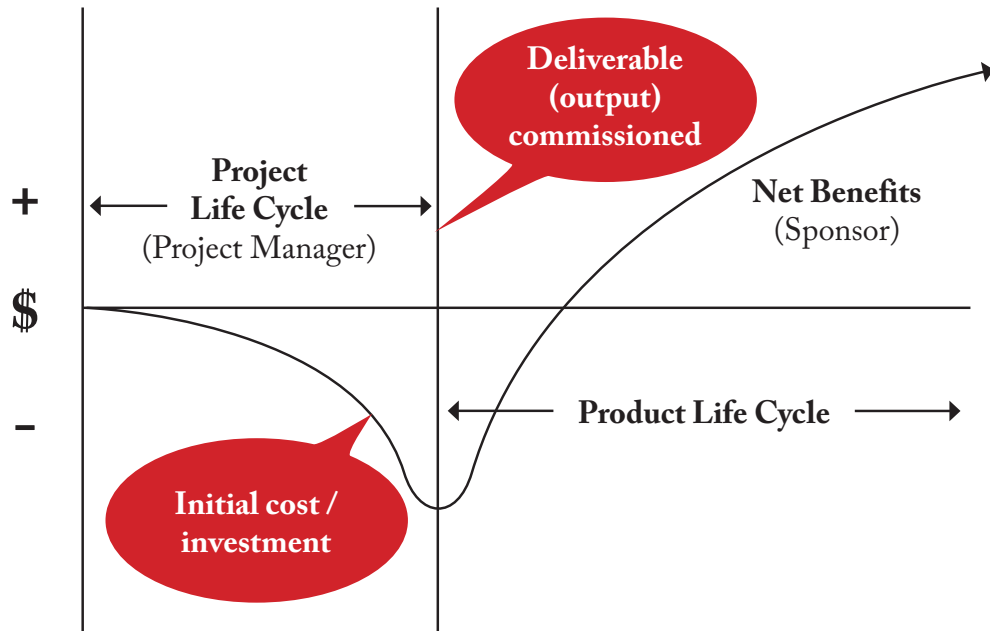


Figure 2.12 shows the project life cycle, which is the project manager's prime concern, and the produce life cycle, which is when the benefits that justified the project investment occur. It is these benefits that particularly concern the sponsor whose responsibility for project success means added value (ie, value = benefits – costs). Sometimes the project life cycle is described as the first stage of product development.

These two different perspectives reveal an important dichotomy in the nature of risk in the context of projects. A project manager is interested in “risks” while their sponsor wants to know about “risk.” While the project manager looks at the risks within the project, the project sponsor looks at the risk of the project. Thus, there are two types of project uncertainty:

- **Internal uncertainty** that involves those things integral to the project such as scope, cost, quality and schedule, which are more or less controllable by the project manager.
- **External uncertainty** that involves those things not under the project manager's control such as the business environment, competition and business strategic decisions. The project sponsor's principal concern is usually with these factors.

In fact a project might be over budget and behind schedule at completion, yet realise its benefits (positive outcomes) to the satisfaction of the sponsor, client and other stakeholders. However, as project managers may not be so happy given that our project management success is usually measured in terms of cost and time. Conversely, a project that is proceeding on time and on budget may be stopped prematurely by the sponsor or business should the business justification for the project evaporate.

This division of responsibilities has its equivalent in New Zealand government practices, whereby outcomes are generally thought of as the results or benefits that our government wants to achieve and outputs are the deliverables (activities, products and services) that our government departments are engaged in producing.

Outputs may or may not help achieve outcomes. This disconnect is a result of the 1980's public service reforms and perpetuated over subsequent decades. Ministers are deemed to be exclusively accountable for outcomes and our public service is exclusively accountable for outputs. The principle behind this split is that managers should be held accountable only for things they control. Outcomes, while very important, are seen as more difficult to control because they were affected by many external factors that better reside in the political domain.

Figure 2.13 shows the interaction of these respective concerns. We might conclude that the sponsor has prime responsibility for project effectiveness and the project manager has prime responsibility for project efficiency. Of course the best projects are both effective and efficient. A measure of project success is the product of project efficiency and project effectiveness. Put simply, there is no point delivering products and projects on time and within budget if the market no longer wants them. So, successful projects do not necessarily mean successful business – if the market has moved on, we may be delivering something that is no longer required. Peter Drucker once said, “There is nothing so useless as doing efficiently that which shouldn't be done at all.” It is the distinction between project risk and business risk, captured in the expression, “The operation was a success, but the patient died.”

Figure 2.13 – Effective and efficient

		Right Project?	
		Yes	No
Done Properly?	Yes	Effective and efficient	Ineffective but Efficient
	No	Effective but Inefficient	Ineffective and Inefficient!

Effectiveness is about “doing the right project” in terms of project selection criteria. It’s a strategic consideration. Effective projects add value. Whereas, efficiency is about “doing the project right” in terms of the project objectives – meaning we aim to complete the entire work scope on time, within budget and to the required standards of quality as per specifications, which are project management operational considerations. Thus:

Project Success = Effectiveness x Efficiency

Sponsors play a vital role in every project’s success. While the project manager has primary responsibility for carrying out project risk management activities, the sponsor and our organisation’s executives are responsible for project selection, which concerns business risk, and they make four essential contributions to project risk management:

- Maintain both a project contingency and management reserve.
- Hold the project manager accountable for undertaking risk management.
- Promote a climate that recognises the value of risk management.

- They appreciate that when they ask us project managers to accelerate our project or to sharpen our pencil to reduce the budget estimate, they are asking us to add risk.

However, sometimes sponsors and the steering committee that they chair can create more problems than they solve:

- Steering committees can become excessively bureaucratic, taking valuable time away from more productive project management activities.
- Steering committees can micromanage, stepping on the authority of the project manager, causing both to lose credibility and influence.
- Steering committees can become preoccupied with political issues, and may then fail to support the project manager who has made unpopular, but necessary, project decisions.

Steering committees are more useful for lengthy, complex projects that are highly visible, risky and costly, and impact multiple business units. Smaller projects don't need steering committees.

Project benefits are the positive impacts of project deliverables on the business, organisation and customers. We can think of benefits as positive business outcomes caused by project outputs, but attaining project outcomes is no sure thing. Project managers are not usually responsible for benefit attainment, but are responsible for setting the conditions, by means of project performance, which will affect and influence the risks of benefit attainment.

However, it is useful if we project managers are involved in the preparation of the project business case, since we may be able to minimise risk through:

- providing early risk input
- gaining an insight about the project's origins
- enabling more realistic assumptions and estimates
- influencing project team composition
- establishing an early cooperative relationship with our project sponsor
- allowing for continuity of project leadership.

From a sponsor's and client's point of view, project success ultimately depends on the production of a deliverable that can be beneficially exploited, and sometimes

for purposes not originally envisaged. Project completion by a certain time may not be an essential requirement. Yet, from our point of view as project managers, the focus of our attention is on coordinating and controlling project execution. With these concerns, it is not surprising that success at our level is usually seen as delivery on time, within budget and to specifications. How useful the final deliverable proves to be may be of secondary concern to the project manager. This same difference in perception of success also arises in the client-contractor relationship. The contractor rather hopes to make a profit somewhat regardless of product success, providing the product is properly built of course. Whether it is a commercial success is mostly the client's concern, although the contractor would appreciate more of the same project work (ie, return business).

Risk and project benefits

Many projects declared successful, never deliver all the benefits predicted by their enthusiastic champions. Benefits may have been oversold to get projects approved. Such projects waste resources and deny better propositions the light of day. Sometimes too, different projects claim the same benefits. And some projects chug on with no prospect of realising any benefits, 'justified' by sunk costs or the wish to avoid the embarrassment of cancellation. But mostly, post-project product or service benefits are not formally assessed. Yet benefits are the rationale for undertaking any project. Thus, project managers may need to take closer interest in anticipated project benefits and risks to these benefits.

While it is generally accepted that the prime role of project managers is to deliver their projects to ensure scope, time, cost and quality objectives are satisfied and that risks to these objectives are properly managed, there is an argument for project managers to also assume greater responsibility for benefit delivery. This would include proactively managing risks to those benefits specified in the business case.

Such a responsibility would require that project managers fully understand the reasons for their projects, be more involved at project conception, and appreciate the explicit linkages between project objectives, outputs, outcomes and benefits, where:

- **Objectives** are parameters or constraints of scope, time, cost and quality, within which us project managers must navigate and build our creations.

- **Outputs** are deliverables – products or services that remain at our project's completion. They may be tangible or intangible.
- **Outcomes** are results or changes caused by using project outputs. Such changes need to be managed to ensure that planned benefits result.
- **Benefits** add value through improvements that result from outcomes and may be quantifiable or defy quantification, direct or indirect, anticipated or sometimes unanticipated, one-time or recurring, and are not necessarily assured – they possess uncertainty for us to manage.

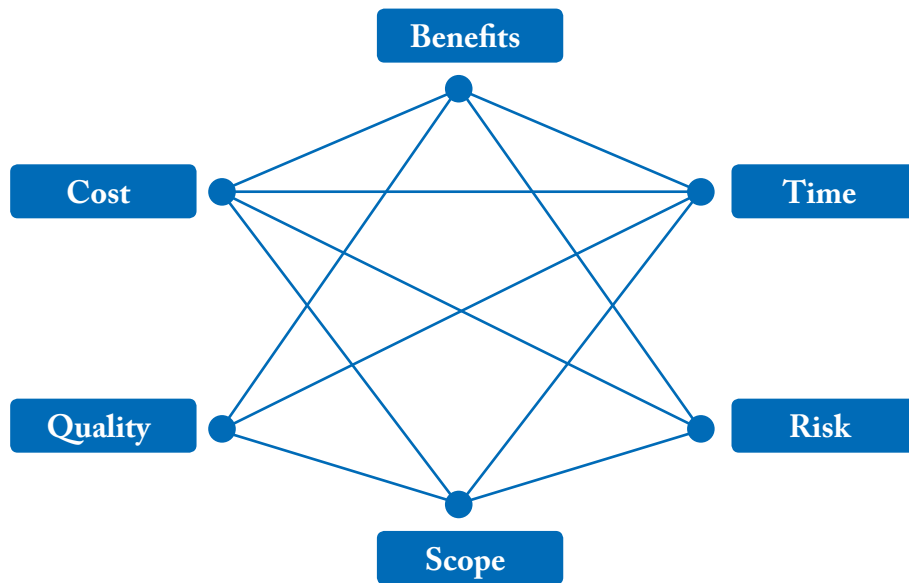
We would need to actively track benefit risk, both threats and opportunities, throughout the project life cycle and beyond. Our project plans would not only include clear responsibilities and methods for benefit mapping, scheduling, tracking, measuring, harvesting and post-project benefit reviewing and reporting, but also provide for benefit risk management.

Our project risk registers would document risks to benefits - not just risks to project management performance, but also risks to post-project product or service performance that for most projects has even more uncertainty. This is a particular challenge when deliverable uptake and added value may be at the mercy of changing factors beyond our control or influence – political, economic, social, technological, legislative, environmental factors and the vagaries of marketplace supply and demand.

A consequence of this expanded job description would be the need for project managers to assume a broader view of project success. We would need to anticipate changing influences and continuously assess and reassess their likely impact on the delivery of project benefits and respond accordingly. External changes plus internal changes to project scope, time, cost and quality objectives could affect business case validity, whereby anticipated benefits might be enhanced, reduced or invalidated. In order that the business case remains 'desirable, achievable and viable' (PRINCE2 mantra), changes to this document and to project objectives would be recommended by the project manager in order to safeguard anticipated benefits and perhaps generate new benefits, but not merely to ensure on time and on budget project completion. Routine status reports would also address benefits and their risks.

Conversely, the impact of any proposed changes to project objectives, in order to keep projects on track, would need to be assessed against business case benefits. The project manager would be permitted some tolerance regarding projected benefits, and estimated impacts to benefits outside those limits would require the sponsor's involvement as is usual practice with proposed risk responses and variation requests.

2.14 – Parameter interaction



Project managers' active involvement on projects may also intrude into the early operational life of the new products or services when initial benefits are to be achieved. They may play a greater role in user-training, preparation of marketing materials, product demonstrations and launches, change management, and so on, in the interests of benefit achievement.

Nevertheless, some organisations will doubtlessly prefer the more traditional division of responsibilities whereby project managers focus on producing the deliverables and sponsors focus on the on-going validity of the business investment and its promotion. Perhaps it is sufficient that the project manager is simply mindful of the project business rationale and the need to protect anticipated

benefits when they plan, solve problems and make decisions throughout the project life cycle. They will advise their sponsors if benefits appear to be threatened. Hopefully no sponsors abdicate their responsibility for benefits and let their project managers take the fall when new products and services underperform or fail. Perhaps those same sponsors could be up front for the accolades should results be positive. Given that a project manager is often deemed to be as good as his or her last project, the added effort, stress and career risk associated with benefit responsibility might warrant improved remuneration, particularly for higher risk endeavours? Yeah right!

To conclude, if the measure of project management performance is to include benefit preservation and achievement, then project managers would need to manage risks to benefits as well as risks to project objectives. Importantly, responsibilities for benefits would need to be clearly specified in the charter for each project, otherwise we can expect 'benefit leakage.' Effective post-project benefit management reviews should make for more realistic and robust business cases and improved project selection procedures. Too-risky project propositions would be recognised and eliminated earlier.

Some common sources of project risk

A project is unique, and as such, risk may be significant, and common to most projects are the challenges or sources of risk listed here together with possible preventative or mitigation measures.

Clients. Essential to any project, clients (employers, owners) notoriously misstate what they want, and what they want isn't always what they need. Furthermore, clients change their minds during the project. *There is a need to define the project as clearly as possible with the client in the first instance and also agree how to properly manage those inevitable changes (variations) as needs continue to evolve.*

Sponsors. To have their pet projects approved a sponsor's assessment can be biased and unrealistic, and thus land a project manager with an impossible challenge. *There is a need for an objective review of the project business case to ensure that the proposition will provide maximum business value for the resource commitment.*

Constraints. Projects usually have tough financial and resource constraints, and often some deadline urgency. Such constraints are not necessarily frustrating providing they are realistic. However, on occasions project estimates are deliberately held down to ensure a project's selection. Later, funding to meet true project costs may not be readily available or cause some reduction in project quality or scope. *There is a need to check the feasibility of working within proposed constraints and make recommendations for their relaxation where appropriate, preferably before the project is planned in detail, but certainly before its execution.*

Other work. Projects often interact with other projects and always interact with the organisation's ongoing business. Projects are often superimposed on other work, which can result in untenable workloads. Also, projects can divert key resources from normal operations to the detriment of business-as-usual. *Workloads need to be planned, prioritised and monitored. Project people may need to be temporarily relieved of other responsibilities. Careful resource scheduling is essential. Some work may need to be outsourced, postponed or even cancelled.*

Contractors. A project often involves consultants, suppliers, contractors and subcontractors. Thus, on occasions, project success seems largely beyond the project manager's immediate influence. *Contractors need to be carefully selected, their tasks unambiguously defined, and their performance regularly monitored. We must ensure too that they can manage their subcontractors. We should include terms to help ensure our ability to manage the contractor (eg, joint planning, control gate reviews, award fees and penalties, and clear evaluation criteria). Also, require that the contractor familiarise our people with the deliverable's operation and maintenance. Spell it out in the contract. A contract can be a very effective risk management tool. We can also vet and veto subcontractors.*

Change. Projects not only change, they cause change. People are usually apprehensive about change and may not be very cooperative, especially if they feel the project outcome could disadvantage them. *Project managers need to be change managers. Communications and involvement are essential. In fact project management is change management. A successful project is happy stakeholders.*

Estimates. Whenever the CEO meets us in the lift and asks for an estimate, we respond with an optimistic, seat-of-the-pants guess, which the CEO then immediately adopts as a firm target. *Estimates evolve, they have a range of possible results, and typically become more accurate as planning proceeds. Avoid premature commitments and always indicate the likely accuracy of our estimates. Be realistic, give a range, not a single figure.*

Related tasks. A project consist of interdependent tasks where delays to some tasks can put the entire project schedule in jeopardy. Tasks delays are invariably passed on, whereas early finishes seldom are. *Those tasks whose delay might cause a delay to the project completion date (ie, critical tasks) need to be identified and carefully monitored from a scheduling perspective, particularly on a time-driven project.*

Stakeholders. Projects often have a variety of stakeholders with conflicting needs. A pervasive source of uncertainty may arise from the involvement in our project of a multiplicity of people or organisations. In any organisation, even small projects usually involve two or more parties working together, where each party may be an individual, some unit of the same organisation, or representatives of entirely separate organisations. The relationships between the various parties may be complex and sometimes involve a hierarchy of contractual arrangements. Such relationships bring fundamental complications, which can have a profound influence on project performance. *The project manager must attempt to keep disparate stakeholders moving in harmony. Better to be proactive than reactive in stakeholder liaison. Indeed, consult with them before they even know they are project stakeholders. We shouldn't expect too much cooperation from stakeholders who are only consulted after project implementation. It is important we don't rely solely on requirements identified by only a single stakeholder.*

User requirements. When we get to project execution, we discover that the so-called user requirements are a compromise, infamous for their complexity, incompleteness and constant modification. *Recognise that user needs evolve. Keep in touch. Sign-off may be essential to discourage never-ending changes, yet avoid premature design freezes. Variations need to be properly managed.*

Team members. Projects often mean teamwork. The project manager's challenge is to elicit high performance from a multidisciplinary team that the project manager may not have selected. They may not have worked together before, may have other agendas, are also responsible to another boss and are not therefore readily or exclusively available, and the project manager cannot necessarily reward them commensurately with their performance. Also the team often grows and membership changes. *Project managers need to be effective leaders and people managers. Team building is an important responsibility. Achieving team "buy-in" is essential. To reduce the impact of team membership changes, we need to document everything in a standard manner and perhaps introduce a buddy system to shorten the learning curve.*

Temporary. Projects are often short-term and expedient exercises. Also they can be halted prematurely when for example their resources might be better used elsewhere. A project manager is a perishable position. Project team members also work themselves out of a job. This can cause concern particularly when the project nears completion and no other work is in the offing. *Redundancy, a certain eventuality in project work, must be planned for.*

Contracts. The contractual agreement is almost impossible to understand, is written in legalese, goes on and on, is full of fine print and ambiguous statements, has little discernible logic in its layout, and is clearly a basis for an adversarial relationship. *Let's ensure that the contract document is clear, consistent, concise, correct and complete, and perhaps above all, reader-friendly. Plain language, not legalise.*

Your appointment. Our first notification about having to manage the project is after the contract price and other terms have been finalised. You wonder the basis for the now accepted quote. *Ideally, the project manager should be involved in preparing tender documents to help avoid unpleasant surprises and a steep learning curve prior to project/contract execution.*

Penalties. Projects often have high rewards for success, but the penalties for failure can also be high. Project managers are often seen to be as good as their last project. *There is a need to learn from both successes and failures to ensure improvement. A post-implementation evaluation is essential. Lessons learned need to be documented as the project proceeds and kept readily available to assist with the planning of future projects.*

Ineffective project manager. Someone who lacks the ability. *Such a risk is avoided through good selection and appropriate training in relevant hard and soft skills.*

Roles and responsibilities unclear. Vaguely described roles and responsibilities create confusion, uncertainty and often conflict. Also, some responsibilities might overlap or be lost between the cracks. *We need to be very clear about roles and responsibilities from the start of the project. A Responsibility Assignment Matrix (RAM) and precise job descriptions help.*

The above challenges are all threats in response to which a project methodology or framework is applied with the purpose of avoiding or at least minimising their impact and probability. Thus, one essential way to prevent or reduce project risk

is to have in place an effective project management framework, which is typically based on the project life cycle. Of course if projects possessed no risk we wouldn't need a project management framework or methodology.

In addition, are we as project managers the biggest risk? We seldom hear anyone talk about the risk project managers ourselves pose. Certainly the above list is influenced by our own strengths and weaknesses. Project managers may come from technical backgrounds that require different skill sets. As a project manager, however, we now need to develop an arsenal of social skills. On a daily basis, we have to work with others to get things done, and the only way to survive is to transition from technical expert or subject matter expert to manager and leader because now we have to communicate, delegate, facilitate and negotiate work through others. Readers excluded of course, but us other project managers can make irrational decisions, accept too much responsibility, waste funding, and approve changes that contradict the goal and objectives of the project and even the organisation's core values. We are certainly a risk if we tolerate more risk than our organisation, and base our decisions on our own risk tolerance levels. Surprisingly, PRINCE2 formal training courses provide no tuition in project management people skills.

We might make a list of the skills we lack and the project constraints that are forcing us to compromise our project goals and objectives. If we aren't sure what our personal strengths and weaknesses are, we might ask those we work with, recognising that leadership is largely in the eyes of our colleagues and followers. Then plan to do something about this list to reduce the potential risk we pose to the success of our project. One strategy that helps is to surround ourselves with people who balance our weaknesses. Something we might work on is emotional intelligence – the ability to understand our emotions and the emotions of others, and to communicate those emotions. I think we also need to be effective networkers and brush up on some key social skills like assertiveness, negotiating, coaching and teaching skills. And we will also need to refine our writing and presentation skills, along with our ability to research and ask the right questions at the right time of the right people. These skills probably take a lifetime to perfect. There are of course very effective training programmes, such as those provided by the New Zealand Institute of Management (www.nzim.co.nz),

aimed at developing these skills. An ability to communicate effectively is often cited as the most important credential for a project manager. Most of our job is communication to which there are many risks, including:

- inattention (by either party)
- jumping to conclusions
- emotions
- message inconsistencies
- tiredness
- stress
- gender differences
- generation gap
- previous experiences
- ethnic differences
- lack of empathy
- personal benefits and values
- language differences and difficulties
- lack of feedback
- vocabulary/terminology/jargon/ semantics
- assumptions
- preconceived ideas
- inappropriate timing
- wrong place
- time-zone differences

In the commercial situation, it is important to remember that a key goal of the project risk management process is to gain competitive advantage by increasing the return on investment from each project. To accomplish this goal our organisation's risk management process needs to:

- Eliminate the use of hidden contingencies. These are buried in the base estimate, which is a practice encouraged when the contingency sum is an imposed, uniform percentage of the total project budget regardless of how risky the project is.
- Reduce the required project contingency through effective risk mitigation and by not using contingency for anything other than identified risk.
- Improve the project team's effectiveness by replacing any atmosphere of distrust with open communications particularly on the subject of project risk.
- Ensure we identify and mitigate risk in all phases of the project, not merely a one-time effort prior to project implementation.
- Provide a method to manage risk that is at least as effective as the methods we use to manage scope, cost, schedule, quality, and health and safety.

Project objective priorities

Key project objectives are scope, time, cost and quality, and it is against these that we can identify and assess risk. However, not all project objectives possess the same importance. They typically have different priorities.

It is very useful to have our client/customer prioritise the project objectives or at least identify the key objective (project driver), which will be the last objective to concede should the going get tough. Some construction industry project management practitioners argue that “health and safety” should also be a key risk factor in addition to the four project objectives. Fair enough. Our sponsors may like us to also include benefits.

Any risk that affects the driver must be carefully analysed since the impact of these risks may be very significant to the success of the project. A useful method to prioritise any list is a paired comparisons chart, where each item is compared against every other item. Consider the Eden Park stadium upgrade for the Rugby World Cup 2011. The project aims to have seating for at least 60,000 spectators in readiness for the first match. If the upgrade to 60,000 seats represent the project scope or size, and quality concerns the comfort of those seats, what priority might we assign the parameters (objectives) for the project? See a suggested answer at Figure 2.15.

Figure 2.15 – Paired comparisons chart

Prioritising Project Objectives						
Rank	Score	Objectives	Quality	Cost	Time	Scope
2	2	Scope (S)	S	S	T	
1	3	Time (T)	T	T		
3	1	Cost (\$)	\$			
4	0	Quality (Q)				

In this instance, time means elapsed time until project completion, whereas cost means 'whole-of-life' cost – construction cost and the cost of ongoing maintenance and repairs, all of which have presumably been included in the business case that justified this investment.

Rugby World Cup

The Rugby World Cup, to be held throughout New Zealand in September and October 2011, is more than just a tournament to decide bragging rights. It's the largest sporting project our country has undertaken since the 1990 Commonwealth Games. Along side the physical struggles on the paddock will be the battle to ensure the success of this mega-project. It's a massive job. Fortunately, Martin Snedden is proving to be an excellent choice as project supremo. No doubt if our All Blacks win the Cup, all expenses will have been justified. However, already the doomsters are suggesting that the team has again peaked too early and the biggest risk is the rise and rise of the Queensland Reds. These Aussies are starting to look

good at the right end of the season. Bugger! Fortunately, the Cup will not be played on a hard, fast Brisbane field in front of a predominantly Aussie crowd. Let's hope that the Wallabies leave their fine weather back home and that the three-wise-men get the selection and preparations right. And then there's the #!! French ...

Contingency plans, we are told, are at present being drawn up to manage anything from a stadium collapse to terrorist attacks causing fatalities. Emergency services, government agencies and Rugby World Cup



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officials have evidently brainstormed possible risks and compiled a comprehensive register of what might go wrong. It includes extreme disaster scenarios ranging from a devastating stadium fire or a crowd crush incident such as the 1989 Hillsborough tragedy, to mass food poisoning, beer shortage, pandemic outbreak

or, more likely, transport chaos. Does anyone worry, that Auckland's rail system can cope? National contingency plans are being prepared to respond to each scenario. The risk management process is being coordinated by Rob Mackie from The Department of Prime Minister and Cabinet. Contingencies also include a plan to coordinate our nation's four burn units to handle victims in the event of a large-scale fire or explosion. One hopes that at least equal attention is being given to risk prevention, especially the risk that we don't win this cup! Yet it's great how New Zealanders have raised to the occasion. We are all stakeholder, even the rugby grinchies. We are indeed a "stadium of four million people" – the land of the long bright crowd.

But the Rugby World Cup is shaping up to be a risky project financially, in large part due to the earthquake damage to the Christchurch stadium. It seems very unlikely that the need to relocate eight rugby matches from Christchurch and refund some 150,000 tickets was anticipated. While it was very appropriate to reschedule matches, the latest estimate is that the tournament will run at a financial loss. The expected deficiency has grown by 30% since project inception. Presumably sales will accelerate near the tournament. Nevertheless, the intangible benefits will surely justify the investment. If the estimated 95,000 visitors have a good time, the tournament will have sold New Zealand to the world, which will trigger longer-term benefits. Shorter-term benefits are some capital improvements around our country, a country-wide morale boost, a period free of politics and grinning wannabes, and huge rent from the Barmy Army living in our homes. And some might add party, party, party with hot guys with cool accents. Of course there are risks here too.

Other than more earthquakes, beer in cans at Eden Park, dodgy tickets, contentious refereeing, and injured All Blacks, perhaps one more risk to the world cup project could be disgruntled activists who wish to disrupt proceedings if current grievances, such as offshore oil drilling and mining in national parks are not addressed to their liking. But protest at this time could cause a strong backlash against their causes. In these circumstances risk management should benefit both World Cup and protest project organisers. Remember too the alleged food-poisoning by "Susie" of our All Blacks during the 1995 World Cup in Johannesburg? This time, samples of food served to the All Blacks are to be frozen to provide a record for food safety purposes, and a record is to be made of

all 103,000 meals provided to teams and officials at the tournament. Although win or lose there is unlikely to be a 'sickie' epidemic after the final since the Monday is Labour Day.

The recent riots in London and other UK cities must surely cause Rugby World Cup organisers, accommodation providers and police to stop and think about the UK rugby fans who are coming here. UK soccer fans, when travelling to continental Europe, have gained a reputation for riots, drunkenness and vandalism. Can we be sure rugby fans will behave? Fifteen thousand police were deployed in London alone to protect against the rioters. New Zealand can't provide that sort of protection. Imagine too the risk management needed for the next Olympics. While they might be 'the best games ever,' they could also be the riskiest given extreme weather events, credit woes, economic strife, al-Qaeda etc.

Could we cope with another Rugby World Cup loss? What about Women's Refugee Services? Will we riot, loot or just take to our beds? Should Nigel Latta be put on standby for national grief counselling?

Finally, we need to understand the difference between a risk and a constraint. A constraint is something that will affect the scheduling of a task, and risk is something that could impact the task for better or worse. A negative risk or threat is that it could rain heavily during the Rugby World Cup final match, whereas a constraint is that the match day is fixed. Another risk is that my liberal use of the protected expression "Rugby World Cup" may incur the wrath of the IRB.

Risk management principles

Principles are guidelines or universal truths that don't guarantee our success, but we ignore them at our peril. Some relevant, hard-earned and hard-learned project risk management principles (in no particular order) are:

Proactive. Proactivity is about assuming control of potential problems before they occur – finding a vulnerability before it finds us. Unless we pre-empt risks, we will find ourselves reacting to them as they arrive. This is usually a very expensive strategy. Prevention of threats is a much cheaper and less disruptive approach. We need to maintain a comprehensive risk register and for every project keep our top 10 risks very visible.

A reactive approach tries to resolve issues when they occur. A proactive project manager tries to resolve potential problems before they occur. This is the art of risk management. Not all issues can be seen ahead of time and some potential problems that seem unlikely to occur, may in fact occur. However, many problems can be seen ahead of time and they should be managed through a proactive risk management process.

Perhaps the key benefit of proactive risk management is that resources are assigned to areas where the greatest risks lie, as opposed to where the biggest fires rage. Unless we take potential problems seriously, we will not have proactive risk management. We need to recognise that some of yesterday's potential problems are today's actual problems, and that we are consumed with actual problems today because we did not avert them yesterday. Also, to clarify the value of acting in advance on potential problems, we might consider how much less some past problems would have cost had they been dealt with before they occurred. It's not unlike good car maintenance that prevents an expensive breakdown.

Incidentally, proactive and reactive planning are not really alternatives, they are complementary aspects of planning as a whole, with proactive contingency planning supporting reactive contingency planning when this is cost effective. Also, crisis management is not an alternative to risk management. It is a consequence of its failure, but even the most effective risk management must fail on occasions if it is to remain overall cost effective. Only if risk management fails completely, or is simply not addressed, will crisis management become the dominant risk management mode.

Continuous. Risk management is not a one-time effort; rather it's an ongoing, never-ending process continued throughout the entire project life cycle from project initiation to closure. Furthermore, some risk responses create new risks (secondary risks) that in turn need to be addressed. We also need to recognise risk symptoms – those indicators of developing risk. The amount of information we know about risk usually increases as the project proceeds and the preparation of the initial risk management plan and risk assessment is just the start of the process, not the end. After our risk management plan is in place, the process starts with risk identification, which is something we do throughout the project life cycle. Of course some risks will evaporate and others will appear and even reappear later. As with all plans, our risk management plan is a basis for revision as circumstances change. Lack of plan version control is a real risk.

Culture. Organisations that wish to be risk-focused or risk-aware need to adopt values and behaviours that encourage project players to discuss potential threats and opportunities, and recognise that Murphy is a factor in all projects. Management must walk the walk and talk the talk (practise what they preach). Their appropriate behaviours are essential if risk management is to be an integral practice. Risk attitudes and tolerances may be expressed in core values and policy statements and revealed in actions. Risk management needs a pro-active culture. We cannot afford to wait until risks happen to only then consider our responses. Sometimes our management might be so caught up in the success of the project that when we tell them about the possible problems our project faces, they somehow do not hear us. Invariably, they will be more interested later, when these potential problems become actual problems. By then, of course, it is often too late.

The risk attitudes of the project stakeholders determine the extent to which an individual risk or overall project risk matters. In particular:

- Risk assessment needs to be incorporated into the procedures for project selection. In fact, whenever throughout our project it's necessary to evaluate options and alternative solutions, risk should be an attribute against which each option is evaluated.
- We should support those project sponsors and managers who communicate openly about project risks, and who recommend reviewing the need for projects whose risks are not commensurate with anticipated returns. Our corporate culture must support the honest, realistic and open recognition of project risks even if they indicate serious problems with the project. For various reasons, some organisations have created a culture that shuns bad news, which, unfortunately, is what risks often are. The most apparent version of this is the "kill the messenger" practice. Milder forms include those people who do not want to "look bad" in front of management or want to be "team players."
- Increase awareness of project risk management and gain visible support for its disciplined application. We need to promote discussion in an atmosphere where there are no risks that are out-of-bounds for discussion.
- Ensure any punishment/award paradigm is designed to encourage risk management good practice. We must encourage talking about risks realistically with no penalty for people who do so openly within the risk management process.

- Ensure consistent, uniform use of the project risk management practice across all programmes, projects and organisation functional areas.

When we work in a blame culture where mistakes are unacceptable and risks are not discussed, money is wasted and quality sacrificed. People waste time trying to hide problems rather than discuss and prevent them, and creativity is nonexistent when new ideas place projects and careers in jeopardy. When running a project in this type of environment, risk management becomes an almost impossible job. It's difficult to manage risks that we cannot see. Not only are people reluctant to discuss them, senior management doesn't want to hear about them, for they may believe that we project managers are simply there to make risks go away.

In these circumstances, we should encourage as best we can the development of a positive risk management culture. That is, make the identification and discussion of risk an acceptable workplace practice. We may not achieve this for our current project since changing the mind-set of an organisation is a challenging project in itself. However, we can include the topic of risk as an agenda item for our project meetings. And we can incorporate risk updates into our project status reports. We can also have team members monitor certain risks associated with their task responsibilities. All this will be a great deal easier with senior management's support. We may need to lobby for such support. The concept that risk might also be an opportunity will help with risk management acceptance.

Responsible risk management might first need to be reflected in our organisation's core values if the necessary culture change is to occur. We may need to develop employee performance criteria and goals that measure the application of the new risk culture in action. Ultimately, we would need to build an environment where, within reason, it's okay to make a mistake and where people are willing to talk about risk. This may require a true paradigm shift, and changing minds takes time and commitment. Developing an effective risk culture probably takes years rather than months. Recently I undertook some project management work for an organisation for which "We encourage innovation and creativity" was a published core value. I soon discovered that the practised value was "Don't take any risks" since mistakes were usually punished. Managers need to practise the published core values if an appropriate culture is to develop.

If a project team member is berated for communicating potential problems on the project, the team is unlikely to be open about risks. That, in turn, leaves us with less response time if any.

History. Review previous project problems, historical data, lessons learned, and databases containing risk information. Thus, a sensible practice is to document risks and how they were managed. Estimating databases also need to be maintained. Risk information may be from within the organisation or from external sources. Project risk profiles can be developed – a possible job for our PMO if established. An important success factor is the commitment to collecting realistic and high-quality data about risks. Risk data are often based on the judgment and expertise of informed individuals. It takes effort and organisational support to spend the time and resources needed to collect and maintain accurate data about project risk. Such data are better recorded than retained in our perishable memories.

Risk management can accumulate a lot of data. While this is useful for audit purposes, it is not much use for actually managing risks unless the information is accessible, current, visual and effectively communicated. Spanish satirist, Jorge Santayana, wrote in 1905, “Those who cannot remember the past are condemned to repeat it.”

Participation. Stakeholders who have different perceptions of risk should be involved in the process of risk management. Recognise too that different people and organisations have different levels of risk tolerance. We should validate risk tolerances and other project assumptions with stakeholders. When project teams hold planning meetings to identify and develop risk response plans, attendees should include a variety of stakeholders wherever practicable. Effective project risk management cannot take place in isolation. Success relies heavily on communication throughout the process.

Risk management is everyone’s responsibility. The job should not be left to one or two risk specialists or even to an impartial group. We use the collaborative efforts of others to build up an appropriate risk list. Perhaps the greatest challenge is to create a culture in which risk management is everyone’s job. It is also important that management participate in policy-making activities such as developing the threshold definitions of risk impact on project objectives, identifying the combinations of probability and impact that lead to ranking risks as low, moderate and high, and determining the relative importance of different objectives for each project.

The risk management process and tools will only be effective if the right people are engaged at the right time. Such engagement might start with a risk management

advocate who sells the benefit of the process to management. Risk management needs champions, people who will drive through the problems and setbacks, convince sceptics of the need for formal risk management and believe that the process will ultimately deliver. The more senior, influential and respected such champions the better.

The simple truth is that people will not embrace a management process unless they get significantly more out of it than they have to put in. If the team thinks that the process is merely for the benefit of senior management or audit/compliance, members may participate but they will do the minimum, effectively ticking the boxes. If we convince our team members that risk management will make their work easier and more effective, there's a good chance they'll really do it.

Communication and consultation. Communication and consultation with project stakeholders is a critical factor in undertaking good risk management and achieving project outcomes that are broadly accepted. Such practices help owners, clients and end-users understand the risks and trade-offs that must be made in most projects. This ensures all parties are fully informed, and thus avoids unpleasant surprises. Within the project team, good communication helps maintain the consistency of risk assessments and their underlying assumptions. In practice, regular reporting is an important component of communication. The risk register provides the basis for such reporting. It must be readily available, easy to complete, and clearly understandable.

Part of risk communication is the need to escalate certain risks, typically those that meet the following criteria:

- The risk has a potential impact higher up the organisation.
- The risk potentially impacts other projects or business areas to a significant degree.
- We cannot manage the risk at our level in the organisation.
- May significantly impact business case viability.

Communication problems are a major root cause of all risks to the success of projects worldwide. Typically there are problems such as general confusion about the intent of the project, a lack of buy-in from the stakeholders, errors in requirements and design flaws, but some of the more complex risks associated with project failure are a direct result of inadequate communication and poor

interpersonal skills. In a functional organisation, roles and responsibilities are divided by function, and lines of authority are typically top-down. We project managers are required to work across these functional lines or barriers with limited or no authority over resources. This creates communication challenges at every level. In fact, the matrix structure has been described as a recipe for conflict and confusion.

Perhaps the top credential for today's project risk manager is to be an effective communicator, which means considerably more than simply receiving weekly status reports and checking the risk register. We need to get out of the office and talk to our project team members about the project. We need to make it easy for them to share their concerns. We need to listen – concentrate, try not to interrupt unnecessarily, ask questions to clarify and discover more, and confirm our understanding. During these discussions, remember too that body language plays an important role. As a minimum we need to look, at least occasionally, at the speaker. Exclusive or over-reliance on written reports can be a risk.

Conflict often grows out of a lack of understanding – an inability or refusal of the warring factions to recognise each other as working on the same team for a common goal. Left to fester, enmity between colleagues can escalate and inhibit our project's progress.

Variety might be the spice of life, but sometimes even the simplest cultural misunderstandings can sabotage our project team's solidarity and put our project at risk.

With so many organisations now taking advantage of globalisation and project teams becoming increasingly diverse, successful project managers must perfect their ability to read facial, verbal and physical cues that reveal how a person is feeling – a skill known as emotional intelligence, and not just this, but emotional intelligence across cultures. Today, New Zealand would be more accurately described as multicultural rather than simply bicultural. Our cultural diversity is increasing.

Cost-effective. The benefits of risk management should exceed the costs if we are to add value as project managers. In particular, it may not be cost effective to avoid or mitigate risks of low impact/low probability. In these circumstances we may chose to accept the risk, sometimes proceeding with no particular risk response.

There is a limit to how much effort we should invest in managing the risk in a project. Before starting, we should recognise that we cannot do a perfect job, and anything approaching perfection will become prohibitively expensive. Instead, our objective should be to obtain as much protection as we can relative to the effort and resources we invest. The notion of risk efficiency is central to this principle. All risk management processes consume valuable resources and can themselves constitute a risk to successful project completion. The level of investment in risk management within projects must be challenged and justified on the level of expected benefits to the overall project. Always consider the resource implications of managing risk.

Pervasive. Project risk management application is a job for all project team members. Every project management tool and technique employed is effectively a risk management measure. Some tools reduce the risk of being late. Others reduce the risk of over-running the budget. All techniques try to increase the satisfaction of every stakeholder and increase the chances of project success. The entire project management framework is of course a vital risk management tool. If there is a single key to making project risk management “stick” in our organisation, it is to make it an integral part of all project phases and to treat it just as seriously as we do project scoping, budgeting, scheduling and resourcing.

Critical attitude. The art of identifying risk begins with a critical attitude – the critical evaluator. Because we’re often trying to find problems before they occur, it’s appropriate to adopt the Murphy philosophy that “Anything that can go wrong, will go wrong.” However, there’s a big difference between grumbling and disciplined risk identification. The project manager sets the tone.

While risk is normally regarded as negative, risk management is also about exploiting potential opportunities. It is important to bear this in mind whenever managing risk. Effective risk management also means:

- increasing the likelihood of events that would have a positive impact on our project
- identifying opportunities where taking risks might benefit our project.

Training. Without training, we might endlessly argue for example what is really a risk. We will have no means of determining the likelihood of a risk or total loss or gain, and will fail at creating risk resolution plans. For our team to be effective

in managing risk, each member must understand the terminology and the process and gain some hands-on practice applying the various tools and techniques. Training also extends to management. If management is not trained in the basic concepts and terminology, our team will suffer through chaotic management reviews while managers argue about the process and attempt to redefine the terms we are using. See www.nzim.co.nz for appropriate project risk management public programmes that can also be customised and delivered in-house to meet an organisation's more specific requirements.

Ownership. Just as every task in the project schedule has an owner, every key risk should be someone's responsibility. That person should monitor the assigned risk, sound the alarm if the risk appears to be moving from potential to real, and take charge of the consequences. Usually the person assigned the task is also the owner for all risks associated with that task.

Risk profiles. One of the best ways to ensure project success is to apply the lessons learned from past projects. History continues to be the best predictor of the future. A risk profile is a list of questions that addresses traditional areas of uncertainty on projects. These questions have been gathered and refined from previous, similar projects. The keeper of the risk profile (typically PMO) should participate in post-project reviews. Useful risk profiles are likely to:

- be industry-specific
- be organisation-specific
- include both threats and opportunities
- address both project management risks and project risk
- predict the magnitude of each risk
- include possible responses.

Foresight. Sometimes it seems that for every risk treated, a new risk appears. For instance, if we contract out specialised work, this can reduce risk by transferring it to a competent subcontractor. But subcontracting can reduce control over the work and increase communication difficulties. This means that we need to weigh the advantages and disadvantages of each proposed risk strategy. We need to be aware of secondary risks.

Reserves. No project, no matter how diligent the risk identification process, will avoid the unknown-unknowns, which are those risk events we don't see coming.

Therefore we need a rainy day fund to enable us to react to the unforeseeable risk events that invariably arise during our project. Contingency reserves are for identified risks and management reserves are for the unknown-unknowns. Both these reserves add to the project budget and if they are very significant, they might cause a re-evaluation of the original business case and justification for the project.

Documentation. A permanent record of risk management activities is important:

- To demonstrate that the process has been properly applied.
- To help develop the organisation's risk database.
- To provide an audit trail.
- To share and communicate information, especially when people and appointments change.

Critical success criteria. PMI general criteria for risk management success include:

- The value of risk management is recognised.
- All project participants and stakeholders are involved.
- All those involved are open and honest in their communication about project risk.
- Risk management is aligned with the organisation's culture and values.
- Risk effort is scaled to the project size and complexity.
- Project objectives (scope, time, cost and quality) are clearly defined.
- Risk thresholds are clearly defined.
- Risks are clearly and unambiguously described.
- Each risk has a single owner.
- Each risk has an appropriate response strategy.
- Risk reviews are held regularly.
- All stakeholders feel able to identify risks openly and honestly.
- Senior management provides visible and continuing support to the risk management process.
- Appropriate risk-taking is encouraged and rewarded.
- Risk management is integrated with project management. It's built-in not merely bolted-on, as the saying goes.

Caution. We wouldn't take any significant project risk when:

- Exposure to the consequence is too great.
- Our organisation can't afford the loss.
- Odds aren't in the project's favour.
- Contingency plans are not in place.
- Benefits of taking the risk can't be identified.

On the other hand, we should not oversell project risk management. A project risk management programme can make substantial improvements to project predictability, but it is not a cure-all. In the real world, project risk management is not a blissful existence where there are no surprises – only one where there are reduced surprises. We cannot afford to eliminate all of the risks that we know about, while we realise that others are simply unknowable. Risk management is a constant game of improving our odds, but the benefits of doing so must exceed the costs involved.

While the above are specific risk management principles, all project management principles help remove uncertainty and contribute to project management success. These principles are typically:

- Develop a solid business case that justifies the investment.
- Have sound governance that provides clear direction and effective support.
- Clearly define the project deliverable(s) and negotiate realistic and precise objectives.
- Involve key stakeholders early and often.
- Apply a disciplined approach from project conception to finish.
- Pre-empt problems and address issues promptly.
- Break projects into manageable chunks.
- Delegate what we don't need to do personally, remove obstacles to team members' success, develop and maintain a motivating environment and promptly recognise good performance.
- Check progress regularly and take timely corrective action.
- Learn from each project.

Important practices

Experience has shown if our organisation's values, culture and policies genuinely endorse the following project risk management practices, project success is much more likely:

- The risk process requires that our project objectives are clearly defined. It is not possible to define risks without a context. We then know what is at risk.
- Shared understanding of our key objectives, tolerance for risk, concepts and principles for project risk management and agreed definitions for risk management terms. A common language helps ensure clear communications.
- Simple and scalable process for risk management with readily understandable explanations to support the risk management process, and proven methods and techniques to implement all elements of the risk management process.
- Skilled and experienced staff to competently and conscientiously participate in the risk process.
- Availability of adequate resources for implementation of appropriate risk responses and buy-in from all key stakeholders to the risk management methodology.
- A risk-aware organisation that recognises the existence of uncertainty in projects and is determined to address it proactively.
- Risk audits should not be a surprise, a threat, or punishment. They are a normal expected part of project risk management. Risk auditors have no other involvement in the project.
- Acceptance of the need to change plans as appropriate in response to risk.
- And, most importantly, a corporate culture that:
 - ◆ Supports the honest, realistic and open recognition of project risks even if they indicate problems with the project.
 - ◆ Encourages talking about risks realistically with no penalty for people who do so openly within the risk management process.
 - ◆ Promotes discussion in an atmosphere where there are no risks that are out-of-bounds for discussion and no enforcement of any inhibiting bureaucratic hierarchy in meetings where risk identification and assessment is discussed.

A key success factor is the commitment to collecting realistic and high-quality data about risks. Risk data are often based on the judgment and expertise of informed individuals. It takes effort and organisational support to spend the time and resources needed to collect accurate, timely and relevant data about project risk. Such data must then be readily available.

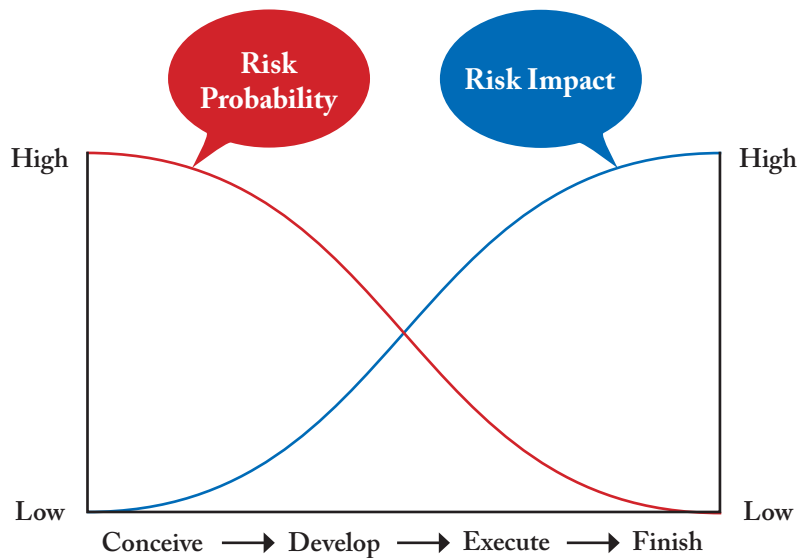
Importantly, project managers must cultivate the courage and competency to push back against arbitrarily imposed budgets and deadlines, and in doing so eliminate a lot of risk before it arises.

Project life cycle and risk

Risk occurs throughout the project life cycle, but is typically more plentiful at the start when there's usually much more uncertainty. However, the impact of risk is likely to be more significant as our investment increases during the project life cycle. See Figure 2.17. As a consequence, it is clearly better to stop a too risky project as soon as possible and preferably prior to its execution. At the end of the project life cycle there is no uncertainty about project time and cost. However, there will be uncertainty associated with the success of the deliverable during the product life cycle when anticipated benefits are realised or not realised. The sponsor's interest in the project thus extends into the operational life of the deliverable or should do.

Unless the project sponsor checks with the client the extent to which project business case benefits are realised during the product life cycle, business cases will continue to be unrealistic, and in some instances business cases for different projects will continue to claim the same benefits. Similarly, the programme sponsor would be keen to check that the extra benefits of combining projects into a programme have also been realised.

Figure 2.17 – Project life cycle and risk



Risk management occurs throughout the project life cycle and all project management activities, tools and techniques can be construed to manage risk. The single best means of minimising risk is to apply a sound project management methodology into which risk management is closely integrated. The project management process at Figure 2.18 is based on a simple generic project life cycle. Integrated risk management activities are identified throughout the process. See Figure 2.19. The process is also scalable, flexible, easy to use and cost-effective, all of which help mitigate risk. As reality unfolds some repetition of some steps will be needed. It is a tool to reduce uncertainty. You will notice that risk management starts even before a project has been formally approved, since a risk analysis must be a key component of a rigorous project selection process. Also, for Agile supporters, Agile principles can be applied within a waterfall project setting, where deliverable groups are timeboxed to provide progressive functionality.

Figure 2.17 – Generic CDEF project life cycle

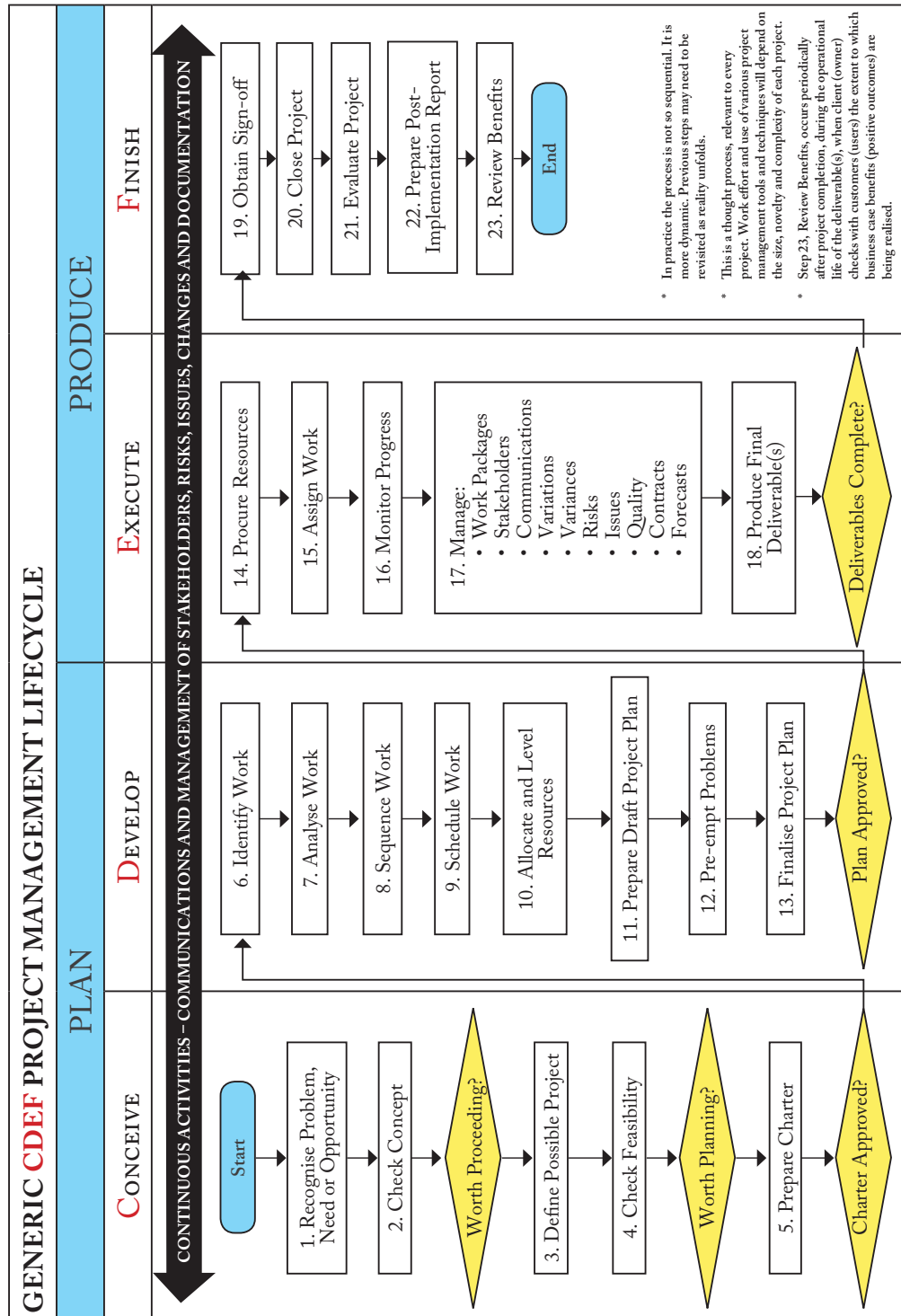
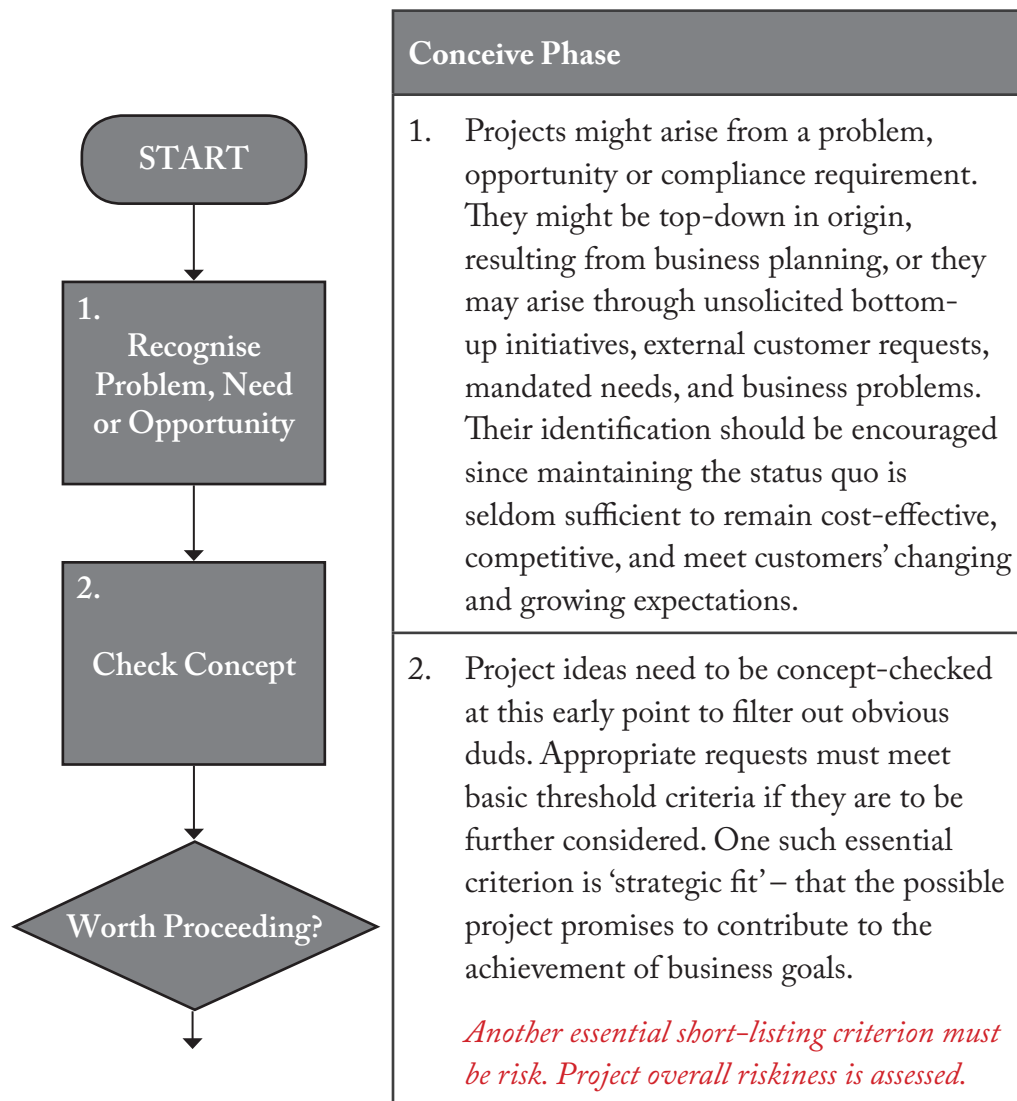
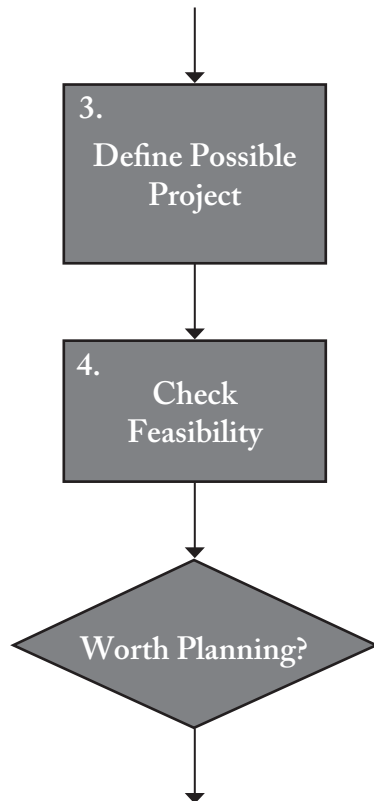


Figure 2.18 – Project life cycle and risk management activities



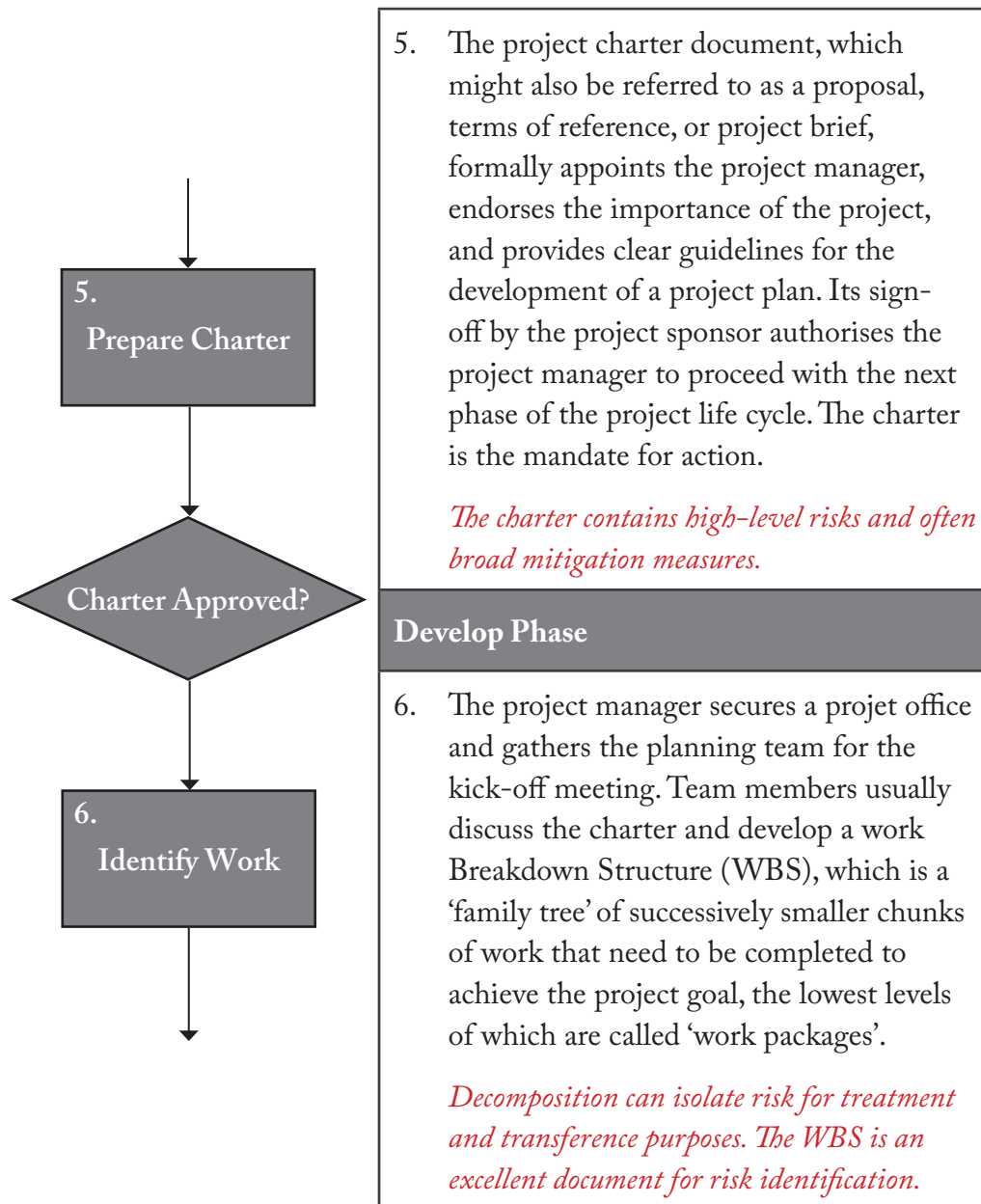


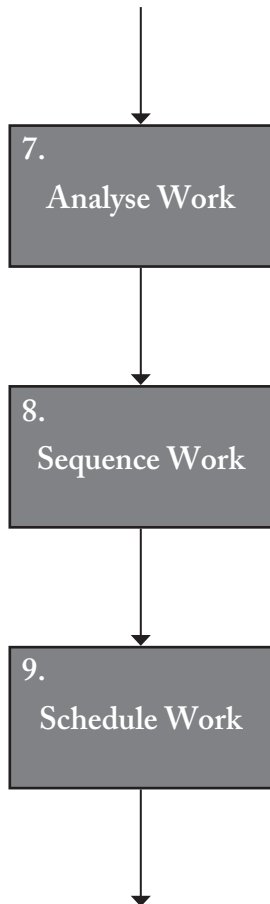
3. Requests that survive the concept check need to be more precisely described and defined to enable their further evaluation. This high-level scoping of the possible project focuses on purpose, goal, benefits, work scope, order-of-magnitude estimates of cost and time, quality, identification of initial stakeholders, risks, assumptions and issues. It's an overview statement of sufficient detail to enable the next step in this process.

Here initial risk and assumptions are identified and documented.

4. The feasibility study culminates in an initial business case that may or may not justify investment in the possible project. The key requirement is that the estimated benefits (positive outcomes) of proceeding sufficiently exceed the likely costs involved, taking account of project risk, opportunity cost, and resource availability. It's a project selection process that recognises organisations possess finite resources and project priorities therefore need to be established.

Risk must be addressed in the project business case. Is the project worth the risk?





7. Once the work has been decomposed into work packages, these are each analysed by team members with appropriate experience and expertise to more accurately determine resource needs, performance standards, costs, work effort and durations. The deliverable is a 'bottom-up' estimate.

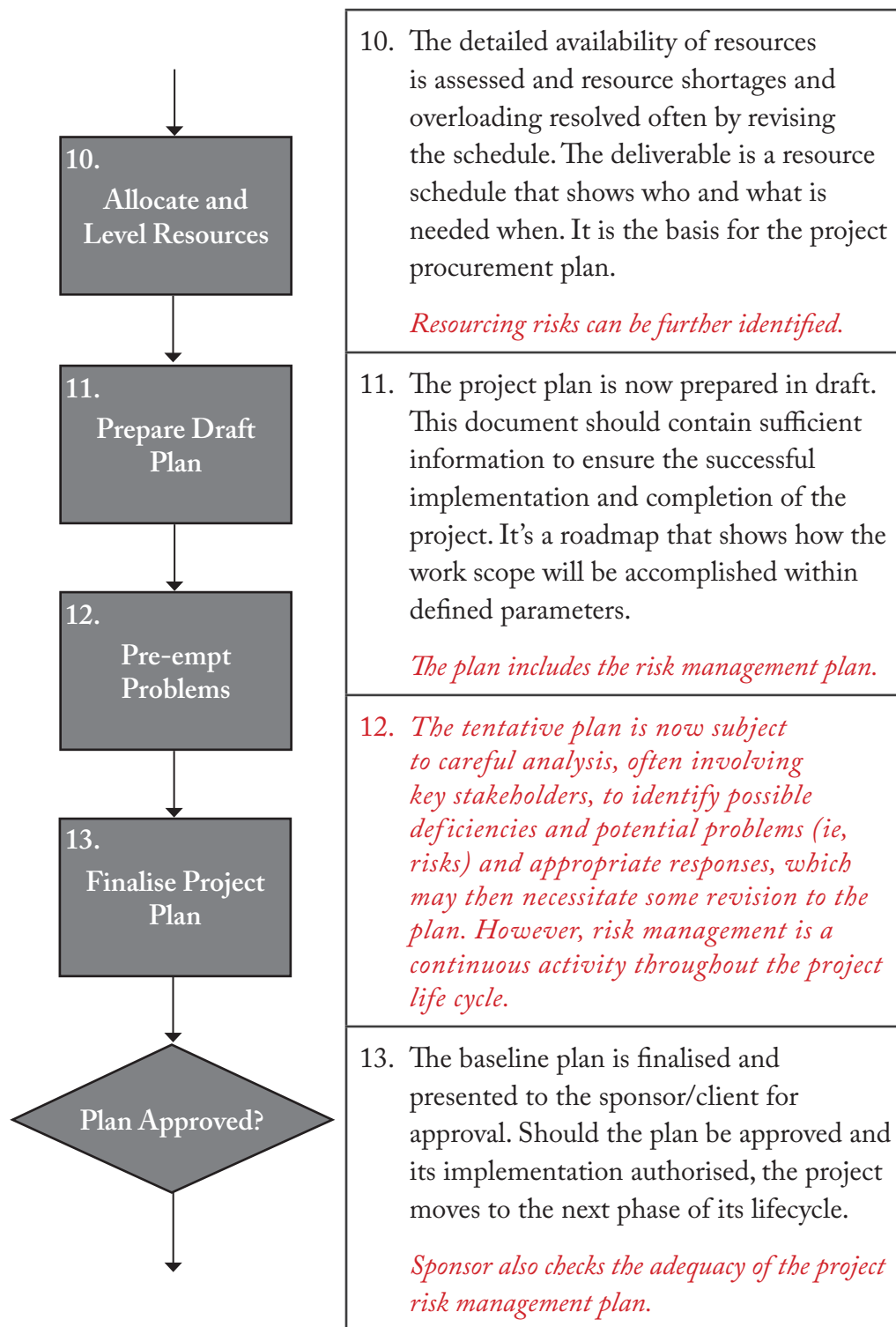
Estimates must make appropriate provision for risk. Time and cost contingencies are included.

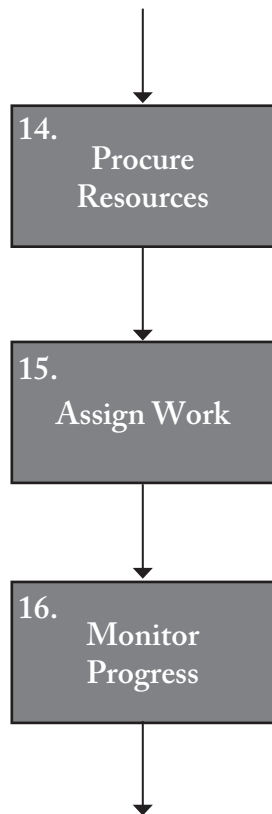
8. This step requires we decide the 'logic' of the project, which recognises the relationships between work packages and illustrates these relationships by network diagram. This output is an analytical tool that enables us to identify the project 'critical path', estimate project duration and completion date, and undertake a variety of 'what-if' assessments.

A network diagram permits risk sensitivity analysis and helps us identify dependency risks.

9. The schedule, or work timetable, is prepared and published as a table or Gantt chart, showing what work is to be undertaken when (calendar dates) and by whom. A variety of software packages are available to assist us with this scheduling activity.

More specific schedule risks can be identified as this step.





Execute Phase

14. Formal approval of the plan and its definitive budget allows us to undertake procurement action to obtain the resources needed for the project. Supply contracts are finalised and signed.

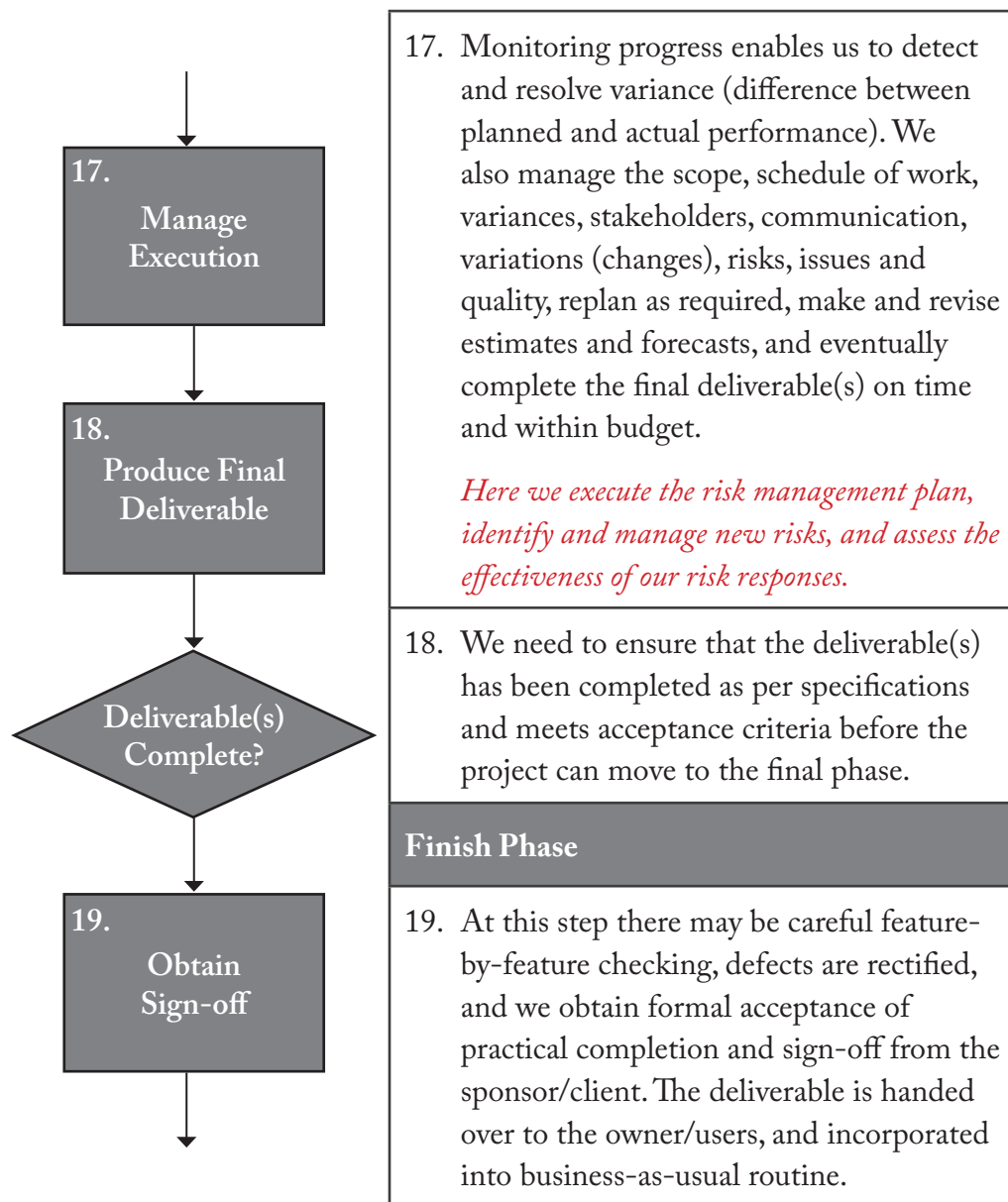
Contracts are risk management tools.

15. Work packages are formally delegated to employees or their completion is outsourced to contractors, suppliers and consultants. Responsibilities, communication and control arrangements are finalised, contracts agreed and work commences.

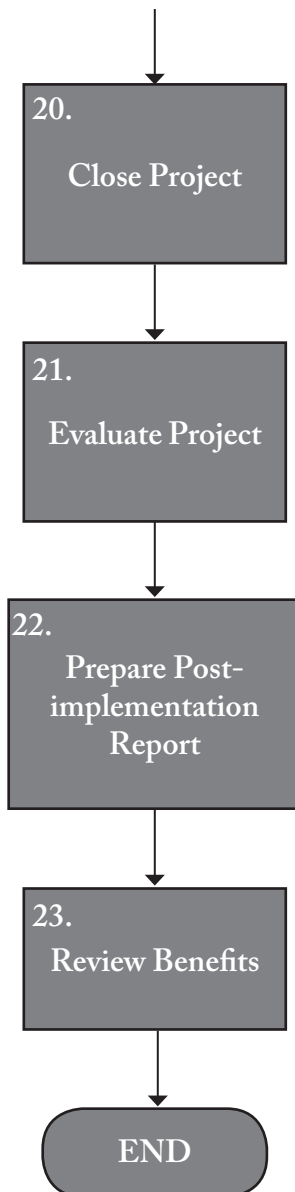
Risk is thoroughly and openly discussed with all project people including contractors.

16. Once work commences, its completion is tracked to ensure progress and performance proceed as planned. Progress is determined through reports, meetings, surveys, visits, reviews, sampling and testing as appropriate.

Risk management monitoring and control is an essential aspect of this step.



The application of this project management framework and the associated tools and techniques are explained in detail in “The Framework for Successful Project Management” the third edition of which has recently been published.



20. Given sign-off, the project can be closed down. Closure will already have been planned, but details will often need updating. This activity is essentially a project within the project when all closure activities are identified, scheduled and responsibilities for their completion assigned. Finish procedure might also address post-project requirements such as user training, deliverable operation and maintenance, and benefits realisation.

21. Before the project team disperses, project performance is evaluated and project final completion celebrated.

22. The project evaluation findings are contained in a formal report. Lessons learned are documented, estimating databases, processes and procedures updated as required, and the project files archived.

Risk management effectiveness is also reviewed and our risk database updated.

23. Periodically after project completion and product/service launch the client/ sponsor will check with users/customers to determine the extent to which business case benefits are being achieved or have been achieved. As a result, project selection procedures may need to be updated.

Our risk management process and practices may also need to be updated.

The framework focuses on results rather than documentation, ensuring that nothing is done because the framework says so but rather because the activity is necessary and will contribute to the success of the project. Each step is designed to add value. Also, there are management activities that continue throughout all phases, such as communication, and management of stakeholders, change and risk. Yes, risk management must continue throughout the life of the project.

Why we don't talk about risk

Firefighting. One reason for not talking about risk is the well-known firefighting mentality. Some people simply prefer to wait until a situation is almost hopeless rather than work to prevent it. Firefighting also exists in part because it is exciting, and this is a key to overcoming this unproductive attitude. Do not fan the flames, so to speak, by encouraging or rewarding the firefighter. Instead, look for and encourage those who are usually working quietly in the background to keep risks from happening. If the firefighters are higher up in management, this approach may not work. Instead, we might collect some data from problems with past projects to show that past fires could have been dealt with far more cost-effectively through prevention. We might discuss our finding at our level and attempt to work them up into a management discussion.

This firefighting syndrome is a cultural impediment. We have very limited power to change such a culture quickly. In fact, even top management has limited power to make such changes. So, what do we do? I suggest that we can work within these impediments by understanding them. In the case of firefighting, know who the firefighters are and how they operate. Anticipate what they might do and how to defuse this.

Frugality. Another source of resistance, increasingly common in this era of stretched budgets, is a reluctance to devote resources to potential problems. Managers may tell us that they have enough actual problems to deal with, so why invest in ones that might not happen. The answer to this is if we do not deal with problems early or pre-emptively, while they are easy to resolve, we will have to spend much more time and money later, when the simple fixes are no longer available. Yes, by putting it off, we save on the problems that do not occur, but we spend very much more on those that do.

We may overcome this reluctance to invest in potential problems by examining some completed projects. See what it cost to fix their problems, and then see how much cheaper they would have been to resolve if addressed earlier. Present the findings for a few of these instances to make the case. Again aim to move the findings up to a management discussion, since this is where the values will need to change. Management should always be interested in how they can complete a project more economically, so show them how addressing potential problems will save money overall by using relevant examples.

Negativity and naivety. Some people do not like to talk about risks because it seems negative to do so. This is an easy trap to fall into. The reality is that risk has two faces, and the often-forgotten face is opportunity. Especially in product innovation, behind each risk is often an opportunity to do something better, faster, or cheaper than before. By listing the drivers and analysing the risk, we are really asking whether we wish to get involved in managing this risk or whether we would rather just let risk take its course. That is, we are putting ourselves in control by deciding which of these threat/opportunity situations to participate in. For the ones in which we decide to participate, we can then discuss them as the basis for an opportunity for a better project outcome rather than as a pitfall to be avoided. We face a difficult problem deciding whether and how to blow the whistle about risks that our superiors either don't see, don't consider significant, or don't want to acknowledge openly. Risk is not something we avoid, rather it is something we manage.

Technical Risk. One other trap that awaits us, especially in highly technical development projects, is to assume that project risks are all technical. Surprisingly few of the risks that can derail a technical development project are technical. If we involve only technicians, engineers and scientists in the risk identification process, we are likely to overlook many project risks and their solutions. The "softer" variety risk often arises due to uncooperative and unsuitable project team members – those with unsatisfactory attitudes, which are usually first addressed by counselling rather than coaching.

Risk management implementation

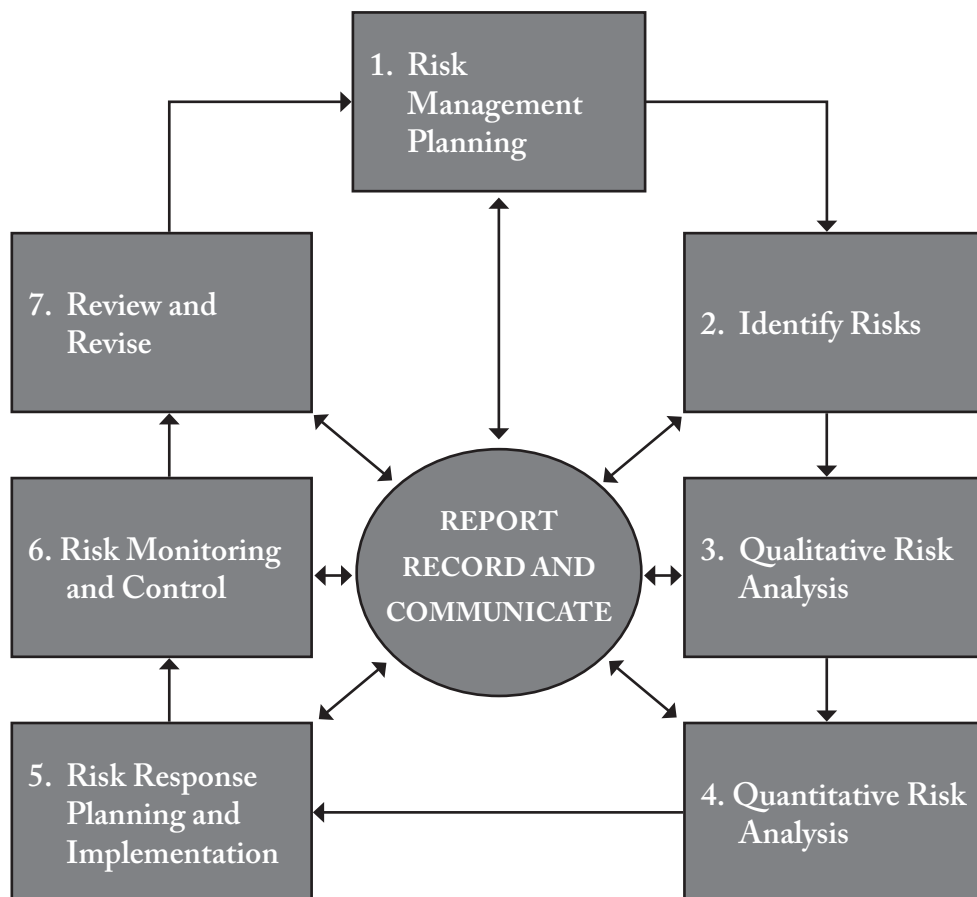
To help ensure the effective implementation of risk management, the following practices are of proven usefulness:

- **Consider risk also as an opportunity.** The tone of risk management can be rather negative. We are usually looking for things that can go wrong and working to keep them from happening. If we follow this trail to its logical end, we will drive out all of the surprise in the project, which is often the very innovation we seek. Innovation requires we assume some risk. We simply would like to be able to choose the risks we take and be aware of the uncertainties in our project. We also need to think opportunities. The potential to add value is greatest at the start of the project and diminishes as the project proceeds.
- **Involve a cross-functional team.** When developing new products, it may be quite natural to see the project as a technical one involving mostly technical people. In contrast, the risks that are likely to keep us from being successful with our project will be mostly non-technical ones. For example, if we do not involve our purchasing people in managing our risks, we would be likely to miss procurement risks. Similarly, we need to involve marketing, human resources, manufacturing, finance, information technology, regulatory, and other functions as appropriate to give a broader perspective on risk.
- **Operate proactively.** The key characteristic of effective risk management is being proactive about it. This means that we identify risks and do something about them before they affect our project. However, this is easier said than done. Many managers are reluctant to spend time or money on potential problems, since they have plenty of real problems to address already. Unfortunately, the proactive management of risks is a style foreign to many managers. Such stressed managers live in the crisis quadrant of Stephen Covey's matrix and therefore have little time to anticipate.
- **Ban firefighting.** The opposite of being proactive is firefighting, a management style that thrives on the excitement of waiting until situations are almost hopeless and then saving them miraculously. This style does not fit with proactive risk management, so if we have such reactive individuals in our organisation, they will need to be reoriented.

- **Train people.** Project teams need to be trained in the nuances of applying the risk management process to their projects. Experience shows that writing clear, specific risk events, impacts, and related statements is a learned skill. Not so obvious is that management will have to be trained also or they may, for example, attempt to reformulate the process and argue over what is a risk.
- **Understand the work involved.** On the surface, risk management seems to be extra work. What is not so clear is that the process ultimately saves time and money because teams will be spending less time during the execution of the project dealing with surprises. Teams need to appreciate this or our risk management plan is unlikely to be accepted or implemented.

Risk management cycle

Figure 2.19 – Risk management cycle



Risk management, as an integral part of project management, occurs on a daily basis, when we proactively look at projects in a comprehensive manner and assess and document project risks. Although the steps are done in sequence, remember that they are each done often during the course of our project. Risks can be identified at any time, as can responses. This iterative process or continuous cycle is illustrated at Figure 2.19. The steps involved provide a basis for subsequent chapters:

1. **Risk management planning.** Risk management planning is the systematic process of deciding how to approach, plan and execute risk management activities throughout the life of our project. It is intended to maximise the beneficial outcome of opportunities and minimise or eliminate the consequences of adverse risk events. The output is the risk management plan that describes how risk management will be done on our project. This plan may be published as a standalone document or incorporated as a section in the project plan.
2. **Identify risks.** Risk identification involves determining which risks (threats and opportunities) might affect the project and documenting their characteristics. It may be a simple risk assessment organised by the project team, or the outcome of a specific workshop process. Risks to the entire project are identified, but also to risks at work package level. The output is invariably a large list of risks and the start of a risk register. While risk identification typically occurs at the beginning of the project, it will reoccur throughout the project life cycle. It's a repetitive event, recognising that new risks arise as the project matures and situations change.
3. **Qualitative risk analysis.** Qualitative risk analysis subjectively assesses the impact and likelihood of the identified risks and develops prioritised risks for further analysis or treatment as appropriate. The project manager, assisted by the project team, assesses each identified risk for its probability of occurrence and its impact on project objectives. Project teams may elicit assistance from subject matter experts or functional units to better assess the risks in their respective fields. Qualitative risk analysis is undertaken for all projects and applies subjective assessments. The output is an updated risk register. A choice is then made about whether quantitative evaluation is necessary for selected risks or to move directly to risk response planning.

4. **Quantitative risk analysis.** Quantitative risk analysis is a way of numerically estimating the probability that a project will meet its cost and time objectives. Quantitative risk analysis is usually applied to larger more complex projects where a higher level of investment in risk management is worthwhile. Monte Carlo simulation is one particular technique that may be undertaken. The output is a further updated risk register. The objective of risk analysis is to transform risk data into decision-making information.
5. **Risk response planning and implementation.** Risk response planning is the process of developing options and determining actions to enhance opportunities and reduce threats to the project's objectives. We identify and assign parties to take responsibility for each risk response. This process ensures that each risk requiring a response has an owner. The project manager and the project team identify which strategy is best for each risk, and later implement that strategy as required. We also create fallback plans to be used if the contingency plans do not succeed. Risk response implementation requires that risk owners complete their agreed actions. Response strategies often result in updates to the risk register and project management plan as well as risk-related contractual agreements.
6. **Risk monitoring and control.** Here we track identified risks, implement risk response plans, as required, monitor residual risk, and identify new and secondary risks. We carry out risk response plans and evaluate their effectiveness in resolving risk. The main outputs of this process include recommended corrective and preventative actions, requested changes, and updates to the risk register and project management plan.
7. **Review and revise.** A risk review looks forward in time, while a risk audit looks backwards at what has already occurred. We recognise that risk management is an on-going process that continues throughout the project life cycle, and we can improve this process continuously as we learn from each new experience. The risk management process is best seen as a basis for improvement. However, proposed improvements need to be endorsed by our organisation before their implementation, otherwise local, well-intentioned enhancements will soon mean we have no standard approach to project risk management. In an ideal feedback loop, lessons learned also serve as a base for risk identification sessions on future projects. Formalising this last step is in addition to those steps contained in some more common risk management models.

The diagram at Figure 2.19 also recognises that communication and consultation with project stakeholders is central to undertaking good risk management and should occur throughout the risk management process. Communication is integral to almost every aspect of a project's life cycle. The purpose of this dialogue is to ensure a two-way flow of information. The views of stakeholders have an impact on the decisions made, so it is important that their views and perceptions are captured and integrated into the process. Communication problems are probably the top risk to the success of projects worldwide.

This process or cycle provides a basis for the chapters that follow, where each of these steps is discussed in more detail. In practice, risk management starts during the project conception phase, continues for the duration of the project, and at any one time all seven steps might be underway simultaneously. Communication is also on-going. In fact, it needs to be clear, concise, complete and continuous.

Risk assessment survey

Before approval is given for a project, it is important to check for project riskiness. How much risk is inherent in the project proposition? Is the proposition within or still within our risk tolerance threshold or through appropriate risk management can we make it so? Honest answers to the following questions may help us reveal potential problems or even have us review the wisdom of proceeding further with our project. It is most unlikely that we will be able to answer yes to all these questions:

- At the start we don't jump straight into risk identification, rather we put some serious thought into how risks will be managed?
- Do we have in place an effective risk management methodology that all project team members can competently apply?
- Is there a widely accepted and persuasive need for the project?
- Is there no significant threat to our organisation if the project is delayed, cancelled or unsuccessful?
- Is there widely shared dissatisfaction with the current situation and a sense of urgency for the change our project will deliver?
- Is there publicly committed sponsorship for the project and is our sponsor recently experienced with similar projects and at a high enough level in our

organisation to have the necessary influence and decision-making authority?
And will the sponsor be readily available for the duration of our project and until project benefits are realised after product launch?

- Do we have sufficient resources within our organisation and are we prepared to fully commit them to sustain the project and the consequential change?
- Is our project goal and method for its accomplishment consistent with our organisation's core business and values?
- Will the project contribute to our organisation's vision and key business goals?
- Does the project promise to exploit our organisation's strengths and avoid our weaknesses?
- Is the project compatible with our existing and pending projects?
- Will the project cause no significant disruption to or distraction from our business-as-usual work?
- Will the project enhance our reputation and public image?
- Is there a well-articulated vision of the change that is clear, compelling and commonly understood and shared by all stakeholders?
- Is the project scope clear and likely to be stable?
- Is the project deadline realistic, the project duration less than three months, and the total project work-effort less than 300 person-days?
- Will the peak size of the core project team be five people or fewer and will this team be fulltime until project completion?
- Has the project team previously worked together successfully and will they be collocated?
- Have we as the project manager successfully completed at least one similar project recently?
- Will most project implementation and control decisions be made by ourselves as project manager?
- Do we understand and monitor the appetite for risk of our key stakeholders?
- Do we review the risks of previous projects and learn from previous projects.
- Are project parameters (ie, scope, time, cost and quality) well defined, with only one constrained?
- Does the project possess less complexity than our other recent successful projects?

- Does our organisation possess the required expertise to undertake the project?
- Will our project use only established and existing technology?
- Is our project independent of outside contractors and suppliers, and if not, are all project materials and components available from multiple and reliable suppliers, and do all key components have short lead-times relative to the project's duration?
- Is project success independent of external factors – political, environmental, economic, technical, social, competition etc?
- Will there be no patent, trademark, privacy, copyright or intellectual property issues?
- Will the project be a sustainable development that meets current needs without jeopardising the ability of future generations to meet their own needs?
- If outside contractors and suppliers are involved, have we used them before, and are we entirely confident about their availability, expertise and reliability?
- Will the project and its deliverables comply with all relevant legislation – existing and pending?
- Will there be at least weekly tracking and reporting of project progress?

The above is not a complete checklist and it is most unlikely that we could confidently answer yes to all these questions since all projects contain some risk. Also, this checklist does not attempt to rank questions in terms of their relative importance, although this could be done for a specific project or organisation. Nor does the checklist allow for graduated responses. Rather wherever we answer no there is some added element of risk to our project that may need to be addressed.

When projects fail to deliver results, ensuing discussions can often become accusatory. Unfortunately, it's usually then too late to repair the damage. This is why every project needs a solid business case at conception. While we project managers do not usually prepare the business case, we do use it as a basis for our decision-making throughout the project. It is therefore in our interests to ask the following questions about the business case:

- Is it clearly stated and in line with the organisation's mission, strategic goals and core values?

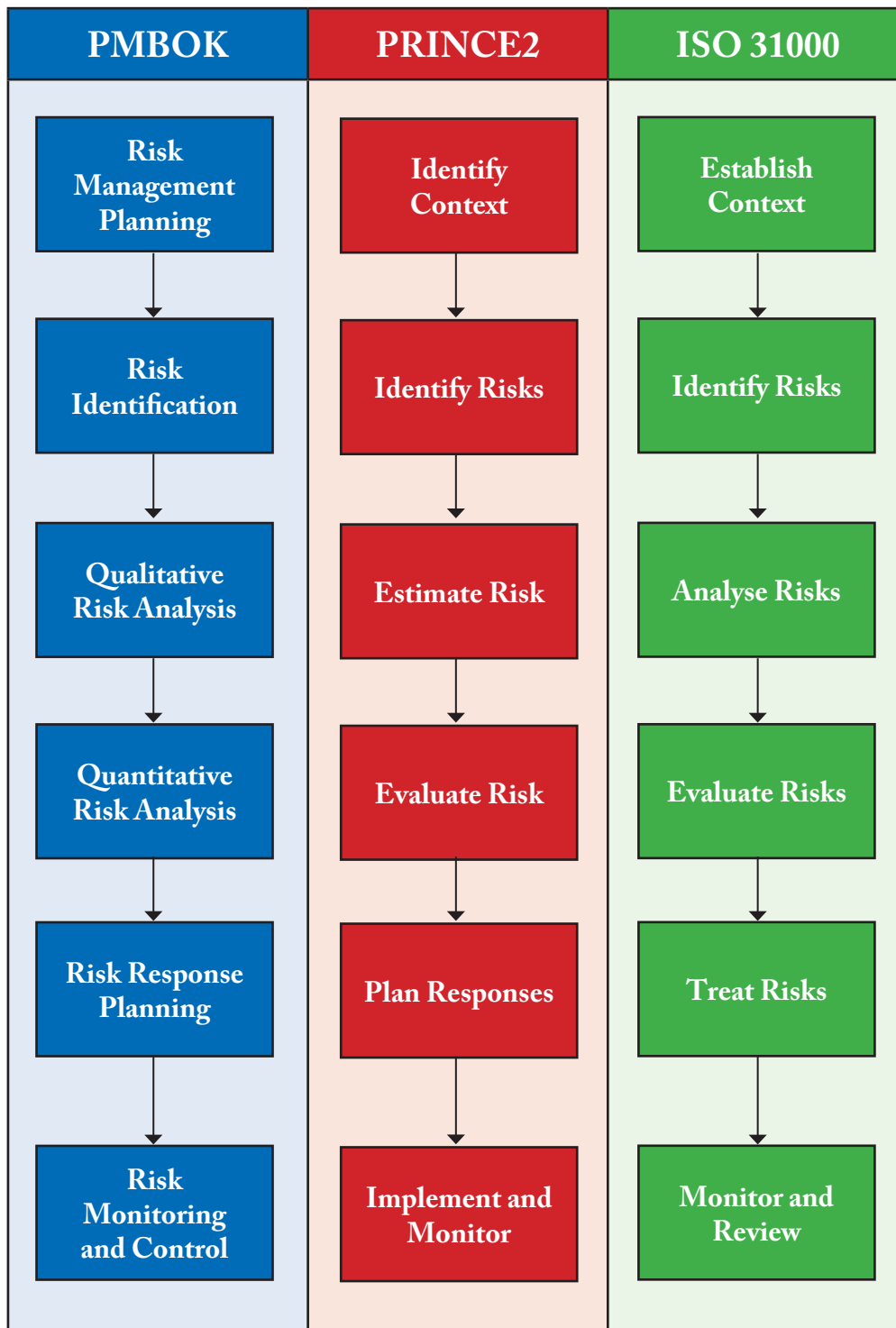
- Have the benefits (tangible and intangible, direct and indirect, immediate and longer term, and their likelihood) been clearly identified and assessed as accurately as possible?
- Is it clear what will constitute a successful project outcome?
- Are there alternative approaches and is the preferred option clearly stated?

Even after the project is initiated, the business case should be revisited as conditions change. Sometimes changing conditions might invalidate the acceptability of the project. The project business case is a living document and needs to be reviewed periodically (particularly the anticipated benefits) as the project progresses. Sometimes the external environment changes, potential risks may become reality, new risks may come to light, and new business decisions may directly impact the priority and validity of the project. While the business case and its on-going review and updating are the project sponsor's responsibility, as project manager we too should understand the rationale for our project in so much as this knowledge will help us in our decision-making during the project life cycle.

Some key risk management processes

You will notice the similarities of the process explained in this book to the more common risk management process steps summarised in the diagram at Figure 2.20. While some different terms are used, the activities undertaken at each step are essentially the same. This process contains a further step – Review and Revise. This further step formally recognises the need to review the effectiveness of our risk management methodology. Lessons learned about the effectiveness of our methodology may cause some revisions.

Figure 2.20 – Common risk management processes



Concepts such as risk tolerance and risk ownership are similar across the different risk management approaches. In the PRINCE2 process, qualitative and quantitative risk analysis are called risk evaluation. Risk response planning is referred to as identifying suitable responses to risk and selecting and planning resource use. The risk register is called a risk log. Otherwise the concepts are very similar.

Some advantages of having a standard risk management methodology appropriate for our organisations are:

- A common language helps ensure effective communications within and among functional departments.
- Helps ensure that risk is managed in a logical manner.
- Reduces the learning time and guides newcomers.
- Helps overcome complacency and procrastination.
- Ensures measurable progress and predictable results.
- Enables comparisons and bench-marking and provides a basis for continued improvement.
- Gives confidence to our clients and other stakeholders.

PMBOK® means Project Management Body of Knowledge, which is authored and owned by the Project Management Institute, PMI®. PRINCE2 stands for Projects in Controlled Environments. PRINCE2 was developed and commissioned by the UK Government. PMBOK® started its life in the United States and PRINCE2 started life in the United Kingdom. These are still their respective strongholds although both, mainly through default, are increasingly used worldwide. ISO 31000:2009 is substantially based on the original AS/NZS 4306 Standard. Importantly, these three main methodologies are not mutually exclusive. Project risk management practitioners typically borrow from all methodologies as appropriate.

Summary

Different project stakeholders are interested in different levels and types of risk, depending on their stake:

- The project team need to know about detailed project risks in their area of the project.
- The project manager needs to know about all risks to project objectives.
- The project sponsor is interested in business benefits and project deliverables, so needs to know about risks to these.
- Users need to know about functionality risks.
- Senior management should be told about strategic risks.

A project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives (PMI). These objectives (sometimes referred to as parameters or constraints) are scope, cost, time and quality. Their priority may vary with each project and this priority may change during the project. Project risk management is primarily undertaken to improve the chances of projects achieving or even exceeding these objectives.

A project involves uncertainty. Because every project is unique, it's sometimes difficult to define its objectives clearly, estimate accurately how long it will take to complete, or determine how much it will cost. This uncertainty is one reason project management is challenging, especially for projects involving new technologies.

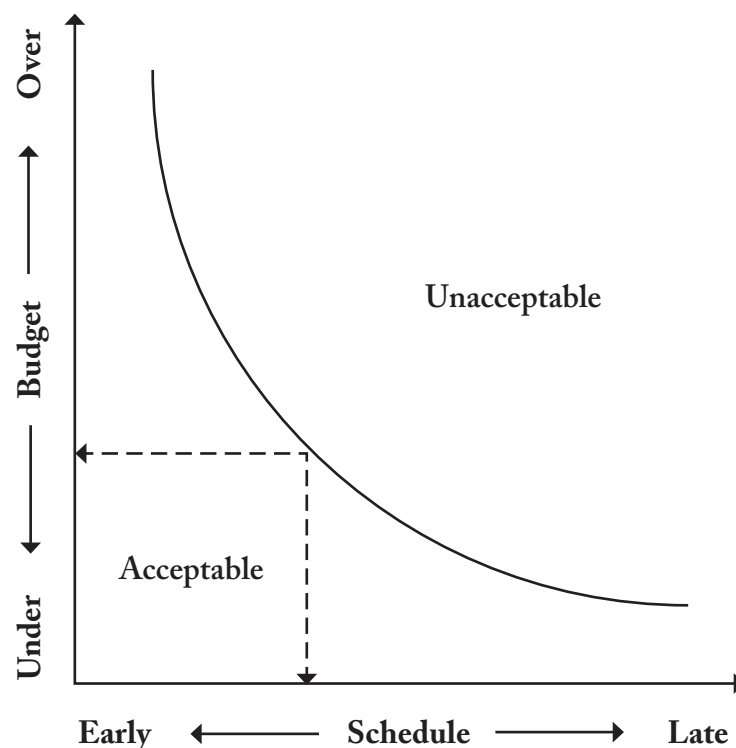
Risk may be internal (within the project) or external (outside the project). The project manager is mostly concerned with the internal variety of risk and the project sponsor keeps abreast of external risks, sometimes depicted by the acronym PESTLEC, the uncertainty of which affect the viability of the project particularly from a business perspective.

In project management, risk tolerance is a measure of the degree of uncertainty that a stakeholder accepts in respect of the project risk assessment. The three major stakeholders of a project are the organisation that implements the project, the client or the owners of the project, and the project manager. Risk is intangible, or invisible, and remains subjective based on stakeholder perception. These three stakeholders rarely share the same view or opinion on the possible outcomes of

a project, having divergent views of what constitutes risk and consequently risk tolerance.

Organisations and individuals often have different tolerances to risk, varying from risk takers to risk avoiders. However, all projects possess risk since they are unavoidably based on assumptions about the future – a future that is somewhat uncertain and always changing. Figure 2.21 is a typical risk tolerance curve, showing what is acceptable in terms of budget and schedule uncertainty. Acceptability depends on risk tolerance.

Figure 2.21 – Risk tolerance curve



Project risks have three defining components:

- The **event** itself. What can happen, good or bad, to the project?
- The **probability** of occurrence. How likely is it that the risk event will occur?
- The **impact** of the event. What could be the effect of the risk on project objectives and how severe will this effect be if the risk event does occur?

Project risk can have either a negative or positive effect on the project. This is the kind of risk every project and organisation should be pursuing, with the aim of reducing the former and maximising the latter. Previously we were preoccupied with treats to the exclusion of opportunities. We now recognise that net risk equals treats minus opportunities.

Risk that has only a potential for loss is called pure or insurable risk. This kind of risk should be avoided or passed to a third party either by purchasing insurance, by using a contractor/subcontractor/consultant, or teaming with another company. It's about shifting, sharing or spreading the risk.

Uncertainty typically diminishes as the project goes through its life cycle. This is because we learn more as the project proceeds. There is no uncertainty at project completion other than the commercial success of the product.

INCIS, the failed IBM/NZ Police computer project provides a useful acronym for key project risk factors – Imprecise, Novel, Complex, Inexperience, and Scale or Size, which factors can have a compounding and “butterfly” effect. The “butterfly” effect occurs when something small happens that starts a chain reaction causing disproportionate consequences. To these we could add assumptions although these may be a function of the other factors. Such project propositions might better be culled early. See Figure 2.22.

Project risk management is the continuous process of identifying, analysing, and responding to the risks in a project, which is an activity for all project players.

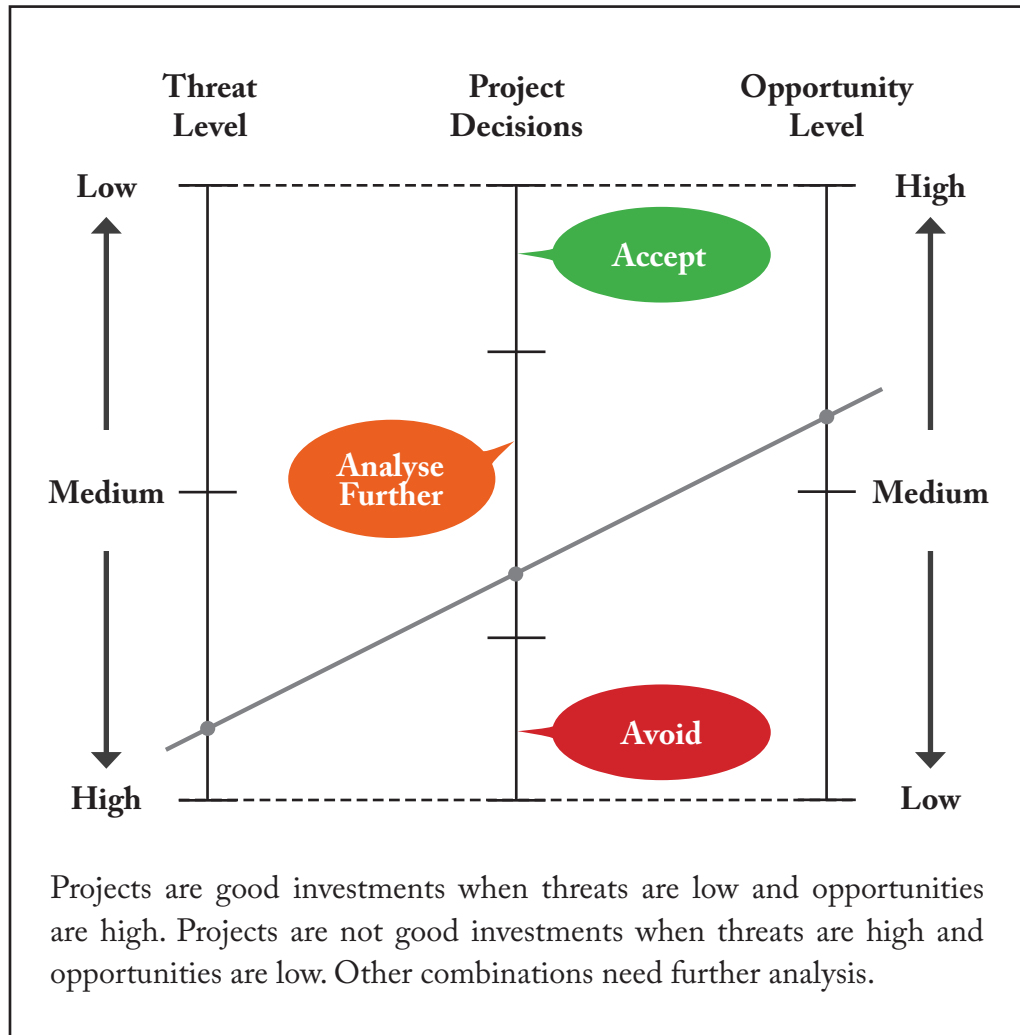
Risk management principles, derived from experience, are hard earned and hard learned. While adherence to them doesn't guarantee project risk management success, we ignore them at our peril. All projects possess some risk and a successful project therefore usually means that someone has made a courageous decision. The top principle is that risk is managed proactively, rather than reactively.

Common barriers to good risk management include:

- An organisational culture that discourages or penalises discussion of risk.
- Product/project complexity and uncertainty with unclear scope, deliverables and requirements.
- Schedule urgency and tough budgetary constraints.
- Lack of knowledge about the client's priorities and users' needs.

- Inability to assemble the project team in one location.
- Lack of historical information.
- Client/sponsor reluctant to spend time and money on risk management.

Figure 2.22 – Decision nomogram



As project managers we have limited control over risks to the benefits that justified the investment. However, if we do spot a risk that has an impact on benefits it should be notified to our sponsor.

All risk management is done by people whose attitudes to risk exercise a major influence on the effectiveness of the risk management process. This situation is further complicated by subconscious perceptual factors. Also, organisational culture has a significant influence over the effectiveness of the risk management process. Where senior management do not recognise the existence of risk, or see risk identification as a sign of weakness, or view resources allocated to contingency or risk responses as wasted, risk management will be on a hiding to nowhere. Conversely, the organisation that knows how to take risk intelligently will reap the undoubted benefits of minimising threats and capturing opportunities.

For many organisations, project risk management is a concept embraced in theory, but neglected in practice. If we are serious about risk management and if we plan to manage risk in our project, then some basic requirements are:

- Include risk management activities in the project schedule.
- Make risk management an agenda item for all project meetings.
- Communicate the importance of risk management to the entire project team.
- Establish the expectation that risk will be properly managed, documented and reported throughout the project life cycle.
- Allow sufficient budget for risk management activities.
- Know our organisation's tolerance for risk. How much risk is our organisation prepared to accept for the project?

The next chapter considers the content of the project risk management plan and further describes the risk management process.

Processes and Planning

Field Marshal Helmuth von Moltke's famous statement, "No plan survives contact with the enemy" sits at the heart of any strategy for managing uncertainty. Some project plans are naively based on a static view of the world, fixed in time at the start of the project. Consequently, the plan only remains valid as long as nothing changes, which usually isn't long. Project environments never remain static and planning assumptions change over time. Therefore, to plan for uncertainty means a willingness to revise the plan when the situation demands. So our plan to manage project risk is always a work in progress – a living document.

The first step in project risk management is not risk identification. The first step is to develop a risk management plan that explains how risk will be managed in our project. We recognise the need to scale the risk management plan to meet the risk challenge of each project. Projects that are more risky or strategically important usually require a more robust approach to risk management than those that are more simple and routine. The scalable aspects of the plan include methodology, tools and techniques, organisation, and reporting arrangements.

Two important matters that need to be decided before we embark on the project risk management process are:

- What risk threshold is acceptable for the project? The answer will depend mainly on the risk tolerance of key stakeholders for the particular project.
- What definitions will apply for terms such as high, medium and low for probability and impact qualitative analysis and risk severity ratings.

Risk management planning is the process of deciding how to approach, plan and implement the risk management activities for the project. The output of this process is a risk management plan that documents the procedures for managing risk throughout the project life cycle.

Project teams should hold a meeting early in the project's life cycle to develop the risk management plan. To help this planning process, the project team would typically review project documents, particularly the draft project plan if prepared, as well as any organisational risk management policies, risk categories, risk lists, lessons-learned reports from previous similar projects, and templates for creating a risk management plan.

It is important to consider the organisation's level of risk tolerance and that of the project's key stakeholders. For example, if the organisation or project sponsor is risk-averse, the project manager would take a different approach to risk management than if the project sponsor was risk neutral or even a risk seeker. One problem could be that the sponsor's attitude to risk for a particular project is markedly different than that of the organisation's. This situation warrants a very honest discussion and perhaps third-party intervention or escalation of the issue in the case of an impasse. If we are unsure, it's usually sensible to be conservative until we know otherwise.

Risk management plan

The risk management plan is developed during the conception and development phases of our project and updated as required during project execution. A risk management plan describes how risk management will be performed on our particular project. It concerns the overall risk strategy for the project and involves the thoughtful development, implementation and monitoring of appropriate risk response strategies. Like other specific knowledge area plans, the risk management plan may become a sub-set of the project management plan. It is important to clarify roles and responsibilities, prepare budget and schedule estimates for risk-related work, and often to identify risk categories for consideration. It is also important to describe how risk management will be done, including assessment of risk probabilities and impacts.

The risk management plan explains how the project manager and project team intend to manage risk for the project. It provides guidance and requirements, and serves as a communication tool for those who wish to be informed of the project's risk management approach. The plan formalises the ideas presented during the risk management process and may clarify some of the assumptions our project team has regarding the risk management process. The project risk management plan provides specific guidance for our project team in all steps of the risk management process for our project. The risk management plan documents the processes to be used throughout our project for identifying, analysing and managing risk.

The risk management plan would typically repeat the project purpose, goal and objectives and depending mainly on the project's size and complexity, would also address the following risk management items as a minimum:

- **Methodology.** How will risk management be performed? What policies, principles and processes will apply? The methodology is adapted to the needs of each project. Low-priority projects will likely warrant less risk management effort than high-priority projects. How much risk management will be performed, taking into account the project's priority, size and complexity?
- **Roles and responsibilities.** What are the specific risk management roles and responsibilities of key players? Who will do what? A Responsibilities Assignment Matrix (RAM) can provide a useful summary. See Figure 3.1. The RAM template allows us to allocate risk management responsibilities for our project, typically using RASCI definitions, where:
 - ♦ **R = responsible.** Those assigned to do the risk management work or for ensuring the work is done.
 - ♦ **A = accountable.** Those who are ultimately accountable for the proper completion of the work, and to whom the person responsible is accountable.
 - ♦ **S = support.** Those who can provide support to the risk management activity.
 - ♦ **C = consulted.** Those whose opinions are to be sought and with whom there is two-way communication.
 - ♦ **I = informed.** Those who are to be kept up-to-date on progress, with whom there is typically only one-way communication.

Sometimes other RAM designations might apply or be more appropriate, such as Driver, Approver, Contributor, Verifier, Signatory, and even Omitted. The Others column might include the Programme Manager, Project Director, Customer Project Manager, etc. The RAM needs to be customised to meet our specific requirements. It may be a basis for detailed job descriptions.

Figure 3.1 – Responsibilities assignment matrix

Risk Management Process Tasks	Main Roles				
	Sponsor	Programme Manager	Project Manager	Risk Owner	Others (specify)
Risk management planning					
Risk identification					
Qualitative risk analysis					
Quantitative risk analysis					
Risk response planning and implementation					
Risk monitoring and control					
Review and revise					

Other topics likely to be addressed in a project risk management plan are:

- **Budget.** What resources are needed and what is the estimated cost for undertaking the risk management process? Cost associated with the provision of risk management and contingency planning is included in the project budget. We should appreciate that this sum is an investment in saving time and money by avoiding or reducing threats and taking advantage of opportunities.

- **Risk categories.** What main categories of risk will be relevant and therefore addressed on the project? There are a variety of ways to classify or categorise risk. One very useful method is to use the categories or objectives of scope, schedule, cost and quality recognising also their relative importance. To which health and safety might also be added. The aim is to have a comprehensive, consistent and coherent approach to risk identification.
- **Risk thresholds.** What level of risk to each project objective will be acceptable? This will be influenced by the relative importance assigned each objective and stakeholder risk tolerance.
- **Risk analysis.** How will risk probabilities and impacts be determined? What methods will be used for qualitative and quantitative risk analysis? A declared standard for probability and impact is defined so the level of application is precise and similar for all involved.
- **Communications.** What risk recording and reporting procedures and templates will be used?
- **Audit.** By whom, how and when will the risk management process be audited?
- **Glossary.** Definitions of project risk management terms may be needed to ensure their common understanding and effective communications.

In addition to these generic matters and after risks are analysed, project risk management plans usually contain some more project-specific risk-related matters, including:

- **Contingency plans,** which are predefined actions that the project team will take if an identified risk event occurs. For example, if the project team finds that the release of a new software package is not to be available in time for them to use it for their project, they might implement a contingency plan to use an existing, older version of the software. Contingency plans are generally part of the risk management plan, but they may also be integrated into other parts of the overall project plan, perhaps as part of the scope management plan or quality management plan.
- **Fallback plans** are developed for those risks for which contingency plans prove to be ineffective. For example, a university graduate might have a main plan and a contingency plan on where to live after graduation, but if neither of those plans work, a fallback plan might be to live at home for

a while. Sometimes the terms contingency plan and fallback plan are used interchangeably, but usually a fallback plan is what we implement if our contingency plan fails. The fallback plan may not necessarily be prepared and published in advance.

- **Management reserves** are provisions typically held by the project sponsor or organisation to reduce the risk of cost or schedule overruns to an acceptable level. For example, if a project appears to be off course because staff are inexperienced with the use of some new technology and the team has not identified that as a risk, the project sponsor may provide additional funds from the management reserve to hire an outside consultant to train and advise the project staff in the use of the new technology. Contingencies, or contingency reserves as they are sometimes termed, are for identified risks, whereas management reserves are for unidentified risks. Management reserves are funds that are part of the project budget to cover the cost of unidentified work. The management reserve is not normally used unless we identify new work to be done. Again, sometimes the terms are used interchangeably. Also, the term reserve might be used with other modifiers such as schedule reserve.

The risk management plan needs to be tailored to suit the project and in particular:

- Type and size of project.
- Experience of project team.
- Level of project risk.
- Importance of the project.
- Consequences of project failure.

The project risk management plan should contain sufficient detail to ensure the proper implementation of the required level of risk management throughout project implementation to closure. The size, cost and complexity of the project will usually have major influence on the content and detail of the risk management plan.

Risk management plan – a checklist of essentials

As a minimum, we should not execute our project until we can confidently tick yes to each of the following ten items:

- ☐ 1. Is there a process for identifying and documenting risks? And is there a readily available risk register in which implementation risks (both threats and opportunities) may be recorded?
- ☐ 2. Is there a process in place to assess the priority of each identified risk using qualitative and/or quantitative methods as appropriate? And do we understand our organisation's appetite for risk?
- ☐ 3. Has a response strategy or strategies been identified for each risk? And have we thought about what will happen if major "unknown unknowns" occur?
- ☐ 4. Has a costed contingency been identified where appropriate for each risk?
- ☐ 5. Has a trigger been identified for each contingency?
- ☐ 6. Does the project plan include provision for active and on-going monitoring of risk?
- ☐ 7. Is there a process to track and report the effectiveness of risk responses?
- ☐ 8. Has the entire project team been trained in risk management?
- ☐ 9. Have we assigned each risk an owner?
- ☐ 10. Does everyone know their responsibilities and how to access and complete the risk register?

Project manager's risk management role

PMBOK identifies particular responsibilities for the project manager in relation to the project risk management process. The project manager has overall responsibility for delivering a successful project, which fully meets agreed objectives. The project manager is accountable for the day-to-day management of the project, including effective project risk management. The role of the project manager with regard project risk management may include any or all the following tasks based on the PMI Practice Standard for Project Risk Management (2009):

- Encourage senior management support for project risk management activities.
- Determine the acceptable levels of risk for the project in consultation with key stakeholders.
- Prepare, review and update the project risk management plan.
- Ensure that risk management activities are in the project schedule and risk management is an agenda item for all routine project meetings.
- Promote the need for project risk management and the process and principles that will apply for the project.
- Facilitate open and honest communication about risk with the project team, management and other stakeholders.
- Lead and participate in all aspects of the project risk management process including risk workshops.
- Ensure subject matter experts are employed as necessary to assess risk impact and probability.
- Approve risk responses and associated actions prior to their implementation and confirm who will carry out these risk responses.
- Apply project contingency funds as appropriate to deal with identified risks that arise during the project.
- Oversee risk management as practised by project team members, consultants, contractors and suppliers.
- Regularly report risk status to key stakeholders, and recommend appropriate strategic decisions and actions to maintain acceptable risk exposure.

- Escalate selected risks to the project sponsor as appropriate. Such risks include those outside the authority or control of the project manager, any that require input or action from outside the project, any that threaten the viability of the project business case, and any for which the release of management reserve funds might be needed.
- Monitor the efficiency and effectiveness of the project risk management process.
- Audit risk responses for their effectiveness and document lessons learned.
- Recommend improvements to organisation's project risk management policies, procedures and practices.

Risk owner

Team members identified as risk owners will be responsible to the project manager to:

- Implement agreed response strategies.
- Report on the effectiveness of risk response actions taken.
- Identify new risks that may emerge after response actions have been taken.
- Communicate with the project manager regularly about risk, including the need for other risk response actions.
- Participate in risk identification and review sessions, including a post-project risk management review.

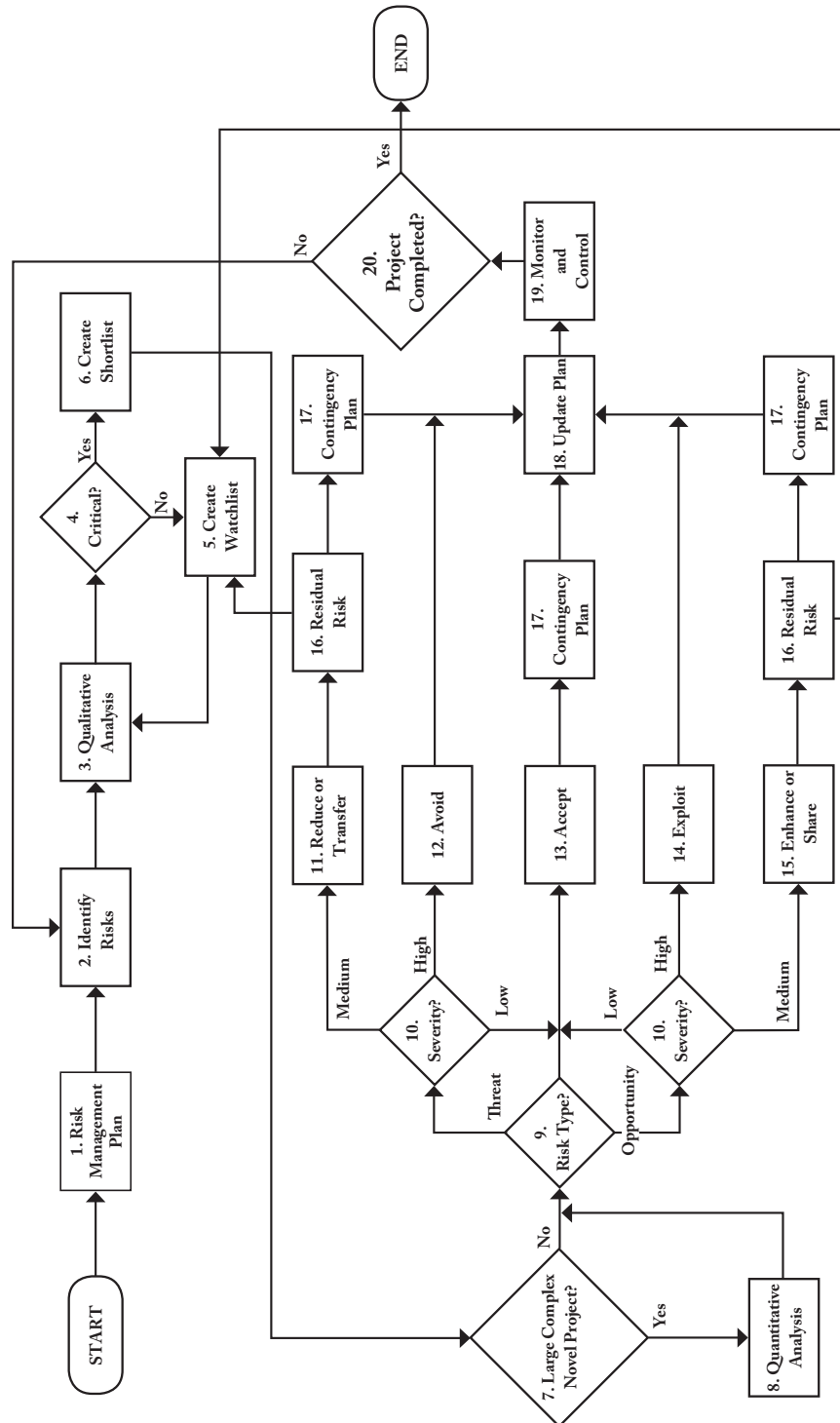
Project risk management responsibilities

Responsibility for risk might sometimes be passed on to others with comments such as, "That's not my worry." This attitude is dangerous since one of the major strategies for controlling risks is to assign risks and accept responsibility for them. We usually assign responsibility for a risk to the person who can best control the situation as shown in the example at Figure 3.2.

Figure 3.2 – Responsibilities for risk

Types of Risk or Risk Classes	Sponsor and/or Steering Committee	Project Manager	Functional or Line Manager(s)	Contractor(s) and Supplier(s)	Client or Owner
Delayed funding	X				
Technical problems			X		
Team member's other work commitments			X	X	
Schedule slippage		X			
Cost overruns		X			
Site safety hazards		X			
Innovative methods			X	X	
Project selection	X				
Legal compliance		X			
Unsatisfactory governance	X				
Poorly trained resources			X	X	
Inaccurate specifications					X
Poor stakeholder communications	X	X			
Subcontractors' poor performance				X	
Absent project					
Team member			X		
Deliverable benefits in jeopardy	X				
Market demand excessively high	X				
External political					
Pressures	X				
Project priority downgraded	X				

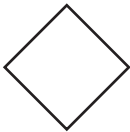
Figure 3.3 – Risk management flowchart

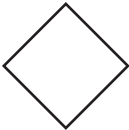
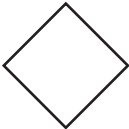
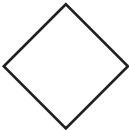


Risk management process description

A comprehensive project risk management process is shown in the flowchart at Figure 3.3 and is described briefly here at Figure 3.4.

Figure 3.4 – Risk management flowchart description

ITEM	STEP	DESCRIPTION
1.	Risk management plan	The risk plan (or section in the project plan) describes how risks will be managed and identifies roles and responsibilities for risk management. It's the first step in the process prior to project implementation.
2.	Identify risk	We may use a variety of methods, particular brainstorming, to identify risks. These risks are recorded in our risk register for qualitative analysis.
3.	Qualitative analysis	Subjectively analysing and prioritising risks to decide their importance and whether they go on the watchlist or go for further analysis.
4.	Critical? 	Critical risks identified by qualitative analysis need to be responded to and may also warrant quantitative analysis. Non-critical risks are usually recorded in the watchlist, where we monitor them and if necessary reclassify them as redundant or critical as the project progresses.
5.	Create watchlist	Watchlist risks are not critical, but may become so. They need to be qualitatively analysed periodically since they may become critical.

ITEM	STEP	DESCRIPTION
6.	Create shortlist	A list of risks that may need quantitative analysis.
7.	Large, complex or novel project? 	These characteristics typically help us determine whether quantitative analysis is appropriate. Projects with these characteristics are usually risky undertakings. While smaller projects can be complex and novel, their smaller size usually does not warrant the time, expertise and expense of quantitative analysis.
8.	Quantitative analysis	A numerical analysis for those risks in larger, more complex and novel projects, where untreated risk is likely to have very significant consequences.
9.	Risk type? 	Is the risk an opportunity or a threat? Opportunities are likely to enable the project to be completed more quickly and cheaper, whereas threats are those risks that cause the project to take longer and/or cost more.
10.	Risk severity? 	Severity is the priority accorded risks based on their estimated impact (consequence) and probability (likelihood). Priority may also consider risk detectability (ie, ease of detection) and exposure period or instances of exposure to the threat or opportunity.
11.	Reduce or transfer	These responses aim to reduce threat probability/impact to a tolerable level or transfer risk to a third party. Such responses may cause secondary risks.

ITEM	STEP	DESCRIPTION
12.	Avoid	This response aims to eliminate high severity (priority) threats usually by scope change. This response may create secondary risks.
13.	Accept	These risks are tolerable. They are within our organisation's risk threshold. Nevertheless, they may require a contingency plan.
14.	Exploit	These risks should be exploited to add value to our project.
15.	Enhance or Share	These risks, if assumed, are likely to improve project value, which might be shared with contractors through outsourcing.
16.	Residual risk	This is risk that remains after strategies to reduce have been applied. These diminished risks are usually documented in the risk watchlist.
17.	Contingency plan	To deal with accepted and residual risks if they occur. Contingency plans are implemented if predetermined trigger conditions appear.
18.	Update project plan	Risk responses may require some revision to the project plan, often time or budget, and sometimes scope or quality (specification) changes.

ITEM	STEP	DESCRIPTION
19.	Monitor and control	This is about checking the effectiveness of response plans, tracking identified risks and identifying new risks. New risks are then recorded.
20.	Project complete?	Risk management is continuous until project completion. On completion a review of risk management effectiveness is appropriate.

Stakeholders typically identify, mainly by brainstorming, a large list of risks for the project. The list is then analysed subjectively (qualitatively) to create a shortlist of higher-ranked risks that warrant doing something further about. The lower-ranked risks are usually put on a watchlist, and the higher risks move forward and (if the project novelty, size and complexity warrants) they are assessed quantitatively for their cost and schedule impacts. We then reduce the overall risk of the project by taking appropriate response measures depending mainly on risk priorities.

This process also includes responses for opportunities, which we exploit (the reverse of avoid), enhance (the reverse of mitigate), share (shift, transfer or spread) ownership of the opportunity to a third party or parties, or simply accept as with threats. The strategy of acceptance for opportunities means if it happens it happens. Again, as with threats, acceptance of opportunities can be either active (create contingency plan) or passive.

Sometimes organisations might put 80% of their risk management resource into risk identification and analysis, and 20% into responding to risk. These figures should be the other way around, with 20% devoted to risk identification and analysis, and 80% devoted to their management.

Summary

A project plan is not completed until a risk plan is also completed. Careful and explicit planning enhances the possibility of the success of the other risk management processes. Risk management planning is about deciding how to approach and conduct the risk management activities for our project – about how to apply risk management. Planning of risk management processes is essential:

- To ensure that the level, type, and visibility of risk management are commensurate with both the risk and importance of the project to our organisation.
- To provide sufficient resources and time for risk management activities.
- To establish an agree-upon basis for evaluating risks.

The risk management planning process is undertaken during project planning, since it is crucial to successfully performing the other risk management steps described in this book. The plan may need to be updated as the project proceeds and following project implementation when its effectiveness will be periodically checked.

The result of risk management planning is a risk management plan. This plan identifies and establishes the activities of risk management for the project and is included in the project management plan or attached as a project management sub-plan. It's a document that tells us how risk management will be performed on our particular project.

It is important to realise that some uncertainty will remain no matter how thoroughly we plan our project and how conscientiously we apply risk management practices. However, it is not a sign of weak project management to acknowledge that uncertainty still exists within our project.

The power of risk management is fully realised when a project manager takes action to respond to identified risks based on the risk analysis, with effort being directed towards those risks that rank the highest in terms of significant impact to project objectives.

The chapters that follow describe in sequence the subsequent steps in the project risk management process, starting with the most important step – risk identification.

Identifying Risk

This chapter discusses risk identification and recording, which is the most critical step in the entire risk management process. This step involves finding and recording an extensive list of risks that might affect our project for better or for worse and typically categorising them for subsequent analysis – the next step. Risks do not exist in isolation. Risk is always related to something and that something is the project objectives. Also, risk identification usually involves identifying risk triggers, which are symptoms or warning signs that a risk is about to occur, although not all risks show obvious or early warning signs.

We need to identify project risks before we can consider their management as per our risk management plan. To commence risk analysis too early reduces the number of risks identified. It's unlikely that we'll identify all the risks. It would not be cost-effective to attempt to do so and some risks just can't be found. They are unknowable. Other risks are unknown particularly at the start of the project and only become evident as the project proceeds. Identified and unidentified risks that actually occur are called issues in project management parlance and they also need to be dealt with and that's essentially problem solving. Issue management is clearly important, but is outside the scope of this book. It's just not practicable or economical to try and uncover all risks, so inevitably there will be some issues, although if risk management has been effective, there will be minimal issues.

Importantly, risk identification should be systematic and continuous throughout the project life cycle. Known risks are watched and new risks are discovered. It's an on-going activity and it's everyone's job. Most project managers do engage in some form of risk identification, although the depth and quality of these efforts vary, and are sometimes only conducted as a solitary one-time effort at the onset of the project.

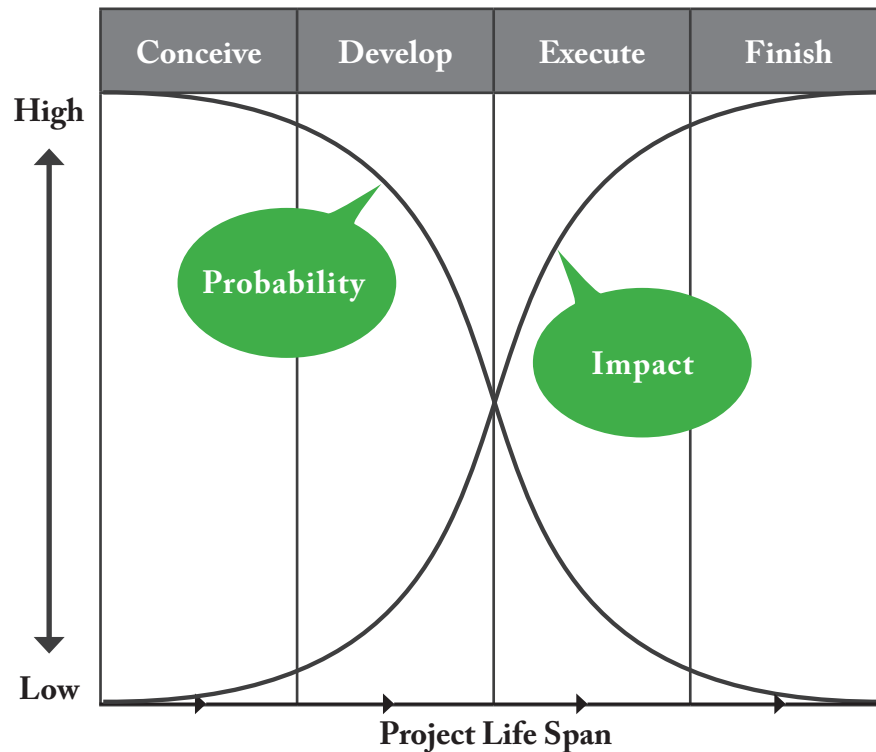
As the project proceeds some risks evaporate. Also, we move past exposure to some or most risks without concern or incident, often because our mitigation strategies have been successful. We also find new risks, some of which are as a result of our risk responses. These are called secondary risks. Other new risks will arise through changes to the project. Such changes are inevitable as projects proceed since we can't forecast the future with total accuracy and we realise that it's foolish to stubbornly adhere to an outdated project plan. Indeed, a project plan is best viewed as a basis or baseline for change. Pointless adhering to an out-of-date plan. Plan version control is important.

The highest level of risk is invariably at the start of the project when the project can face a long and uncertain future. As the project proceeds, there is typically diminishing uncertainty or growing certainty. But also, as the project proceeds, there's usually an increasing commitment of human and material resources – the stake or risk exposure is greater especially once the project is implemented. We can see that cash flow timings are important. The later that finances need to be committed, the better this is from a risk perspective, since uncertainty typically diminishes over the life of the project. This interplay of probability and impact is shown at Figure 4.1, which reminds us of the need to pull the plug on a too-risky project earlier rather than later. Thus, an important occasion to reassess project risk is once the project plan has been prepared and before its implementation.

While we are to consider this risk identification step in isolation, in practice all risk management steps will be undertaken concurrently and repeatedly throughout the project life cycle, which means that at any one time:

- New risks are being identified.
- Identified risks are being analysed.
- Risk responses are being determined and applied.
- Effectiveness of risk responses is being assessed.

Figure 4.1 – Risk probability and impact



This concurrent activity is an essential characteristic of an effective risk management system. Some other characteristics are continuous, cost-effective and proactive. Before project implementation, risks shouldn't usually be analysed as soon as each risk is identified since this practice will usually reduce the number of risks identified. It's a bit like premature proofreading – we never finish writing the first page. Better to write the script first then check it. There are several other common risk identification mistakes and concerns such as:

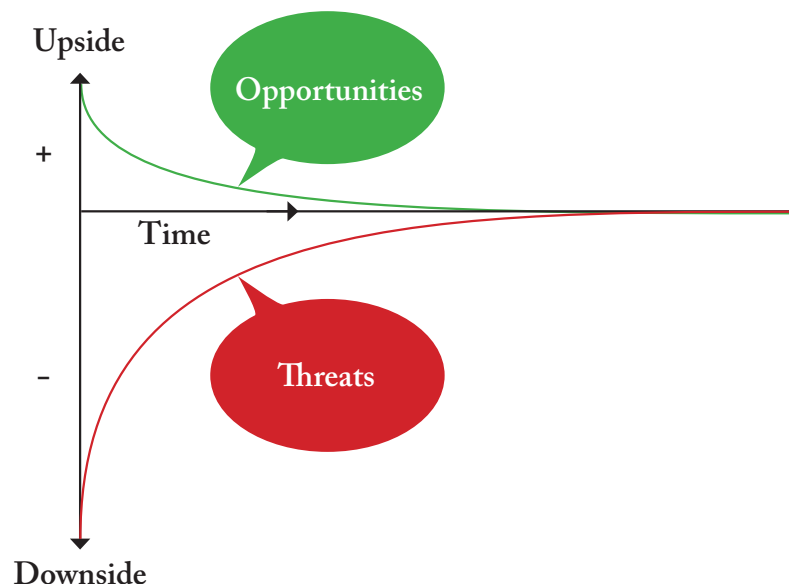
- **Identified risks aren't risks.** Remember a risk is an event that has uncertainty. For example, if our project definitely has too few resources, this is not a risk. This is a fact. Also, the expression "communications" is not a proper definition of a risk. Perhaps it's a category of risk. And including causes or effects in our list of identified risks may obscure genuine risks. For example, "We intend

to outsource procurement (cause); we may be able to learn new practices from our selected contractor (risk), leading to increased productivity and profitability (effect).”

- **Risks aren’t fully described.** For example, a risk of “insufficient resources” is too vague. Risks need to be specific rather than general. Sweeping generalisations don’t help. They can be ambiguous. A more precisely and fully described and thus more useful risk description would be “poor communication of customer’s precise needs for the grommet installation design” would likely be a more useful risk event description. I’m suggesting that we don’t sacrifice clarity and specificity for brevity. Risk statements such as “insufficient time” are too generic to communicate the real concerns and therefore cause unnecessary confusion and give no insight to guide risk analysis. This furthers the perception that the risk process is not adding value. At the opposite end of the scale, some risk statements may resemble essays and therefore they never get read. Also, lack of time is not a risk, but a fact, which is addressed in the project plan typically through crashing, fast-tracking, re-estimating or removing scope. Also, we need to ensure it’s a risk and not an issue, requirement or an effect. A risk has uncertainty. For example, the exchange rate will change during the project. From experience, this is certain, but by how much is uncertain. Therefore changing exchange rates is a risk if material is to be procured from overseas, and it could be a threat or opportunity, although its effect may be negligible in terms of impact on an inexpensive or short duration project.
- **Entire categories of risk are missed.** We might focus only on technical risks and thus miss other relevant categories of risk. We need to think holistically and systematically, and involve other stakeholders who have different perspectives and definitions of project success and obstacles to this. Systematically addressing each category of risk can help ensure that all risks are identified.
- **The risk identification process cannot be completed in a vacuum.** We must begin with inputs, which typically include such items as a project idea, request, opportunity or compliance need, concept, definition, charter, business case, terms of reference, proposal, Work Breakdown Structure (WBS), project team members, other stakeholders, network diagram, budget, schedule, risk identification tools and techniques etc.

- **Use a variety of methods.** Sometimes only one method is used to identify risks, such as using a predetermined checklist. A combination of methods usually helps ensure more risks are identified.
- **Risks aren't all bad.** We may forget that risks are both threats and opportunities, not just threats. Figure 4.2 shows that both opportunities and threats are usually plentiful at the start of the project, although there is typically more threats than there are opportunities. When implemented fully, risk management should also realise events in the form of opportunities. Gamblers understand this duality of risk. The benefits of extending risk management to include opportunities are:
 - ♦ Formalising the capture of opportunities that would otherwise have been missed.
 - ♦ Individuals may be less enthusiastic about risk identification if opportunities were not included.
 - ♦ Opportunities offset threats to some degree.
 - ♦ Management of opportunities often means that our project is completed more quickly, cheaper and may also deliver more. So opportunities allow us to work smarter, faster or cheaper.

Figure 4.2 – Opportunities and threats



While risks aren't all bad, it is the bad ones, if not identified, that have the most obvious impact as issues, whereas opportunities that are not identified usually have no obvious impact.

One concern is that proactively seeking opportunities may result in scope creep as we extend the project to capture unplanned benefits. Rather we might consider anything that will help us achieve the agreed objectives. We look for ways to work smarter, faster and cheaper, within the existing scope. Nevertheless, sometimes a small scope increase can produce large extra benefits.

- **Lack of involvement.** We neglect to involve all key stakeholders in the risk identification process. We might exclude those who don't support the project. Yet their concerns might be very valid. Stakeholders, whatever their attitude towards the project, might readily identify risks, especially if their expectations could be in jeopardy. They should therefore be involved early and often. Early involvement might also win them over. Properly manage their concerns and they could become project champions who positively influence others.

Participants in risk identification activities can include, as appropriate, the project manager, project team members, subject matter experts both from the project and from outside the project team, customers, end users, other project managers, stakeholders, and risk management experts. While these people are often key participants for risk identification, all project members should be encouraged to identify risks and to do so throughout the project life cycle. The first rule of risk identification is to involve those who are to execute the work. We must recognise and value their different perspectives.

The lack of involvement in risk identification is more difficult to counter with a distant and separated project team – sometimes referred to as a virtual team. We may find it difficult in these circumstances to share our concerns about risks and also to measure progress and build a sense of team since the team never works together in close proximity. These problems are usually best overcome or minimised by getting the team together at the start of the project for a kick-off meeting or some type of function where everyone can meet and build initial relationships and thereafter put faces to names and more freely discuss risk among other things. Incidentally, we don't need any death-defying commando-type team building exercises – usually a more relaxed social get-together is preferable, even if the cost seems prohibitive. The

foundation of trust that is established will help with the risk identification and discussion process, albeit mainly electronically thereafter.

- **Procrastination.** We postpone risk identification until we know more about the project, sometimes we do not do risk identification until we have prepared a comprehensive project plan. In practice, risk identification should start as soon as possible and usually as soon as we have a project idea. A concept check should be designed to weed out the overly risky project ideas before effort is wasted researching project propositions that will clearly remain beyond our organisation's tolerance for risk.
- **One-time effort.** Often risk identification is a one-time effort prior to project implementation and is thereafter pretty much ignored. Importantly, risk identification must be an on-going iterative process because new risks usually become known as the project progresses through its life cycle and previously identified risks may drop out of consideration. The frequency of this iteration and who participates will vary depending on the nature of the project. However, the project team should always be involved so that they develop and maintain a sense of ownership of, and responsibility for, the risks and the associated response actions. Also, risks do not remain static and the initial assessments should be revisited and updated regularly as more or better information becomes available and/or as circumstances change.
- **Black swans.** The black swan theory demonstrates why our experiences don't make us much wiser. In the Western world it was always assumed that all swans were white, until naturalists in the seventeenth century discovered a breed of black swans. What had hitherto been unimaginable was now reality. Are there black swan risks in our project? They are the unknown unknowns, where we are unaware of our ignorance. The black swan is a valuable concept that warns us to expect the unexpected – the wild card.

The expression is a simile for a rare, unpredictable event with big consequences. World War One, the dissolution of the Soviet Union, the September 11 attacks, the rise of Islamic fundamentalism, the invention of antibiotics, the internet, the 2008 banking crisis, the Christchurch quakes, are all examples of black swan events. They lay outside the realms of our expectations and caused incalculable impacts – either disastrous or beneficial. Many risk experts argue that our world is dominated not by normal events, but by improbably surprising events. We might count the technological changes and inventions

since we were born and compare them with what we expected before their advent. Perhaps there will be more black swans in the future and although we spend much of our lives recovering or benefiting from such events, we dismiss the prospect of one hitting us tomorrow. Projects too experience black swans and it is very difficult to develop a “black swan robust” project, one that can withstand the difficult-to-predict that has the ability to grow from random events, errors and volatility.

- **Ignore risks.** We may dismiss a risk because we can't do anything about it, which is typical of many risks external to our organisation. However, this sort of rationalisation doesn't turn our risk into a non-risk, and should the risk arise it will still affect our project. Another type of risk that can considerably influence project success, but is often ignored, is personal risk. Personal risks for project managers include:
 - ♦ the degree of skill stretch required
 - ♦ the impact on our reputation
 - ♦ the impact on our health
 - ♦ the emotional impact
 - ♦ exposure to personal litigation
 - ♦ potential ethical and/or professional compromise
 - ♦ impact on family and friends.
- **Non-rational factors.** Dr Paul Slovic from Decision Research Inc (US), a leading researcher in the field of risk psychology, has produced some valuable insights to help us understand how and why we feel the way we do towards risk. Slovic lists the following:
 - ♦ **Dread.** If the outcome of a particular risk is something we imagine to be terrible, painful or fearful, our perception of the risk is heightened. For example, anything that might cause cancer is seen as a high risk because the thought of cancer evokes fear.
 - ♦ **Control.** Where we believe we have control, we perceive risk as lower. Travelling by car is a clear example – we feel less comfortable as a passenger than if we are driving.
 - ♦ **Natural vs man-made.** Hazards resulting from human actions are seen as more risky than natural hazards. Nuclear power stations appear to be more risky than severe weather or natural disasters.

- ♦ **Choice.** If we have some choice over our exposure to a risk, then it seems lower than if we are exposed involuntarily. For example radiation from cell-phone transmitters gets more public attention and action than exposure to solar radiation when sunbathing.
- ♦ **Children.** Any risk that affects children is perceived as worse than one which only affect adults. Playground safety gets more attention than road safety.
- ♦ **Novelty.** New risks are seen as being more serious than ones we have grown used to seeing. Genetically modified food is viewed as more risky than pesticides. And continued exposure to the same risk results in it being seen as less risky.
- ♦ **Publicity.** If a risk has a high profile in the media or public consciousness, it will be perceived as being more risky. Terrorism is an obvious current example.
- ♦ **Personal.** If we could be a victim, the importance of the risk seems higher than it really is. For example, we may worry about post-operative complications after surgery even if the hospital or surgeon has a good track record.
- ♦ **Risk-benefit trade-off.** If exposure to a risk could also result in a perceived benefit as well as a threat, the risk is discounted. Examples include smoking and drink-driving.
- ♦ **Trust.** Where protection from a risk is offered from a trusted party, the risk is perceived as lower, but lack of trust makes the risk seem greater. For example, public trust in government or the police can influence the perceived level of threat from crime.

These non-rational factors can have significant effects on how well risk is assessed and managed. Although Slovic's work relates to public perceptions of risk within society, his conclusions apply equally well to the assessment of project risks. If we remain unaware of these factors, we are likely to make wrong judgements about how important a risk is, and our responses may then be inappropriate.

The inputs to the identify risks process include the project charter, risk management plan, and outputs from project planning such as the work breakdown structure, estimates, schedule, and risk checklist.

Risk identification is the process of uncovering risk events. Remember, risks might be threats or opportunities. We ask ourselves and others, “What could happen that would positively or negatively impact schedule, cost, quality or scope?”

This process is undertaken systematically and continuously throughout the project life cycle. We focus on both internal and external risks, the latter usually being outside our control, but they too might help or hinder our project. Participants in the risk identification process might include any of the following as appropriate – project sponsor, project manager, project team members (ie, employees, contractors, consultants and suppliers), risk management team (if assigned), subject matter experts both from the project and from outside the project team, clients (owners), customers (end-users), other project managers, stakeholders, and risk management experts. In particular, all project team members should be encouraged to identify and report risks properly and promptly throughout the entire project life cycle. Ready access to the risk register is important in order that details may be recorded properly and promptly.

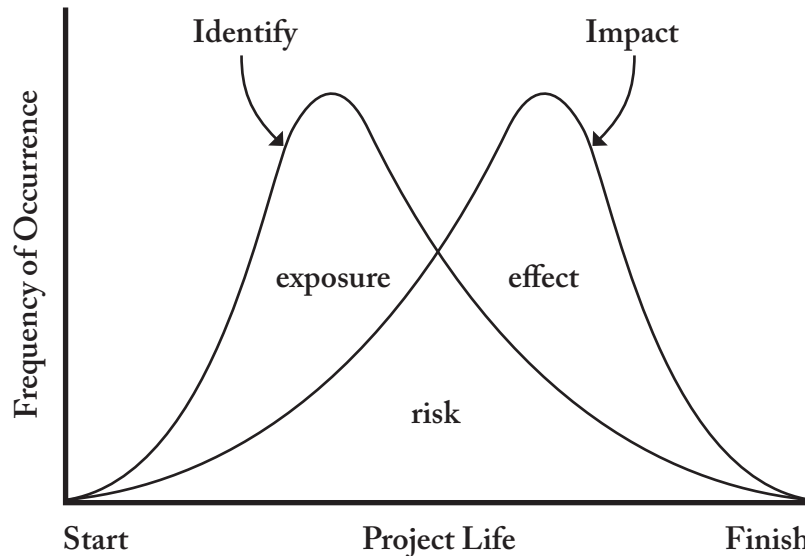
Risk workshops may be conducted regularly and possibly at selected project milestones. Certainly the project team should be involved in the process. Stakeholders outside the project team may provide additional assessments. Project team members identify risks using:

- Various tools and techniques, particularly brainstorming.
- A predetermined risk list.
- Their knowledge of the project and similar projects.
- Consultation with others who have knowledge of this and similar projects.

Some risks are easy to identify because they are associated with familiar work and other risks are more difficult to uncover because they arise from new, unusual, or otherwise unique requirements. It’s a mistake to consider a risk as impossible merely because it hasn’t happened before, at least to our knowledge. And, wrongly, it’s not uncommon to dismiss huge risks because they are assessed to have very low probabilities of arising.

Most risks are identified early in the project, but most do not impact the project until later. See Figure 4.3. Therefore, the risk management process mainly helps prevent future problems from occurring.

Figure 4.3 – Risk emergence



Also, as the project proceeds, we need to identify residual and secondary risks, and consider risk interaction:

- **Residual risks** are those that remain after we develop responses to the project's original risks. Residual risk will also need to be responded to if such remaining risk moves beyond our risk tolerance limit.
- **Secondary risks** are those caused by our responses to original project risks. For example, outsourcing a project task may mitigate a project risk, but we may have now created other risks as a result of using a contractor. The number and impact of secondary risks might exceed the primary risks in some instances.
- **Risk interaction** of two or more risks may result in a greater combined good or bad effect than each risk would have independently. For example, a project task with an unrealistically early or late completion date may also be under or over funded, the worst combination of these being an optimistically early completion date for an underfunded task, recognising that more realistic funding may have enabled the work to be accelerated. Murphy tells us that related threats are more likely to have a compounding effect than they are to have a compensating or neutralising effect.

The risk identification step should stop short of assessing or analysing risks so that it doesn't inhibit the identification of risks. In practice, however, risk identification and risk analysis are sometimes completed in a single step, a process that could be called risk assessment. For example, if a risk is identified in the process of interviewing an expert, it makes sense to also discuss at that time with this expert the probability that this risk will occur and its possible impact, when the risk might occur, and possible ways to prevent it or deal with it. Nevertheless, the risk register should show these identification and analysing activities separately to help ensure clarity.

Risk-finding tools and techniques

There are two main techniques for identifying risk – brainstorming and document review. There are also two main needs – the need to look backward at risk from similar previous projects and the need to look forward through the project life cycle to identify future risk. Other approaches to risk finding include the Delphi technique, Crawford slip method, root cause identification, SWOT analysis, predetermined checklists, surveys, and team meetings. These techniques aren't mutually exclusive and depending on the project more than one of them should be used. To help ensure a productive risk-finding workshop the following measures should help:

- Invite the right people – those with the requisite interest and expertise.
- Brief them fully about the project – tasks, deliverables, parameters etc.
- Get the project sponsor's backing and their attendance too if practicable – at least to kick off the session.
- If larger numbers are involved, split participants into smaller groups of say four to six people and perhaps by areas of expertise or sometimes by project phase for some concurrent deliberation/maximum participation.

Brainstorming. Most people are very familiar with this process. It is sometimes called risk storming. This very popular, effective and simple technique requires that the facilitator, possibly the project manager, stands at the whiteboard or flipchart, thick pen in hand, and the project team members and other stakeholders present are encouraged to tell us what might be a threat or opportunity with the project – whatever risks come to mind. It's usually better to check for threats

first since there's likely to be more of them and they can then be assessed for opportunities. However, when a project is already in trouble, team members may feel discouraged and the session might better start with the identification of opportunities. Perhaps the facilitator could draw a line down the centre of the flipchart page or whiteboard much as one completes a force field analysis. All contributions are clearly recorded. The key emphasis at this time is quantity. Nobody is judgmental at this point. We suspend comment, questions, or criticism. Rather, many and divergent contributions are encouraged – no matter how wacky. Participants might spring-board off each other's contributions. Once these risks are recorded, we typically delete the totally non-sensible, irrelevant, or duplicate contributions, and then further discuss those remaining to ensure we properly understand them before entering them in the risk register for their further analysis. The usual brainstorming rules apply, where we think fast and reflect later. In particular:

- We start with a precise question that clearly defines the purpose of the session, without suggesting what might be an acceptable answer, “What could threaten or enhance this project's success? What risks relate to this project as a whole? What risks relate to each activity? What are the risks by category?”
- We postpone debates, discussion, critiques and withhold judgment, which encourages rather than discourages others' contributions.
- We also invite the identification of wild and bizarre risks and do not dismiss any risk ideas out of hand. Divergent thinking is encouraged.
- We recognise that the number of risks identified counts more than their timing, plausibility, impact or probability at this stage.
- We give everyone the opportunity to contribute, to be acknowledged by the group, and to build on others' contributions.
- We remind participants that a cause (risk driver) may result in an event (threat or opportunity), which may affect one or more of the project objectives of scope, time, cost or quality.

We should keep in mind that although brainstorming is an open and inclusive process, the stakeholders involved may have considerably different levels of knowledge, ability and assertiveness, and different project perspectives, which means that they may be inclined to mostly or exclusively identify those risks that

appear to impact their personal and unique expectations. This may not result in a balanced list unless we are selective about who participates, but this too could be a dangerous practice. To help ensure balanced and comprehensive coverage, the facilitator might systematically work through different categories of risk, such as those risk events that might impact project scope, schedule, budget and then quality. Sometimes the facilitator might pose questions, such as:

- What is the risk to our organisations if the project fails (or even succeeds)?
- Does the organisation have the capability to undertake the project?
- What has gone wrong in past projects? Here we should look at both project risk registers and lessons learned from previous projects and try to pre-empt the same mistakes being made.
- Will other initiatives (projects and programmes) being undertaken within our organisation impact our project?
- Have all the sponsors reached a genuine consensus on the goal and objectives for the project?
- Can the benefits of the project be defined objectively so that it is possible to measure success?
- Have the key stakeholders been involved in defining and planning the project?
- Are approval and sign-off procedures already understood.
- Are the interdependencies between different projects clearly defined?
- Is risk management a part of all sub-projects, and do we have visibility of the risks facing each project?
- Has enough time been allowed to arrange for the use of external resources?
- Are solid practices in place for the management of contractors?
- Are there any risks associate with contractors? This is especially important if the relationships are not win-win in nature.
- Can principal contractors properly manage their subcontractors?
- This might seem obvious, but are the expectations of senior management at the outset realistic?
- Has consideration been given to performing proper piloting of any product developed?

- Don't forget to consider the end game. By end game I mean those things which typically happen at the end of the project causing it to delay, such as user testing, proofreading, performance testing, end-to-end testing, and late stage integration.
- Are there any project team working relationship issues?
- Is project governance in place and has it been used before?
- Is any technology being used new, rather than tried and tested?
- Are there any big decisions still waiting to be made? This could include technology, business case, and which resources will carry out the work, etc.

Workshops are not always an effective way of capturing risks where group dynamics will allow some individuals to dominate the discussion while others remain quiet. Whereas interviews ensure that all voices are heard equally and are usually more efficient than workshops for risk identification. We may need to suggest some risks to get the brainstorming session underway, but most of our own suggested risks might be contributed toward the end of the session.

The idea is to capture every risk without comment, question or criticism. We need to stimulate people to think of new risks triggered by the thoughts of others. We usually keep the process going until the flow of ideas seems to dry up. We typically conclude the process by restating any risks that seem unclear. We might also combine or eliminate risks where there's redundancy. Finally, as a sanity check – do the risks all make sense? Each risk needs to be clearly stated.

Brainstorming project risks is very popular for a variety of reasons:

- Everybody feels involved, with an opportunity to share their opinion openly.
- It produces visible results quickly as the flipcharts fill up around the room.
- It's usually conducted in an atmosphere of fun away from the usual workplace.
- It gives people the chance to be creative and “think outside the box.”
- It encourages team-building and creates a sense of shared ownership of the resultant list.

But there are some drawbacks to brainstorming that can lead to it becoming less effective. For example:

- It can be difficult to get the right people to attend, and if key stakeholder perspectives are not present, important risks may be missed.
- The way the group functions can be influenced by groupthink and other subconscious biases.
- Strong individuals can impose their view on the session and inhibit others from contributing.
- The creative non-critical approach often results in identification of other things which are not risks (such as problems, issues, worries etc).

When brainstorming is used for risk identification, we need to be sure that we identify as many risks as possible from a wide range of sources across the project. Unfortunately the creative process can result in identification of things which are not risks. It is not uncommon for a brainstorm session to concentrate on areas where participants are comfortable, such as technical risks, ignoring other important areas. It is also possible for a brainstorm session to go down a blink alley, with people being very creative about unrealistic risks (such as an alien invasion, everyone dying from a mystery disease, or the project manager winning Lotto).

Document review. Here we distribute to participants whatever relevant project documentation we currently have for their critical assessment. Depending on when during the project life cycle this assessment is undertaken, this documentation may include historical information, risk lists, the project request, concept, definition, specifications, business case, proposal, terms of reference, assumption list, charter, work breakdown structure (WBS), network diagram, Gantt chart or a comprehensive draft baseline project management plan with a number of sub-plans covering communications, procurement, etc. We can work through the plan, often task by task, to identify risks. This can be combined with the brainstorming technique. Participants may also be provided with a checklist of risks – generic risks and those typical for projects of this type. Maintaining such risk lists would be a useful job for the PMO if we have one. They would update these lists for the various types of projects as a result of the organisation's previous experience, previously completed risk registers, and lessons learned and recommendations extracted from post-project reports. Every project has differences, so we also need to think outside the lists, but such lists can be very useful to trigger our thinking.

Expert interviews. There might be experts available either inside or outside our organisation for a new project. Expert interviews must be handled with care. If the project manager is not properly prepared for the interview, time can be wasted with the interviewee simply telling stories about their exploits. A list of open questions needs to be developed prior to the interview, some of which might be:

- What is the risk?
- What problems do you foresee?
- What opportunities do you see?
- How likely is the risk?
- What kind of effect will it have?
- Who will it affect?
- How much will it cost if it happen?
- When might it happen?
- Will it affect the schedule?
- What will be the effect on quality?
- What risks do you foresee concerning human resources, material resources, and health and safety?
- Could poor project performance jeopardise the image of our organisation, customer or client, or our contractors, or limit our future business opportunities?
- Could the project cause any legal or regulatory issues?
- Could the project create issues about privacy, patents, copyright or ownership?
- Are there external risks and issues that might affect project success?

The questions asked might be open, probing, hypothetical, reflective and/or closed, often starting with open questions to identify key areas for examination. To get the right answers we need to ask the right questions.

Lessons learned list. An important activity during the project life cycle is the identification of lessons learned, which will include the consequence of both the successful and unsuccessful management of risk. Such lessons will help ensure that our risk management methodology is continuously improved and that our project risk list is kept up-to-date. Sources for our lessons learned risk list include

final project reports, risk response plans, organised lessons learned, discovery sessions, the experience of project stakeholders, and published information such as commercial databases and academic studies. Of course some experts contend that one of the biggest flaws in the risk identification process is relying primarily on past data to predict future events.

Delphi technique. This is an anonymous process of risk identification designed to avoid some of the problems of brainstorming – compromise, groupthink, shyness, domination, intimidation and peer pressure. There's no collusion. Participants (typically a panel of independent experts) are anonymous to each other. They identify what they believe are project risks. This technique can be conducted with Internet messaging or by email and has the advantage that people can participate from many different locations. A consolidated list of their risks is then prepared and circulated. Anonymity is maintained. People usually give more forthright opinions if they know their names won't be attached to their opinions. Some iterations of this risk collecting process might occur. It's also a useful technique to use when project team members are dispersed and rely on electronic communications. The process does create a lot of work for the facilitator. All ideas need to be listed by the facilitator, who also has to contact the participants in order to get them on line to participate in each round.

Incidentally, Delphi, near Mount Parnassus in Greece, according to the legend was the sacred site of the Temple of Apollo where Pythia, The Oracle of Delphi, frequently forecast the future, hence the expression "Delphi technique." Some centuries later a French expedition discovered an oil deposit under the Temple of Apollo. It was then suggested that when Pythia visited the Temple dungeons to put herself in a trance in order to make her prophesies she may have been breathing in a heady mixture of ethane, methane, propane and other gases to become drunk as a skunk presumably. This might explain why her prophesies were in the form of riddles. Surprisingly, this was probably the greatest period of progress and accomplishment in Greek history, not that we should encourage drug-taking to enhance creative risk identification.

Nominal group technique. This is another type of meeting technique. The participants are known to one another as in brainstorming, and risks are submitted to the facilitator as written lists. This makes the risks, if not the participants,

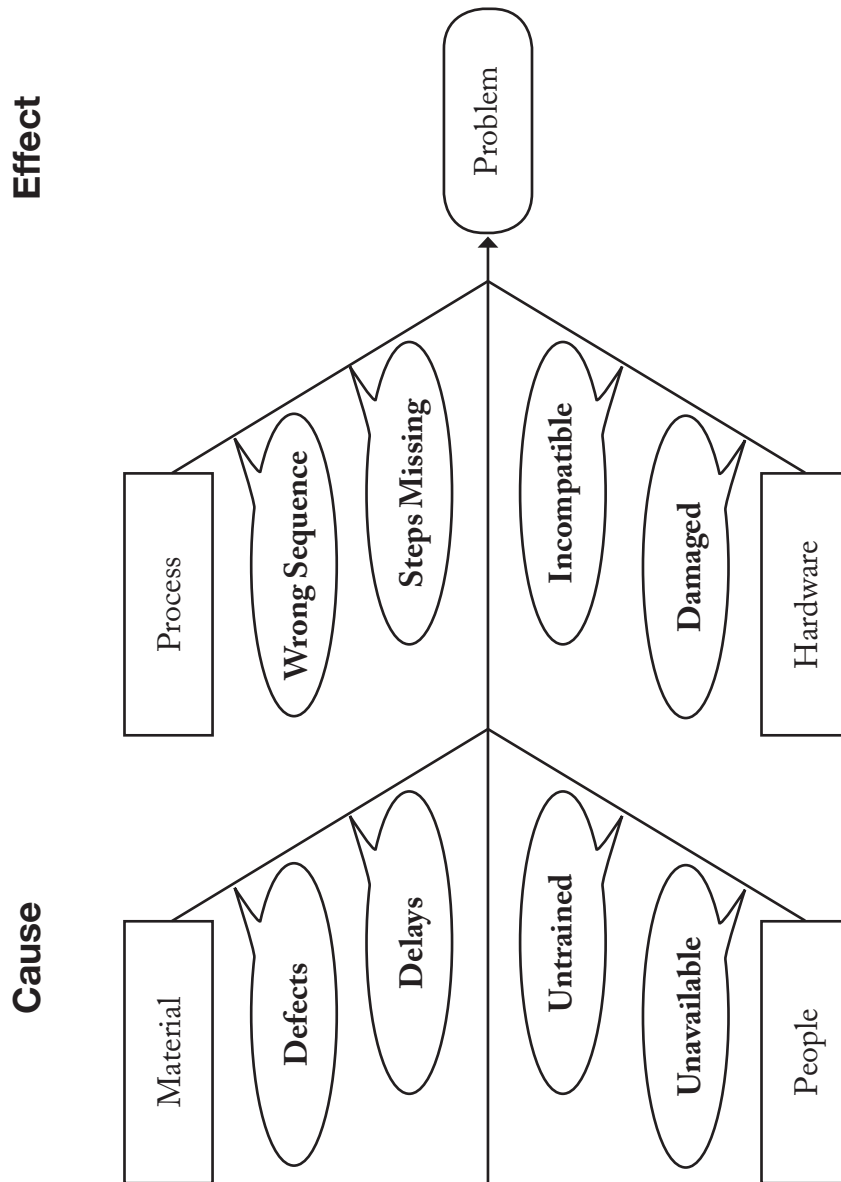
anonymous. The facilitator lists the ideas on a flip chart or a whiteboard, and the participants may add more risks with another round of written lists until no additional risks are identified.

This technique reduces any status concerns or intimidation that might be present in a brainstorming session, but does not eliminate it entirely. There is more work for the facilitator, but the nominal group method can be done in a single meeting, and participation usually improves over brainstorming even if some speed, spontaneity and enthusiasm may be lost.

Crawford slip method. This technique is a very simple way to collect ideas on what might be project risks. This method was developed in the 1920's by a Mr Crawford. It requires we give paper slips to everyone in the risk-finding group and ask them to write one risk on each separate slip. After a predetermined time they hand in their slips and these may then be consolidated as a single list. It could be useful to do the process twice – once for threats and once for opportunities. It helps ensure that everyone contributes or has the chance to do so, since conventional brainstorming is sometimes monopolised by a few extroverts.

Cause and effect diagrams. These diagrams, also called fishbone diagrams or Ishikawa diagrams (named after their founder – Kaoru Ishikawa), allow us to show the causes of risk events. We might start with a generic risk such as major schedule delay and then try to identify all the possible reasons why that might happen on our project and document these causes on our diagram. Different diagrams can be developed for each major impact and for both threats and opportunities. For example, we might have a diagram for early completion or major under-run. See Figure 4.4.

Figure 4.4 – Cause and effect diagram



Surveys. Surveys or polls are also a useful means of identifying risks particularly if project participants, other stakeholders, subject matter experts, and individuals who may have participated in similar projects are geographically spread. But this technique may lack full participation and the advantages of interaction and synergy.

Team meetings. Regular team meetings throughout the project are an excellent occasion to update the risk register and risk must be a standard agenda item. We should check with the team for new risks – those that were unnoticed when work was first planned. This is also an appropriate occasion to review each active risk in the register. Risks to work already completed are obsolete. Also, during such meetings we might:

- Discuss the risks that have become significant issues, what impact they have had, and why they weren't detected or satisfactorily managed as risks.
- New risks arising from our risk response measures. These are secondary risks.
- Review risk contingency plans and determine if they're still satisfactory.

The process will only be as good as the knowledge and participation level of those who attend the meeting. Recognise that domineering team members can sway the team or prevent others from fully participating. We also need to encourage the quieter participants to become involved.

During the meeting we could allocate participants different roles reflecting different ways of thinking about risk events. Edward de Bono's six hats is one such approach:

- *White hat* – focuses on evidence and facts. They provide realism.
- *Red hat* – focuses on emotion and gut feel.
- *Yellow hat* – focuses on the positives (opportunities). They are optimistic.
- *Green hat* – focuses on lateral thinking. This is outside the square risk.
- *Black hat* – focuses on the negative (threats). They are pessimistic.
- *Blue hat* – focuses on the clarity of risk descriptions.

The role of devil's advocate can be useful in testing established attitudes to risk, We might give someone this role or perhaps it's a black hat function.

Strengths, weaknesses, opportunities and threats (SWOT) analysis. A SWOT analysis examines the project from the perspective of each project's strengths, weaknesses, opportunities and threats to increase the breath of the risks identified. This qualitative method provides an organised way of assessing the ability of the project team to execute the job successfully. To conduct a SWOT analysis, the team answers the following two questions:

- Considering our organisational strengths, what are the opportunities for our project?

- Considering our organisational weaknesses, what are the threats for our project?

The impact and probability of these risks is not usually addressed during this identification step, except perhaps if we are interviewing experts whose availability may be limited. There is a useful tool and explanation for conducting a SWOT analysis at www.lewisinstitute.com.

Checklists. Also mentioned earlier, a checklist is a predetermined database of recurring risks developed from historical information and lessons learned from previous projects. Checklists may be organisational or commercial. However, they are seldom complete, since just because a risk hasn't occurred before doesn't mean it will not happen. Therefore risk checklists should not be the only tool we use. Also, a more open-minded analysis will usually be needed to identify project-specific risks. A generic checklist is at Appendix 3 and any 'no' answers to these questions may reveal a risk to our project, yet a 'yes' response to all answers does not guarantee a risk-free project or even a successful project. However, by observing this checklist we will have much more time to respond to surprises.

Assumptions analysis. With project planning, assumptions are unavoidable, although we shouldn't make assumptions when the facts are available. There are stated (implicit) and unstated (implied) assumptions. Both types possess uncertainty and therefore harbour risks. To help ensure our assumptions are only low-level risks we need to check that our estimating and planning assumptions are reasonable – that they're very likely to be true. The rules with assumptions are – recognise them (they sometimes masquerade as facts), record them, and regularly review them. If in any doubt, treat assumptions as risks to ensure their analysis. Remember the old adage – to 'assume' makes an 'ass' out of 'u' and 'me'. Wrong assumptions are a definite risk.

There are a variety of tools and techniques that can help in the risk identification process. Brainstorming is the most popular technique and probably the most effective providing it's done properly and with the right people. We should also employ at least one other technique. However, most importantly, remember too that any individual at any time might identify a project risk. A prescribed risk submission form might be useful, but otherwise any note, email or verbal message should suffice. It would be crazy that a risk goes unreported due to bureaucracy

or because people are waiting for the next scheduled meeting. Identified risks are promptly recorded in sufficient detail to help ensure their subsequent useful analysis.

Risk identification questions

Some questions that may help uncover project risk are listed here.

Stakeholders. The following questions about our project's stakeholders may help us identify risks:

- Who are the stakeholders?
- What are their objectives and expectations?
- What are their areas of influence/weakness?
- Do they understand their roles?
- What is the time commitment and availability required of them?

Project scope. To properly perform risk management, it is helpful to understand all the work that needs to be undertaken. The following questions may help us identify scope risks:

- What areas of the scope of work are unclear?
- What has been excluded?
- What work has never been done before?
- What work are we inexperienced at?

Project objective (constraints). The project constraints are anything that limit our options such as time, cost, scope, quality, risks, resources, health and safety, and stakeholders. Key risk identification questions are:

- Are the constraints precisely described?
- Are any constraints unrealistic?
- Are parameters prioritised?
- How might a constraint in one area affect other areas of the project?

Assumptions. Assumptions are things we accept as true.

- Have we documented our significant assumptions?
- What assumptions might prove to be incorrect later in the project?
- How can we prevent problems by clarifying assumptions early?

Work breakdown structure. Risk identification is both at project and work package (lowest level of work breakdown) level.

- Is the WBS complete (inclusions and exclusions)?
- Are there any particularly risky work packages?
- Does the WBS include risk management and project management activities?
- Is there buy-in to the work breakdown structure?
- Are the work package time and cost estimates achievable?
- Is any part of the scope incomplete or unrealistic?

Network diagram. The network diagram shows the sequence of project activities (tasks).

- Where do paths converge?
- Are any inexperienced resources allocated to critical path activities?
- Can all parallel activities be completed at the same time?
- Is the critical path duration within the project completion date?
- Are there near critical paths?
- Are all dependencies logical?

Estimates. Inaccurate estimates add risk.

- Who created the estimates?
- How knowledgeable and experienced were the estimators?
- How confident are the estimators about their estimate accuracy?
- What method was used for estimating?
- Do estimates include contingency for identified risks?
- Do the estimates include padding?

Human resources.

- Is there a human resource plan?
- Are there any troublesome stakeholders?
- Are team members exclusively available or shared?
- What is their knowledge level and skill?
- Do they possess a positive attitude to the project?

Communications.

- Are there any poor communicators on the team?
- What areas of communication need careful management?
- Where are we likely to have communication problems?
- How will we evaluate the effectiveness of our communications?

Procurement.

- Were we involved before any contracts were signed?
- Was risk management done by both parties before the contracts were signed?
- What is our expertise at managing contracts?
- What were the specific terms and conditions of the contracts?
- Are procurement lead-times realistic?

Risk management.

- What policies, procedures and templates are already developed?
- Have risk thresholds been clearly defined?
- Do we have reporting forms for risk, standard probability and impact scales, procedures for involving stakeholders, procedures for risk audits etc?

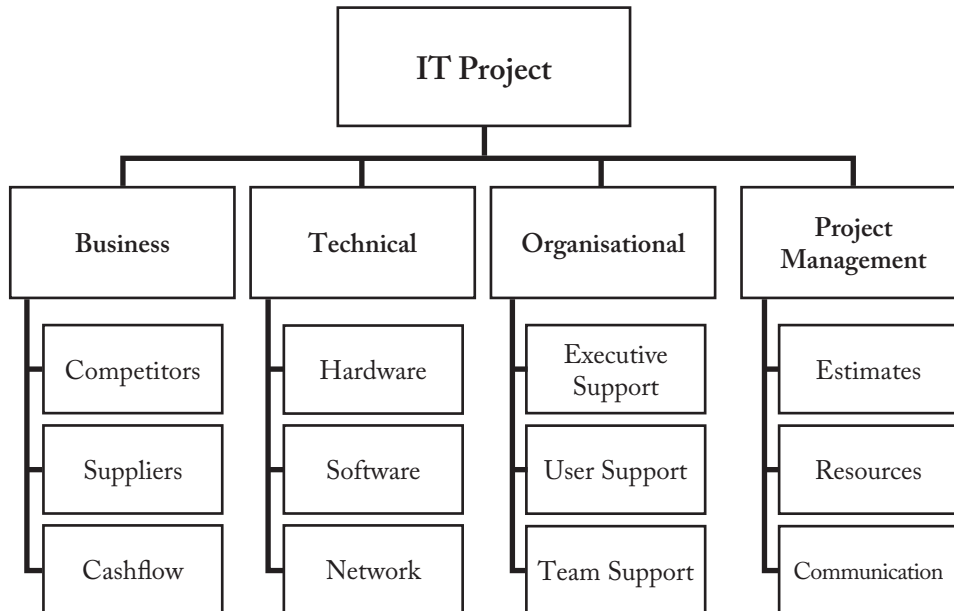
History.

- What were the risks and issues of past, similar projects?
- What risk procedures have proved effective and ineffective?

Risk categories

After or before risks have been identified, we might categorise or classify risks into like groups to help reduce redundancy. This often provides for easier management of risks in later steps of the risk management process. Classifying risks also allows for the development of risk lists and databases for future projects. Most importantly, checking risks by categories is a systematic approach that helps ensure a full and thorough search. Also, experience may show that some risk categories are more important and prevalent than some other categories for different projects, organisations and industries. Such categories might therefore receive priority or more thorough attention when we search for risks. Also, the risk category might help us to determine who should be involved in their identification, and who should own the risk for analysis and possible response purposes. Sometimes a Risk Breakdown Structure (RBS) is developed that shows categories of risk, but this approach is overkill for smaller projects. One such breakdown structure for an IT project is shown at Figure 4.5.

Figure 4.5 – Risk breakdown structure



There are several ways to categorise risks, including:

- **Threats and opportunities** is the most fundamental classification. A threat could have a negative impact on the project, whereas an opportunity could have a positive impact on the project.
- **Known-knowns, known-unknowns, and unknown-unknowns.** Actually, a known-known contains no uncertainty and therefore no risk. For example, we know that our roof will eventually leak. Unknowns are events we know will happen but we don't know how they will affect the project. A known-unknown is an identifiable uncertainty. For example, we know that our roof will need maintenance, but it's not known when this will be needed. An unknown-unknown is a risk whose existence is yet to be encountered or imagined, such as a yet unknown threat to our roof or a new technology opportunity yet to be invented to extend the life of our roof. See Figure 4.6. The black swan concept warns us to expect the unexpected.

Figure 4.6 – Risk categories

		Known	WHAT?	Unknown
WHEN?	Known	Electricity demand peaks in winter	Opening a new bridge	
	Unknown	Earthquake in Wellington	Could be anything! (Black Swans)	

- **Impact on project parameters** (objectives or constraints) of scope, time, cost and quality. To this we might add health and safety. I have excluded benefit risks since these are primarily the sponsor's concern. Thus, project risks can be classified by project parameters. This approach is particularly useful if we know what priority each parameter has been assigned for our project. For example, any risk that could alter the duration of our project would be important if ours is a time-driven project. In practice, a risk may directly affect more than one project parameter or have a domino effect.
- **Risk source** is yet another way to classify risks. Five categories is not uncommon – external unpredictable, external predictable but uncertain, internal non-technical (ie, mainly people-related risks), technical, and legal. Other categories might include reputation, benefits, physical resources, performance, management, organisational, environmental, and commercial.

Yet another risk source classification is business risks, project risks and task risks. Business risk is about project selection and are those risks that the business is exposed to by undertaking a project, project risks are inherent in a project, and task risks are inherent in any of the tasks that comprise the work scope of the project, usually contained in the project Work Breakdown Structure (WBS) – a family tree of work chunks. Some examples of business risk are a change in market conditions, imposing or lifting of constraints on business activities (legal, regulatory and environmental), competitors' activities and the success or otherwise of their new products, and customers' changing preferences. Risks peculiar to a project might be about security and confidentiality, management support and advocacy, user requirements, unproven technology, and cooperation within the project team. Any of these risks could be for better or for worse.

- **Unknown unknowns.** Cornell Professor David Dunning and Justin Kruger studied the mysterious cases of people who are so incompetent that they don't know just how incompetent they are. In a recent interview, Professor Dunning said that the skills needed to produce the right answer are exactly the same skills you use to evaluate the answer, and that this particularly applies in project risk management.

Those affected are not able to recognise that their risk assessment is poor, and do not seek or listen to external advice. This is all summed up by former

US Defence Secretary Donald Rumsfeld's famous "unknown unknowns" comment, where he admitted that in gathering and assessing intelligence there are some things you don't know (known unknowns), but also some that you don't know you don't know (unknown unknowns). Knowing that there are unknown unknowns he suggests is a sign of competency.

It seems that being incompetent isn't necessarily confined to those who are not so smart, but Professor Dunning did say that knowing what you don't was a hallmark of an intelligent person.

For our purposes, I'll use the project parameters (objectives or constraints) as risk categories and thus classify project risks as scope, time, cost and quality risks. Arguably, if a risk doesn't directly or indirectly impact these parameters then it shouldn't trouble our management of the project. This would hold good for all significant risks. For example, a project task may involve several people who don't communicate properly with one another and therefore cause quality problems. Another example is a task using scarce resources that could be temporarily reassigned to higher-priority work. The consequence is a schedule delay. My point is that every risk to the project can be linked to at least one project parameter, and if this is not possible, then the risk is likely to be of no consequence to our management of the project. This is a convenient way to categorise risks because the four parameters can be prioritised by the client. This enables us to identify the driver that is the most important parameter and last to be compromised should the going get hard.

Any risk that affects the project driver is likely to be important. If ours is a time-driven project, and a risk might have a positive or negative impact on the schedule, then that risk needs serious consideration and might best be managed by some trade-off with another parameter – preferably the parameter of least importance. In particular, the risk might concern the delivery date of material required for a project critical task. Late delivery would threaten to delay the project, whereas early delivery might provide an opportunity for early completion. Although, in some projects early delivery, perhaps to take advantage of bulk purchase rates and favourable prices, could create problems of storage, congestion, obsolescence, deterioration and so on. Yet just-in-time delivery is also fraught with risk since this means there is no on-site inventory to absorb fluctuations in supply and demand that are typical of those construction endeavours that are vulnerable to

weather, as opposed to routine operations when things are generally much more predictable.

In summary, probably the most common and logical risk categories are project parameters, where, as I mentioned earlier:

- **Scope risk** concerns risks that could reduce, increase or otherwise alter work needed to produce the project deliverables.
- **Time risk** concerns risks that could impact the project schedule to delay or accelerate the project.
- **Cost risk** concerns risks that could impact the project budget to increase or decrease project costs (ie, realise savings).
- **Quality risk** concerns risks that could impact project requirements (features and functions of deliverables) to improve or diminish their compliance with specifications.

We appreciate that some risks could impact more than one project parameter, and some solutions create further risk. For example, the delayed delivery of an item may threaten to delay our project. This risk may be sufficiently reduced by using a more readily available local supplier, but perhaps at greater cost and diminished quality, which in turn creates other or secondary risks. It may then be that the project scope and functionality are reduced to exclude any need for the item. In this instance, all project parameters are affected. It could be, the “for want of a nail the battle was lost” scenario. Threats can have an ongoing and compounding effect and this is usually much more likely than is some compensating effect that neutralises risk or provides opportunities.

We can create risk on our project by accepting unrealistic constraints. For example, it is impossible to accurately predict the future. Yet, some project managers continue to try. We create schedules that implicitly state a task will be completed at 3:30pm on 1 December this year and cost precisely \$400,876.54. Yet these estimates, based on detailed calculations, are no more accurate than estimates made in more general terms and covered with an appropriate range indicator. Attaching a precise number to the nearest day or dollar only raises stakeholder expectations about the degree of accuracy possible. And that leads to perceived failure when the stakeholder’s unrealistic expectations are not realised. Unrealistic estimates set up our project and ourselves for failure.

Estimating can be a complex process but it has to be done in order that we can assess the feasibility, relevance and benefit of doing the project. Estimates also serve as good targets for the project manager and project team. We must remember that estimates need to evolve as our project progresses and previously unknown factors start to reveal themselves.

Risk register

The primary output from this risk identification step is a partially completed risk register in which we typically record:

- **Risk identification including a code** or number for ready reference purposes, the date when the risk was identified or logged, and possibly the name of the risk identifier, originator or author (who may not necessarily need to be identified and/or be assigned risk ownership), and the risk owner who is the person appointed to monitor the risk and warn us project managers if the risk is starting to happen or if its status changes. The risk owner is usually the person responsible for the task that contains the risk and may also have the authority to take action to deal with the risk.
- **Brief description of each separate risk** even if they arise from the same circumstance, take care not to combine risks since this could over complicate and confuse their subsequent analysis. Each risk might also be given a name (eg, good publicity or defective server). For example, the risk name “reduced consulting costs” might be expanded to describe that the organisation will be able to negotiate lower than average costs for a particular consultant because the consultant really enjoys working for the company in that particular location or because of future work opportunities.
- **Risk classification of either threat or opportunity.** Sometimes a risk might be both a threat and an opportunity in which case it might best be recorded twice (once as a threat and once as an opportunity) to help ensure its proper analysis as both a threat and an opportunity.
- **Briefly describe the risk trigger if it can be identified.** A risk trigger tells us that a risk event is about to occur. It is an indicator or symptom of an arising risk event. If a piece of equipment is not delivered on time, this might be a trigger for schedule delay. Cost overruns on early activities may be symptoms

of poor cost estimates. Absenteeism and staff attrition rates may be symptoms of poor people management. Defective products may be symptoms of a low-quality supplier. Shortening telomeres evidently tell us about the probability of disease and early mortality. Like a runny nose or scratchy throat signals an oncoming cold, or dark clouds gathering is a sign of impending rain, a risk trigger is a symptom or warning sign that tells us a risk is becoming a near-certain event. Its appearance may also trigger the implementation of a contingency or response plan. The “frog boiling experiment” demonstrates why we need a well-defined trigger. Without a trigger we are inclined to wait for improvements or more substantial evidence – oops too late the frog is dead.

- **Risk owner.** A risk owner is the person we assign to watch for triggers, and usually manage the risk response if the risk occurs. A risk owner is typically a project team member. The identification of risk owners doesn't necessarily need to be finalised until we consider responses.

The purpose of the risk register is to assist in project risk management by centralising the recording, analysis, monitoring and controlling of project risks. The register is used throughout the project life cycle, but should be populated and updated with identified risks prior to project commencement and updated as the project and risk-finding proceeds. A possible format for a risk register is at Figure 4.7. It may use a database such as Excel. There is also a useful web-based register at <http://mediumrisk.com>, which we may find more useful than a spreadsheet-based register. A risk register is essential.

Figure 4.7 – Typical risk register templates

Comprehensive version															
Risk Identification		Registered		Risk Category	Risk Symptoms	Preliminary Assessment			Response Strategies	Residual Assessment			Risk Owner	Risk Review	
ID	Description	By	Date			Prob	Impact	Score		Prob	Impact	Score		Date	Status

Fundamental version								
Risk Identification		Preliminary Assessment			Response Strategies	Risk Owner	Risk Review	
ID	Description	Prob	Impact	Score			Date	Status

Notes

1. Some risk registers might also include columns for risk cause(s), WBS element affected, parameter proximity, ease of identification, cost if risk materialises, risk trigger, risk category, closure date, threat or opportunity, expected value, parameter most impacted, description of other risk response strategies, fall back plan should risk event still occur, description of secondary risk that may arise as a result of applying the risk response measure, current response effectiveness, adequacy of existing controls, response category etc.
2. Usually anyone associated with the project can insert detail, which would be routinely checked by the project manager.
3. Secondary risk is entered as a new risk.

Summary thus far

The risk identification step requires that we find and perhaps also categorise risks that could affect the attainment of our project's objectives for better or for worse. It's a process of uncovering risk events in a systematic manner. We document these risks and, as a minimum, produce a list of risks that can be analysed and later be assigned to team members and tracked throughout the project. Risk identification is continuous and new risks should continually be invited into the process.

If available, the main documents that help us identify risk are the specification for the final deliverable, the project work breakdown structure (WBS), the baseline schedule, and the project budget.

The tools and techniques described here, used as appropriate, will support the risk identification process. The most widely used and effective technique for risk identification is simply group brainstorming. The resultant risks can be classified in a variety of ways of which risks to scope, time, cost and quality seem to be four most appropriate categories given that these are the project's objectives or constraints within which as project managers we must navigate our project to successful completion. Any risk that represents a significant threat or opportunity to these four parameters will be identified – well that's the aim.

Some project risks are easy to identify because they are associated with familiar work. Other project risks are more difficult to uncover because they arise from new, unusual, or otherwise unique requirements. Also, it is a mistake to consider a risk as impossible merely because the problem happens only very rarely or has not happened yet.

As we gain experience in managing risks and issues we can develop a checklist of those risks that are more likely to arise on our particular projects. Once risks have been identified as we move through the project life cycle, they are then analysed – the next step in the process of effective risk management. Some points worth reiterating are:

- A risk can only be managed if it is first identified.
- Identifying risk starts as soon as possible, it is ongoing, and risks should be identified to the maximum extent practicable.

- While we aim to identify as many risks as practicable, identifying 200 risks doesn't mean that a project is riskier than a project with only one risk.
- Risks can be both threats and opportunities.
- Each risk should be clearly and unambiguously described and related to at least one project objective.
- Identification should be open and honest, and free of bias and subjectivity.
- Identification may involve historical reviews, creative techniques such as brainstorming, assumption analysis, and use of a risk breakdown structure to prompt analysis. At least two identification techniques should be used.
- The risk register is set up at the start of the project and maintained throughout.

Risk categories can be arranged in a WBS-type organisation framework to form a Risk Breakdown Structure (RBS), with the risk categories replacing the major deliverables of the WBS. The categories could be scope, cost, time, and quality, or for external risks, we could make use of the PESTLEC acronym (political risks, economic risks, social risks, technological risks, legal risks, environmental risks, and competitor risks). Another breakdown might be technical, non-technical, external, organisational, and project management.

Early assessment

A project Concept Check is designed to weed out as early as possible ideas for projects that are too risky or otherwise unacceptable and not worth proceeding further with. An example concept checklist is at Figure 4.8. An acceptable project proposition does not need to meet all criteria necessarily to justify its further analysis, but we are now better aware of risky areas.

Other questions that might be applied at this early stage to uncover risk are:

- Is there a convincing need for the project?
- Would there be significant risks to the business if the project is unsuccessful?
- Is the project dependent on other projects?
- Is the project within our capability?
- Is there committed and capable sponsorship for the change?
- Does the sponsor clearly understand his or her responsibilities?

- Do we have an absentee sponsor?
- Is the sponsor at the correct level?
- Is the sponsor at a high enough level to have sufficient influence and decision-making authority?
- Will those implementing the change be considered credible by those affected by the change?
- Have we successfully completed similar projects previously?
- Do line managers support the change?
- Is there a tight link between the project and the organisation's strategic direction?
- Is the project proposition clear, convincing and compelling?
- Does the project align with the organisation's values and culture?

Such questions provide for a high-level analysis of a prospective project's riskiness before its approval and before a Charter is contemplated. Some possible projects may have some negative responses in this initial concept check, but are still worthy of further assessment.

The kiss of death for our project is to have a sponsor who shows no interest in the project. In this circumstance we might expect any or all of the following consequences:

- Project failure.
- Lack of timely decision-making.
- Poor scope definition.
- Lack of commitment from project team members.
- Unclear expectations of the project and of the project team.
- Limited stakeholder interest and involvement.
- Poor team motivation and morale.
- Uncontrolled changes.
- Lack of funds.

Figure 4.8 – Project concept checklist

PROJECT CONCEPT CHECKLIST	
<p>The project idea or request is _____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	
<p>Does the project idea or request appear to be in harmony with:</p>	
• our business purpose?	Yes/No
• our core values?	Yes/No
• our long-term goals?	Yes/No
• our current and pending programmes and projects?	Yes/No
• our existing policies, protocols, and procedures?	Yes/No
Is it a sustainable development?	Yes/No
Is the risk of proceeding likely to be worth the investment?	Yes/No
Is the project idea likely to be technically feasible?	Yes/No
Are sufficient resources likely to be available?	Yes/No
Are the benefits of implementation likely to exceed the costs?	Yes/No
Is there likely to be sufficient support and demand to proceed?	Yes/No
Is implementation likely to enhance our public image?	Yes/No

Murphy's Law

"If anything can go wrong, it will go wrong." This law, which lends its name to this book's title, is attributed to an USAF officer who apparently created this now famous phrase when a series of electrical errors and problems kept occurring at a Californian Air Force base missile site. These problems were caused by an unfortunate electrician named Murphy who had a habit of wrong-wiring components.

These are some similar risk expressions to which most of us will relate:

- Left to themselves, things tend to go from bad to worse.
- Whenever you set out to do something, something else must be done first.
- Nothing is as easy as it looks.
- Everything takes longer than you think.
- If there is a possibility of several things going wrong, the one that will cause the most damage will occur.
- Nature always sides with the hidden flaw.
- It always costs more than first estimated.
- It is easier to get involved in something than it is to get out of it.
- Every solution breeds new problems.
- If you try to please everybody, somebody will be disappointed.
- It is impossible to make anything foolproof, because fools are so ingenious.
- If you tinker with anything long enough, it will become confused.
- If there is a 55% chance of success that means there is a 95% chance of failure.
- Interchangeable parts won't.
- In any computation the figure that is obviously correct will be the source of error.
- Blame will never be placed if enough people are involved.
- Nothing is lost until you begin looking for it.
- If in the course of several months only three worthwhile social events take place, they will all fall on the same evening.

Reducing Murphy's influence

John Mowen's book "Judgment Calls" identifies the following practices that can help safeguard us from Murphy's influence:

- Think realistically when making decisions and act confidently when implementing them.
- When unsure, select the alternative that would result in the least negative outcome, should we happen to be wrong.
- Give decision-makers frequent feedback on the accuracy of their assumptions and predictions in order to reduce their overconfidence.
- Avoid entrapment, which means doggedly pursuing a losing course of action. Don't throw good money after bad. Know in advance when to stop.
- To avoid entrapment, create milestones which if not achieved will result in the cancellation of the project.
- Sunk costs should have no influence on future decisions. A sunk cost is the investment that cannot be recovered if a project is abandoned. If future benefits do not outweigh future costs, it is time to quit.
- If endurance is paramount, burn our bridges and commit ourselves to the project.
- Identify the underlying cause, not just the obvious symptom, in order to properly solve problems. Otherwise problems just return.
- Avoid the tendency to attribute bad outcomes to uncontrollable situational factors and good outcomes to our own brilliance.
- Do not assume that big problems result from single, big causes.
- We usually exaggerate in hindsight what we anticipate in foresight.
- Use reason to analyse problems and emotion to enhance action.
- Leave intuitive decisions to the experts when time is short and facts are unavailable.
- Have a contingency plan should the original plan go wrong.

Risk registration form

Sometimes a separate form may be used to document and help with the basic analysis of each risk. A typical risk registration form is shown at Figure 4.9. Sometimes it would be appropriate that risk finders remain anonymous. If the risk is a fellow team member, anonymous reporting may help save personal or professional embarrassment.

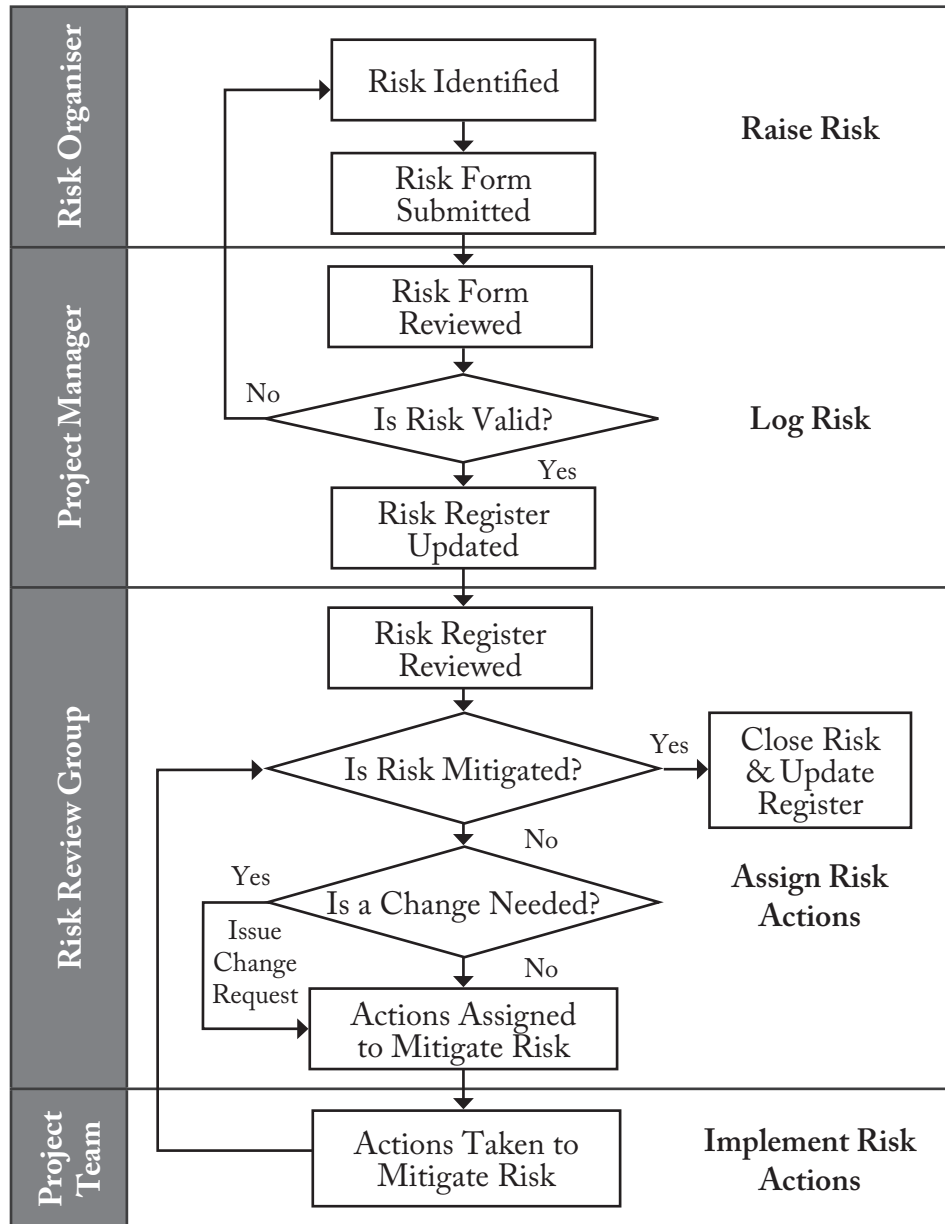
Figure 4.9 – Risk registration form

PROJECT DETAILS	
Project Name:	<i>Name of the project to which the risk relates</i>
Project Manager:	<i>Name of the project manager</i>
RISK DETAILS	
Risk ID:	<i>Unique identifier assigned to this risk</i>
Raised By:	<i>Name of person who is raising the risk</i>
Date Raised:	<i>Date on which this form is completed</i>
Risk Description: <i>Provide a brief description of the risk. Is it a threat or opportunity?</i>	
Risk Likelihood:	Risk Impact:
<i>Describe the likelihood of the risk eventuating (ie, Low, Medium or High).</i>	<i>Describe and rate the impact on the project if the risk eventuates (ie, Low, Medium or High).</i>
RISK ACTION	
Recommended Actions: <i>Add a brief description of any actions that might be taken in response to the risk.</i>	
Recommended Contingent Actions: <i>Add a brief description of any actions that might be taken, in the event that the risk happens, to manage its impact on the project.</i>	
APPROVAL DETAILS	
Supporting Documentation: <i>Reference any supporting documentation to substantiate this risk.</i>	
Risk Finder's Name: _____	Date Risk Registered: ____/____/____
PLEASE FORWARD THIS FORM TO THE PROJECT MANAGER – NOW	

Typical risk administrative process

A typical risk management administrative process is shown at Figure 4.10.

Figure 4.10 – Risk administration



Johari window of risk

At Figure 4.11 there is an adaption of the Johari window to illustrate the value of involving others in risk identification. The main value being that the open box will increase in size and the unknown box will diminish in size.

Figure 4.11 – Johari window of risk

RISKS	Known to Self	Unknown to Self
Known to Others	OPEN	BLIND
Unknown to Others	HIDDEN	UNKNOWN

OPEN are those risks we and others readily identify.

BLIND are those risks that others identify, but we don't.

HIDDEN are those risks that we identify, but others don't.

UNKNOWN are those risks that nobody identifies and are often referred to as 'unknown-unknowns'. We aim to reduce this box.

We involve others in risk identification to enlarge the open quadrant and thus reduce the size of the other quadrants.

Project-related risks

To show some very specific project-related risks, consider the construction of a 40 x 6 metre pole timber wall, in New Zealand native bush, above a creek, close to a marae, and along side a state highway on a notoriously accident prone corner. The builder I spoke to quickly identified following risks with this seemingly straightforward project:

1. **Stolen traffic signs.** With the rise in scrap metal value this is an increasing problem, yet correct safety signage is essential especially on a state highway.
2. **Contamination of creek with excavated material.** Environmental authorities can very quickly shut down a project if we destroy or threaten to destroy the creek's ecology.
3. **Road collapse during excavation.** If the bench collapses the road goes with it.
4. **Unmarked graves.** Local iwi could have unmarked graves on site.
5. **No hard ground.** Engineers could not give us details of hard natural ground to key our wall into. Hard ground is a best guess, with no guarantees of course.
6. **Unacceptable destruction of native bush.** Opinions vary as to how much we can remove without causing damage to the local ecology.
7. **Wet weather.** Heavy rain on site could de-stabilise benching and cause a collapse. Also, adverse weather is likely to cause delays. And weather seems to be increasingly difficult to predict.
8. **Wooden poles too crooked to use.** It has happened before.
9. **Serious vehicle accident on site.** The resultant investigation will halt work.
10. **Employee injury.** Their treatment and the investigation will halt work.
11. **Post hole auguring not possible.** Sometimes mechanical drilling is not possible. Digging by hand is sure to extend the completion date.
12. **Theft from site.** A stolen vehicle battery can hold up work for at least half a day.
13. **Complaints over traffic management.** If road users are unhappy with the flow of traffic this can cause difficulties.

14. **Management and consultant engineer arguing over design.** Such disagreements cause delays and animosity. Also, future cooperation may be jeopardised.
15. **Backfill material not compacting to required standard.** Always a risk when material choice is based on convenience and price rather than suitability and quality.
16. **Subcontractors not turning up or being unreliable.** Their absences can cause delays and quality issues.
17. **No credit given by suppliers.** If we can't buy the materials we can't do the job.
18. **Design anomalies.** When an engineer says, "We'll reassess things as you get into the job." a chill passes down one's spine.
19. **Damage to vital equipment.** If we only have one and we break it, there is a delay for repair or replacement.
20. **Changes to scope.** Quite common and annoying when we're working to a tight schedule. There can also be cost and quality implications.

Force field analysis

A force field analysis is a qualitative method, in which we brainstorm and record the forces for (opportunities) and against (threats) a project. We could select a possible community project such as a building a swimming pool, new prison, playground upgrade, road/bridge or a more familiar work-related project and then study the prospective project using this tool to identify threats (forces against) and opportunities (forces for). It is a form of structured brainstorming.

Risk categories

Sometimes it can be useful to identify risks by working through different categories of risk. This usually helps ensure a comprehensive search. Sometimes after risks have been identified, they may be categorised prior to their further analysis, since some categories may be more relevant than others to our project or organisation. Some ways of classifying risks are:

- external and internal
- technical and non-technical
- business and project risks (where ‘project risks’ are inherent to the project, and ‘business risk’ concerns exposure of the organisation)
- customer satisfaction, financial, and quality
- scope, time, cost, and quality risks.

The matrix at Figure 4.12 shows one method to classify risks and also shows whose primarily responsible for the type of risk:

Figure 4.12 – Risk categories

	Technical	Non-Technical
Internal (within project)	A PM's	B PM's
External (outside project)	C Sponsor's	D Sponsor's

Internal risks are those that arise within the project. They will usually be controllable. These risks will particularly concern the project manager.

External risks are those that arise outside the project and may be beyond our organisation's ability to control or influence. These risks will particularly concern the sponsor.

Technical risks are concerned with technology, processes, components, materials, supplies, plant, equipment, but exclude human resource risks.

Non-Technical risks are sometimes overlooked and are concerned mainly with stakeholders – their availability, attitude, aptitude, skill levels, co-operation, conflict, motivation, morale etc. Within the project team, these risks can be a source of performance and productivity issues, and are best avoided by careful selection, leadership, team building, coaching and counselling.

Groupthink

Groupthink is a silent disease, doing its devastation in quiet, subdued ways. It is often blamed for project dysfunction and the reason why risks are not foreseen. There are up to eight symptoms present in project teams that produce unsuccessful plans, decisions and solutions. The more obvious the following symptoms, the greater likelihood of groupthink being present at our project team planning sessions:

1. **Illusion of invulnerability.** The belief by the decision-making group that whatever their decision it will be successful.
2. **Belief in the group's morality.** The belief by the group that their decisions are consistent with the highest levels of morality.
3. **Rationalisation.** This involves the complete downplaying of the decision's drawbacks. Legitimate objections and threats are overshadowed by likely negative reaction to anyone voicing these concerns to the group.
4. **Stereotypes of out-groups.** This involves falsely characterising those stakeholder groups that challenge the decision as the enemy and adopting a 'them and us' attitude. The group then becomes less receptive to even valid criticism from legitimate outsiders.

5. **Self-censorship.** This is when the group suppresses their doubts under the guise of group loyalty, project team spirit, or perceived adherence to company core values, policy and rules.
6. **Direct pressure.** This involves pressure upon individual group members to keep dissident views to themselves. It may even involve ridicule or sarcasm.
7. **Mind guards.** This occurs when data, facts and opinions, which might be important are not advised to the group or simply ignored as they are of “doubtful relevance”, “the group already has sufficient information”, “the time factor”, etc.
8. **Illusion of unanimity.** The group coalesces around the decision. Drawbacks and threats are downplayed in the interest of morale, consensus and unanimity.

Solutions. Groupthink can be mitigated by:

- | | |
|---|--|
| • encouraging free, open discussion | • using sub-groups and compare |
| • keeping an open mind | • accepting divergent thinking |
| • ensuring senior management don't express their opinions before the discussion | • sleeping on important issues |
| • admitting preconceptions | • using outsiders to check assumptions |
| • preferring non-judgemental attitudes | • encouraging criticism |
| | • each person being a critical evaluator |

We might tackle project team risk denial by using the following strategies:

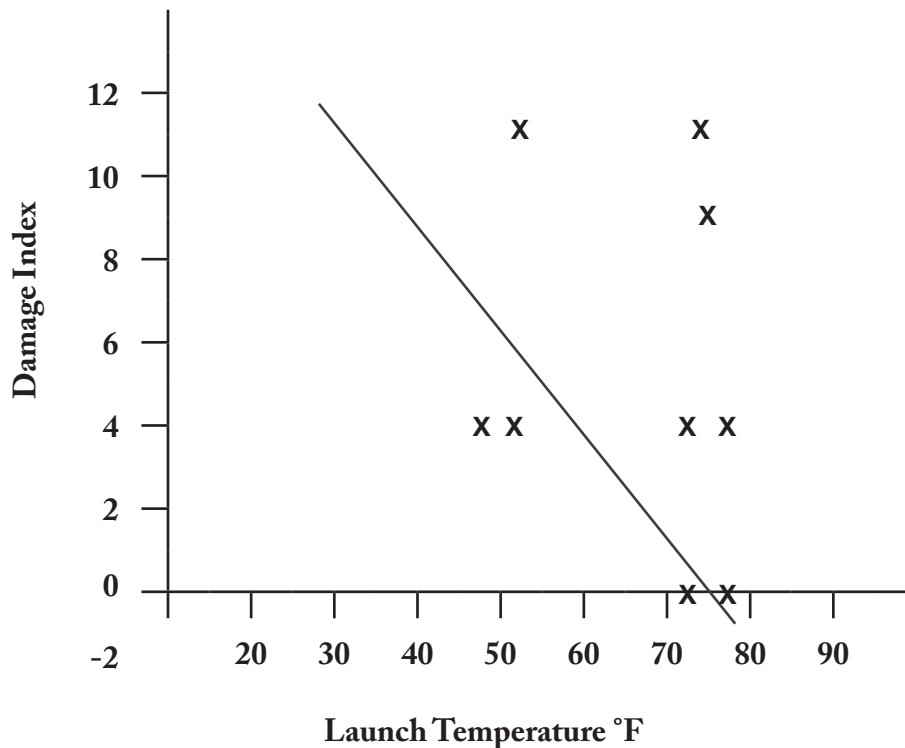
- First ensure we understand the risk.
- Muster our relevant evidence and present it well.
- Put our concern in writing, which usually ensures its closer attention.
- Bring in the non-combatants (eg, third-party, mediator, expert).
- Encourage group to consider the consequences of their attitude.
- Get the sponsor involved.
- Put an entry in the risk register.

O-ring damage on space shuttles flights

The 1970 Challenger space shuttle disaster is a very good example of groupthink and high impact risk. Most of those responsible for the launch decision believed that the probability of failure of the O-ring seals was very low. However, the explosion killed all of the astronauts aboard. Perhaps if the launch authorities had better considered the impact of such a risk, they would have delayed the launch until the atmospheric temperature rose to a safer level. As it was the decision-makers were under a lot of pressure to get the job done, which is a possible trap for any obsessively can-do project manager.

This scatter diagram at Figure 4.13 shows no clear relationship between damage index and launch temperature. But would you have taken the risk? Good risk management usually goes unnoticed and in this instance would have generated further adverse comment about NASA. The decision to delay the launch until the temperature warmed up would have been an example of risk avoidance.

Figure 4.13 – O-Ring damage versus temperature



Projects typically need much decision-making throughout their life. Some key things to remember to help ensure effective decision-making meetings are:

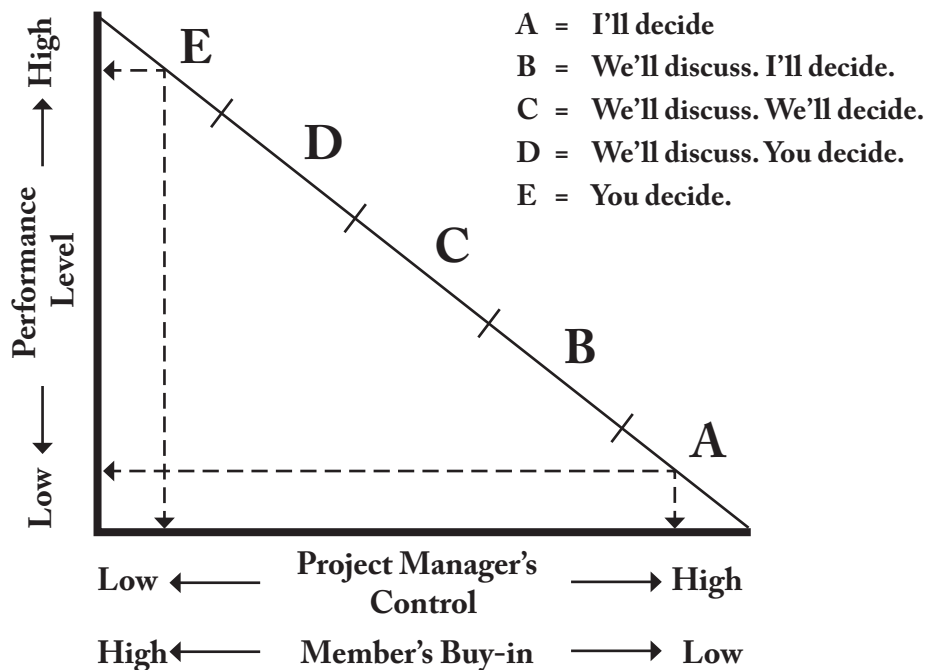
1. The leader should avoid expressing a preferred course of action in the initial stages of a group's decision-making discussion.
2. The group should be asked to offer options in a brainstorming fashion – that is, with no evaluation during the idea-generation phase.
3. Once evaluation begins, all members should be encouraged to play the role of critical evaluator – looking for the potential risks and consequences of a particular option, no matter who offered it as a possibility. Such criticism should deal with issues, not personalities. That is, an idea should never be labelled dumb, or any other derogatory term, since this tends to attack the person who suggested it. Rather, the person might say, I have a concern with this option for this reason, and then state the reason. De Bono's Six Hats helps ensure a multi-perspective analysis.
4. If time permits, a final check should be made a day later, so that people have time to reflect on it. If concerns occur to them overnight, they should bring them back to the group to consider. Final decisions are postponed until after this incubation period.

When the shuttle lifts off from Cape Canaveral on 9 July 2011 this will be the 135th launch and final mission of the shuttle programme.

Groupthink also played a fundamental role in the fiasco of the US invasion of Cuba at the Bay of Pigs. More recent examples might be the decision to occupy Iraq and Afghanistan, and the negligence of many democratic governments in allowing banking and credit institutions to regulate their own affairs, unhindered by objections and fears that the large-scale leveraging of risk in money markets would result in a global recession.

The extent to which we involve people in decision-making might also depend on their attitude and aptitude. To involve those with inappropriate attitudes and lack of aptitude can also be a risk. Consensus is not always appropriate or even practicable in some projects, especially in the time-driven variety. See figure 4.14. If time is short we are inclined to err towards the extremes – either A or E, both of which take little time. C is serious meeting territory.

Figure 4.14 – Performance versus control



Decision matrix

An effective risk aware decision-making tool that minimises subjectivity and groupthink is a weighted attributes approach whereby feasible options are evaluated against weighted attributes (success criteria). This is usually much better than making decisions based on organisational seniority or on the eloquence of someone's speech.

During the project life cycle a variety of decisions need to be made, including project selection, strategy adopted, best solution, suitable contractor, contract, proposal, consultant, supplier etc. To minimise risk a decision matrix may be used to reduce subjectivity and maximise objectivity.

It's about evaluating viable alternatives against weighted attributes. The process is:

1. Identify and prioritise selection attributes using a paired comparisons chart as shown at Figure 4.15. This step recognises that some attributes are more important than others. There may, of course, be more than five attributes.

Figure 4.15 – Paired comparisons chart

Rank	Score	Attributes	5	4	3	2	1
		1					
		2					
		3					
		4					
		5					

2. Record attributes in rank order and evaluate viable alternatives against weighted attributes using a scale of say 1 to 5, where 1 is adequate only and 5 is excellent. Attributes are weighted from 10 to 1, where 10 is the top weight. Alternatively, weight may be expressed as a percentage. See Figure 4.16.

Figure 4.16 – Decision matrix

Attributes	Weight	Option 1	Option 2	Option 3
1.	10			
2.				
3.				
4.				
5.				
Totals				

3. Highest total is the selected option. Apply the Pareto principle to break ties, which requires we total the relevant columns from the top (most important attribute) downward until one total exceeds the other(s).

Summary

Risk identification is a process of uncovering potential risk events. We identify what might happen that could affect the objectives of the project, and how those things might happen. It should be undertaken systematically and continuously, and involve to some degree all project stakeholders. It can focus on both predictable and unpredictable risks, those over which we have some control and those that are largely uncontrollable, and those that are technical versus those that are not.

Risk identification typically occurs at the beginning of the project, but may occur at any stage of the project and continues through the project life. Each project meeting should include risk as an agenda item.

The process of risk identification determines what might happen that could affect the objectives of the project, and how those things might happen. The risk identification process must be comprehensive, as risks that have not been identified cannot be assessed, and their emergence at a later time may cause unpleasant surprises and threaten the success of the project.

A number of techniques can be used for risk identification, but brainstorming is a preferred method because of its simplicity, flexibility and capability, when appropriately structured, of generating a wide and diverse range of risks. Information used in the risk identification process may include historical data, theoretical analysis, empirical data and analysis, informed opinions of the project team and external experts, and the concerns of other stakeholders. The output is a comprehensive list of risks, which could help or hinder completion of the project, documented in a risk register, with management responsibilities (risk owners) allocated to them.

In risk identification, sometimes there is a temptation to dismiss a risk because we can't do anything about it. This argument does not change the risk into a non-risk, simply because there appears to be no viable mitigation strategy. The risk that cannot be mitigated may have an effect on the project and can be calibrated in qualitative and quantitative analysis. It is just not possible to handle this risk, but it is still a risk. Also, some of these risks may be affected by management. For instance, political risk may be influenced by public outreach and information campaigns.

The process of identifying risk does not have to be cumbersome, formal, or mundane. In fact, an ingenious project manager will use an exercise such as risk identification to glean other benefits. For example, the risk identification session can create the foundation for cohesion among project team members. As ideas are solicited from contributors, they develop a sense of substantive contribution to team achievement.

Team members identify risks (threats and opportunities) using:

- sample risk lists
- their own knowledge
- consultation with others
- various tools and techniques.

It is important that risks are properly described and recorded in the risk register typically using the format – “Because of the (cause or condition), (a risk) may occur, leading to an impact (as yet not analysed) on XX objective”, where XX is cost, time, scope and/or quality. Unambiguous risk descriptions are essential. For example, “Because it may rain (cause) people will not attend our picnic (risk event) and food will be wasted (effect on budget).”

Also, risks might interact as shown at Figure 4.17. For example, should a quality risk cause rework, there might also be budgetary and schedule consequences.

Figure 4.17 – Risk interaction



Remember, to raise the topic of risk is not to admit failure. If the culture in our organisation is to see discussion of risk as an admission of failure, we must change that culture. Driving risk underground is not the way to deal with it. Also, different stakeholders may have different perceptions of project risk.

Some key questions that might reveal considerable risk are:

- Will this project have dedicated or shared resources?
- Are there multiple customers for the deliverables?
- Has a completion date and budget been set without our input as project manager?
- Is there solid justification for the project?
- How interested and involved is our sponsor and senior management in our project?

While most project teams are good at identifying big, obvious risks, perhaps we don't invest enough time exploring for low-probability risks of high impact. And not all black swans are catastrophic. Some of these game-changing events are auspicious opportunities. As NZ Futures Trust advocate, our minds always need to be curious, open to new information, flexible and creative, adjusting to novelty, avoiding fixed and rigid thinking, capable of holding to ambiguity, and willing to look beyond the horizon.

Remember, that it is neither possible nor desirable to live life without taking risks. If we tried to be safe all the time, and not expose ourselves to any uncertainty, we would never do anything. Of course we should try to reduce our risk exposure to a level that is acceptable, while not stifling creativity and innovation, but that level is not zero. We need to take some risk, without being irresponsible. This is true of life and projects.

Winston Churchill once said that "A pessimist sees the difficulty in every opportunity, and an optimist sees opportunity in every difficulty." We welcome both perspectives in our search for risk.

The output of this step is a list of possible risks to the successful or more successful completion of the project, usually in the form of a risk register, with management responsibilities (risk owners) allocated to them.

Risk management would be a whole lot easier if we knew exactly what the risks were. In the real world, there is neither money, time nor other resources to identify and deal with all risks. We therefore need to examine each risk and classify it by impact or severity on the successful completion of our project, and by probability or likelihood. This process concerns risk analysis, the subject of the next chapter, where a qualitative analysis (Chapter Five) is mandatory and a quantitative analysis (Chapter Six) is optional and usually the preserve of larger, more expensive and more complex projects.

Qualitative Analysis

Risk identification, as mentioned in the previous chapter, results in the initiation of a risk register. The register can be sizeable and it is then necessary to evaluate and prioritise the risk events identified. Prioritising risks helps ensure that valuable resources are focused on the right risks at the right time.

Perhaps the most difficult aspect of analysing and planning for risk is not risk identification, but determining how to place some value, numerical or otherwise, on the probability that the risk event will occur. Without a way to assess this aspect of risk, it is difficult to determine the severity of project risks and to prioritise risks for their necessary degree of project management attention.

Usually, a lot of effort goes into prioritising risks, so that an appropriate level of attention can be devoted to dealing with them. Several different parameters can be used to rank risks, although it is most common to use just two – probability and impact. Other secondary, yet relevant factors might include urgency, detectability, exposure period, exposure frequency, manageability, and response cost.

Risk analysis is primarily concerned with determining which risks warrant some response. However, this analysis is complicated by factors such as:

- opportunities and threats can interact in unanticipated ways
- a single risk event can cause multiple effects, both threats and opportunities
- threats for one stakeholder can be opportunities for others
- the difficulty of assessing the likelihood that a risk will occur
- mathematical tools can create a false impression of accuracy and reliability.

Risk analysis is most effective when a numerical probability of risk occurrence can be determined with reasonable accuracy. It is not always possible to do this. We should nevertheless understand the fundamental concepts of probability theory to better estimate the chances of a risk occurring, and the interaction of related risks. We should also understand the differences between qualitative and quantitative approaches to measuring risks and the advantages and disadvantages of each approach.

Qualitative analysis provides a convenient and user-friendly way to analyse project risks and doesn't usually involve measurement and numbers. To undertake a qualitative risk analysis we would typically:

1. Gather our risk team.
2. Make sure we have agreed precise definitions for impact and probability.
3. Assess all the identified risks and rank the probability of each occurring.
4. Separately assess their impact should they occur.
5. Determine risk priorities based on their probabilities and impacts.
6. Rank them in order of priority (severity).
7. Update the risk register with the above assessments.
8. Decide which risks will then undergo quantitative analysis.

Our organisation's management, project client, and sponsor have an important role in qualitative risk analysis. The sponsor defines the levels of impact on our project's objectives that would qualify risks as say very low, low, moderate, high or very high, and determines the combinations of probability and impact that make a risk low, moderate or high priority for each objective. It is important that we project managers seek to have these categories clearly defined, since a common accusation when a project flounders is that risks were wrongly prioritised. As a prudent minimum, we might check periodically during the project that our sponsor is content with our application of these definitions.

Qualitative risk analysis uses relative degrees of probability and impact for each identified risk event in descriptive non-numeric terms such as "high," "medium," and "low" to describe the probability and impact of risk events. Unless the person providing the information is an exceptional writer, this form of presenting risk information is generally better than some narrative form for explaining the

severity of risk impact. Qualitative analysis uses word form or descriptive scales to describe the size of a potential impact and the likelihood that this impact will occur. We subjectively assess each identified risk for its probability of occurrence and its impact on project objectives to produce a list of prioritised risks.

Quantitative analysis uses numerical values for both impact and probability rather than the descriptive scales used in qualitative and semi-qualitative analysis. The scales can be adapted or adjusted to suit circumstances, and different descriptions may be used for different risks.

Our organisation's management, project customer and sponsor have an important role in the qualitative risk analysis process. In particular, the project sponsor:

- defines the levels of impact on time, cost, scope and quality that would qualify a risk as having a low, medium or high impact on each project objective
- determines the combination of probability and impact that make a risk low, moderate or high priority for each project objective.

Once these definitions are in place, team members can assess the identified risks in terms of their probability and impact, and then put them into high, medium and low risk categories for each project objective. We revisit the qualitative risk analysis process as the project proceeds since circumstances change.

But the qualitative form has its limitations. Describing a risk event as having a medium probability of occurrence provides a sense of how likely the risk is to occur, but leaves a wide range of possibilities to consider. In addition, high, medium, and low are rather subjective expressions. A high risk for one person may be a medium risk for another and so on. Even with the qualitative form of presentation, it is more helpful if the qualitative scale can be defined more quantitatively. For example, defining low risk as those falling between zero and 20 percent probability of occurrence helps clarify what is meant by "low risk." It is usually better to apply a specifically quantified number than a range where possible, which is sometimes described as semi-quantitative analysis.

In a quantitative analysis, numbers are always used to assess probabilities and impact. This is useful for two important reasons. First, assigning a number to the risk's probability affords the opportunity to use more tools to assess the risk. Second, quantifying the risk's probability provides some clarity and objectivity

to the assessment of risk. Like it or not, we have to realise that there will always be a certain amount of subjectivity in assigning probabilities to a risk event, but there are tools that can help us mitigate risk if we can first quantify them. The qualitative analysis of some unspecified risks is shown at Figure 5.1.

Figure 5.1 – Qualitative analysis

Risk	Probability	Impact	Rating	Rank Order
A	L (low)	M	L/H	3
B	M (medium)	H	M/H	2
C	H (high)	H	H/H	1

Qualitative analysis is used in any one of the following circumstances:

- As an initial screening activity to identify risks that require more detailed analysis.
- Where the level of risk does not justify the time and effort required for quantitative analysis.
- Where the numerical data are unavailable or inadequate for quantitative analysis.

In semi-quantitative analysis, qualitative scales are given values. The number allocated to each description does not necessarily bear a very accurate relationship to the actual magnitude of impact and probability. The objective is to produce a more detailed and precise prioritisation than is usually achieved in qualitative analysis. Semi-quantitative analysis may not differentiate clearly between risks, particularly when either impact or likelihood is extreme. A quantitative assessment is shown at Figure 5.2.

Figure 5.2 – Quantitative analysis

Risk	Probability	Impact	Rating	Rank
D	10%	\$50k	\$5k	3
E	50%	\$70k	\$35k	1
F	70%	\$10k	\$10k	2

While there are a variety of tables that help us analyse or evaluate risk, the two dominant factors that decide a risk's priority are most appropriately risk impact and risk probability, where:

- **Impact** is the affect the risk will have on the success of the project. “To what extent would this risk, should it occur, frustrate or facilitate us achieving our project goal?” Impact is sometimes described as consequence or significance. It's the amount of pain or gain the risk event promises the project. Impact might also be described as the loss or gain caused by the risk, which can sometimes be expressed in dollar terms. A risk could have a high probability, but a negligible impact. In this case the risk can usually be ignored or at least tolerated.
- **Probability** is the likelihood or chances of the risk occurring on our project. This assessment is usually based on historical frequency. However, such records may be lacking and history is not always a reliable indicator of future probability given our rapidly changing environment and the inevitable differences between projects. If the chances of a risk occurring are slim to none, then we don't really have a risk. Probability exists in a spectrum from impossible to certain, where certain is a fact (issue). Risk probability cannot be measured, only estimated, and it is usually more difficult to assess than is impact.

In addition to these two principal factors, risk priority might also consider risk exposure, risk urgency and how easy or otherwise the risk is to detect:

- **Exposure** is the period or periods that the project is susceptible to the risk. This period might be brief or prolonged. Also, should a risk event be likely to occur over and over, it would generally warrant greater attention than would a one-off risk event. Frequency concerns repeatable events. Most risks have a temporal component that can be expressed as time or a condition that causes the risk to expire. Consider “the new hardware platform will not be ready in time for software integration testing.” Once the new platform is ready, this risk vanishes.
- **Urgency** is whether the risk event is likely to occur earlier or later in the project. If the event is earlier, then it may need to be addressed now. Longer-term risk events may not need to be addressed so soon. Risk is time-based. It is always in the future. If there is less time available to accomplish a task or project, then risk anxiety increases.
- **Detectability** or ease of detection is sometimes considered when determining risk priorities, where greater attention is given those risks that might arise quickly with little or no warning or obvious symptoms that typically trigger risk contingencies.

We might also be influenced by how easy and expensive would it be to manage the risk, whether the risk is related to other risks, and even how important the risk is to us personally.

A more complex formula that considers several key risk characteristics would be: Risk Priority = Impact x Probability x Exposure x Urgency x Detectability, where the greatest values would normally be assigned impact and probability if the formula was to be quantified. For example, urgency might be scored as follows:

3 = likely to happen within one month
2 = likely to happen within two months
1 = likely to happen within three months.

Probability is usually expressed as either likelihood, a frequency, or a combination of exposure and likelihood.

Thus risk has two main dimensions – the uncertainty dimension (assessed as probability of occurrence), and the effect dimension (assessed as impact on project objectives). While effect on objectives is relatively simple to estimate, assessing probability is much less straightforward, yet very important since:

- Faulty probability assessments will affect the priority given risks leading to the possible neglect of significant risks or selection of inappropriate or excessive risk response measures. Also, if risks are not managed effectively, people will lose confidence in the risk management process and its adoption.
- Conversely, if assessment of risk probability is sound, this will help ensure the success of the project. This success will also enhance the credibility of the risk management process.

Research has shown that while the above factors are of considerable importance, the following additional factors might also influence a risk's acceptability:

- whether the risk is voluntary or involuntary
- the degree of control we have over the risk
- whether it is a familiar or new risk
- how long before the consequences become evident
- the size of the group exposed
- the social and geographic distribution of the risk
- the necessity of exposure
- the effect on future generations
- the degree of personal exposure
- whether the consequences are reversible.

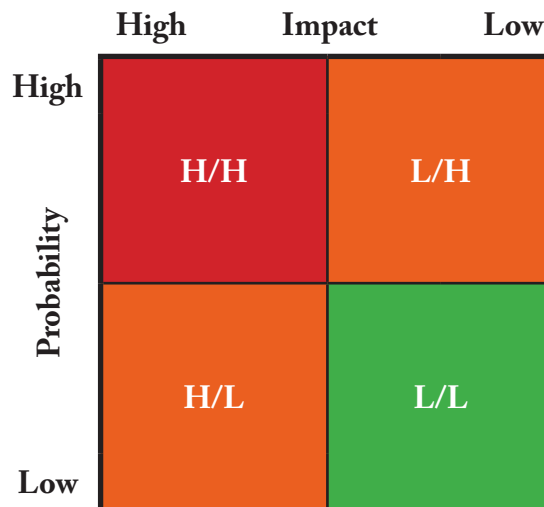
However, most models limit the assessment to that of impact and probability, recognising that exposure period or frequency and detectability are arguably factors inherent in the determination of impact and probability.

We face a particular challenge with probabilities because the human brain does not deal well with these. Mostly, there is a bias in favour of what we wish to

happen – the “Lotto effect.” Also, if it’s a problem that occurred in another project recently then there can be a “recency effect” that has us over-estimate probability. Also, those who identify a risk, because they have experienced it themselves, might exaggerate its probability. Suffice to say that a variety of opinions should help compensate for our individual excessive optimism or pessimism.

Risks can be presented and assessed using a variety of formats. A risk matrix is a very common approach. The matrix can typically be setup in a 2x2, 3x3, 4x4, or 5x5 configuration. The most basic format is a simple 2x2 or four-square grid. This format is more appropriate when only qualitative data is used. See Figure 5.3. Once the matrix is created, we could write each risk onto a Post-it Note (perhaps red for threat and green for opportunity) and then locate this in the appropriate quadrant on the matrix. To ensure a sufficiently large matrix for this purpose we might use a whiteboard or flipchart page or several A4 pages.

Figure 5.3 – Basic risk analysis grid (2x2)



Given this basic grid, it is easy to see that risks falling in:

- Low Impact/Low Probability (L/L) quadrant risks may be ignored or given a lower priority. These risks are essentially benign and warrant little attention from a risk management perspective.

- High Impact/High Probability (H/H) quadrant risks are likely to occur and if they do their consequences will be considerable, perhaps disastrous. Such risks are best dealt with proactively. They are of critical importance.
- Low Impact/High Probability (L/H) and High Impact/Low Probability (H/L) quadrant risks might warrant some action – perhaps contingency planning. These risks should be viewed with a cautionary perspective. They are of medium importance. We should do what we can to reduce their impact or probability. Of the two, L/H is usually of higher priority.

The problem with this 2x2 matrix is where the lines dividing the quadrants lie. For example, should we ignore a 49% probability risk that will cause 49% of maximum loss? And why, in this example, should we pay maximum attention to a risk that has a 51% probability of occurring, with a loss of 51% of maximum loss? The four quadrant grid is too simplistic to be of much value except for preliminary analysis.

A more comprehensive grid or matrix would also include medium or moderate ratings usually for both impact and probability scales, but sometimes only for the impact scale, recognising that probability is usually more difficult to assess with reasonable accuracy. See Figure 5.4, where the smaller the number, the greater the risk severity, exposure or priority:

- **High (1, 2, 3)** – would cause significant or considerable change to scope/schedule, increase or decrease in cost, or degradation or improvement in project performance.
- **Medium or Moderate (4, 5, 6)** – would cause some change to scope/schedule, increase or decrease in cost, or degradation, or improvement in project performance. We cannot work around the problem.
- **Low (7, 8, 9)** – would have little potential for affecting scope/schedule, cost or project performance. The problem can be worked around.

Alternatively, numerical values might be applied to both probability and impact. For example, in terms of cost, high impact might be a risk with the potential to cause a project cost increase (or reduction) in excess of 25% and/or a project delay (or earlier) finish in excess of 25%, the actual figures expressed in dollars and days, where the specific amount would depend on the particular project.

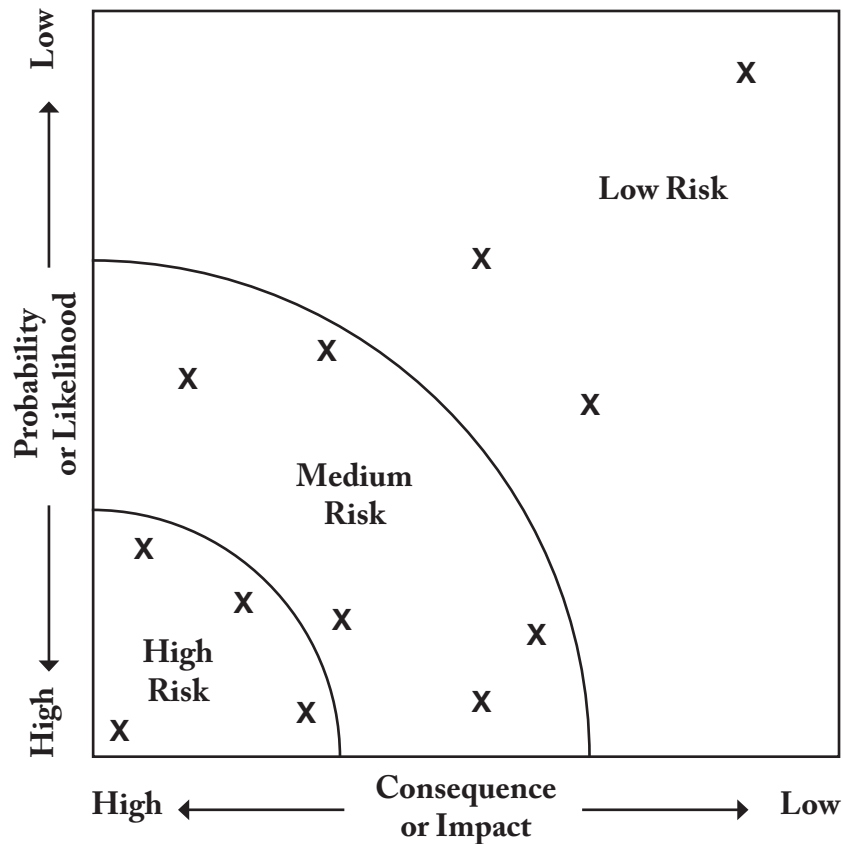
Qualitative risk analysis involves us assessing the probability and impact of identified risks, to determine their priority. For example, there might be a high probability of rain, the impact of which might also be high if we were to have a large outdoor function on that day. Such risks can then be plotted directly onto the matrix (grid or chart as it is sometimes called) in the appropriate square or assigned a priority rating of say H/H or a number if the squares are numbered as in the example at Figure 5.4. In this example, the smaller the number the higher the risk priority, otherwise the number has no units. It may be useful to use separate charts for threats and opportunities.

Figure 5.4 – Risk analysis grid (3x3)

		Impact		
		High	Medium	Low
Probability	High	1	3	6
	Medium	2	5	8
	Low	4	7	9

Another approach to assign risk priorities is to use a Risk Priorities Chart or Graph as shown at Figure 5.5. Using this chart, the further the risk is plotted from the origin, the lower is the risk priority.

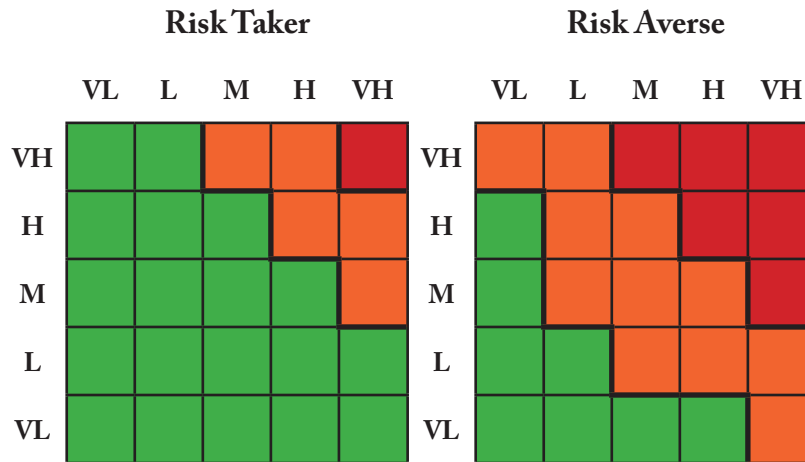
Figure 5.5 – Risk priorities chart



A more comprehensive risk analysis grid would include say five measures of both impact and probability, enabling some greater accuracy or at least creating an impression of some greater accuracy. However, this illusion of accuracy can be a source of risk in itself. Making subjective information look objective and precise can result in unwarranted confidence or pessimism and poor decision-making. In this example, the risk tolerance boundary shows what level of risk we can tolerate in our project. The matrix identifies acceptable risks for which we may or may not prepare a contingency plan. The matrix can be adjusted to reflect our particular risk tolerance. See Figure 5.6.

There is an argument that a 4x4 grid is a better answer, since there's no middle ground. Users are forced to choose something other than 'medium' for impact and probability.

Figure 5.6 – Risk tolerances



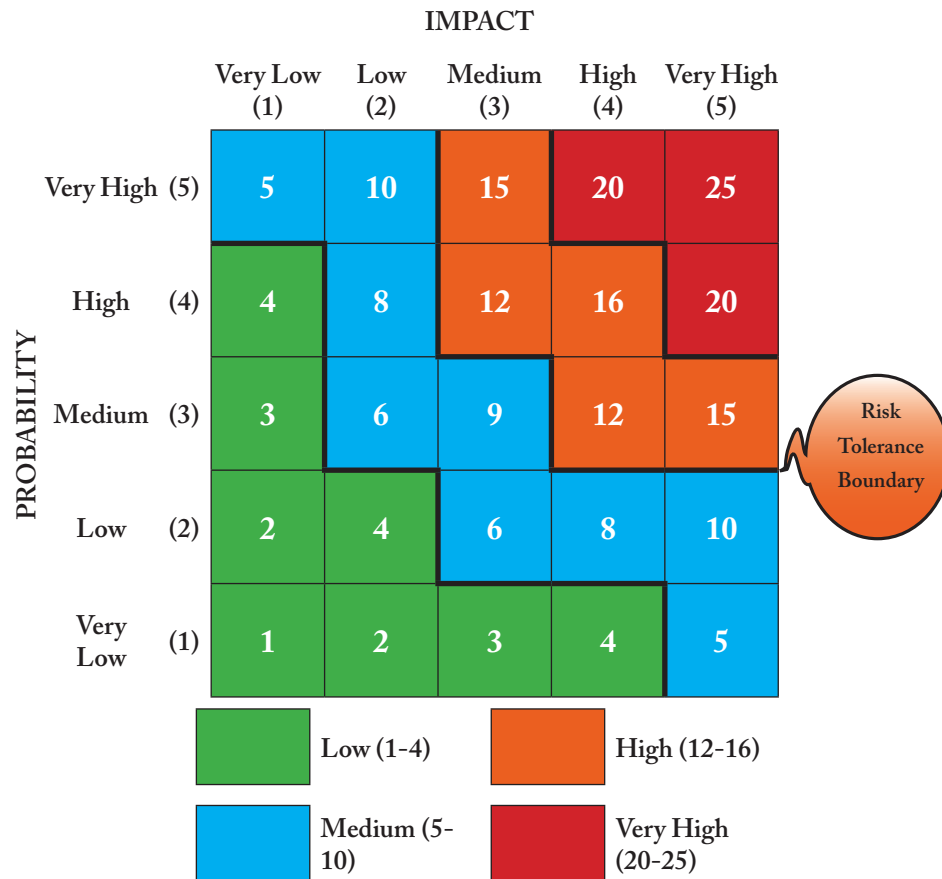
Risk tolerance might be categorised as very high, high, medium, low, very low for each project objective (scope, time, cost and quality).

Individuals and organisations often have different levels of tolerance to project risk. As mentioned earlier, the three most common classifications are risk-averse or avoider, risk-neutral or balanced, and risk-taker or seeker.

Illustrated at Figure 5.7 is another five-column/row matrix model used for qualitative risk assessment. The main difference in such charts is usually where the divisions are drawn. It is not uncommon that the divisions favour impact, which would not fit with the numbering shown here. For example, the RED zone might then consist of squares labelled 15, 20 and 25, but exclude 16. Boundaries are inserted in the matrix according to our organisation's tolerance for risk and the specific project we analyse. A brief description of probability and impact categories is provided at Figures 5.8, 5.9 and 5.10. These examples enable semi-quantitative analysis.

Figure 5.9 shows impact of threats, whereas the impact of opportunities might be the same scale for time and cost, but quality and scope impacts would need to be expressed in positive terms. For example, a very high impact opportunity might "significantly increase functionality."

Figure 5.7 – Risk analysis grid (5x5)



A further example of 5x5 risk matrix without figures or precise definitions is shown at Figure 5.11 where each cell represents a possible combination of probability and impact. In this example, there are four categories of risk (extreme, high, moderate and low) and different expressions are used to describe probability and impact.

Figure 5.8 – Probability and impact descriptions

Probability	Synonyms		Figures
Very High	Almost certain	Very sure	Over 90%
High	Likely	Pretty sure	80%
Medium	Possible	Maybe	50%
Low	Unlikely	Seldom	20%
Very Low	Rare	Improbable	Under 10%
Impact	Synonyms		Figures
Very High	Very critical	Very strong	Over 10%
High	Critical	Strong	8%
Medium	Moderate	Average	4%
Low	Slight	Mild	2%
Very Low	Very little	Very mild	Under 1%

A few things to be aware of when we assess risks are:

- **Confirmation bias** is a tendency for us to favour information that confirms our preconceptions or hypotheses regardless of whether the information is true. As a result, we recall and research information selectively and interpret it in a biased way. This bias can apply to risk analysis.
- **Recency effect** means we recall more clearly recent events, which can apply to our more recent project risk/issues experiences. Of course recency bias can work both ways. A risk can be positive or negative, either of which we might overestimate due to our recent experience.
- **Appeal to probability** is a logic fallacy. It either assumes that because something could happen, it is inevitable that it will happen,. Conversely, another form of the appeal to probability is the appeal to improbability or an

appeal to impossibility in which the likelihood of an occurrence is drastically downplayed to bolster an insecure proposition or brush aside a problematic event. Recall the “black swan” concept.

Figure 5.9 – Impact on parameters

Rating	Probability	Impact		
		Schedule (weeks)	Cost (\$000)	Quality (performance)
VH	Over 80%	Over 8	Over 10	Unacceptable
H	51-80%	4-8	5-10	Significant reduction
M	21-50%	2-4	2-5	Slight reduction
L	6-20%	1-2	1-2	Minor reduction
VL	Under 6%	Under 1	Under 1	No reduction

Project Objective	Very Low	Low	Moderate	High	Very High
Cost	Insignificant	Under 10%	10-20%	20-40%	Over 40%
Schedule	Insignificant	Under 5%	5-10%	10-20%	Over 20%
Scope	Barely noticeable	Minor areas impacted	Major areas impacted	Changes not acceptable to sponsor	Product becomes useless
Quality	Barely noticeable	Minor deviations	Sponsor must approve quality change	Quality change not acceptable to sponsor	Product becomes useless

Figure 5.10 – Probability and impact scales

Probability	Measure	Remarks
Very Low	0-5%	Very unlikely
Low	6-20%	Unlikely
Medium	21-50%	Fairly likely
High	51-80%	Likely
Very High	Over 80%	Very likely

Impact	Delay or Gain	Remarks
Very Low	Under 2 days	Insignificant
Low	Under 2 weeks	Small
Medium	2 to 8 weeks	Significant
High	2 to 3 months	Large
Very High	Over 3 months	Major

Figure 5.11 – Risk analysis grid (5x5)

Probability	Impact				
	Insignificant	Minor	Moderate	Major	Severe
Almost certain	Moderate	High	High	Extreme	Extreme
Likely	Moderate	Moderate	High	High	Extreme
Possible	Low	Moderate	Moderate	High	Extreme
Unlikely	Low	Moderate	Moderate	Moderate	High
Rare	Low	Low	Moderate	Moderate	High

Risk rating chart

To help with the risk prioritising process a risk rating chart could be used in conjunction with Post-it Notes (each records a risk). See Figure 5.12.

Figure 5.12 – Risk rating chart



Comparative risk ranking

Another way to prioritise risks is to use a paired-comparisons table. For example, if our project was for New Zealand to host the Olympic Games, what might be the risks in doing so and what ranking would we assign these? See Figure 5.13. The total score is given by a formula where N is the number of items (five in this instance). In this example, a boost to tourism is an opportunity of a positive risk.

Figure 5.13 – Threats and opportunities

Rank	Score	Risk Description	5	4	3	2	1
2	3	Not enough accommodation 1	1	1	1	2	
1	4	Inadequate venues 2	2	2	2		
4	1	NZ's remoteness 3	3	4			
3	2	Tourism boost 4	4				
5	0	Earthquakes 5					

$$\frac{10}{1} = \frac{N(N-1)}{2} = \frac{5 \times 4}{2}$$

Top-ten risks

Top-ten risk tracking is a qualitative risk analysis tool, and in addition to identifying risks, it maintains our awareness of top risks throughout the life of our project. It requires periodic review. The review begins with a summary of the status of the top-ten sources of risk on the project. The summary may include each item's current ranking, number of times it appears on the shortlist over a period of time, and a summary of progress made in resolving the risk item since the previous review. Importantly, the list needs to be visible, not filed out of sight.

Updated risk register

The risk register is established no later than during initial risk identification and is further developed during risk analysis. The output of qualitative risk analysis is an updated risk register. The ranking column of the risk register should be filled in, along with a numeric value or high/medium/low rating for the probability and impact of the risk event. Additional information is often added for risk

events, such as identification of risks that need more attention in the near term or those that can be placed on a watch list. A watch list is a list of risks that are of lower priority, but are still identified as potentially important risks and need to be reviewed periodically. Qualitative analysis also identifies risks that should be evaluated on a quantitative basis, as described in the next chapter.

Risk impact on project parameters

The PMBOK describes risk as an event that, if it occurs, has a negative or positive effect on project time, cost, scope, or quality. Project parameters or objectives are known in advance. They are fixed, representing constraints within which the project must work. The feasibility of doing so will depend considerably on what impact risk has on these parameters. Thus, one relevant and very effective way of assessing the impact of a risk event is to evaluate it in terms of each project parameter. For example:

- **Scope threats** arise from failure to complete the project work scope.
- **Quality threats** arise from failure to complete work to the required performance standards.
- **Schedule threats** arise from failure to complete work within estimated time limits.
- **Budget threats** arise from failure to complete work within estimated cost limits.

Many identifiable risks will have an impact on two or more of these parameters, particularly on both schedule and budget constraints. One way of assessing and distributing the impact of risk among project parameters is to develop a risk impact table. For example, New Zealand is to host the Rugby World Cup 2011. One major project in preparation for this event is the upgrading of Eden Park, which is primarily a time-driven endeavour. The assessment at Figure 5.14 suggests some possible risks and their impacts on this project, where for example:

- **Catastrophic** – risks that mean the Eden Park upgrade will not be completed in time for the event – not even the closing ceremony.
- **Serious** – risks that cause months of delay to the upgrade work.
- **Moderate** – risks that cause weeks of delay to the upgrade work.

- **Minor** – risks that cause days of delay to the upgrade work.
- **None** – risks that cause no or merely hours of delay to upgrade work.

Figure 5.14 – Impact of risk on project schedule

Risk Event	Schedule Impact				
	Catastrophic	Serious	Moderate	Minor	None
Delays due to late plan approval sign-offs		X			
Resolving different stakeholders needs			X		
Funding constraints		X			
Dependence on unproven suppliers	X				
Unclear deliverable specifications		X			
No back-ups for key project people		X			
Under-qualified contractors		X			
'Best case' estimating			X		
Earthquakes	X				
Change orders (variations)			X		
Funders lack commitment	X				
Late delivery of seats	X				
Overuse of JIT scheduling		X			
Frequent scope changes		X			

Risk Event	Schedule Impact				
	Catastrophic	Serious	Moderate	Minor	None
Incomplete designs provided		X			
Requirements 'creep'			X		
Political interference	X				
Erroneous assumptions			X		
Inexperienced steering committee		X			
Leading-edge untried technology	X				
Vandalism		X			
Uncooperative neighbours		X			
Project manager departs early		X			
Lawsuits		X			
Employee seriously injured				X	
Unanticipated bad weather		X			
Understating risks to protect project status and stakeholders' morale		X			
IRB's overly ambitious reliability requirements		X			
Accelerated schedule imposed		X			

The importance of project parameter priorities can be illustrated by an example. Suppose a project has two risks:

- **Risk A.** There is a 25% chance of a problem that will cost \$60,000, but will cause no schedule delay.
- **Risk B.** There is a 25% chance of a problem that will delay the project four weeks, but will cause no extra cost.

In a time-driven project, Risk B will have greater impact and higher priority for treatment. However, in reality the cost to treat risk must also be considered. In our effort to preserve the timeline, we may increase risk to other constraints. In effect we are making a trade-off between constraints (objectives).

Probability assessment

The impact of a risk can usually be assessed with some accuracy, but not so risk probability. For example, when we purchase a new laptop, the salesperson usually attempts to sell us an extended three-year warranty. Whether this is a good idea or not depends on the price of the laptop, the price of the warranty, the probability that the laptop will go wrong within the next three years, and our personal tolerance for risk. Every decision has costs and benefits, threats and opportunities and calls on our ability to estimate probabilities, which most of us are not good at. I have a huge drawer of unused, expired warranties. I now no longer fall for costly 'extended warranty' offers. They don't withstand rational scrutiny. However, insurance for expensive essentials is a different matter.

When big impact risks stir strong emotions, we often exaggerate the benefits of such preventative, risk-reducing or ameliorate measures and go to great lengths to avoid risks that are unlikely. It's called 'probability neglect.' Worst-case scenarios are particularly compelling because they often evoke vivid mental images that overwhelm our rational thinking. For example, the fact that no zombies live next door seems to be strong evidence that they don't exist, but we're told that 'absence of evidence is not evidence of absence.' 'Keep your mind open,' another saying goes, 'but not so open that our brain falls out.' We must retain a reasonable degree of scepticism. Yet, what is reasonable? For example, 'clear and convincing evidence' is a lesser measure than 'beyond all reasonable doubt' but stricter than

‘on the balance of probabilities’ which merely requires that the matter asserted, the risk, seem more likely than not to occur. With regard qualitative probability risk assessments, some argue that labels such as ‘high’, ‘medium’ and ‘low’ should be dispensed with, because we interpret such expressions in our own idiosyncratic way and create some false illusion of communication and agreement. Thus, perhaps risk probabilities should always be probabilistic rather than categorical? Two suggestions are:

- We should always assess risk probability before we assess risk impact, since a big impact risk may have us overlook any serious assessment of risk probability.
- We should always attempt to quantify risk probability in terms of percentages rather than use imprecise adjectives such as ‘high’, ‘medium’ and ‘low,’ which are open to widely different interpretations. For example, what is the likelihood that there are more people in the world than there are chickens – 0%, 20%, 40%, 60%, 80% or 100%? In fact there are more chickens!

Summary

Prioritising risks by their potential to affect objectives, as well as their chance of happening, ensures that we give most attention to the risks that matter most.

Qualitative analysis is a more subjective, quicker and usually more cost-effective way to analyse risk than is quantitative analysis. Qualitative analysis is performed with the objective of gathering data on:

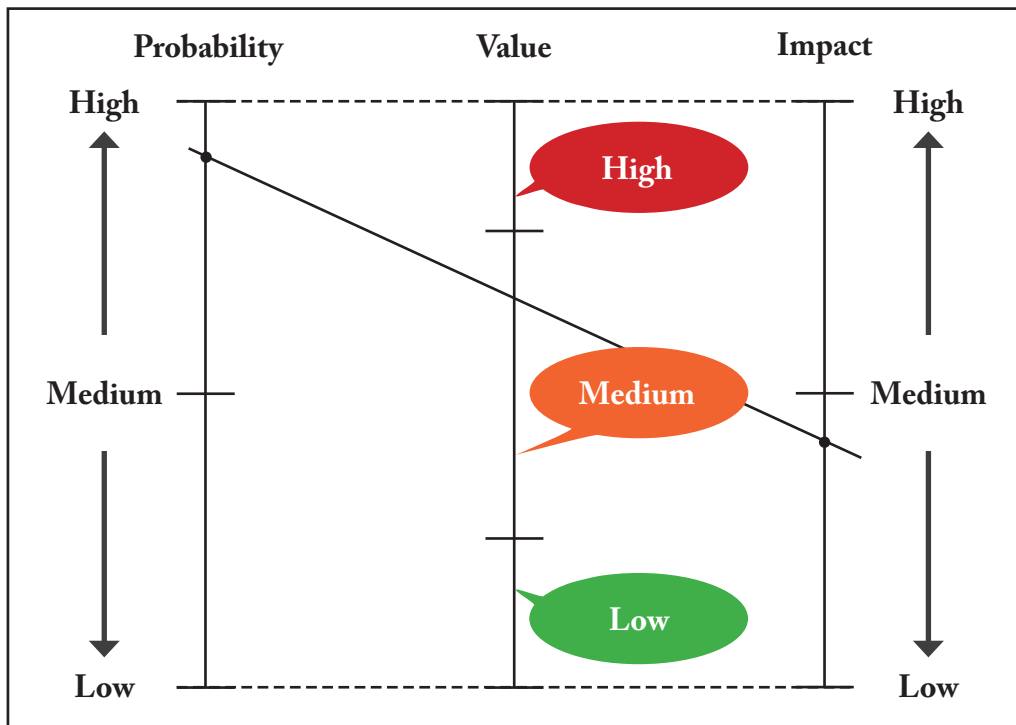
- the impact of risks on project cost and schedule
- the probability of meeting project cost and schedule targets.

Qualitative analysis should always be done and occurs prior to conducting quantitative analysis. Not every risk needs to be subjected to quantitative analysis. And once qualitative analysis is completed our risk register needs to be updated with at least:

- risk impact description
- risk probability estimate
- risk score
- risk priority.

One simple way to assess risk is the use of a nomogram such as that shown at Figure 5.15. Probability and impact are marked on their respective scales, and a straight line is drawn through these marks across the tie line, which shows risk value.

Figure 5.15 – Risk value nomogram



Qualitative risk analysis can also be used to:

- Compare the risk of the project with the overall risk of other projects.
- Determine whether the project should be selected, continued or terminated.
- Determine whether to proceed to perform quantitative risk analysis or to plan risk responses without further analysis.

Probability scales are easy to define. Impact is more difficult. Who is to say whether a delay of one month is an inconvenience or a disaster? Would saving \$20,000 be a triumph or just a pleasant surprise? So impact needs to be defined for each project and programme. One universal approach to define impact, using a 5 point scale, might be: 1 = 10% under/over budget or behind/ahead of schedule, 2 = 20% under/over budget or behind/ahead of schedule etc. Of course, while probability is easier to define, it's more difficult to determine with any reasonable accuracy.

Sometimes risk analysis can be semi-quantitative where descriptive scales of numerical values are used to assess probability and impact of identified risks.

In extreme circumstances the precautionary principle is appropriate, and we should choose the safe option, at least until we have better data. But sometimes we can be too safe and stifle innovation.

Typically we proceed to quantitative risk analysis if:

- It is worth the time and cost.
- If ours is a high priority project or has high visibility.
- There is little or no tolerance for cost or schedule overruns.

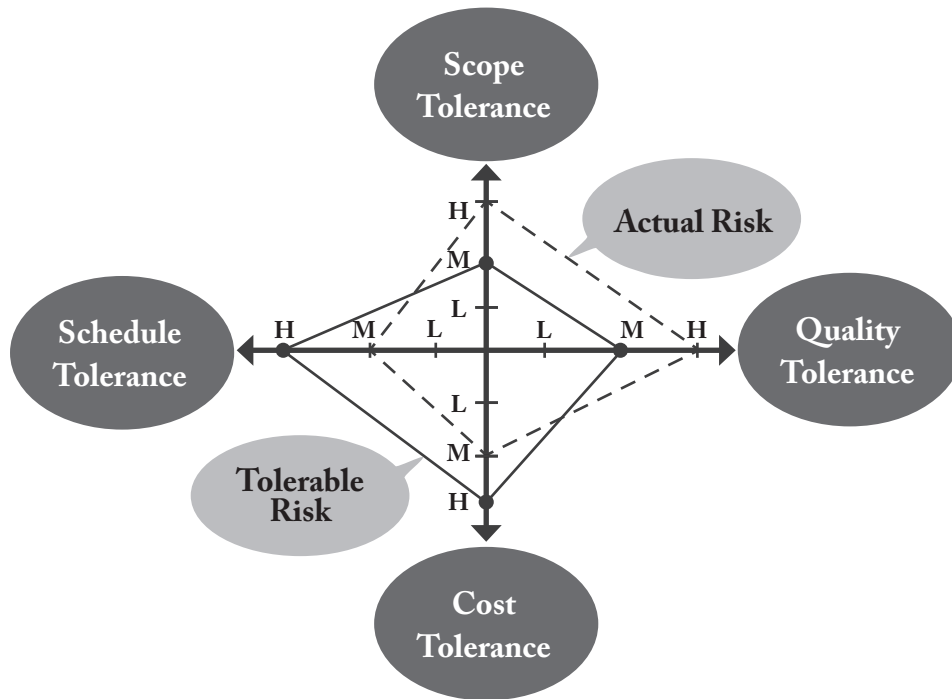
Both tangible (eg, financial) and intangible (eg, client satisfaction, team morale, etc) results should be considered when describing the impact of a risk. There are a variety ways to describe risk impact. Some basic definitions might be:

- **Low** means we can work around the problem.
- **Medium** means we cannot work around the problem, although the risk does not seriously impact project objectives.
- **High** means that the risk has no work-around and will almost certainly and significantly impact project objectives.

Risk thresholds are a companion to the concept of risk tolerance. Threshold means how much is too much and can be applied at project, activity or work package levels. Risk thresholds for project objectives might be illustrated by a risk radar chart as at Figure 5.16 where each spoke represents the project objectives and acceptable levels of tolerance for a particular project. In this example actual risk is within allowable tolerances except for scope and quality.

Once risks are identified and have been screened using qualitative analysis, more significant risks may then need to be analysed more comprehensively, which involves quantitative analysis – the subject of the next chapter.

Figure 5.16 – Risk profile



Quantitative Analysis

Quantitative risk analysis, if undertaken, typically follows qualitative risk analysis, although both processes could be done together. On smaller and more familiar projects, the project team may only perform qualitative risk analysis. The nature of the project and availability of time and money help determine the type of risk analysis used. Large, complex projects involving leading-edge technologies often justify and require extensive quantitative risk analysis for which data gathering usually involves interviewing, expert judgment, and collection of risk probability distribution information.

Qualitative risk analysis is an attempt to determine how much risk our project has, and where, so that we can spend our limited time and effort in the areas of greatest risk, to decrease the risk on the project. Quantitative risk analysis has the same objective, but attempts to complete a more comprehensive and accurate assessment based on numerical values.

A quantitative risk analysis always has numbers associated with it. It is a way of numerically estimating the probability that a project will meet its objectives. It is a numerical analysis of the project's more significant risks in an attempt to remove subjectivity from the analysis process. Techniques are used that attempt to quantify the probability and impact of risks. For example, if we can estimate that an event has a 15% probability of occurring and that its impact would be a cost to the project of \$10,000, then we have quantitatively defined the risk. We might, for example, assign 20% rather than a probability of low and an impact of two weeks or \$30,000 rather than an impact rating of medium. As with the qualitative analysis, it is usually difficult to accurately assign a probability to a risk event; it is often a matter of experience, expert opinion, lessons learned and

so on. The more relevant and recent the historical data, the more accurate the probability and impact assessments are likely to be. The quality of the analysis depends largely on the accuracy and completeness of the numerical values used.

Risk quantitative techniques are more complex than qualitative techniques and therefore usually require more time, effort and expertise to complete. If we decide to perform quantitative analysis on any risks, the following steps usually make for a consistent and organised approach:

1. Gather our risk team.
2. Make sure we have an agreed and clear definition of probability and impact.
3. List the risks selected for assessment and rank the probability of each occurring using a numerical equivalent for probability.
4. Separately rank the impact of each risk should it occur using a numerical equivalent for impact, such as dollars or days.
5. Multiply impact (\$) and probability (%) for each risk to get an expected monetary value (EMV).
6. Rank risks according to their expected values.
7. Identify which risks will need responses.

Quantitative risk analysis may start with a model of the project, usually either its schedule or its budget. The degree of uncertainty in each schedule activity and each line item cost element can be represented by a probability distribution. The distribution can be specified as the optimistic, the most likely, and the pessimistic values for the activity or cost item. This approach is typically called a three-point estimate. Such figures can seem quite accurate and convincing, but quantitative techniques can easily be the victims of garbage in, garbage out. Given this warning, some more common quantitative techniques are:

- **Sensitivity analysis** is usually considered to be the simplest form of quantitative analysis when we determine the effect on the whole project of changing one of its risk variables such as a delay or earlier finish to one task or cost reduction or increase for an item of material. It is sometimes referred to as a “what if” analysis. What if say task three takes 20 days rather than 15 days? What affect might this have on the project duration and/or float for non-critical tasks? Its importance is that it highlights how the effect of a single change in one variable can produce a difference in the

project result. A delay to a critical path task has the potential to delay project completion and a delay to a non-critical task might result in reduced float and sometimes a new critical path. We perform sensitivity analysis to determine which risks might have the most impact on the project. Since some of the assessments made in quantitative analysis are imprecise, a sensitivity analysis can be carried out to test the effect of changes in assumptions and estimates.

- **Expected monetary value analysis.** To evaluate a risk, we can look at the probability or the impact, but calculating the expected monetary value is a better measure to determine an overall ranking of risks. Expected monetary value (EMV) is risk probability multiplied by impact. For example, if the probability of a particular risk occurring is 30% and its impact (money lost plus the cost to put it right) is \$40,000, then its EMV is \$12,000. EMV might also be referred to as weighted value, expected outcome, or risk factor.
- **Probabilistic analysis** specifies a probability distribution for each risk and then considers the effect of risks in combination. This is a common method of performing a quantitative risk analysis and employs Monte Carlo simulation, which uses three estimates of time or cost – minimum (optimistic), mean (most likely) and maximum (pessimistic). The result is a probability distribution for the task or project completion date or cost.
- **Influence diagrams** provide a means of modelling the events in a project that are subject to risk. Such diagrams provide a useful means of constructing models of the items in a project that are subject to risk. As a result influence diagrams are now used as the user interface to a computer-based risk tool thus allowing the development of complex risk models that can be used to analyse the cost, time and economic parameters of projects.
- **Decision trees** are a graphical method of structuring models that bring together the information needed to make project decisions and show possible courses of action and their outcomes. Each outcome is given a probability value indicating its likelihood of occurrence. This form of risk analysis is mainly used for project cost risk analysis.

Given the difficult task of assigning accurate risk ratings, presentation models can be combined in a way that helps reduce the subjective nature of the ratings. Quantitative ratings can be broken down so that within one level there are two or more further levels. For example, high might have additional levels of very high,

medium high, and low high. Then numerical probability ranges can be assigned to aid in determining a reasonable probability number for each risk event. The chart at Figure 6.1 demonstrates this progressive breakdown of probability.

In a similar manner we can illustrate degrees of precision for risk impact. Dollars may be assigned to these impact values. Exactly how many dollars would depend on the total dollar cost of the project. See Figure 6.2. The impact scale is tailored to suit our project.

A much more complex matrix is shown at Figure 6.3, where risks could be rated separately for each objective (cost, time, scope and quality). Risks that fall into the red-shaded cells of the matrix are the highest priority, and should receive the majority of risk management resources during response planning and risk monitoring and control.

Figure 6.1 – Risk probability ranges

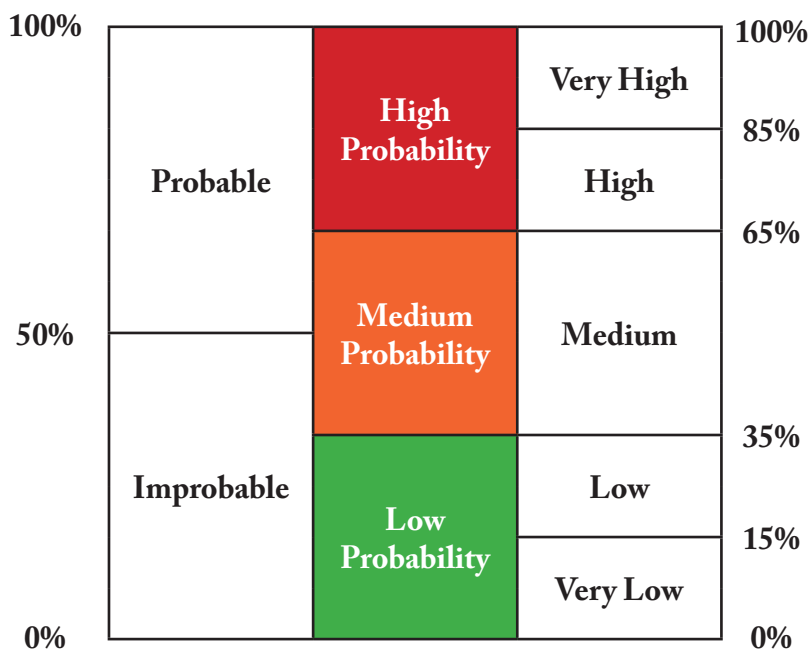


Figure 6.2 – Risk impact ranges

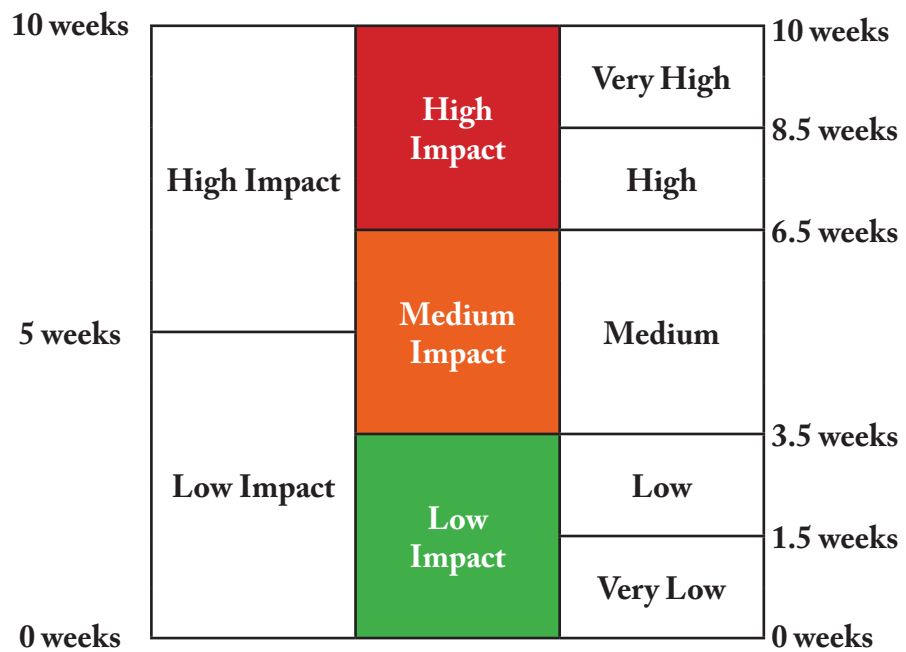
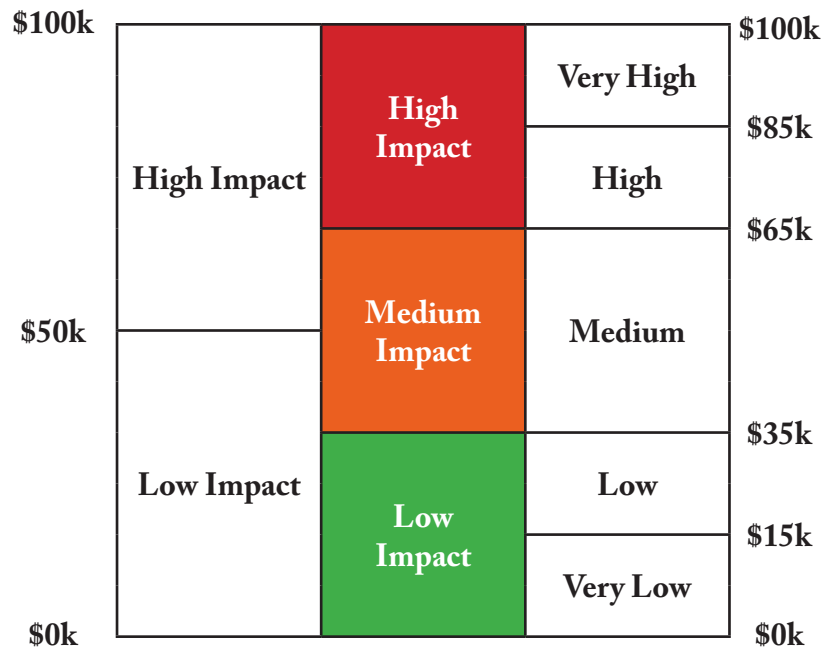


Figure 6.3 – Complex matrix (9x9)

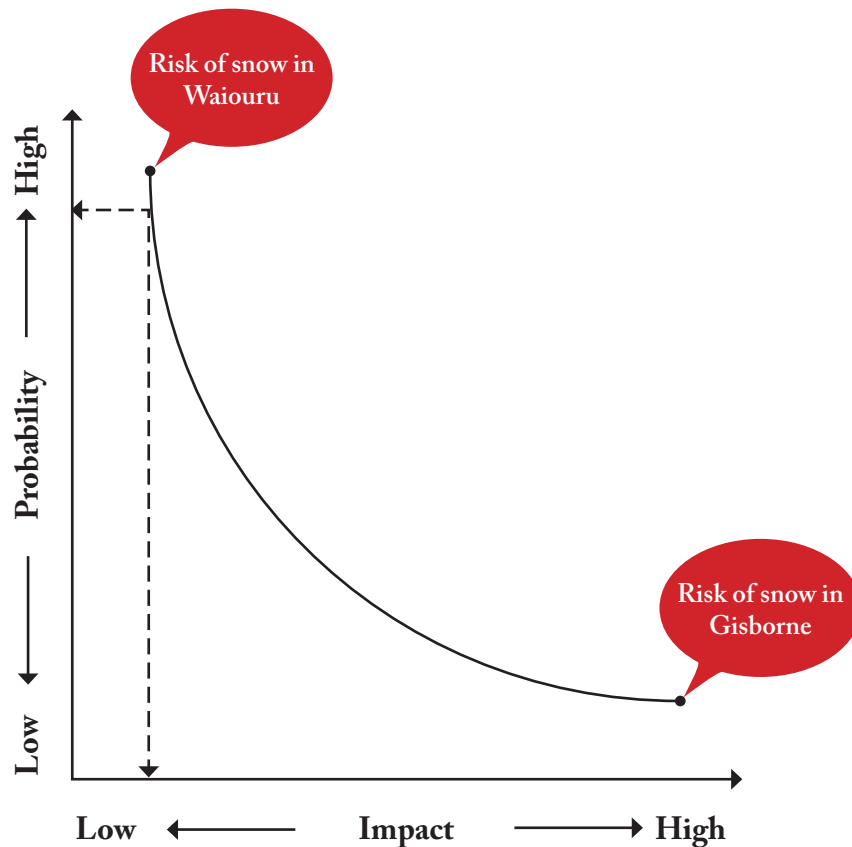
Probability	Impact Values (Opportunities or Threats)								
	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.9	.045	.09	.18	.27	.36	.45	.54	.63	.72
0.8	.040	.08	.16	.24	.32	.40	.48	.56	.64
0.7	.035	.07	.14	.21	.28	.35	.42	.49	.56
0.6	.03	.06	.12	.18	.24	.30	.36	.42	.48
0.5	.025	.05	.10	.15	.20	.25	.30	.35	.40
0.4	.02	.04	.08	.12	.16	.20	.24	.28	.32
0.3	.015	.03	.06	.09	.12	.15	.18	.21	.24
0.2	.01	.02	.04	.06	.08	.10	.12	.14	.16
0.1	.005	.01	.02	.03	.04	.05	.06	.07	.08
0.05	.0025	.005	.01	.015	.02	.025	.03	.035	.04

This type of matrix requires we estimate risk probability and impact values. Impact values may be replaced with dollars – the estimated loss or gain should the risk occur. The matrix enables us to prioritise risks as high, medium or low, or further divisions if required. Such a detailed breakdown scale for probability and impact may be optimistic given the accuracy with which we can assess these factors.

Regardless of the matrix used, the results of quantitative analysis will help us to:

- Assess the likelihood of project success.
- Decide the size of the project contingency (reserves of time, money and other resources) needed to meet our organisation's required level of certainty (risk tolerance), which can be illustrated by a curve as at Figure 6.4.
- Decide what elements of the project contribute most risk.

Figure 6.4 – Risk probability and impact curve



Probability theory and risk

Quantitative risk analysis requires we have some basic knowledge of probability theory. For example, should our project have two risks (A and B), which are mutually exclusive (statistically independent), they might have the following individual probabilities of occurring:

- Risk A = 5%.
- Risk B = 15%.

Some other probabilities are:

- Likelihood of one of these two risks occurring is 5% (Risk A) + 15% (Risk B) = 20%.
- Likelihood of both of these two risks occurring is 5% (Risk A) x 15% (Risk B) = $0.05 \times 0.15 = 0.0075 = 0.75\%$.
- Likelihood of neither of these two risks occurring is 95% (Risk A) x 85% (Risk B) = $0.95 \times 0.85 = 0.8075 = 80.75\%$.

With six consecutive rolls of a single die, what is the probability of getting no sixes and getting at least one six? Getting no sixes is $(5/6)^6 = 1/3$. Getting at least one six is $2/3$.

Key terms associated with statistical analysis are best explained with an example. In a particular project, ten change orders have the following prices, in thousands of dollars:

2, 2, 2, 3, 3, 4, 5, 7, 10, 12

Given these figures we can determine their mean, median, mode, variance and standard deviation values, where:

1. **Mean** = $50/10 = 5$ (average).
2. **Median** = $(3+4)/2 = 3.5$ (middle value).
3. **Mode** = 2 (most frequently occurring number).
4. **Variance** = $114/(10-1) = 12.66$ (sum of n squared deviations from the mean divided by n-1, where n is the number of items).
5. **Standard deviation** = 3.558 (square root of variance).

Expected monetary value

Expected monetary value (EMV) is a very useful method of expressing and prioritising risk, where project contingency is the sum of the product of impact (\$) and probability (%) for each risk identified. This technique works best when there are several risks involved, since the resultant risk budget is then more widely spread. This technique can be applied to both cost and time, and to opportunities and threats. An example is at Figure 6.5, where risk item 8 is an opportunity.

Figure 6.5 – Example expected monetary value calculation

Risk Item	Cost Impact	Probability	Earned Monetary Value
1	\$5,000	0.2	\$1,000
2	\$6,000	0.3	\$1,800
3	\$4,000	0.6	\$2,400
4	\$2,000	0.3	\$600
5	\$8,000	0.4	\$3,200
6	\$12,000	0.6	\$7,200
7	\$10,000	0.4	\$4,000
8	+\$4,000	0.1	+ \$400
9	\$7,000	0.5	\$3,500
10	\$3,000	0.3	\$900
11	\$2,000	0.4	\$800
12	\$11,000	0.6	\$6,600
13	\$10,000	0.4	\$4,000
14	\$5,000	0.5	\$2,500
Total Contingency			\$38,500

Although the contingency might appear to be relatively small compared to the total risk impact values, the probability of all these risks occurring within the same project is very low. For example, the likelihood of just the first three risks all happening is only 3.6%:

$$0.2 \times 0.3 \times 0.6 = 0.036 \text{ (3.6\%)}$$

Also, you will notice that risk item 8 is an opportunity and its impact and expected value are therefore shown as positives, which reduces total contingency.

As our project moves safely past exposure to these risks, the total contingency might be reduced to avoid irresponsible spending towards the end of the project.

This same technique can also be used to determine time contingency, where risk impact is expressed as delay or gain. For example:

- Unseasonably poor weather: 15% x 50 days' schedule slippage.
- Unseasonably good weather: 8% x 50 days' schedule gain.

This common way of prioritising risks (ie, product of impact and probability) seems very logical but can be a distortion because:

- **Impact** is usually defined in terms of financial impact, and is very difficult to apply to things such as quality, performance, reputation and relationships. Such items defy quantification. In practice, risks can have many types of impact that are difficult to represent numerically or financially.
- **Probability** is very difficult for an individual to estimate. Probability is how likely the risk is to occur if we take no action. It is difficult to think about a risk without also thinking about what we might do to manage it. Thus we can't help factoring this into our estimates of probability, often assessing probability lower than it should be.
- **Time and urgency** are not usually considered, which means that risks with big exposure (probability x impact) estimated to occur in six months time might therefore be treated before risks with moderate exposure that are about to impact. Another argument is a risk that might occur later in the project should be rated higher than one that could occur earlier in the project, because the later the risk occurs, the greater the impact it will have on the project given the growing investment that is at stake.

Monte Carlo analysis

Some organisations simply require we add say 10% contingency to all project base estimates to accommodate risk. This practice is fallacious since projects are unlikely to have the same levels of schedule and budgetary uncertainty. The greater the uncertainty, the greater is likely to be the contingency. Frequently undertaken projects usually have little uncertainty about their estimated cost and duration and therefore need little contingency, since we have learnt from experience. However, pioneering or novel project endeavours usually have considerable uncertainty and thus warrant greater contingencies.

Using Monte Carlo analysis (named after the famous casino in the Mediterranean Principality of Monaco), we can determine an appropriate project contingency to provide our organisation with a required level of confidence that our project will meet its completion date or budget (ie, not exceed our organisation's level of risk tolerance).

Monte Carlo is a name given to a technique that is used to create a simulation, or a model, that describes how a process will likely turn out. The simulation does not return a single answer, but a range of possible answers, and the probability that each answer will occur. Although you may have heard the term in the context of project management, it is actually a general modelling technique that can be applied to any process where there is uncertainty involved in the process. The term was coined during the Manhattan Project (building the atomic bomb) during World War II. It has become more common now that computers can be used. The common theme is that there must be a series of discrete tasks to simulate, and there must be uncertainty with the tasks.

When we put together our project schedule we typically create a series of tasks, and an estimated duration for each task. When we are done we look at the resulting critical path to determine the estimated end date. However, the chance of hitting that exact end date is not 100%. In fact, the chance of hitting that exact end date is probably pretty low. That is because we are never 100% certain of the duration of the underlying activities. Since we have process steps and uncertainty associated with each step, a Monte Carlo analysis can be performed.

To use the Monte Carlo analysis, we can not just create one estimate of duration for an activity. We need to create three. First, we estimate the most

likely duration, and then we estimate the worst case and the best case. Along with each estimate, we include a probability that it will occur.

The basic steps of a Monte Carlo analysis are:

1. Assess the most likely, optimistic, and pessimistic estimates for the project variable. If we are considering schedule variance, the project network diagram will be our model.
2. Determine the probability distribution of the variable. For example, a most likely estimate might be 10 weeks, an optimistic estimate might be 8 weeks, and a pessimistic estimate might be 15 weeks. We then assess the likelihood of completing the project between 8 and 10 weeks. We might decide that there is a 20% probability of this result.
3. We select a value between 8 and 10 weeks 20% of the time, and a value between 10 and 15 weeks 80% of the time. We then run a deterministic analysis or one pass through the model using these values.
4. Now we repeat step 3 many times to obtain a probability distribution of the model's results. Of course we need computer software to do this.

Let's look at a small project with three tasks that must be worked on sequentially. Task A is likely to take 3 days (ie, 70% probability), but it is possible that it could take two days (10%) or four days (20%). Task B will likely take six days (60%), but could take as little as five days (20%) or as long as eight days (20%). Likewise Task C will probably take four days (80%), or as little as three days (5%) or five days (15%). The question is, how long will this project take to complete?

The Monte Carlo analysis involves a series of random simulations on this three-step project. Each time, it plugs in random task durations for A, B and C based on the probabilities that we provide. It is possible that the first time through, it calculated twelve days ($2 + 6 + 4$). The next time it calculated eleven days ($3 + 5 + 3$). Then it calculated twelve days again ($3 + 5 + 4$).

Now, imagine that this simulation is run 1000 times. By the time the simulation is completed we would expect that there are around 700 simulations where task A took three days (70%). Likewise there should be around 150 simulations where task C took five days (15%). Each time a simulation is run, an end date is determined.

When the Monte Carlo analysis is completed we do not have a single date. Instead we have a probability curve showing expected outcomes, and the probability of

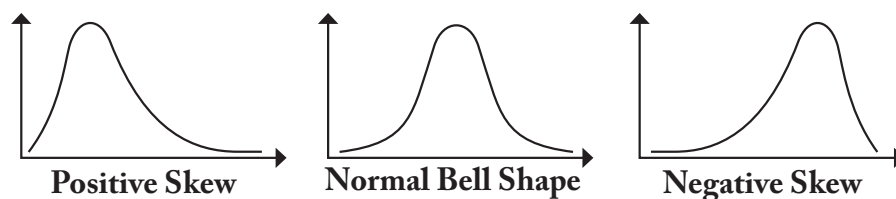
achieving each one. Should we tell our stakeholders when the project will be completed, we might pick the duration that gives a 90% chance of success. In other words, we would say that, based on the Monte Carlo simulation, we have a 90% chance of completion within X days, and then report the date that this falls on.

The earlier example contained three tasks. Think about the projects that have hundreds of tasks. The Monte Carlo analysis allows us to show the uncertainty associated with the duration of these tasks. The software can run thousands of simulations on our workplan, and then give us information that will show the dates where we have a 50% chance of completion, 80% chance of completion, 90 chance of completion, etc.

Monte Carlo analysis is not something that most project managers need. However, certain major projects contain enough risk and uncertainty that it would make sense to use the technique. However, much more diligence is required for determining the detailed estimates. If we provide estimates and probabilities for the detailed activities that are not well thought out, the resulting simulations will be invalid, and we may end up with schedule completion dates that are not realistic.

There are a variety of software programmes that employ Monte Carlo techniques to simulate project cost and time completion probabilities. Four more widely used packages are @Risk, Crystal Ball, Risky Project, and REP/PC. These packages enable us to run some 600 to 1000 simulations (at which number of iterations results are inclined to stabilise) to produce a histogram that displays our project's likely cost or duration ranges as a continuous curve. Some examples are at Figure 6.6. @Risk, Crystal Ball and Risky Project are all Windows compatible and work with Excel, whereas REP/PC is a standalone package, but not available in Windows. Most project distributions will be positively skewed, which recognises that longer is more likely than is shorter, and over-expenditure is more likely than is under-expenditure.

Figure 6.6 – Example histograms

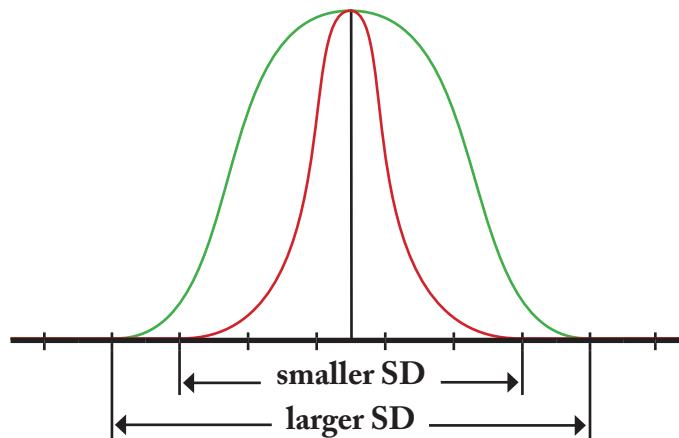


Depending always on the accuracy of the input data, the resultant curve or histogram enables us to answer questions such as:

- What will be the likely cost and duration of my project?
- What is the likelihood that these estimates will be under-run or exceeded?
- What size time and cost contingency will my project need to reflect my organisation's particular tolerance for risk (risk appetite or risk threshold)?
- What activities or line-items contribute most to the possibility of under-running or over-running schedule or cost targets?

Figure 6.7 shows the frequency distribution for two projects, where the average or mean duration is the same, but the range (statistical variance or standard deviation) of their expected durations is different.

Figure 6.7 – Frequency distributions



We can also alter our project estimates and see what effect such alterations have on project time and cost completion probabilities. As we increase estimates our project histogram is likely to change shape, but most projects show a beta-frequency distribution. This is a positively skewed distribution that shows a longer tail to the right, recognising there is a limit to how quickly or cheaply we might complete our project, but there is much less limit to how long our project might take or how much it might cost. The software will show us the results of possible risk responses, from which we can assess the adequacy of the proposed response.

Some key points about Monte Carlo analysis are:

- It is usually done with a computer-based software programme.
- It evaluates the overall risk in the project.
- It provides the probability of completing the project on a specific date or for a specific cost.
- It provides the probability of any activity being on the critical path.
- It takes into account path convergence where in a network diagram paths converge on one activity (task).
- It translates uncertainties into impacts to the total project.
- It can be used to assess cost and schedule impacts.
- It results in a probability distribution.

The risk model produces a range of possible cost and schedule outcomes. The percentile level used in establishing contingency is directly related to our level of risk aversion. The more risk averse, the higher the percentile. One standard deviation above the mean would be at about 85%, which figure is sometimes used for setting the project contingency, depending on our risk tolerance.

One of the key results is the amount of extra dollars or time that need to be added to the project baseline to guarantee that the budget or completion date is not exceeded at a certain confidence level. The higher the required confidence level, the larger the amount of contingency needed.

Criticality index

Criticality index is used with Monte Carlo analysis to express how likely a particular project task is to be on the critical path. Tasks with a high criticality index (based on numeral one) are more likely to cause project delay if delayed themselves. By monitoring and controlling tasks with high criticality indices, a project is less likely to be late. However, criticality index does not consider task duration. A one-day task could have a 1.0 or 100% criticality index. Thus, we must also consider the correlation between task duration and project duration.

Cruciality index

The cruciality index is a measure of particular project task's important to project success. The task may or may not be on the critical path. It may be represented as a percentage value between 0 and 100.

PERT formula

IN 1958 the US Navy, and Booze, Allen and Hamilton consultants developed PERT (programme evaluation and review technique) to help schedule the more than 3,300 contractors involved on the Polaris submarine project and to cover uncertainty of activity time estimates. The PERT formula uses three time estimates for each activity as shown at Figure 6.8.

An optimistic estimate is one that would be achievable about 90% of the time. Likewise the pessimistic estimate would occur about 10% of the time. The amount of uncertainty is the difference between O and P values. For example, for a particular task, P = 14, L = 6 and O = 4, where time is measured in days, the Best Estimated Time is:

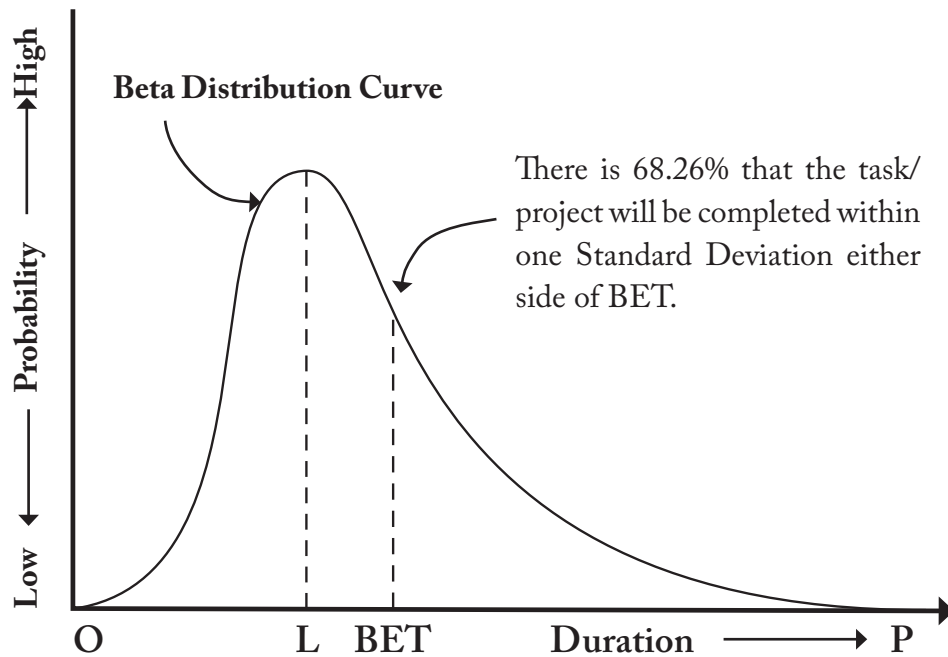
$$\text{BET} = \frac{14 + (4 \times 6) + 4}{6} = 7 \text{ days}$$

The basis of this useful formula, is that the likelihood of the project's duration (or cost) being within one standard deviation either side of the norm is about 68%, whereas the likelihood of being more than one standard deviation either side of the norm is about 16%. The resultant formula is:

$$\begin{aligned}\text{BET} &= \frac{(16 \times O) + (68 \times L) + (16 \times P)}{100} \\ &= \frac{0 + 4L + P}{6} \quad (\text{about})\end{aligned}$$

For example, if the optimistic duration is 20 days, pessimistic is 32 days, and most likely is 23 days, the BET would be 24 days.

Figure 6.8 – PERT formula



$$BET = \frac{O + 4L + P}{6}$$

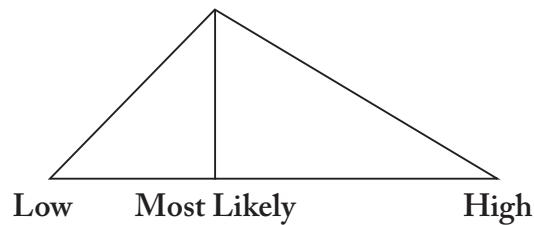
Where: BET = Best Estimated Time (or Cost)
O = Optimistic (best case)
L = Likely (normal circumstances)
P = Pessimistic (worst case)

While this formula is based on a bell-shaped distribution curve, the Central Limit Theorem recognises that a number of sequential skewed distributions (eg, durations of tasks on the project critical path) will in total approach a normal distribution for the critical path duration. Of course, project cost includes the cost of all tasks, not just the cost of critical path tasks.

Project probability distributions

Project probability distributions may be shown as a simple triangular distribution, in which all three values are equally weighted, or as a beta distribution based on the PERT formula as at Figure 6.8. A triangular distribution is at Figure 6.9. A critical path method (CPM) schedule normally represents the most likely duration of a project. This means that the calculated end date is at the mid-point of the range of dates that could be realised.

Figure 6.9 – Example triangular distribution



Project Tools	Durations			Mean	Sigma $\sqrt{\text{Variance}}$	Statistical Variance Sigma ²
	Low (a)	Most Likely (b)	High (c)			
Gather data	40	45	80	55.0	8.9	79.2
Write sections	35	50	100	61.7	13.9	193.1
Review	10	15	30	18.3	4.2	18.1
Inspect	18	25	50	31.0	6.9	47.2
Prepare defects list	10	20	40	23.3	6.2	38.9
Resolve defects	10	25	60	31.7	10.5	109.7
Make changes	15	20	40	25.0	5.4	29.2
Totals	200			246.0	22.7	515.2

$$\text{Where: Mean} = \frac{\text{Low} + \text{Most Likely} + \text{High}}{3}$$

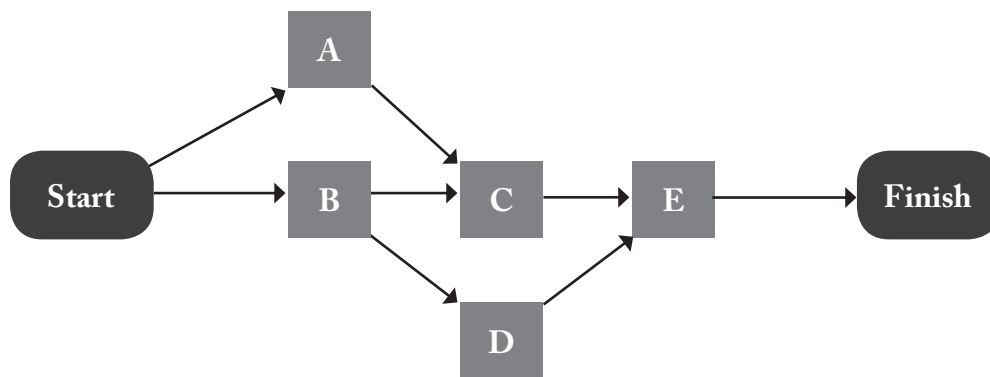
$$\text{Statistical Variance} = \frac{[b - a]^2 + (c - a)(c - b)}{18}$$

Project completion probabilities

The concept of standard deviation is important in risk analysis. Standard deviation measures the variability of an estimate – the estimate’s “give or take.” Risk is concerned with variability. Thus standard deviation can be taken to be a measure of risk. The larger the standard deviation of an estimate the greater is its variability or uncertainty and concomitant risk.

The PERT formula also allows us to estimate project completion probabilities in situations of uncertainty. For example, we have determined the critical path for the project at Figure 6.10 is 14 days. The customer has asked us what is the probability of completing the project in 13 days and 16 days.

Figure 6.10 – Example project network diagram



Critical Tasks	Optimistic	Likely	Pessimistic	Best Estimates
B	1	2	3	2 days
C	3	5	7	5 days
E	3	6	15	7 days
				14 days

The first calculation is to determine the standard deviation along the critical path:

$$\text{Variance} = \left\{ \frac{\text{Optimistic} - \text{Pessimistic}}{6} \right\}^2$$

$$\text{Variance for B} = \left\{ \frac{1 - 3}{6} \right\}^2 = 0.11 \text{ days}$$

$$\text{Variance for C} = \left\{ \frac{3 - 7}{6} \right\}^2 = 0.44 \text{ days}$$

$$\text{Variance for E} = \left\{ \frac{3 - 15}{6} \right\}^2 = 4.0 \text{ days}$$

$$\begin{aligned} \text{Standard Deviation} &= \sqrt{0.11 + 0.44 + 4.0} \\ &= 2.133 \text{ days} \end{aligned}$$

Given that BET = 14 days, the likelihood of completing the project in say 13 days requires the calculation of the Z Score:

$$\begin{aligned} \text{Z Score} &= \frac{\text{BET} - \text{Target Duration}}{\text{Standard Deviation}} \\ &= \frac{14 - 13}{2.133} \\ &= 0.46 \end{aligned}$$

Using the table at Figure 6.11, the Z Score for 0.46 shows a probability of 0.1772, and since 13 is less than BET we subtract 0.1772 from 0.5. The resultant 0.3228 is the probability (ie, 32%) that the project will be completed in 13 days.

The probability of completing the same project in 16 days provides us with a Z Score of 0.93 giving a probability of 0.3238 that we add to 0.5 to result in a 0.8238 probability (ie, 82%) that the project will be completed in 16 days.

Figure 6.11 – Probability distribution table

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0735
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4816	.4817
2.1	.4812	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986

Estimate confidence levels

To determine project durations that provide the desired level of confidence or risk threshold, we can use the distribution shown at Figure 6.12 and the following formula:

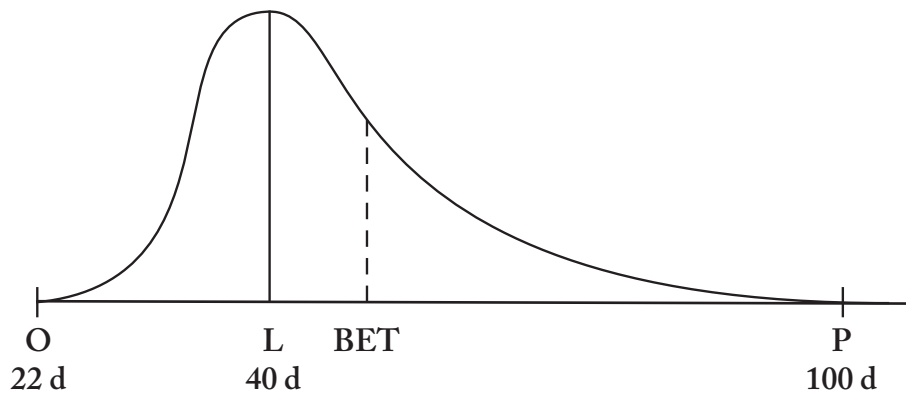
Duration = Best Estimate Time (BET) + Standard Deviation (SD) x SF

$$\text{Where: BET} = (O + 4L + P) / 6$$

$$\text{SD} = (P - O) / 6$$

$$\text{Contingency} = \text{SF} \times \text{SD}$$

Figure 6.12 – Example project duration distribution



Using this distribution, we can determine the various project durations that will provide us with our required level of confidence or tolerance for completion certainty, where the Standard Factor (SF) is shown in the table at Figure 6.11. For example, 85% confidence level is 35% over BET (50%). The table at Figure 6.11 shows that 35% (0.3508) provides a Z score or SF of 1.04. And for confidence levels of less than 50% the SF is a negative value.

Confidence Level	Standard Factor (SF)	Duration (days) = BET + Contingency
50%	0.00	$47 + (0.00 \times 13) = 47.00$
60%	0.25	$47 + (0.25 \times 13) = 50.25$
70%	0.53	$47 + (0.53 \times 13) = 53.89$
80%	0.84	$47 + (0.84 \times 13) = 57.92$
90%	1.28	$47 + (1.28 \times 13) = 63.64$
95%	1.65	$47 + (1.65 \times 13) = 68.45$
99%	2.33	$47 + (2.33 \times 13) = 77.29$

Sometimes a 50% chance of meeting the schedule or budget is good enough. The answer will depend on:

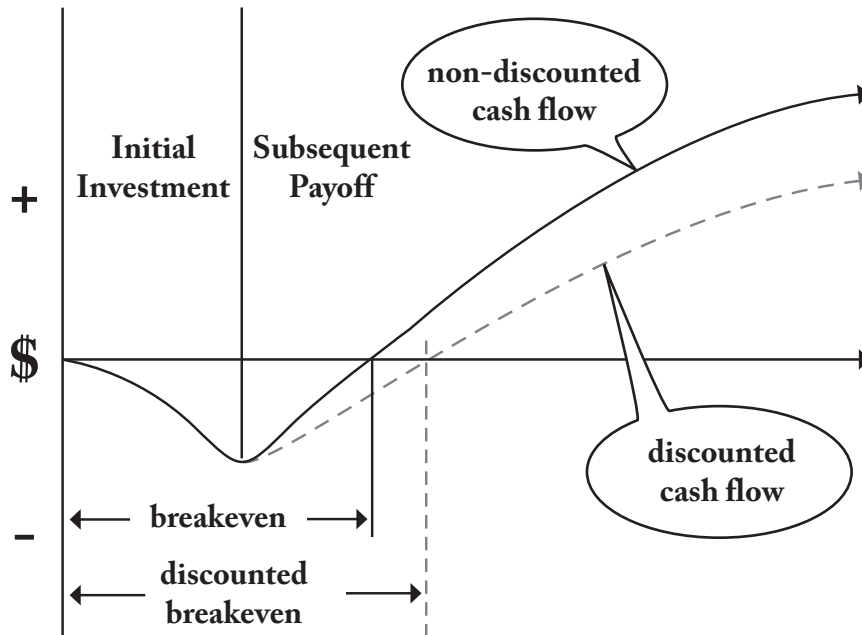
- Penalty for missing the completion date or exceeding the budget.
- Completeness of the work scope.
- How well the work is managed.

To determine the contingency to be allocated to our project, we need to define what confidence level we would like to achieve. The higher the confidence level, the larger amount of contingency needed. A risk averse organisation might prefer a 95% confidence level of on-time and on-budget completion.

Net present value (NPV) and project risk

The time value of money is an important consideration for longer term/more expensive project investments. In effect the estimated future cash flow, discounted at the prevailing discount or hurdle rate (the weighted average cost of capital), helps us determine a project's financial viability and breakeven point as shown at Figure 6.13. Financially viable projects have a positive NPV.

Figure 6.13 – Net present value calculations



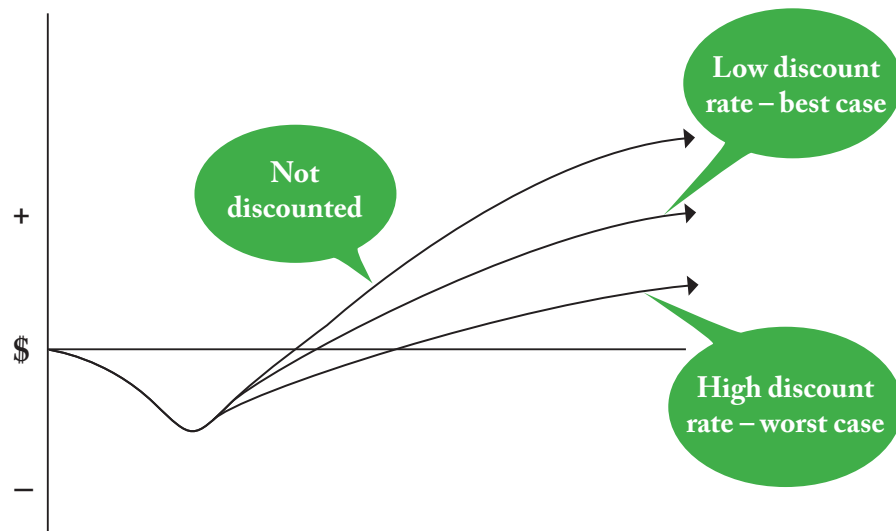
The hurdle rate for a project is the risk-adjusted cost of capital used to discount estimated future costs and benefits. Increased hurdle rates may be applied to projects by risk averse organisations as a safeguard against financial uncertainty. See Figure 6.14. The hurdle rate is the minimum rate of return needed to financially justify a project. To ensure that only the strongest projects survive the selection process, and as a hedge against risk, organisations may require a rate of return that is higher than the standard rate (weighted average cost of capital). This higher rate of return is the risk-adjusted rate of return. It is this value that is used to calculate a project's NPV. The result is a reduction in NPVs and later breakeven points for all projects.

Thus, a risk-adjusted discount rate is applied to uncertain future cash flows. A risk-adjusted rate is higher than a risk-free discount rate. If an investment project involves risk, then it will have to provide a higher rate of return to compensate for that risk. The risk-adjusted discount rate can be regarded as the risk-free or riskless rate plus a risk premium appropriate to the level of risk aversion. The risk-adjusted hurdle rate is higher for riskier projects and may be twice or even three times the risk-free rate.

$$\text{Hurdle Rate} = \text{Riskless Rate (Cost of Capital)} + \text{Risk Premium}$$

Similarly, some organisations may reduce a project's estimated useful life, whereby such projects must be able to produce a larger, more rapid financial return in order to be considered financially worthwhile.

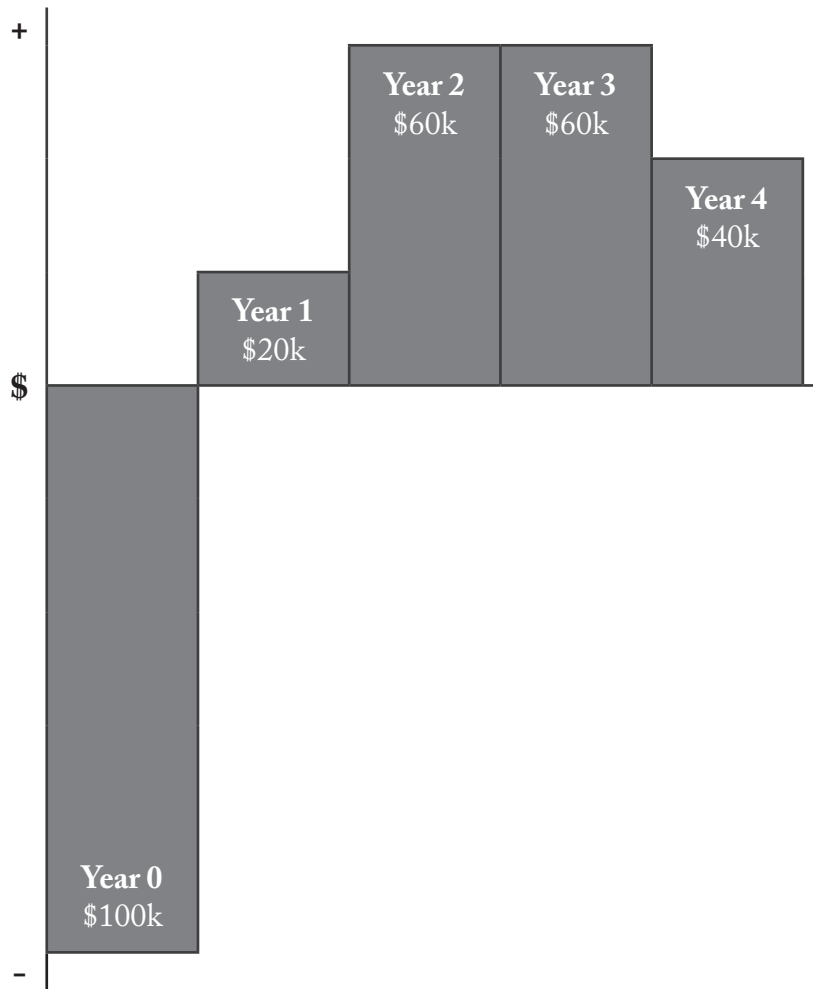
Figure 6.14 – Net present value discount rates



The affect of higher discount rates may mean that a financially risky project does not achieve its financial breakeven point within the required timeframe and might then be excluded from contention during the project selection process.

It's about the time value of money or Net Present Value (NPV), which is a tool typically used by financial managers to assess the financial viability of more costly and longer-term investments. Future cash flows are converted to present day values to enable a valid comparison with the project investment cost. The cost of capital or hurdle rate that is applied will vary from year to year. Effectively, it is compound interest working in reverse. In the example at Figure 6.15, we use a prevailing risk neutral discount rate of 10 percent, and assume the investor requires that the project breaks even before Year 4 in this instance, as it is anticipated that beyond this period financial uncertainly increases dramatically. Discount rates are shown in the table at Figure 6.16.

Figure 6.15 – Net present value



Year	Cash flow	Discount Factor	Present Value
0	(\$100k)	1.000	(\$100,000)
1	\$20k	0.9091	\$18,182
2	\$60k	0.8264	\$49,584
3	\$60k	0.7513	\$45,078
		NPV =	\$12,844

If NPV is positive, the project is worth proceeding with (from a financial perspective anyway). Other factors might of course cull the project from contention. There are also other financial tools that may be used to assess the financial viability and riskiness of a project.

While NPV calculations are typically part of the project selection, the calculation may need to be repeated during the project life cycle, when input factors change, to reassess the financial viability of the project.

A construction project and product life is expected to be about 10 years, with an estimated product salvage value of \$35,000 in year 11. The estimated cash flows over the period are shown at Figure 6.17. Using a risk-adjusted discount rate of 12 percent, we can see that the project will have a positive net present value. In the first three years net cash flows will all be negative. And, in year 8 the investment would break even. Of course over this period the discount rate might change requiring a reassessment of the project's financial viability and breakeven point.

The risk premium can be the difference between project acceptance and rejection. A possible project may have a negative NPV in the moderate risk range, but a positive NPV in the low risk range. A sensitivity analysis helps us identify those variables that particularly affect NPV.

Figure 6.16 – Discount rates

n	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	.9901	.9804	.9709	.9615	.9524	.9434	.9346	.9259	.9174	.9091	.9009	.8929	.8850	.8772	.8696	.8621	.8547	.8475	.8403	.8333
2	.9803	.9612	.9426	.9246	.9070	.8900	.8734	.8573	.8417	.8264	.8116	.7972	.7831	.7695	.7561	.7432	.7305	.7182	.7062	.6944
3	.9706	.9423	.9151	.8890	.8638	.8396	.8163	.7938	.7722	.7513	.7312	.7118	.6931	.6750	.6575	.6407	.6244	.6086	.5934	.5787
4	.9610	.9238	.8885	.8548	.8227	.7921	.7629	.7350	.7084	.6830	.6587	.6355	.6133	.5921	.5718	.5523	.5337	.5158	.4987	.4823
5	.9515	.9057	.8626	.8219	.7835	.7473	.7130	.6806	.6499	.6209	.5935	.5674	.5428	.5194	.4972	.4761	.4561	.4371	.4190	.4019
6	.9420	.8880	.8375	.7903	.7462	.7050	.6663	.6302	.5963	.5645	.5346	.5066	.4803	.4556	.4323	.4104	.3898	.3704	.3521	.3349
7	.9327	.8706	.8131	.7599	.7107	.6651	.6227	.5835	.5470	.5132	.4817	.4523	.4251	.3996	.3759	.3538	.3332	.3139	.2959	.2791
8	.9235	.8535	.7894	.7307	.6768	.6274	.5820	.5403	.5019	.4665	.4339	.4039	.3762	.3506	.3269	.3030	.2834	.2655	.2490	.2338
9	.9143	.8368	.7664	.7026	.6446	.5919	.5439	.5002	.4604	.4241	.3909	.3606	.3329	.3075	.2843	.2630	.2434	.2255	.2090	.1938
10	.9053	.8203	.7441	.6756	.6139	.5584	.5083	.4632	.4224	.3855	.3522	.3220	.2946	.2697	.2472	.2267	.2080	.1911	.1756	.1615
11	.8963	.8043	.7224	.6496	.5847	.5268	.4751	.4289	.3875	.3505	.3173	.2875	.2607	.2366	.2149	.1954	.1778	.1619	.1476	.1346
12	.8874	.7885	.7014	.6246	.5568	.4970	.4440	.3971	.3555	.3186	.2858	.2567	.2307	.2076	.1869	.1685	.1520	.1372	.1240	.1122
13	.8787	.7730	.6810	.6006	.5303	.4688	.4150	.3677	.3262	.2897	.2575	.2292	.2042	.1821	.1625	.1452	.1299	.1163	.1042	.0935
14	.8700	.7579	.6611	.5775	.5051	.4423	.3878	.3405	.2992	.2633	.2320	.2046	.1807	.1597	.1431	.1252	.1110	.0985	.0876	.0779
15	.8613	.7430	.6419	.5553	.4810	.4173	.3624	.3152	.2745	.2394	.2090	.1827	.1599	.1401	.1229	.1079	.0949	.0835	.0736	.0649
16	.8528	.7284	.6232	.5339	.4581	.3963	.3387	.2919	.2519	.2176	.1883	.1631	.1415	.1229	.1069	.0930	.0811	.0780	.0618	.0541
17	.8444	.7142	.6050	.5134	.4363	.3714	.3166	.2703	.2311	.1978	.1696	.1456	.1252	.1078	.0929	.0802	.0693	.0600	.0520	.0451
18	.8360	.7002	.5874	.4936	.4155	.3503	.2959	.2502	.2120	.1799	.1528	.1300	.1108	.0946	.0808	.0691	.0592	.0508	.0437	.0376
19	.8277	.6864	.5703	.4746	.3957	.3305	.2765	.2317	.1945	.1635	.1377	.1161	.0981	.0829	.0703	.0596	.0506	.0431	.0367	.0313
20	.8195	.6730	.5537	.4564	.3769	.3118	.2584	.2145	.1784	.1486	.1240	.1037	.0868	.0728	.0611	.0514	.0433	.0365	.0261	.0221

Figure 6.17 – Estimated cash flows

Year	Estimated Cash Flows (\$K)			Discount Factor	Net Present Value
	Positive	Negative	Net		
0	0	125	-125	1.0000	-125
1	0	100	-100	0.8929	-89.29
2	0	90	-90	0.7972	-71.75
3	50	0	50	0.7118	35.59
4	120	15	105	0.6355	66.73
5	115	0	115	0.5674	65.25
6	105	15	90	0.5066	45.59
7	97	0	97	0.4523	43.87
8	90	15	75	0.4039	30.29
9	82	0	82	0.3606	29.57
10	65	0	65	0.3220	20.93
11	35	0	35	0.2875	10.06
TOTALS					\$61,840

Decision tree analysis

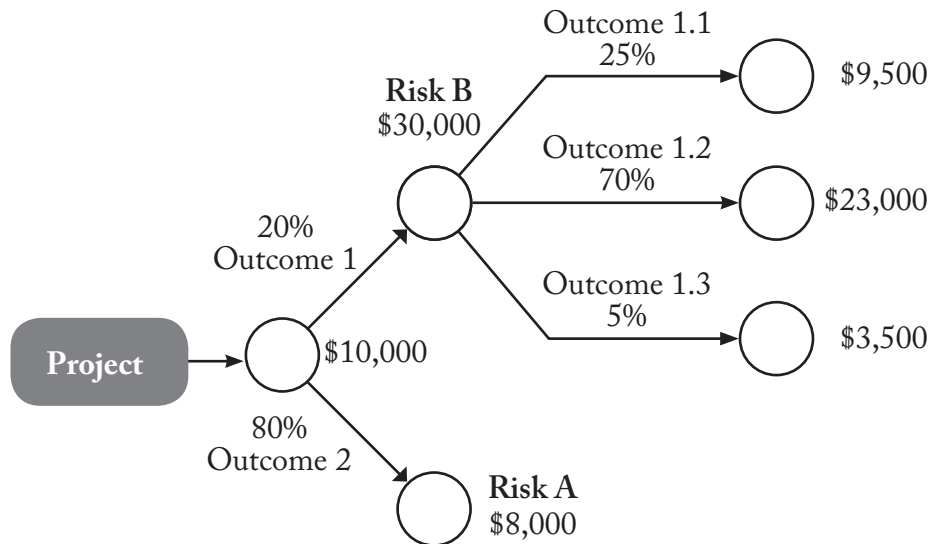
A decision tree is useful for decision-making and problem solving occasions when we need to choose between courses of action given various probabilities. The technique can also help us determine the overall risk associated with a series of related risks. A typical decision analysis involves the following steps:

1. Determine the alternatives.
2. For each alternative, identify possible outcomes and their values.

3. Assess the probabilities for the various chance events.
4. Solve expected monetary value (EMV) for each alternative.
5. Implement the best alternative.

In a particular project, there is a 20% likelihood that our primary supplier will not provide the required item (Risk A) and there is a 25% likelihood that our secondary or back-up supplier may also be unable to provide the item (Risk B). If we can successfully manage Risk A, there will be no reason to use the secondary supplier and Risk B will not arise. However, should Risk A occur, we would then be confronted with Risk B. We can illustrate these options as shown at Figure 6.18.

Figure 6.18 – Example decision tree



Using this decision tree, the financial risks of the various outcomes can be determined:

$$\text{Outcome 1.1} = (20\% \times \$10\text{K}) + (25\% \times \$30\text{K}) = \$9,500$$

$$\text{Outcome 1.2} = (20\% \times \$10\text{K}) + (70\% \times \$30\text{K}) = \$23,000$$

$$\text{Outcome 1.3} = (20\% \times \$10\text{K}) + (5\% \times \$30\text{K}) = \$3,500$$

$$\text{Outcome 2} = (80\% \times \$10\text{K}) = \$8,000$$

We should attempt to achieve Outcome 1.3 because it has the smallest financial impact. If we don't think 1.3 is achievable (there is only a very small chance that it is achievable), we should then try for Outcome 2, which has an 80% likelihood.

Consider another example, where to complete a project at normal duration will result in either 30% likelihood of a \$20K loss or 70% likelihood of profit, and to crash the same project will result in either 80% likelihood of \$20K loss or 20% likelihood of \$100K profit. Would you recommend the normal or crash duration? See Figure 6.19. The crash duration is the better option.

Another application of a decision tree might be the choice of an aggressive or conservative schedule as illustrated at Figure 6.20.

Decision tree exercise

A decision tree diagram can be used to depict a series of alternative decisions, events or outcomes. In performing risk analysis, project managers may use decision trees to better understand possible outcomes. The decision tree begins with a risk event and depicts the consequences that flow from this.

In this example, a project task can be done by three different methods. Each method will be delayed if there is rain. And the duration of each method may be long, medium or short according to the probabilities in the table at Figure 6.21.

Figure 6.21 – Methods and probabilities

Duration	Method A	Method B	Method C
Long	65%	32%	10%
Medium	30%	41%	60%
Short	5%	27%	30%

Given that the probability of the rain risk is 35% (and thus no rain is 65%) calculate the probabilities of increased, decreased and unchanged task durations for each method, and what is the overall likelihood that each method will increase

task duration? Which method would you recommend – A, B or C? A worksheet is provided at Figure 6.22 and a suggested solution is at Figure 6.23.

Figure 6.19 – Example decision tree

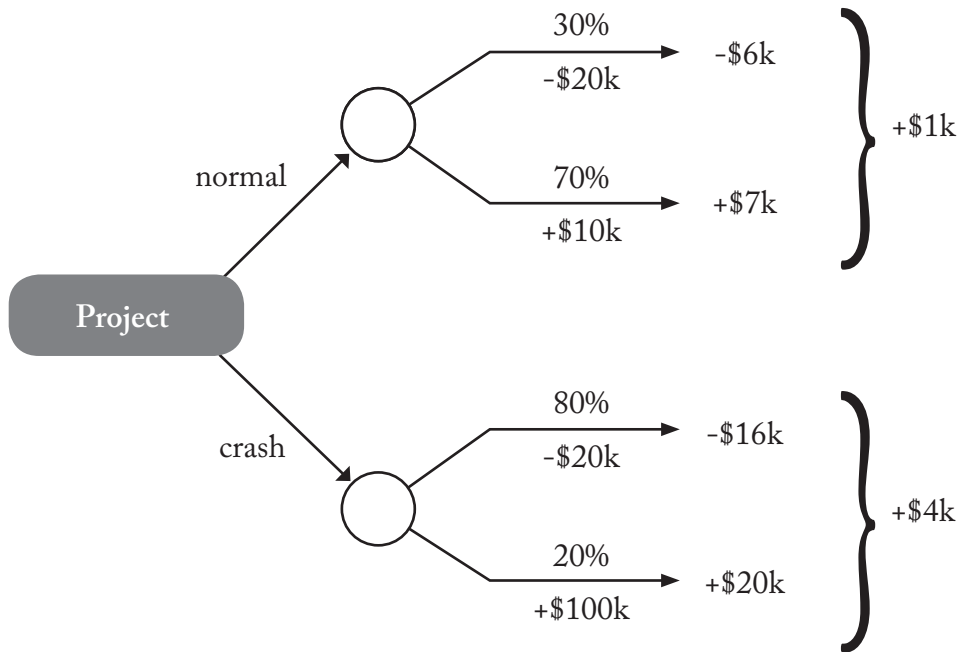


Figure 6.20 – Aggressive versus conservation schedule

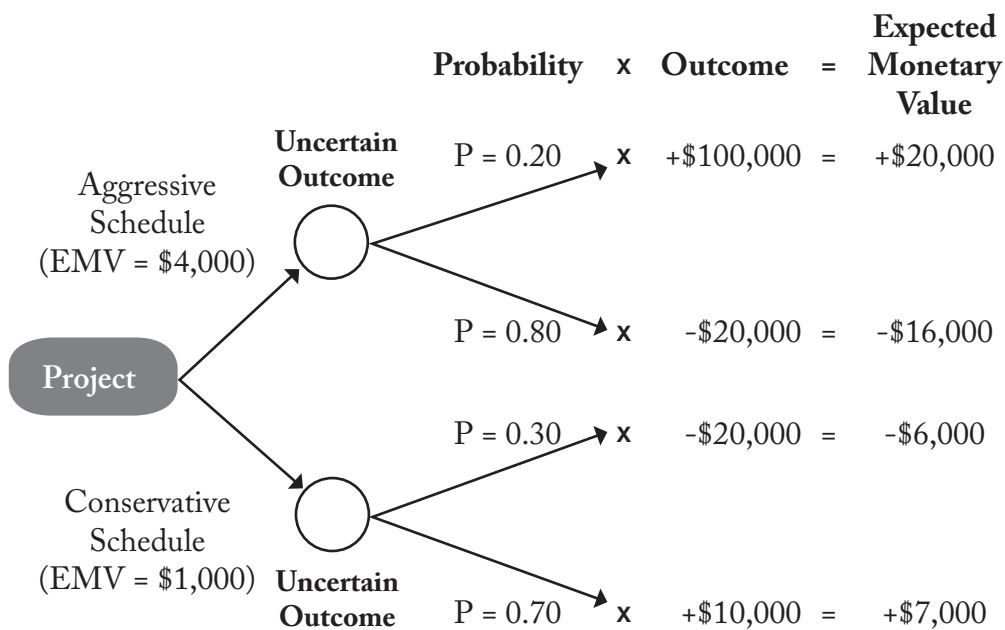


Figure 6.22 – Decision tree worksheet

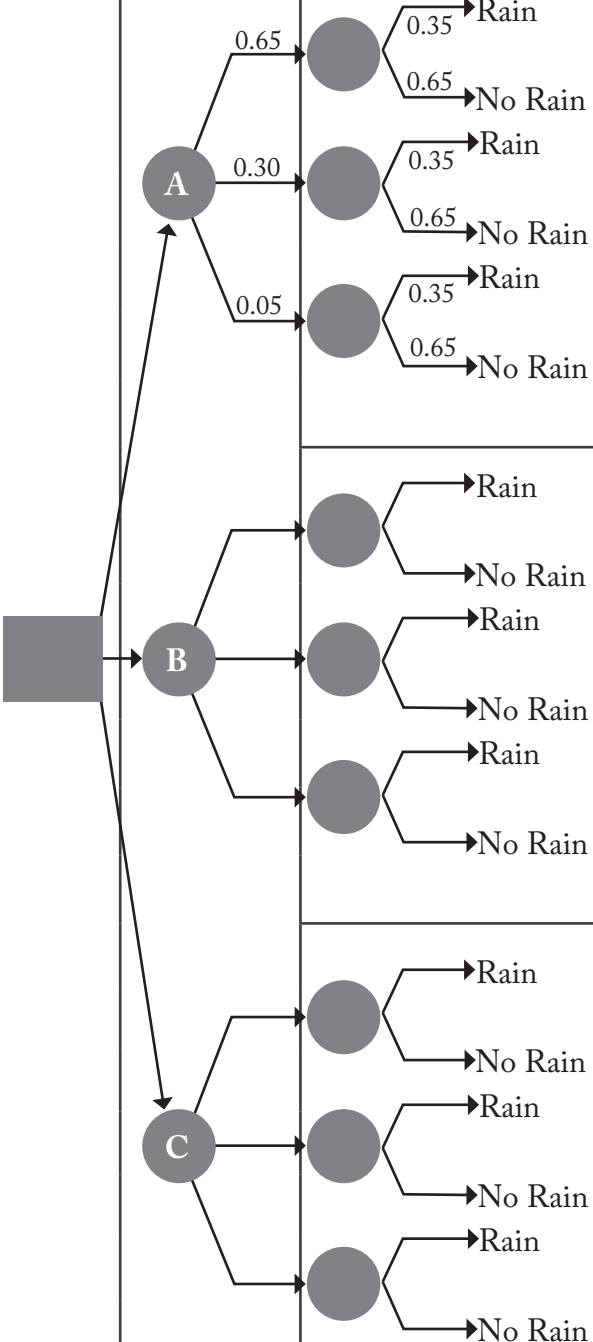









TASK	METHOD	WEATHER	PROBABILITY	DURATION
	A	  	0.2275	increased increased increased
				decreased
				unchanged
				decreased
	B	  		increased unchanged unchanged
				decreased
				decreased
				decreased
	C	  		increased unchanged increased
				unchanged
				unchanged
				unchanged
			1.0000	
			1.0000	
			1.0000	

Figure 6.23 – Decision tree solution

TASK	METHOD	WEATHER	PROBABILITY	DURATION
	A		0.2275	increased
			0.4225	increased
			0.1050	increased
			0.1950	decreased
			0.0275	unchanged
			0.0325	decreased
			1.0000	(0.7550)
	B		0.1120	increased
			0.2080	unchanged
			0.1435	unchanged
			0.2665	decreased
			0.0945	decreased
			0.1755	decreased
			1.0000	(0.1120)
	C		0.0350	increased
			0.0650	unchanged
			0.2100	increased
			0.3900	unchanged
			0.1050	unchanged
			0.1950	unchanged
			1.0000	(0.2450)

Summary

The assessment of each risk is best performed by subject matter experts since we as project managers may not possess the necessary expertise and might sometimes be subject to political pressure.

A qualitative risk assessment is mandatory, whereas a quantitative assessment is optional and to be cost-effective is usually the preserve of larger, more complex and expensive projects, where to fail is not an option.

Quantitative risk analysis involves a numerical analysis of the probability and impact (amount at stake or consequences) of the risks moved forward from qualitative analysis. The assessment process:

- Determines the impact or consequence of each risk, should it arise.
- Assesses the probability or likelihood of those impacts occurring.
- Converts the impact and probability ratings to provide an initial priority for each risk.

Keep in mind that estimates are probabilistic, not deterministic. We might use these best guesses to do deterministic calculations to identify the project critical path. Yet during project execution it may be a non-critical path that determines project duration because of estimate inaccuracies, uncertainty or delays.

It is also important to recognise that there is additional investment required for quantitative risk analysis, including the purchase of software, associate training, and the time and effort needed to generate input data, run the model, and interpret the results. Thus, quantitative techniques need to be used with some discretion and are most appropriate when our project is particularly complex or risky, or we are a contractor and need to prepare an accurate quote for a bigger job.

When performing a risk analysis, one of the key results is the amount of extra time and money that we need to add to the project cost and schedule baselines to ensure that the budget and schedule are not exceeded at a certain confidence level. The purpose of quantitative risk analysis is to:

- Determine which risk events warrant a response.
- Determine overall project risk (risk exposure).

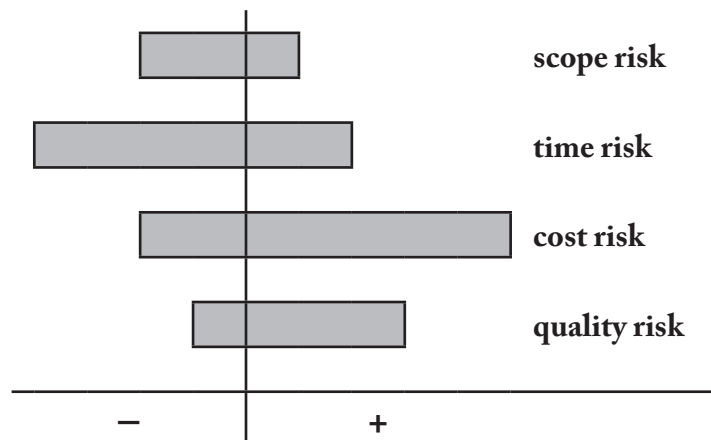
- Determine the quantified probability of meeting project objectives (“We have an 85% chance of completing the project within the required eight months.” “We have a 70% chance of completing the project within the \$100,000 budget.”).
- Determine cost and schedule contingencies reserves.
- Identify those risks that will need most attention.
- Create realistic cost and schedule targets.

Expected monetary value (EMV) of an individual risk is probability multiplied by impact, and EMV or risk exposure of a project is the sum of all those probabilities and impacts, some which could be positive, recognising opportunities as well as threats.

Quantitative risk analysis can be repeated after responding to risk to determine if the reduced amount of risk in the project is within the acceptable project time and cost requirements.

If cost effective, quantitative analysis can be conducted several times throughout the project; trends can be identified, and mitigation strategies can be implemented and monitored. The risk profile of the project evolves and changes as the project progresses as knowledge is gained and variations occur. Sometimes we can illustrate the overall effect of risk on project parameters with a tornado diagram, an example of which is shown at Figure 6.24.

Figure 6.24 – Risk tornado diagram



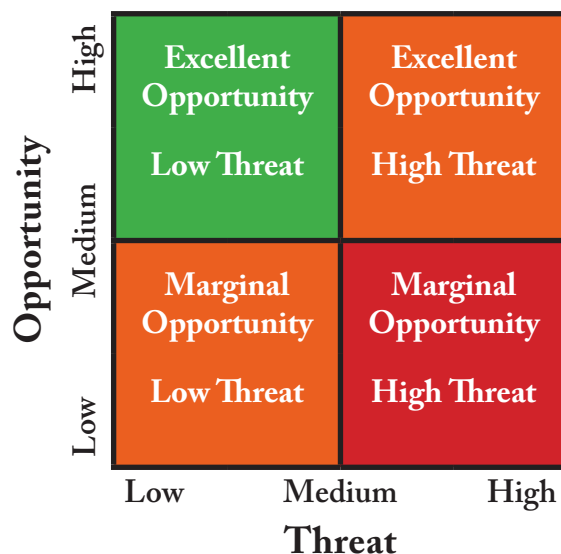
The priorities assigned risks are used to determine where the greatest effort should be focused in treating identified risks. Priorities allow for structured action planning and resource allocation. The risk analysis steps in the risk management process generate two ranked and fully analysed lists of risk events, one for threats and one for opportunities, and a detailed understanding of their impacts upon the project objectives. The impact and probability ratings are recorded in the risk register.

Finally, IT black swan management deserves mention. An article by Flyvbjerg and Budzier, in a recent Harvard Business Review suggested that given the uncertainty involved, two key questions need to be answered:

1. Is our company strong enough to absorb the hit if its biggest IT project goes 400% over budget and/or if only 25 percent of the projected benefits are realised?
2. Can our company sustain the hit if 15 percent of its medium-sized technology projects exceed their cost estimates by 200 percent?

At this stage in the process, we have a good idea of what risk events can arise and their likelihoods and consequences. See Figure 6.25. Now the question is, “What can we do about them?” This next chapter considers risk responses – where we identify what actions we can take either to avoid a risk event or to dampen its impact in order to reduce our project’s exposure to risk. There may also be opportunities to enhance.

Figure 6.25 – Threat and opportunity model



Responding to Risk

“Intellectuals solve problems, geniuses prevent them”

Albert Einstein.

The purpose of the next step in the project risk management process is to determine what will be done to treat the risks that have been identified, in order to reduce overall project risk exposure. We decide how to decrease the probability and impact of threats and increase the probability and impact of opportunities. This step is sometimes described as risk treatment. Unless this response action is taken, the risk identification and analysing steps have been wasted. Risk response or treatment converts the earlier analysis into substantive actions to shift the odds in favour of project success.

Risk response planning is defined as developing procedures and techniques to enhance opportunities and reduce threats to our project’s objectives. Responding to risk is the most important step in the risk management process, since this is where we get the chance to make a difference to the risk exposure facing our project. The primary inputs to this step are the lists of risks and their agreed priorities (from the previous step) and the current project plan and budget.

Thus, once risks have been identified, analysed and prioritised, responses need to be developed to contend with the risks. While identifying risks uses experience, and risk analysis uses analytical and mathematical skills, the response step uses creativity. Such responses may require changes to our project’s budget, schedule, specifications, resources and scope. Our basic risk response options are:

- Avoid or exploit.
- Mitigate or enhance.
- Transfer or share.
- Accept.

Sometimes acronyms apply, such as ACAT (avoid, control, accept, transfer), PRACTical (prevent, reduce, accept, contingency, transfer), and MATE (mitigate, accept, transfer, eliminate). Risk usually has a negative connotation – they are the bad guys that can harm our project, whereas contemporary risk management approaches now recognise positive risks or opportunities. These good guys make our projects faster, better or cheaper (or more profitable). Our risk responses need to consider both threats and opportunities.

Threats

The four basic response strategies for dealing with negative risks or threats are each discussed below:

1. **Risk avoidance** means preventing or eliminating a specific threat, usually by removing its cause or causes, often by changing aspects of the overall project management plan to eliminate the threat by isolating project objectives from the risk impact. We might also relax the project objective that is in jeopardy, such as extending the schedule, increasing the budget, or reducing scope. We could also avoid the risk by choosing not to do part of the project. Of course, not all risks can be eliminated, but specific risk events might be. For example, a project team may decide to continue using a specific piece of hardware or software on a project because they know it works. Other items that could be used on the project may be available, but if the project team is unfamiliar with them, they could cause significant risk. Using familiar hardware or software eliminates this risk.

Essentially, with risk avoidance the project plan is changed to eliminate the risk or to protect the project objectives (time, cost, scope, quality) from its impact. We might achieve this by changing scope, adding time, or adding resources (thus relaxing the constraints). A specific example would be to hold an event indoors to avoid the risk of adverse weather. However, avoiding all risk is a poor strategy – in fact it would be impossible to do so. Not all risks can be avoided or eliminated, and for others this strategy may be too expensive or time-consuming, although avoidance is often the preferred strategy. Suppose we are to construct a house in July and we run the threat of

slow progress due to poor weather. To avoid this risk, we could simply delay construction until next January when the weather is likely to be much better, in New Zealand at least.

Risk avoidance is a legitimate strategy and is not to be confused with risk aversion that is usually inappropriate and can result in:

- ♦ Tendency to avoid or ignore risks regardless of the information available and costs in treating those risks.
- ♦ Failure to treat any risks.
- ♦ Leaving or deferring critical decisions.
- ♦ Selecting an option of lower risk regardless of that option's benefits.

In summary, risk avoidance requires we take action to ensure the probability or impact of a threat is eliminated. Avoid does not mean ignore. Consider the risk of avoiding all risks. The result would be no projects, which means no progress.

2. **Risk acceptance** means accepting the consequences should a risk happen. The term accept refers to risks that remain after risk response action and/or for which response is not practicable or cost effective. Risks that are uncontrollable might also be accepted. Such tolerance is a selected strategy when we are unable to identify any other suitable risk response or it is not practicable or cost effective. It is best suited for small risks or risks that are prohibitively expensive or not easily insured against. As long as the consequences are cheaper than the cure, this strategy makes sense.

With acceptance, the project plan is not changed, usually because the risk is insignificant and tolerable. Importantly, accepted or retained risk is not ignored risk and should be covered by the project contingency and needs to be monitored. For example, a project team planning a big project review meeting could take an active approach to risk by having a contingency or back up plan if they cannot get approval for a specific site for the meeting. On the other hand, they could take a passive approach and accept whatever facility their organisation provides them. Having one car only, despite the risk that it will breakdown, is another example of acceptance.

If a contingency plan is developed, a risk trigger is established, which if it occurs, the contingency plan is implemented. There are two types of acceptance:

- ♦ **Active acceptance**, which usually means establishing a contingency allowance of time, money or other resources to accommodate known risks. A contingency plan is developed that will only be executed under certain predefined conditions commonly called triggers.
- ♦ **Passive acceptance**, which requires no prior action, leaving the project team to deal with risks as they occur. Such an impromptu response is a workaround implemented when the risk occurs, whereas a contingency plan is implemented if a trigger event indicates that the risk is about to occur. A warning about the acceptance strategy. There are a number of valid reasons for risk acceptance. However, the following aren't necessarily them:
 - » "A good project manager would just deal with it." This could be an attempt to discredit the project manager who requests resources, time, and effort to address a risk. The comment presupposes that good project managers show their skill by waiting for catastrophes to happen and then react with precision. This attitude helps ensure we continuously work in crisis mode, often characterised by frantic panic.
 - » "A truly effective project team is always lean and mean." Us human beings can exist only so long when we are deprived of sufficient food and water. So too projects. We usually face enough character-building challenges on projects without deliberately setting them up for failure.
 - » "If we had only known!" Sometimes we unconsciously accept risk because there was no early risk assessment or simply because the risk was never identified. Possible indicators of unknown risks could be:
 - › Budget constraints set before the project scope was properly considered.
 - › A schedule, perhaps set for sales or political reasons, that is much too optimistic.
 - › A contractor's or sub-contractor's quote that is substantially less than others.

3. **Risk transference** or shifting the exposure and consequence of a risk and responsibility for its management to a third party – possibly a contractor or consultant who is better able to manage the risk. Transference, deflection, allocation or contracting out the risk simply gives another party responsibility for its management, it does not eliminate the risk. Also, we need to consider the cost of residual risk after transferring risk. For example, risk transference is often used in dealing with financial risk exposure. A project team may purchase special insurance or warranty protection for specific hardware needed for a project. If the hardware fails, the insurer must replace it within an agreed-upon period of time. Transference reduces the risk only if the contractor is more capable of taking steps to reduce the risk and does so.

Risk transference nearly always involves payment of a risk premium to the party taking on the risk. Transference tools include the purchase of insurance, performance bonds, warranties, guarantees, incentive clauses, or outsourcing the work. Clearly outsourcing in itself will not reduce risk unless a highly reliable contractor is engaged. Also, insurance does not transfer the risk, but does transfer the liability to the insurer. Transference of risk is included in the terms and conditions of the contract. Also, we must complete risk assessment before we sign a contract. Risk transfer usually involves payment of a premium, and the cost-effectiveness of this must be considered when deciding whether to adopt a transfer strategy.

Project work is not only contracted out for risk reasons, but often because our organisation simply does not have the expertise, time and resources to do the work, and in these circumstances new risks can arise. In summary, transfer the risk means to outsource the function, task or process that is at risk to a third party contractually making them responsible for that risk, or we can choose to get insurance.

4. **Risk mitigation** means reducing the impact (consequence) of an adverse risk event or reducing the probability of its occurrence to an acceptable level or threshold – making it a smaller risk and thus removing it from the list of top risks on the project. Examples of risk mitigation include using proven technology, having competent project personnel, using various analysis and validation techniques, and by maintenance or service agreements with subcontractors.

In projects that involve procurement, sole-sourcing is a risk. To mitigate this risk, we might second-source all procured parts or equipment. Taking early action to reduce the probability and/or impact of a risk is usually more effective than trying to repair the damage after the risk has occurred. Risk mitigation may take resources or time, but may still be preferable to going forward with an unmitigated risk.

Mitigation actions may include increasing the number of parallel activities in the schedule, early involvement of regulatory agencies, early and continuous outreach to advocacy groups, implementing less complex processes, or choosing a more reliable supplier. A further example of risk mitigation is to regularly backup data on our computers to keep lost data to a minimum.

Sometimes programme and project managers are the only stakeholders who recognise the value of proactive risk management. It is our challenging responsibility to convince influential others of its importance.

Opportunities

The four basic response strategies for dealing with positive risks or opportunities are described here:

1. **Risk exploitation** or doing whatever we can to make sure the positive risk happens – that the opportunity is realised. This is the opposite of avoid. For example, suppose our company funded a project to provide a new computer classroom for a nearby school in need. The project manager might organise news coverage of the project, write a press release, or hold a public event to ensure the project produces good public relations for the company, which could lead to more business. It's about taking advantage of the opportunity – making the opportunity more likely. Essentially, this strategy seeks to eliminate the uncertainty associated with a particular upside risk by making the opportunity definitely happen. We put everything in place to increase the probability or the occurrence of the risk. We add work or change the project to make sure the opportunity occurs.
2. **Risk sharing**, transferring or allocating ownership of the risk to a partner or another party who is best able to capture the opportunity for the benefit

of the project. Sharing an opportunity is when we collaborate with others to exploit the risk. Using the same example of implementing a new computer classroom, the project manager could form a partnership with the school's principal, school board, or parent-teacher association to share responsibility for achieving good public relations for the project. Or, the company might partner with a local training organisation who agree to provide free tuition for all of the teachers on how to use the new computer classroom. Risk sharing means bringing an outside partner onto the project that creates opportunities to improve on one of the project objectives. In essence risk is transferred to insurers or allocated in contracts to achieve an opportunity.

3. **Risk enhancement** is about changing the size of the opportunity by identifying and maximising key drivers of the positive risk. It's about seeking to facilitate or strengthen the cause of the opportunity and proactively targeting and reinforcing its trigger conditions. Impact drivers can also be targeted, seeking to increase the project's susceptibility to the opportunity. We influence the root cause to increase the likelihood of the opportunity. For example, an important driver of getting good public relations for the computer classroom project might be getting the students, parents, and teachers aware of and excited about the project. They could then do their own formal or informal advertising of the project and our organisation, which in turn might interest other groups and could generate more business.

Enhancement is about increasing the value of the opportunity to the project. Seeking to facilitate or strengthen the cause of the opportunity, and proactively targeting and reinforcing its trigger conditions, which might increase risk probability. Impact drivers can also be targeted, seeking to increase the project's susceptibility to the opportunity. Thus, to enhance an opportunity we do something to increase the likelihood and/or positive impacts of the risk event thereby maximising benefits realised for the project.

4. **Risk acceptance** applies to both negative and positive risks when the project team cannot or chooses not to take any actions toward a risk. At times opportunities simply fall on our lap and we choose to accept them. This strategy also means that we acknowledge that we would rather not exploit, share or enhance the risk. For example, the computer classroom project manager might just assume the project will result in good public relations

for their company without doing anything extra to achieve this. The project plan is unaltered often because the opportunity is so small or so unlikely that the risk of change creates a threat that outweighs the opportunity. A contingency plan might be prepared and a trigger identified to provide notice that an opportunity is now available to improve on one or more of the project objectives. Having a generator ready in case of a power cut is a contingency. So, as with threats, acceptance can be either active (contingency plan prepared) or passive. The most common risk acceptance strategy is to establish contingency reserves – for those that arise from known risks.

Avoid and exploit are the most aggressive of the response strategies and are usually reserved for those risks with high probability and high impact characteristics.

In addition to these strategies, sometimes ‘risk deferral’ is practiced, which typically involves postponing a risky activity until later in the project when the threat may have diminished or the opportunity improved. Some reasons for deferral might be a pending legislative change, exchange rate improvement, or to take advantage of cheaper or better quality resources not yet available – hard or soft variety. However, such scheduling flexibility may not be practicable, and of course there is the argument that it may be better to do the riskier work earlier, such that there is minimum financial loss if this risk is not properly managed and the project is prematurely stopped.

Risk response strategies often include identification of residual and secondary risks as well as the preparation of contingency plans and identification of reserves, where:

- **Residual risks** are risks that remain after all of the response strategies have been implemented. For example, even though a more stable hardware product may have been used on a project, there may still be some risk of it failing to function properly. Residual or remaining risk should be within our organisation’s risk tolerance level.
- **Secondary risks** are a direct result of implementing a risk response. For example, using the more stable hardware may have caused a risk of peripheral devices failing to function properly. Thus, a response to a risk can create another risk. These too need to be addressed. A secondary risk should not have a greater rating than the initial risk from which it was derived. Secondary risks should be registered and included in risk response planning. For those

secondary risks that remain, contingency plans, fallback plans, and triggers should also be identified. Be sure that contingency plans and fallback plans do not have a greater impact than the risks – a worse effect on the project than the original risks.

Having selected a risk management strategy, we must then develop specific actions to put the strategy into practice. It is at this point where many risk management processes fail. Whichever response strategy is selected, it is vital to go from options to actions, otherwise nothing changes. If actions are not identified and implemented, risk exposure remains the same. Each risk response action needs to be properly defined with a budget. This will often mean a new task to be included in the project plan for each agreed risk response to be completed, reviewed and reported on as with any other project task.

Every risk should be allocated an owner, responsible for ensuring the effectiveness of the risk response. Sometimes a different person might be responsible for implementing the response (risk action owner). Also, a mature PMO organisation is likely to develop three levels of risk response:

- A response plan that includes identifying trigger events that need to be understood in order we know if the threat or opportunity has or is about to occur.
- A contingency plan that includes what actions will be taken if or when the trigger event occurs.
- A fallback plan that includes what actions will be taken if or when the contingency plan is not effective.

Whether we are responding to threats or opportunities, the following are relevant:

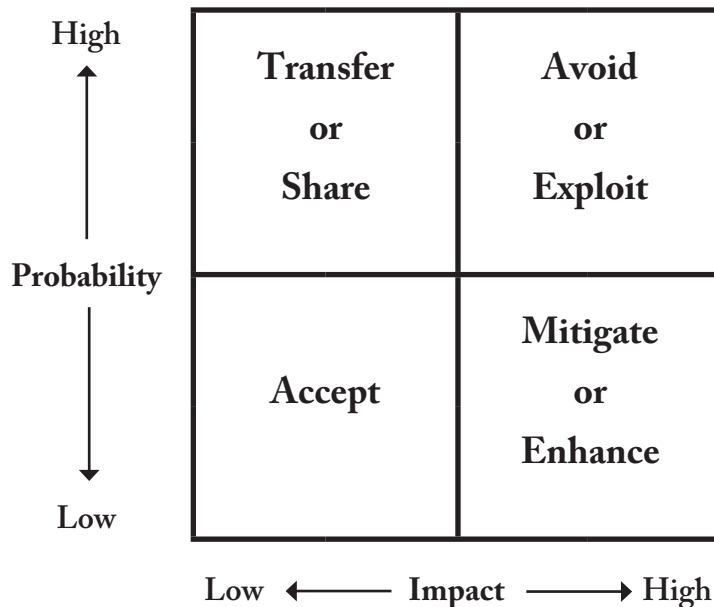
- Sometimes the first response strategy identified is selected without looking at other options and finding the best option or combination of options.
- Response strategies must be implemented in a timely manner.
- Effort must be appropriate to the severity of the risk, which means we don't spend more money preventing the risk than the impact of the risk would cost if it occurred.
- Sometimes one response can be used to address more than one risk, and sometimes more than one response can be used to address the one risk.

- A response might best address a root cause of risk and thereby address more than one risk.
- Involve the project team, other stakeholders and experts in selecting a strategy.
- Risks that arrive from outside our project (such as a delay to a deliverable from another project that may cause a delay to our project) are not necessarily within our authority to control and will need the sponsor's or programme manager's active involvement in response planning.
- As we continue through the project the project risk profile will change. Typically as we successfully respond to risk and our project knowledge increases our risk exposure will diminish. In effect we can retire risk reserves as risk events are successfully avoided or mitigated or we have passed the time during which the risk is active and it becomes redundant.

Simple response matrix

A simple risk response matrix is shown at Figure 7.1 whereby for example, high probability/high impact risks are avoided or exploited depending on whether they are a threat or an opportunity, and so on.

Figure 7.1 – Simple response matrix



Risk response analysis

A worksheet to help us describe and analyse alternative risk responses is shown at Figure 7.2, where box sizes are expanded as need be.

Figure 7.2 – Risk response worksheet

Risk Description: <div></div>					
THREAT	Avoid	Transfer	Mitigate		Accept
			Reduce Impact	Reduce Probability	
Strategy					
Advantages					
Disadvantages					
Preference					
OPPORTUNITY	Exploit	Share	Enhance		Accept
			Increase Impact	Increase Probability	
Strategy					
Advantages					
Disadvantages					
Preference					

Management reserves and contingency allowances

Contingency planning is about identifying what to do if the threat or opportunity happens. Fallback planning is about identifying what to do if the contingency plan does not work.

Management reserve or management contingency reserve is provision to mitigate cost and/or schedule risk that cannot be predicted (ie, unknown-unknowns) and is typically to cover unanticipated changes to the project scope. This reserve may be in proportion to the project contingency and is normally under the control of the sponsor. The management reserve may be a percentage of the total project cost and typically some 5 to 15 percent, depending on how much effort has been given to risk management. Thus the total project budget includes the cost of all activities, the contingency reserve and management reserve.

Setting management reserve for unknowns is a difficult challenge, simply because we don't know what we don't know! This means that there is no simple formula that works in every situation, although it would be nice if there was. Some organisations pick a percentage – either of total budget or of overall contingency. But what percentage should we pick, since unknowns are unknown?! For any particular project there may be a million unknowns, or there may be none – who can tell!

The best way to set management reserve intelligently is to take a longer view over time. We can review similar completed projects and see how much was actually spent on addressing unexpected problems that materialised but which had not been foreseen as risks. That will give us an average management reserve requirement for that type of project, expressed as a percentage of the total project budget (or better, we can calculate a range if possible). Then we can determine how similar our current project is to the dataset in our previous experience. Finally we can make a judgement on whether our current project might need more or less management reserve than our previous set of completed projects. Ultimately we are still making a judgement, but we are starting from a point that has some basis in experience, and we are then modifying from that point based on an assessment of the degree to which our current project differs from the dataset.

Of course to do this we require a reliable and comprehensive data on the performance of previous projects. We need good risk data, to be able to decide what proportion of spend was due to unforeseen risks. And we also need a robust way of categorising projects to decide which previous completed projects we should select as comparators for our current project. Many organisations lack this information, which is why they have to resort to the above mentioned fixed percentage.

Contingency allowance is extra money and/or time kept aside to respond to anticipated risk (ie, known-unknowns). Strictly speaking, contingency is not risk management. Risk management is about stopping risks occurring (proactive) whereas contingency planning relates to what to do if the risk impacts (reactive). This contingency allowance, which is normally used at the discretion of the project sponsor and/or project manager, might be determined in a variety of ways:

- **Qualitative assessment.** Contingency allowance is a percentage added to the total base estimate. The percentage usually depends on a subjective assessment by stakeholders of the project's riskiness. The percentage might range from 5 to 25 percent. For example:
 - ♦ Total cost of \$80K x 10% = \$8K cost contingency.
 - ♦ Total duration of 60 days x 5% = 3 days' time contingency.
 - ♦ Total work effort 300 person-days x 5% = 15 person-days' work effort contingency.
- **Monte Carlo simulation.** Contingency allowance is the extra time or money needed to increase the project base estimate to a point where there is a specific likelihood of on-time or on-budget completion, perhaps the 50/50 point or some other ratio depending on our tolerance for risk. This method of contingency calculation is usually determined using software such as @RISK. The base estimate and extra time or money needed to bring the estimate up to our organisation's risk tolerance level is shown at Figure 7.3.
- **Expected Monetary Value (EMV).** Contingency allowance is the sum of each risk exposure, where each exposure is the product of risk probability (percentage) and risk impact (time or cost lost or gained). See Figure 7.4. In this example, Risk C is an anticipated opportunity, which allows us to reduce the total contingency.

Figure 7.3 – Contingency to achieve required risk tolerance

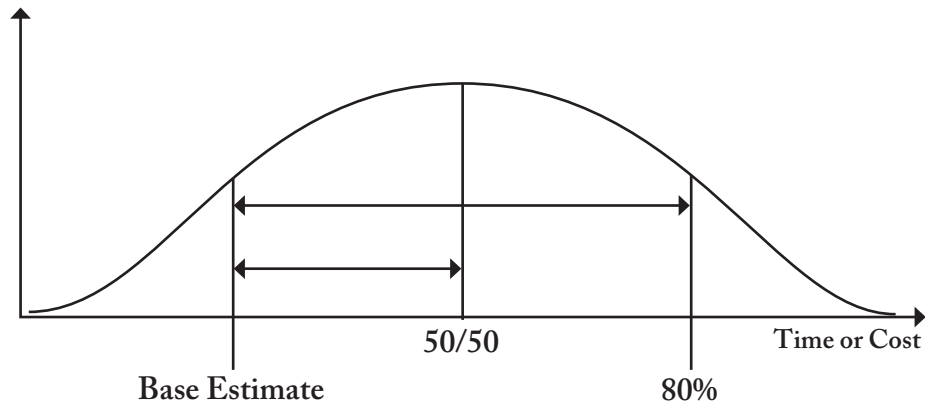


Figure 7.4 – Contingency calculations (budget and schedule)

Risk	Probability	Impact	Contingency
A	20%	+\$10k	+\$2.0k
B	50%	+\$8k	+\$4.0k
C	30%	-\$5k	-\$1.5k
D	40%	+\$5k	+\$2.0k
TOTAL			+\$6.5k

Risk	Probability	Impact	Contingency
A	40%	+10d	+4.0d
B	30%	+5d	+1.5d
C	15%	+8d	+1.2d
D	20%	-10d	-2.0d
TOTAL			+4.7d

- **Combined assessment.** Contingency allowance is the average of contingency sums determined by two or three of the above qualitative and quantitative methods.

One problem might be that sponsors are reluctant to accept contingencies. They may see them as built-in delays and invitations to overspend. Of course the need for contingencies doesn't disappear and realised risk is then going to push the project over budget and/or behind schedule. While the project manager usually controls the project contingency reserves it helps to reassure the sponsor that they will only be accessed when a documented risk trigger condition has been met.

Budget variations are not provided for risk management purposes, but for events beyond the project manager's control such as scope changes authorised by the sponsor, a Force Majeure event, abnormally bad weather, latent or changed conditions, strikes, business risks and political risks.

Transfer of risks

While we might contract out (transfer or share) risk, in doing so we may open our project to secondary risks. Outsourcing does not equal simplicity. It generally adds a new layer of complexity. We aim to avoid or minimise these risks by proper selection of contractors and through appropriate contractual terms. Listed at Figure 7.5 are some possible opportunities and threats associated with risk transfer or sharing risk with those we assess are better able to manage the risk. As this list illustrates, the outsourced work presents a litany of challenges, which must be recognised and addressed. Risk management will help determine what terms and conditions to put into contracts to decrease project threats, to increase opportunities, and to properly distribute risk between the buyer and seller. A contract should not be created without a risk analysis, and work should not start until the contract has been agreed and risks discussed with the contractor. Our negotiating power is zero once the contract is signed.

Retentions are worth a mention. They are a risk management measure whereby a portion of payments to a contractor or subcontractor are retained to cover repairs after practical completion. In New Zealand up to \$200,000 can be retained, but when things go wrong, one thing is at present certain – the subbies are screwed.

Figure 7.5 – Risk transfer opportunities and threats

OPPORTUNITIES	THREATS
<ol style="list-style-type: none"> 1. Accountable for quality results 2. Fixed cost/accurate pricing 3. Experience/expertise 4. Fresh perspective 5. Easier to hire and fire 6. Frees up own resources 7. Avoid undesirable jobs 8. We can learn from them 9. Allows us to concentrate on core business processes 10. Impress client 11. Contract penalties available 12. No capital investment 13. Only pay for what is used 14. Avoid obsolescence 15. They look after tax 16. Innovation and new ideas likely 17. Save on overheads 18. More likely to meet deadlines 19. Latest technology/techniques 20. Encourages a disciplined approach to quality assurance 21. Increased certainty of success 22. Forces us to think thoroughly about the project 23. We can be choosy 	<ol style="list-style-type: none"> 1. Their ability may be over-rated 2. Lack of flexibility/more complexity 3. Administrative costs (eg, tenders) 4. Security concerns/confidentiality 5. Short term costly 6. Demotivate own staff/redundancy 7. Loss of corporate knowledge and expertise (deskilling) 8. Increased dependency on outside sources creates vulnerability 9. No priority attention 10. Less control (subcontractors) 11. Not compatible with your own organisation's methods/culture 12. Solvency problems 13. Market vulnerability 14. Lack of emergency response 15. Divided loyalties 16. Legal costs (eg contracts) 17. They learn at your expense 18. Provide support 19. Hidden/unexpected costs 20. Time to brief/learning curve 21. Space and resource needs 22. Disruption/bad influence 23. Lack of subsequent maintenance

<div> <div>OPPORTUNITIES</div> <div>←→</div> <div>THREATS</div> </div>	
24. Reduce inventory	24. Location inconvenient
25. Transfer/share risk	25. Lack familiarity with your business
26. Partnership synergy	26. Lack of commitment
27. We can subject contractors to conditions unacceptable to employees	27. Scope creep and suspect invoices
28. Want future contracts	28. No long-term accountability
29. Less work in process/progress	29. Security risk
30. Unreceipted levies!	30. Client approval needed
31. Facilitation fees (legal in NZ)	31. Intellectual property ownership
	32. Bid rigging, low-balling, bribery

A payment is a facilitation payment, and not a bribe, where it is paid to speed up an administrative process where the outcome has already been determined. It is designed to expedite a function that an official is already obligated to perform. In terms of contracts, a bribe is given prior to acceptance, whereas a facilitation payment is made after the award decision. However, such payments may be a risk and could border on extortion or bribery, and may be an incentive for delay and bureaucracy. Surprisingly, facilitation fees are legal in NZ.

While there are many threats associated with contracting, bid rigging or collusive tendering is not uncommon, particularly in Asia. It is a real threat to our ability to achieve best value for money. When competitors collude, we the customer, risk being overcharged. It's a form of fraud that's often hard to detect. Some common bid rigging practices are:

- Where contractors agree not to submit bids or to submit bids that will be unsuccessful, on the understanding that some parts of the successful bidder's contract will be subcontracted to them.
- Where contractors agree not to submit bids so that another conspirator can win the contract. Contractors might take it in turn to be successful bidder.
- Where contractors deliberately bid too high or include conditions that will preclude their bid.

Strategies to mitigate bid rigging risk are to include an anti-collusion clause in the Invitation to Tender and to invite a larger number of potential bidders.

A contract contains terms to secure the opportunities of outsourcing and terms to reduce or avoid the threats involved. Remember that a threat to a client can be a contractor's opportunity. Don't finalise or sign the contract until after risk analysis and only after the project plan has been approved, but before its implementation. Contracts are important risk mitigation documents.

It is worthwhile to include in a contract a clause such as, "Risk assessment is a project management function only. It will not affect the legal relationship between the parties. The requirement for a risk assessment shall not limit or exclude the Contractor's obligations under this contract."

The drive for cost savings has led organisations to depend more heavily on outsiders to help them in their work. Even as some organisations downsize, they may increase their business activity. This apparent contradiction is made possible by the contracting out of work – often project work and sometimes entire projects. Such work is outsourced under contracts – legally binding agreements, of which there are a variety of types with different risk-sharing characteristics.

Figure 7.6 – Basic contracts and risk allocation

	Buyer	Contractor
Firm Fixed Price	LOW RISK	HIGH RISK
Cost Reimbursement	HIGH RISK	LOW RISK

Figures 7.6 and 7.7 summarise the spectrum of risk to the buyer and supplier for different types of contracts. Buyers have lowest risk with firm-fixed price contracts, because they know exactly what they will need to pay the supplier. Buyers have the most risk with cost plus percentage fee (CPPF) contracts, because they do not know what the supplier's costs will be in advance, and the suppliers may be motivated to keep increasing costs. From the supplier's perspective, there is the least risk with a CPPF contract and the most risk with the fixed price (FP) contract. See Figure 7.7 and 7.8.

Figure 7.7 – Contract risk

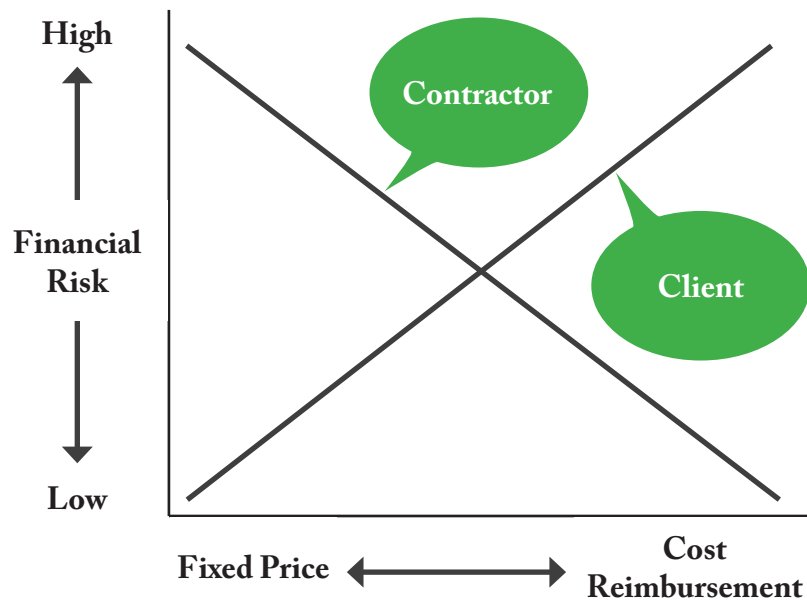


Figure 7.8 – Contracts and risk distribution

Scope Definition	Minimal		Partial		Complete
Level of Uncertainty	High		Moderate		Low
Degree of Risk	High		Medium		Low
Likely Risk Allocation	Buyer		Both/Shared		Contractor
Contract Type	CPPF	CPIF	CPFF	FPIF	FP

- Where:
- CPPF - Cost Plus Percentage Fee (reimbursement)
 - CPIF - Cost Plus Incentive Fee (to minimise cost)
 - CPFF - Cost Plus Fixed Fee
 - FPIF - Fixed Price Incentive Fee
 - FP - Fixed Price (lump sum)

There are advantages and disadvantages to every kind of contract. Different kinds of contracts carry different risks to both the buyer and the seller as explained here:

- **Fixed price (FP)** means that we are going to pay one amount regardless of how much it costs the contractor to do the work. A FP contract only makes sense in cases where the scope is very well known. If there are any changes to the amount of work to be done, the contractor does not get paid any more to do it. The contractor's risk is greater. The main risk for the buyer is if the contractor does not deliver due to costs. Unexpected costs could exceed the contract itself.

- **Fixed price plus incentive fee (FPIF)** means that we are going to pay a fixed price for the job and give a bonus based on some performance measure. We might set up a contract where the contractor gets a bonus if they manage to deliver an acceptable product before the contracted date. There is not much risk to the buyer. The contractor still has the same risks as FP, but may make more profit.
- **Cost plus fixed fee (CPFF)** means what it says. We pay the contractor back for the costs involved in doing the work, plus we agree to an amount that we will pay on top of that. These contracts have risks for both parties. If costs are too high, the buyer will have to pay a lot more. And a fixed fee on top of costs might not be worth it for the contractor.
- **Cost plus incentive fee (CPIF)** means we will reimburse costs on the project and pay a fee if some performance goals are met. Incentive fees are a good way to reduce the risk to the buyer on a cost-plus contract. There is still a risk of cost overruns, but not as great. However, the incentive fee is not guaranteed, so it might not be paid.
- **Cost plus percentage fee (CPPF)** is similar to the CPFF contract, except that instead of paying a fee on top of the costs, we agree to pay a percentage of the total costs of the project. If costs get high, then this is really expensive for the buyer. The seller has little risk. CPPC contracts are the most risky variety for the buyer, because if costs or contractor get really high then they end up paying a whole lot more for the work.
- **Time and Materials (T&M)** this contract is in effect a combination of a cost-plus and fixed price contract, because we pay a fixed price per hour for labour, but on top of that we pay for costs as with a cost-plus contract.

This type of contract is often used in labour contracts. It means we pay a rate for each of the people working on our project plus their materials. The time part means the buyer pays a fixed rate for labour – usually a certain number of dollars per hour. The materials part means that the buyer also pays for materials, equipment, office space, administrative overhead costs,

and anything else that has to be paid for. The seller typically purchases those things and invoices the buyer for them. This is a good contract if we do not know exactly how long our contract will last, because it protects both the buyer and seller. The risk to the buyer is if costs are too high, the contract could get expensive. T&M contracts may therefore include a “cost-not-to-exceed” clause to make sure this does not happen. If the contract does not have this clause, there would be increased risk for the buyer.

- **An outcome-based agreement (OBA)** not only commits the contractor to delivery outputs, but also commits them to achieving the client’s outcomes. For example, whereas the traditional output-based contract would require the contractor to deliver a website for online ticket sales, the OBA would also measure the number of tickets sold through the website.

The OBA is very much a collaborative relationship that requires the client and contractor to assume joint responsibility for mutually beneficial outcomes. Such an arrangement could be high-risk for the contractor who would usually only commit to what they can control – output, functionality and services. This OBA risk might be reduced if the partners shared the same values, clearly agreed their respective responsibilities, and agreed to readily measurable outcomes and periodic third-party reviews.

Even if our project has several contracts, they do not need to be the same type, but in each instance the allocation of risk between buyer and seller will be an important consideration.

Many of the risks on the project can be eliminated if the buyer and seller work together. Some risks caused by the buyer, seller, or activities on the project may be eliminated, thus decreasing project time and cost in a practical manner without having to resort to reducing overheads, rates and profit margins.

Health and safety

Worth emphasising is that when we contract out work, we still have a responsibility for the safety and health of our contractors and their staff. If we are in business and contract people or businesses to do work for us, we will have duties as a Principal under the NZ Health and Safety in Employment Act 1992. Putting work out to contract doesn’t remove our health and safety obligations.

The aim of the Act is the prevention of harm to people at work or people who could be affected as a result of work activities. To do this, the Act places a range of duties and responsibilities on people in the workplace to manage hazards and ensure work is done safely. The duty for Principals to a contract is to take “all practicable steps” to ensure contractors, subcontractors and their employees are not harmed while undertaking work under the contract. The Principal cannot contract out of their responsibilities by passing the duties on to contractors or subcontractors. Courts will not accept contractual clauses that attempt to do so.

The NZ Department of Labour has produced new guidance for Principals to Contracts to meet their obligations under health and safety legislation. It is available at www.dol.govt.nz. There are significant fines for non-observance.

Reducing estimating risks

Uncertainty stems mainly from a lack of information. Risk is something we must take on because of uncertainty. Risk and uncertainty are immutably linked. Many sources of uncertainty, and therefore often risk, can exist in the information, methods and assumptions used to make estimates of time and cost. In project management, the uncertainty that matters is that uncertainty that affects our project’s objectives.

Coming in late or over budget are risks every project faces. Our performance as project managers is likely to be determined in large part by the accuracy of our estimates. To reduce such risk to tolerable proportions, the following risk mitigation practices are suggested to help ensure reasonable time and cost constraints:

- Ask the experts and know their optimistic or pessimistic tendencies.
- Don’t confuse elapsed time, duration and work-effort.
- Check with those who have done it before.
- Use normal work-package team sizes for estimates.
- Review relevant reports/historical data.
- Conduct trials or dummy runs or build prototypes, and allow for the learning curve as productively improves with repetitive work.
- Consult published productivity data.

- Check we have identified all the work to be done.
- Focus on longer duration and more expensive tasks – Pareto Principle (80:20 Rule).
- Adopt phased estimates (rolling wave strategy).
- Allow for the unexpected – Murphy!
- Learn with experience – update our estimating database.
- Identify all factors that will affect time such as weather, weekends, work hours, holidays, skill levels, machine variations, industrial action, sickness, fatigue and staff turnover.
- Find out current labour and material costs, insurance rates, interest rates, exchange rates, etc for costing purposes.
- Don't plan to do overtime.
- Develop a spreadsheet for bottom-up estimating.
- Document estimate assumptions.
- Include indication of estimate accuracy (eg, range).
- Don't reduce the estimate without commensurate scope reduction.
- Provide estimators with feedback on variance.
- Apply the Delphi technique.
- Combine the PERT formula and Delphi technique.

Updating the plan

The response process may require that some work packages be changed, added to, or even removed from the project work breakdown structure, and people may be reassigned. Risk can affect the project work scope, network diagram, schedule, budget and management plans.

Once the draft project plan is updated to account for risk, if we do not now meet the project objectives, there are a variety of actions we may take to reduce cost or accelerate completion. If such options don't work or aren't available, management may choose to cancel the project, although projects might go over budget and schedule and still realise benefits well beyond the original investment and ongoing costs.

Trade-off analysis

A trade-off analysis looks at rebalancing the project objectives, often making a trade-off of lower priority objectives in order to achieve the project driver, which is usually non-negotiable. If, for example, the project must be delivered by a specific date we may need to obtain a bigger budget to facilitate quicker completion should risk threaten the schedule. However, we should be aware of the Hershey-Schoemaker effect, which argues that an attribute usually receives more relative weight when it is used as a trade-off.

For example, to meet the new commissioning date for a water purification programme, and avoid the risk of cancellation, work on the remote control building would need to be completed more quickly than originally planned.

The original contract was to complete the remote control building project in 12 weeks at a fixed cost of \$61,000. Contractors have now provided us with the following risk-adjusted estimates for an accelerated project. The costs take into account the extra risk incurred by the contractors. Figure 7.9 refers.

Task

Determine the minimum cost in which to do the project within various timeframes (ie, 7, 8, 9, 10, 11, 12 weeks). In effect these are Plan B options.

Approach

1. Draw the network diagram showing normal task durations.
2. Identify the critical path.
3. Reduce critical path task durations to meet the new duration, and then reduce other task durations to ensure that no path exceeds the new critical path duration.
4. Determine the extra (or incremental) cost incurred for each task that is accelerated and add this to the normal cost (\$61K) to determine the new cost for project for the various durations.
5. Some tasks are cheaper to accelerate than others. Some trial and error work may be needed to determine the optimum (ie, cheapest) solution for the required durations.

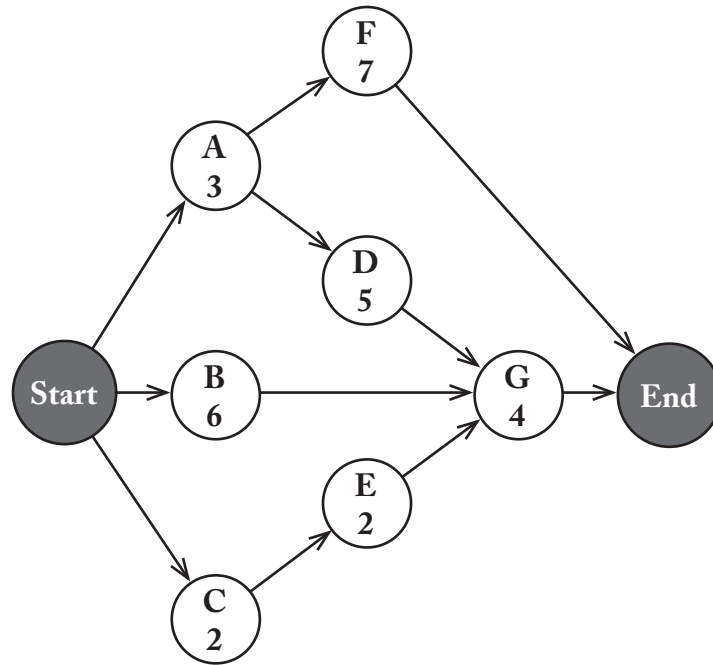
Figure 7.9 – Project duration and cost data

Task ID	Description	Immediate Predecessor	Normal		Crashed		Extra Cost
			Weeks	\$k	Weeks	\$k	Per Week of Acceleration
A	Procure materials	Nil	3	5.0	2	10.0	5.0
B	Prepare site	Nil	6	14.0	4	26.0	6.0
C	Prepare request	Nil	2	2.5	1	5.0	2.5
D	Prefabricate and deliver	A	5	10.0	3	18.0	4.0
E	Obtain Council approval	C	2	8.0	2	8.0	N/A
F	Install connecting lines	A	7	11.5	5	17.5	3.0
G	Erect building	B,D,E	4	10.0	2	24.0	7.0
Project Duration and Cost			12	61.0	7		

Solutions

The solutions to the trade-off analysis problem are summarised at Figure 7.10, which shows how cost increases progressively as the project duration is reduced.

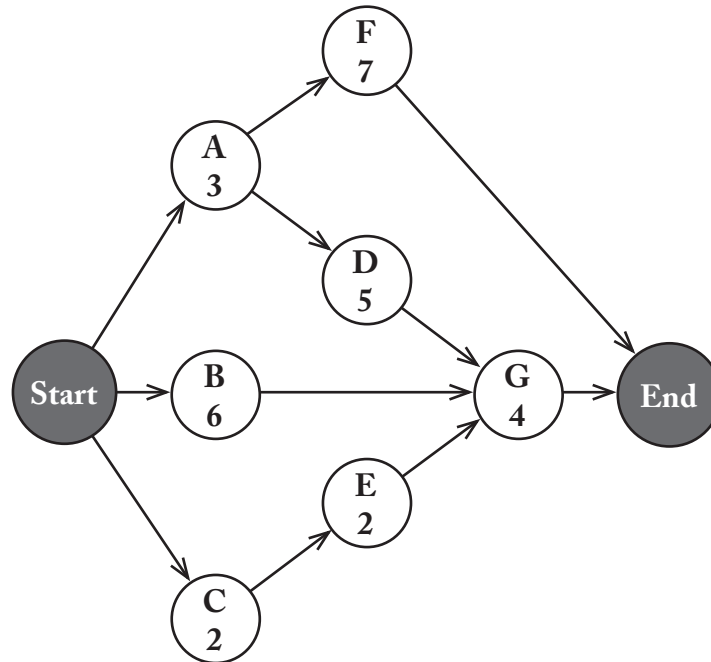
Figure 7.10 – Summary of results



Project Duration (weeks)	Minimum Total Cost
7	\$100,000
8	\$87,000
9	\$77,000
10	\$69,000
11	\$65,000
12	\$61,000

The following series of networks shows how the project can be progressively shortened from twelve to seven weeks. A task with an asterisk means it is at a minimum duration.

1. **Case Project Length = 12 weeks**

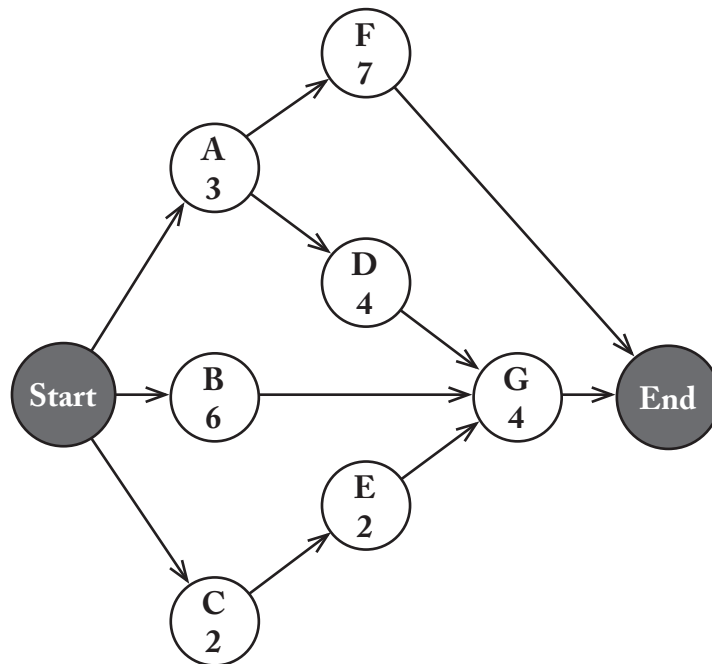


Critical Path – ADG – Total Cost = \$61,000

2. Change from 12 to 11 weeks

Alternative	Action	Incremental Cost of Action \$
I	Reduce A by 1	5,000
II	Reduce D by 1	4,000
III	Reduce G by 1	7,000

Best alternative is II

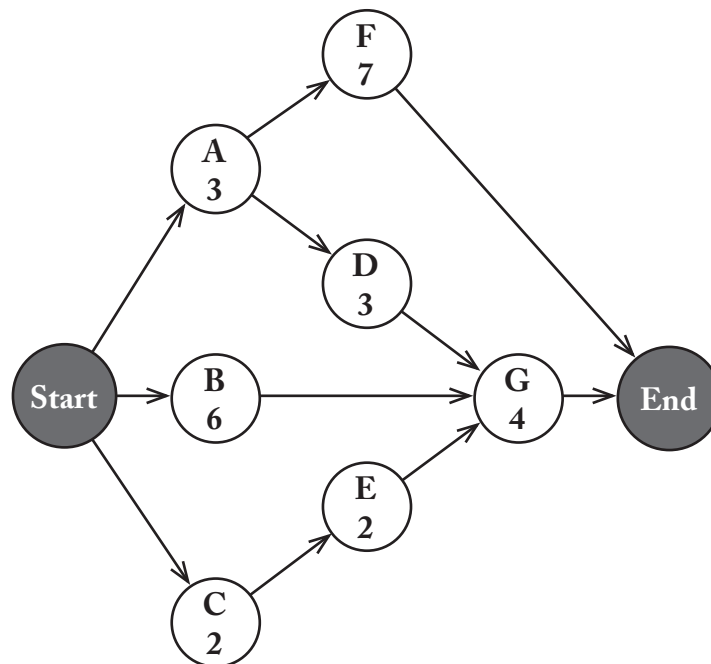


Critical Path ADG – Total Cost = \$61,000 + \$4,000 = \$65,000

3. Change from 11 to 10 weeks

Alternative	Action	Cost \$
I	Reduce A by 1	5,000
II	Reduce D by 1	4,000
III	Reduce G by 1	7,000

Best alternative II



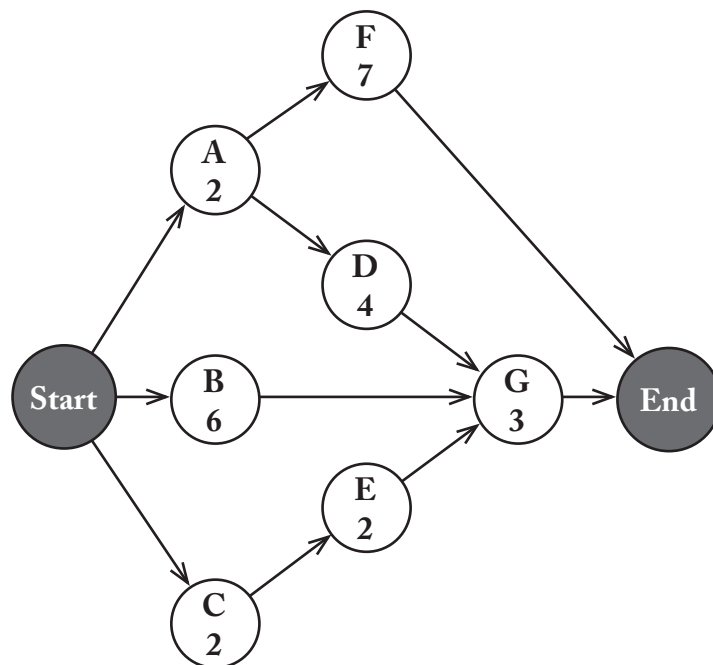
Critical Paths ADG, AF, BG

Total Cost = \$65,000 + \$4,000 = \$69,000

4. Change from 10 to 9 weeks

Alternative	Action	Cost \$
I	Reduce A by 1 and Reduce G by 1 and Increase D by 1	8,000
II	Reduce A by 1 and Reduce B by 1	11,000
III	Reduce G by 1 and Reduce F by 1	10,000

Best alternative I



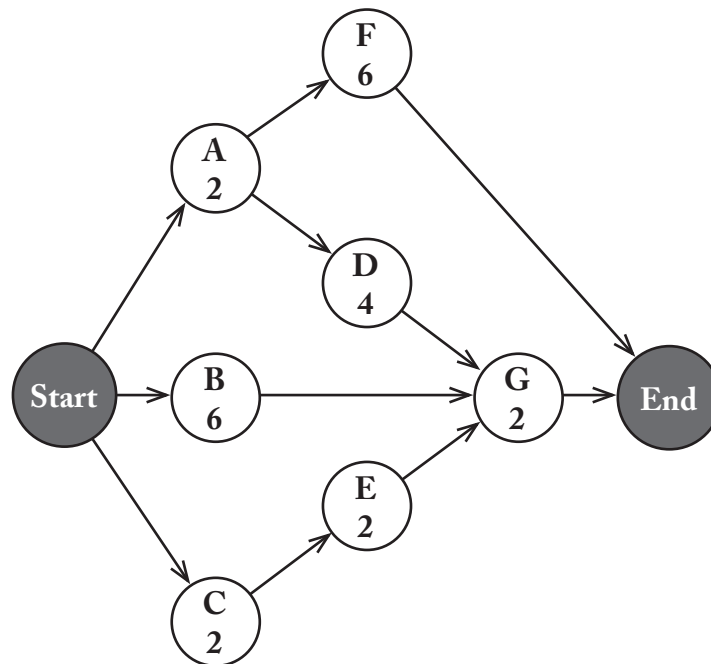
Critical Paths ADG, BG, AF

Total Cost = \$69,000 + \$8,000 = \$77,000

5. Change from 9 to 8 weeks

Alternative	Action	Cost \$
I	Reduce F by 1 and Reduce G by 1	10,000
II	Reduce F by 1 and Reduce B by 1 and Reduce D by 1	13,000

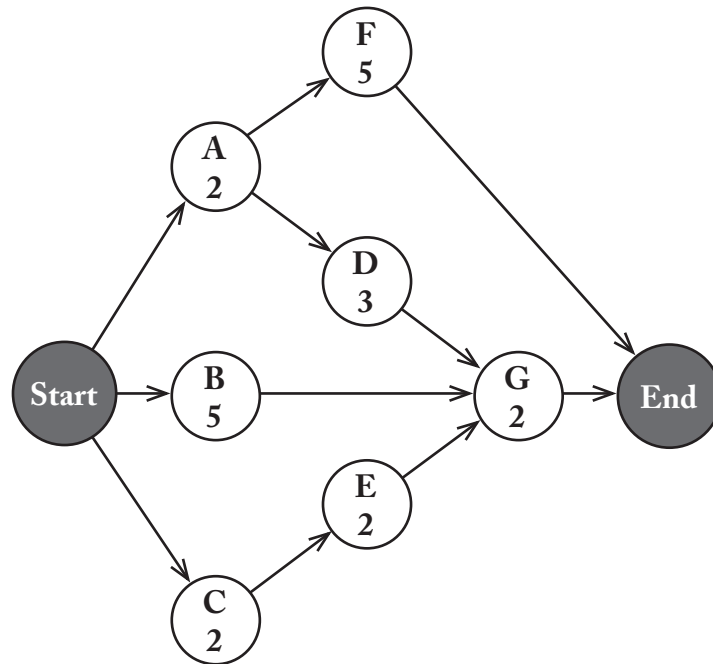
Best alternative I



Critical Paths ADG, BG, AF. Total Cost \$77,000 + \$10,000 = \$87,000

6. Change from 8 to 7 weeks

Alternative	Action	Cost \$
I	Reduce F by 1 and 2 Reduce D by 1 and Reduce B by 1	13,000



Critical Paths ADG, BG, AF. Total Cost – \$87,000 + \$13,000 = \$100,000

Overcome schedule slippage

To prevent, reduce the chances of, or recover from schedule slippage, the following strategies are possibilities:

- Renegotiate milestones, finish date, work scope and/or performance standards (ie, specifications).
- Deploy more resources and/or more productive resources. However, Brook's Law states that adding more resources to an already late project further slows the work.

- Stand down any trainees and poor performers.
- Redeploy resources to focus effort on critical and near-critical path tasks.
- Undertake more work concurrently, overlap tasks and/or break dependencies.
- Use more efficient processes, methods and technology.
- Work overtime and/or contract out work.
- Impose late completion penalties (eg, liquidated damages).
- Set incentives for early or on-time completion and productivity improvements.
- Accept partial delivery (ie, postpone less-essential work).

Reduce over-expenditure

To prevent, reduce the chances of, or recover from over expenditure, the following strategies are possibilities:

- Check schedule progress. Ahead of schedule work incurs early unexpected expenditure.
- Renegotiate project budget, work scope, specifications, pay rates and material costs.
- Minimise order quantities and/or purchase economical order quantities (EOQ).
- Sell off excess inventory for immediate cash injection. Avoid stockpiling. Practice JIT.
- Substitute cheaper processes, labour, materials and equipment.
- Eliminate advances, deposits, rework, wastage, theft, spoilage and scope creep.
- Have more progress payments from client. Delay own payments (ie, improve cash flow).
- Optimise schedule/budget. An ambitious schedule is usually an expensive schedule.
- Shun perfection and extra audits. Curb ultra-perfectionists. Settle for “good enough.”
- Ensure all charges against project are accurate, legitimate and properly authorised.
- Review delegated financial authorities. Centralise financial approvals. Vet all purchases.
- Ensure payments are only made for satisfactory completed work. Apply retentions.

Risk responses

A simple risk register that includes risk responses is shown at Figure 7.12.

Figure 7.12 – Example risk responses

Project: Conference		Compiled by:		Page 1 of 1
Date Initiated:		Approved by:		Chart date:
Risk Area	Probability H/L/M	Impact H/L/M	Score	Risk Response
Not enough tickets sold	M	H	2	Ensure adequate resources for promotion
Insufficient cash flow	M	H	2	Tight cash flow and budget control
No profit	M	H	2	Ensure adequate financial (blow out) control
Not enough sponsorship/ funding	M	H	2	Ensure adequate resources for seeking sponsorship
Insufficient exhibitors	M	H	2	Ensure adequate promotional resources
Venue disaster	L	H	4	Check venue reliability. Identify other venues.
Catering food poisoning	L	H	4	Ensure reputable caterer contracted
Sponsor doesn't approve	L	H	4	Ensure quality of planning process
No suitable venue in Wellington	L	H	4	Investigate other venue options
Earthquake	L	H	4	Familiarity with civil defence procedures
Venue bankrupt	L	H	4	Check reputation of venue
Lack of accommodation	M	M	5	Research of accommodation options and adequate pre-confirmation planning

Team member buy-in strategies

Within any project, stakeholders can have a positive or negative impact on our project. This influence may be direct or indirect, depending upon the stakeholders' role (active or passive). Stakeholder influence can be a risk. Misinformation, negative comments, poor attitudes, lack of co-operation, lack of support, lack of interest and even sabotage can quickly defeat a project.

To reduce the risk of having uncommitted project team members, which can be a high-impact risk, some of the strategies at Figure 7.13 might help.

Figure 7.13 – Buy-in strategies

Strategy	Likely Effectiveness?		
	High	Medium	Low
Establish a project vision, which if practicable encompasses individual goals and expectations.			
Clarify individual values, expectations, assumptions, perceptions, and anticipate hidden agendas and covert objectives.			
Recognise, welcome and use individual expertise.			
Provide frequent, specific, objective and balanced feedback on their performance.			
Encourage their participation in planning, problem solving, decision making, information sharing and coaching.			
Be positive yourself about the project and use your personal power.			
Prepare for objections and talk to objectors in person.			

Strategy	Likely Effectiveness?		
	High	Medium	Low
Enlist the support of those already committed to the project/mentorship/buddies.			
Get project advocates/champions.			
Invite the CEO to sign your project charter and distribute widely.			
Have senior management repeatedly demonstrate their support for the project – walk the talk!			
Encourage effective communications: <ul style="list-style-type: none"> • listening skills • interpersonal skills • discourage jargon • develop empathy • be approachable • openness • interactive • feedback 			
Capitalise on common interests – work and non-work related.			
Reward team behaviours and evidence of buy-in.			
Have a project newsletter. Use the intranet.			
Do things together outside the project.			
Be a competent project manager with a history of success.			

Strategy	Likely Effectiveness?		
	High	Medium	Low
Make it fun or at least enjoyable/interesting.			
Develop and if possible, deliver the solution in value-adding increments.			
Structure the schedule for early successes.			
Describe the consequences of project failure – organisational and personal.			
Have a top sponsor who has both interest and influence.			
Provide stakeholders with honest and timely feedback on the suitability of their ideas and concerns.			
Sell the project's benefits (WIIFM): <ul style="list-style-type: none"> • useful experience • personal development • challenge • achievement • recognition • credibility • teamwork • performance bonus • enjoyment • flexible work hours • effective benefits are quick and tangible. 			
Facilitate collaboration/problem solving.			

Strategy	Likely Effectiveness?		
	High	Medium	Low
Manage conflict.			
Provide deserving project members with positive evaluations, reports, references, letters of commendation, future job assignments.			
Involve and win over their line managers. Exchange concessions perhaps.			
Recognise, publish and celebrate successes – testimonials and positive performance reports. In fact – arrange for early successes.			
Review teamwork effectiveness often and take early remedial action as appropriate.			
Establish a conveniently located and well-equipped project office. Co-locate team.			
Develop a team logo, nickname, T shirt, inspired project name, business cards, wrestle in rubber suits, have a lavish conference, fly to Taupo for a bonding spend-up, join Housing NZ at a swanky location...			

While structuring the schedule to achieve early success might enhance buy-in, another view is to do the risky stuff first and fail early rather than later when the loss will be greater. This will free up resources sooner for other projects.

Poor risk response

A recent letter to the editor reveals an interesting approach to avoid risk by adding six minutes to commuters' misery.

"Last Monday, Kiwirail implemented their new timetable. Getting Palmerston North commuters out of bed six minutes earlier is their best shot at fixing the appalling punctuality record.

In the past three years, we made it to Wellington at the scheduled 8.21am no more than five times. The reasons we have always arrived late are one or more of the following issues:

- Damaged/unrepaired track
- Points failure
- Signals failure
- Summer heat restrictions
- Goods trains having priority over passenger trains
- Waiting outside Wellington station for a platform to come free
- Locomotives that break down
- Underpowered locomotives.

Last Monday, we got in at 10.30am thanks to problem No 7."

Risk owner

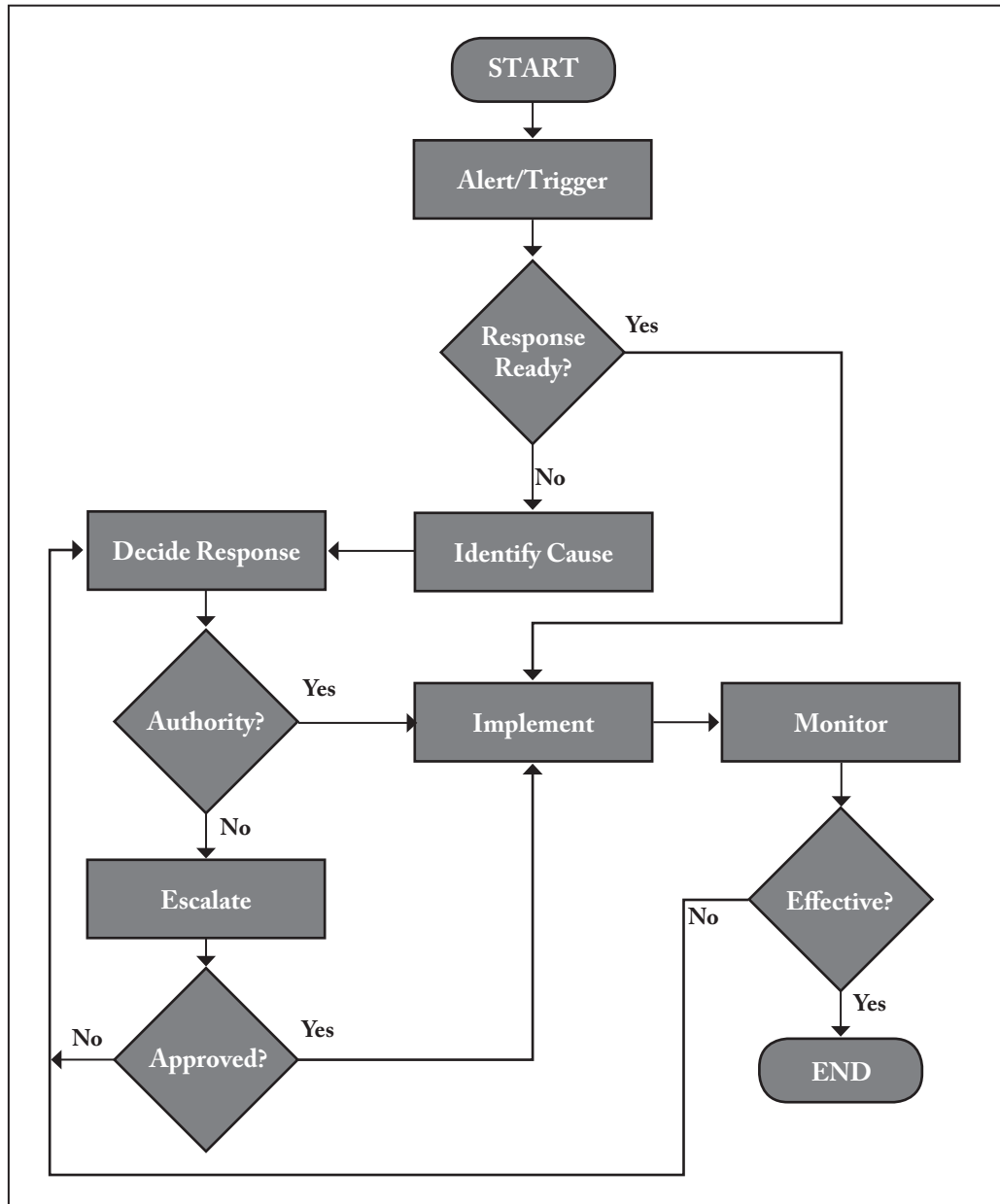
Most people become risk owners because of their expertise with the issues relating to the risk, or because they have a responsibility for the at risk work. Risk owners can have useful insight into risk analysis, as well as response planning.

We project managers assign a risk owner to watch for triggers and manage the risk response if the risk is about to occur. A risk owner is a stakeholder who may also be a project team member. The risk owner will also help create the contingency or fallback plans for their assigned risk and be responsible for their implementation.

Risk response process

A summary of the typical risk response process is at Figure 7.14 where if no response has been previously identified the event may need to be managed as an issue.

Figure 7.14 – Risk/issue response process



Risk response effectiveness

Quantitative risk analysis is sometimes based on wild numerical guesses and leads to incorrect prioritising and inappropriate responses. We tend to focus on the risks that we can quantify. For example, contractual penalties or direct cost of resources, and play down risks that have softer impacts that can't be so readily quantified, such as impacts on quality, relationships or reputation.

But how can we tell if our risk responses are good enough? Can we assess their potential effectiveness before we decide to implement them? Here are some criteria by which we can check our planned risk responses:

1. **Appropriate?** The correct level of response must be determined based on the risk priority or score. This ranges from a crisis response where the project cannot proceed without the risk being addressed, through to a “do-nothing” response for minor risks. We should not spend large amounts of time or effort developing responses for minor risks.
2. **Affordable?** The cost-effectiveness of risk responses must be determined, so that the amount of time, effort and money spent on addressing the risk does not exceed the available budget or the degree of risk exposure. Each risk response should also have an agreed contingency sum.
3. **Actionable?** An action window should be determined, defining the time within which risk responses need to be completed in order to properly address the risk. Some risks require immediate action, while others can safely be left until later. We must be careful not to leave it too late before we act. Identifying a trigger point is very useful.
4. **Achievable?** There is no point in describing risk responses, which are not realistically achievable or feasible, either technically or within the scope of our capability and responsibility. If our planned response is “Change the Government” or “Invent a radical new solution”, we may be disappointed.
5. **Agreed?** The consensus and commitment of relevant stakeholders should be obtained before determining and confirming responses, especially if the proposed response might affect a part of the project in which they have an interest.

6. **Allocated and accepted?** Each risk response should be owned by a single person (and accepted by them) to ensure a single point of responsibility and accountability for implementing and monitoring the response. Allocating risk responses requires careful delegation, including provision of the necessary resources and support to allow effective action to be taken in a timely manner.

Each proposed risk response might be assessed against these six criteria before it is accepted. A sound response will pass all these tests, and it is more likely to achieve the desired effect than a response that has not been properly evaluated and confirmed in advance. Some ideas to help ensure that risk responses become more than just good intentions, and are translated into effective action are:

- Ensure each risk response has a agreed owner who is responsible and accountable for its execution.
- Allocate realist durations, budgets and resources to each risk response.
- Include agreed responses as part of the project plan.
- Monitor each risk response as we would for any other project activity.

To validate a risk response, sometimes a simulation might be appropriate. For example, a risk might be that a key project worker goes on emergency leave. To simulate this we could require that the worker does not do their allocated project work for a predetermined period. During this period we validate our risk response. Evidently, in readiness for Y2K some organisations ran complete IT shutdown tests, and others employed hackers to test cyber security.

Tempting though it is, particularly for team buy-in purposes, we should not defer riskier activities until later in our project. This practice can lead to both increased project risk and cost. By scheduling risky activities earlier where practicable, we can learn faster, and frequently with less effort, whether there are any show stoppers. Also, when we address problems earlier, we usually have more options for their resolution. In the worst case, we can then terminate the project early before too much expenditure. Late cancellation is usually expensive and more demotivating for our project team and other stakeholders.

Summary

Risk has two main sides – uncertainty, which can be expressed as probability or likelihood, and how much it matters, expressed as impact or consequence. Both these dimensions need to be understood so that good decisions can be made. If an uncertain event is very unlikely then it might be appropriate to take no explicit action, even though the consequence of that event on project objectives would be very significant should it occur. However, different individuals or organisations may perceive both probability and impact differently, and have different risk thresholds, leading to different decisions.

Planning risk responses means deciding what to do about each risk. Responses may include one or all of the following:

- Doing something to eliminate the threat before it happens or doing something to make sure the opportunity does happen.
- Doing something to decrease the probability and/or impact of threats or increase the probability and/or impact of opportunities.

And for the remaining or residual risks:

- Doing something if the risk happens (contingency plan).
- Doing something if the contingency plan is ineffective (fallback plan).

Prevention plans reduce the probability that a risk event will occur, whereas contingency plans reduce the impact's severity (either its probability of impact or its total loss or gain) if the risk event does occur.

A mature approach to project risk management will include three levels of risk response:

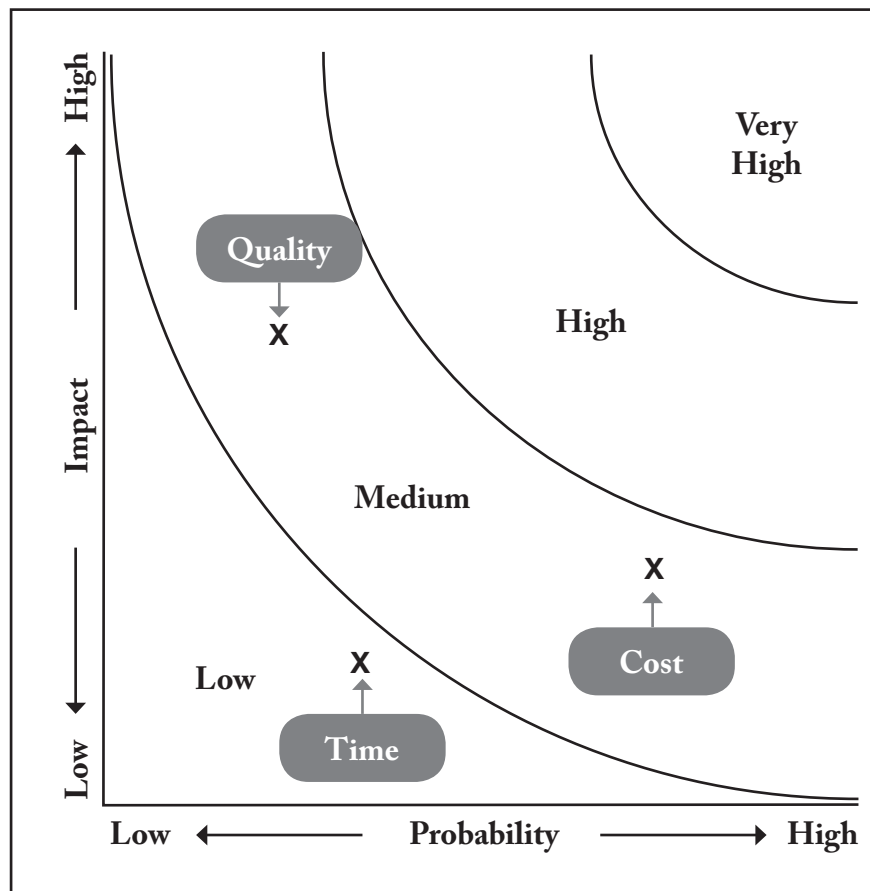
- Response plans, which include identifying trigger events that need to be understood in order to know if each threat or opportunity has or is about to occur.
- Contingency plans, which include what actions will be taken if or when trigger events occur.
- Fallback plans, which include what actions will be taken if or when contingency plans are not effective.

There are several mitigation strategies to consider when developing responses to project risks:

- Responses to threats are to avoid (change plan to eliminate cause of risk), mitigate (reduce the probability and/or impact of the threat), transfer (assign the risk to someone else), or accept (do nothing to prevent the risk occurring).
- Responses to opportunities are to exploit (make the opportunity more likely), enhance (increase the value of the opportunity), share (partner with those who can capture the opportunity), or accept (do nothing).

The response selected is influenced mainly by the level of risk. See Figure 7.15. High impact and high probability risks require aggressive responses (threats should be avoided and opportunities exploited if possible).

Figure 7.15 – Level of risk



The results of response planning should be documented in the risk register. The following minimum information would typically be recorded:

- response strategies
- trigger points
- risk owner.

Minor risks don't usually have risk owners. The project manager is usually responsible to monitor these.

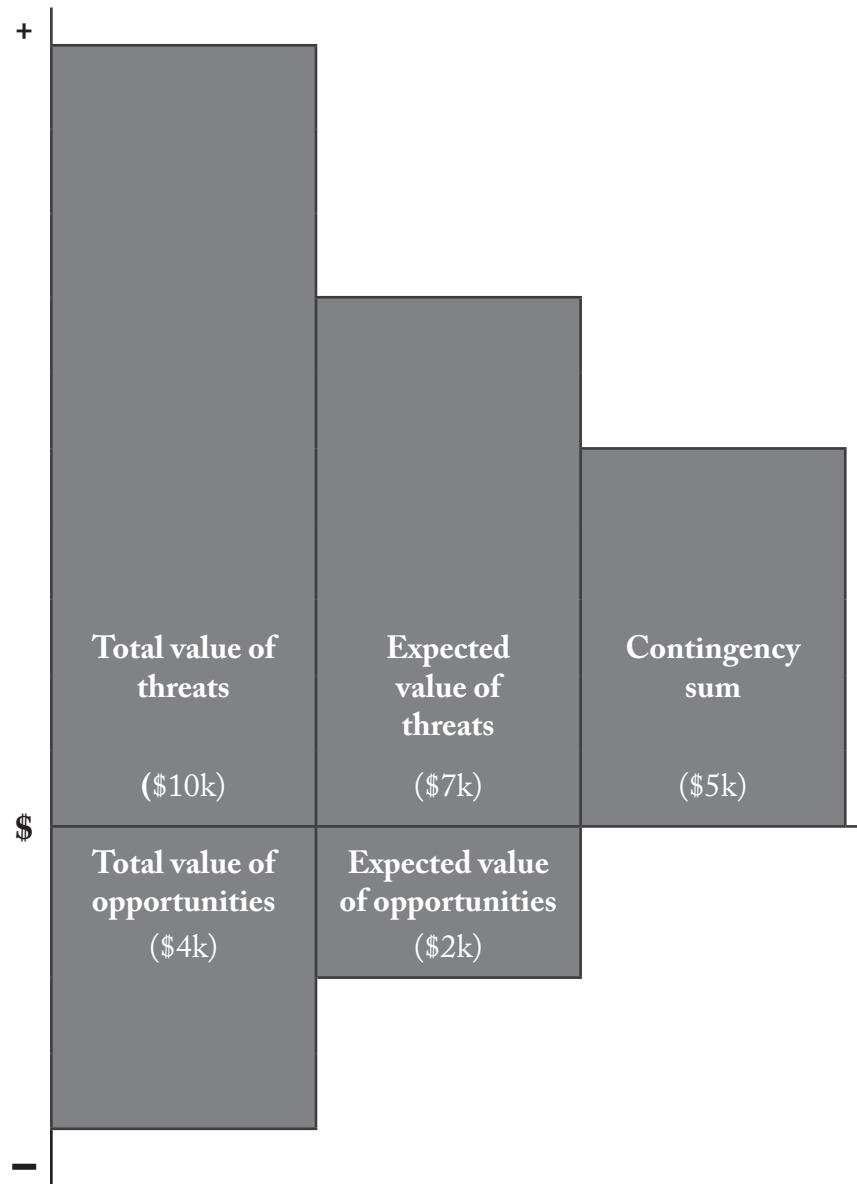
A trigger is an early warning sign that tells risk owners and the project manager that an accepted risk has occurred or is about to occur and, therefore, when to implement contingency or fallback plans. Triggers are listed in our risk response plans. To determine triggers we should ask:

- What will happen just before the risk occurs?
- What can we measure to discover that the risk is about to occur?
- How will we know right away when the risk occurs?

Depending on what level of risk is considered acceptable, there is a threshold where it becomes uneconomical to tackle further uncertainty. And each project and organisation may have a different capacity for uncertainty. This is a measure of how much uncertainty a project can tolerate. Perhaps the best way to determine and build in a contingency is to extend our project duration and budget to the point when the probability of completing the project on schedule and within budget equals our risk tolerance.

Contingency accounts for identified risks, known-unknowns, whereas the management reserve accounts for the unknown-unknowns. Both these reserves add to the total budget for the project. That may require that the original business case be re-evaluated, particularly if there was no allowance for risk originally. Also, the project team should not make the mistake of thinking that as long as there is contingency then it is okay to let things slip. The net expected value of threats and opportunities might be illustrated as at Figure 7.16.

Figure 7.16 – Contingency sum



The fundamental effect of risk responses on risk probability and impact is summarised at Figure 7.17.

Figure 7.17 – Effect of responses

Response Type	Effect of Response	
	On Probability	On Impact
Accept	No effect	No effect
Transfer	No effect	Reduce
Mitigate	Reduce	Reduce
Avoid	Reduce	Reduce
Exploit	Increase	Maximise
Share	No effect	Increase
Enhance	Increase	Increase
Accept (reject)	No effect	No effect

The next chapter discusses executing risk responses, monitoring their effectiveness and taking further action as necessary.

Monitoring and Controlling

Risks have a shelf life, and risk management plans can become stale if not monitored and updated regularly. We need to make use of information when it is fresh and keep our project management and risk management plans up to date so they do not lapse into irrelevance. In fact, a project management plan is simply a basis for updating as reality is revealed.

The lynch-pin to effective monitoring and control is communication within and among our project team, as well as communication with management and other stakeholders.

During monitoring and controlling, the benefits of the previous steps in the process are realised. If previous steps have not been done properly this step will be difficult, with plenty of time spent dealing with problems that could have been avoided. There will be rework and overtime, as well as reputational damage.

Risk monitoring and control involves executing the risk management processes to respond to risk events. Executing the risk management processes means ensuring that risk management is an ongoing activity performed by the entire project team throughout the entire project. Project risk management does not stop with the initial risk analysis. Identified risks may not materialise, or their probabilities of occurrence and loss or gain may diminish. Also, previously identified risks may be determined to have a greater probability of occurrence or a higher estimated loss or gain value. Similarly, new risks will be identified as the project progresses.

Newly identified risks need to go through the same process as those identified during the initial risk assessment. Also, a redistribution of resources devoted to risk management may be necessary because of relative changes in risk exposure.

At the start of our project, potential risks are identified and evaluated. As the project ensues, circumstances may change, and risks once thought to be unlikely and insignificant, can quickly become very likely and dangerous. For this reason, identified risks must be continually monitored as the project progresses. And, of course, new risks can arise, some as a result of earlier risk responses.

The monitoring and control process involves the systematic and continuous tracking and evaluation of the appropriateness and effectiveness of risk responses. Key activities that we undertake during the monitoring and control stage are:

- Manage the risk management plan and implement risk response measures.
- Ensure the risk register is kept up to date.
- Watch for triggers arising.
- Keep track of identified risks.
- Ensure risk owners are performing their job.
- Deal with risks that were not identified.
- Perform workarounds, risk audits and risk reviews.
- Ensure risk response strategies are properly implemented.
- Identify, analyse and plan for new risks.
- Routinely revisit the risk watchlist to see if additional risk responses need to be determined.
- Look for any unexpected effects or consequences of risk events.
- Re-evaluate risk identification and analysis when the project deviates from the baseline.
- Check changes, including recommended corrective actions, to see if they lead to identifying more risks.
- Update the risk management and response plans.
- Monitor residual risks.
- Review project performance information, such as Earned Value Analysis (EVA), progress and status reports, issues, and corrective actions.

- Re-analyse existing risks to see if the probability, impact, or response plan needs to be updated. Develop new responses as required.
- Review the execution of risk responses and assess their effectiveness.
- Create a database of risk information that may be used on other projects.
- Manage the contingency and management reserves.
- Ensure proper risk management policies and practices are being used.
- Document lessons learned.
- Identify new risk responses.
- Review the adequacy of contingencies.
- Re-visit non-top risks to check their current rankings.
- Collect and communicate risk status.
- Communicate with stakeholders about risks.
- Determine if assumptions are still valid.
- Identify and register new risks.
- Change the project management plan as required when new risk responses are developed.

Carrying out individual risk management plans involves monitoring risks often, usually based on defined milestones and making decisions regarding risks and their response strategies. It may be necessary to alter a response strategy if it becomes ineffective, implement a planned contingency activity, or eliminate a risk from the list of potential risks when it no longer exists. Also, project teams sometimes use workarounds – unplanned responses to risk events – when they do not have contingency plans in place.

Risk reassessment, risk audits, variance and trend analysis, technical performance measurements, status meetings, and periodic risk reviews such as Top Ten Risk Item Tracking are all tools and techniques for performing risk monitoring and control. Outputs of this process are requested changes, recommended corrective and preventive actions, and updates to the risk register, project management plan, and lessons-learned information that might help us manage risk even better in our future projects.

Managed risks need to be monitored on a regular basis to assess the effectiveness of our risk response measures. Reassessment needs to be carried out whenever new risks are identified. Sometimes workarounds will be needed. These are unplanned responses to unanticipated risks.

Planned risk responses should be executed as required over the life cycle of the project, but the project should also be continuously monitored for new and changing risks.

A problem with an activity on the critical path usually requires immediate attention. Also, we need to manage the path with the greatest risk score. Some paths possess greater uncertainty than do other paths. Due to this uncertainty near-critical paths might readily become critical.

Risk control is the process of identifying, analysing, and planning for newly arising risks, keeping track of the identified risks and those on the watchlist, re-analysing existing risks, monitoring trigger conditions for contingency plans, monitoring residual risks, and reviewing the execution of risk responses while evaluating their effectiveness.

The risk control process applies techniques, such as variance and earned value trend analysis, which require the use of performance data generated during project execution. Risk control, as well as the other risk management processes, is an ongoing process for the life of the project.

Other purposes of risk control are to determine if:

- Project assumptions are still valid.
- Risk, as assessed, has changed from its prior state, with analysis of trends.
- Proper risk management policies and procedures are being followed.
- Contingency reserves of cost or schedule remain adequate.

Risk control can involve choosing alternative strategies, executing a contingency or fallback plan, taking corrective action, and modifying the project management plan.

The risk response owner reports periodically to the project manager on the effectiveness of the plan, any unanticipated effects, and any mid-course correction needed to handle the risk appropriately.

Risk control also includes updating project lessons-learned databases, risk management profiles and templates for the benefit of future projects. In particular, issues, usually more so than successfully managed risks, will represent lessons.

Project risk audits may be performed periodically throughout the project to ensure that the project stays on track. The first step in such an audit is to assign someone the role of project risk auditor. If there is no one available or no one who is suitable, we should hire an external auditor. Some useful questions to ask at risk audit meetings are:

- Have avoided risks been eliminated?
- Have mitigated risks been contained?
- Have transferred risks been fully shifted?
- Can accepted risks be tolerated?
- What risks have now expired?
- What additional risks have we uncovered since our last meeting?
- Which of the triggers that we have identified no longer seem appropriate?
- Which of the risk response plans that we have created now need more development?
- Which contingency plans need to be updated?
- What now might be the revised order of our top risks and which residual risks now need to be reassessed?

If properly managed, a risk review will result in:

- Adding response ideas.
- Changing some risk priorities.
- Revisiting watchlist risks to see if their ranking needs to change.
- Adjusting the severity of actual risks.
- Determining if assumptions are still valid.
- Looking for any unexpected effects or consequences of risks.
- Monitoring residual risks.
- Reviewing all workaround situations to see if they provide insight into the existence of additional risks.
- Making changes to the project management plan when new risk responses are developed.

Remember that a contingency reserve may only be used to handle the impact of the specific risk it was set aside for and not used for scope changes. If the change is part of the risk response plan that was previously budgeted for, the reserve may be used. If it is not, we must take preventative or corrective action, fast track, crash, or otherwise adjust the project to accommodate or make up for the impact of the problem and its resulting changes. However, management reserves might be used to accommodate problems that have not previously been identified as risks.

The management reserve should be used for unknown unknowns (risks that have not been identified) that occur related to the baseline scope of work. Any change to the baseline scope of work requires a change to the project and thus a change order with additional reserves. The contingency reserve is for known unknowns (identified risks).

Some early warning signs that the project may be in trouble are:

- Lack of interest in the project by project team members and other stakeholders, often evidenced by poor attendance at project meetings.
- Poor communications and a no-bad-news environment.
- Lots of overtime, which leads to exhaustion, diminished productivity and mistakes.
- Division of resources, when people are pulled from the project to work on business-as-usual or other projects.
- Milestones not met and scope reduction, where features are eliminated and requirements are relaxed.
- Ratios in trouble, where actual performance is less than planned performance, perhaps evident from Earned Value Analysis.

In summary, the purpose of the monitor and control process is to:

- Track identified risks.
- Monitor residual risks and identify new risks.
- Ensure the proper execution of risk response plans.
- Check the overall effectiveness of the project risk management process.

The common reasons for risk management failure are:

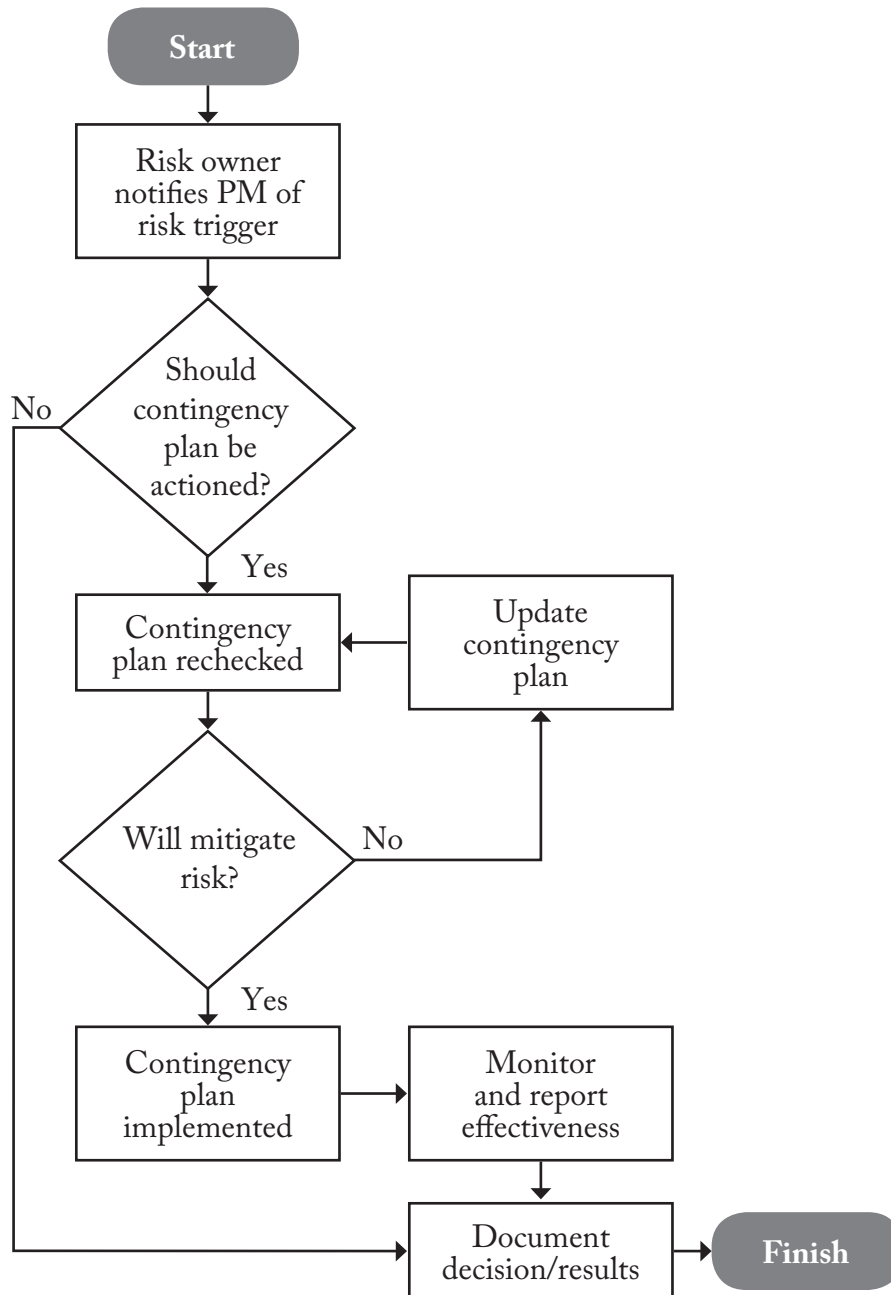
- Important risks are not identified.
- Risks are identified, but not prioritised correctly.
- Risk are identified, but not properly mitigated or inappropriate response actions are taken.

The results of risk monitoring and control should be documented in the risk register, where the following information may be recorded:

- Risk status, which might be one of the following – identified, analysed, planned for, trigger occurred, risk resolved, or risk retired.
- Trigger date – if the risk has been triggered.

The process for contingency planning is the same as for any other project planning undertaking. Each contingency plan implementation begins with a trigger event that signals the risk has occurred. The most effective risk triggers precede the risk consequences. Early triggers increase the number of potential recovery options. Each risk to be managed by a contingency plan must have an owner who is usually the owner of the task related to the risk. For risks with project-threatening consequences, the project manager may be the better choice. A typical process for implementing contingency plans to deal with risks is as shown at Figure 8.1. An effective means of tracking project progress is Earned Value Analysis (EVA).

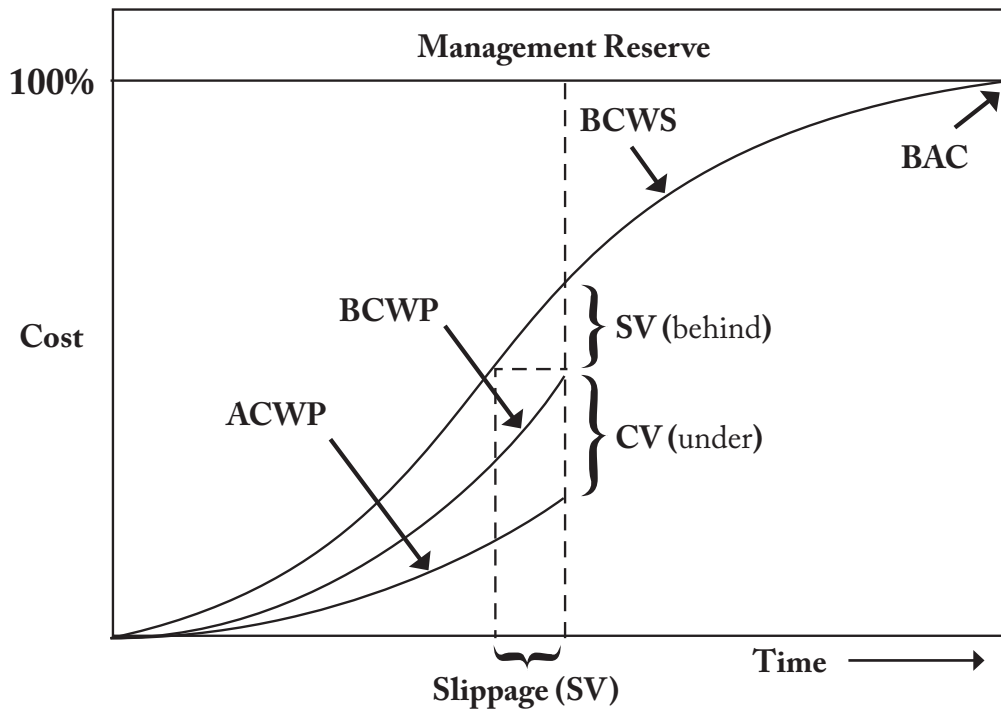
Figure 8.1 – Contingency plan implementation



Earned value analysis

Earned value analysis (EVA) is used to quantitatively measure and monitor overall project performance against the project baseline. The example at Figure 8.2 depicts a project that is currently behind schedule and underspent. EVA allows us to predict project performance and risks.

Figure 8.2 – EVA graph



BCWS	=	Budgeted Cost of Work Scheduled (baseline)
BCWP	=	Budget Cost of Work Performed
ACWP	=	Actual Cost of Work Performed (earned value)
SV	=	Schedule Variance = $BCWP - BCWS$
CV	=	Cost Variance = $BCWP - ACWP$
BAC	=	Budget at Completion
SPI	=	Schedule Performance Index = $BCWP/BCWS$
CPI	=	Cost Performance Index = $BCWP/ACWP$
CR	=	Critical Ratio = $SPI \times CPI$
EAC	=	Estimate at Completion = BAC/CPI

If SV or CV is positive, the project is exceeding planned performance, and if SPI or CPI exceed unity (1), the project is also exceeding planned performance.

Currently EVA and risk management operate as parallel coexisting processes without systematic integration. The strength of EVM lies in its examination of what has already happened. It goes on to predict future performance by extrapolations from the past, which is not a particularly accurate way of predicting the future. However, it is this forward view that risk management offers.

An important contribution that risk management can make to EVM is to make explicit the uncertainty factor when developing the BCWS baseline by having three BCWS 'S'-curves to create an uncertainty box that reveals both opportunities and threats to be addressed. See Figure 8.3 and 8.4.

Figure 8.3 – EVA uncertainty box

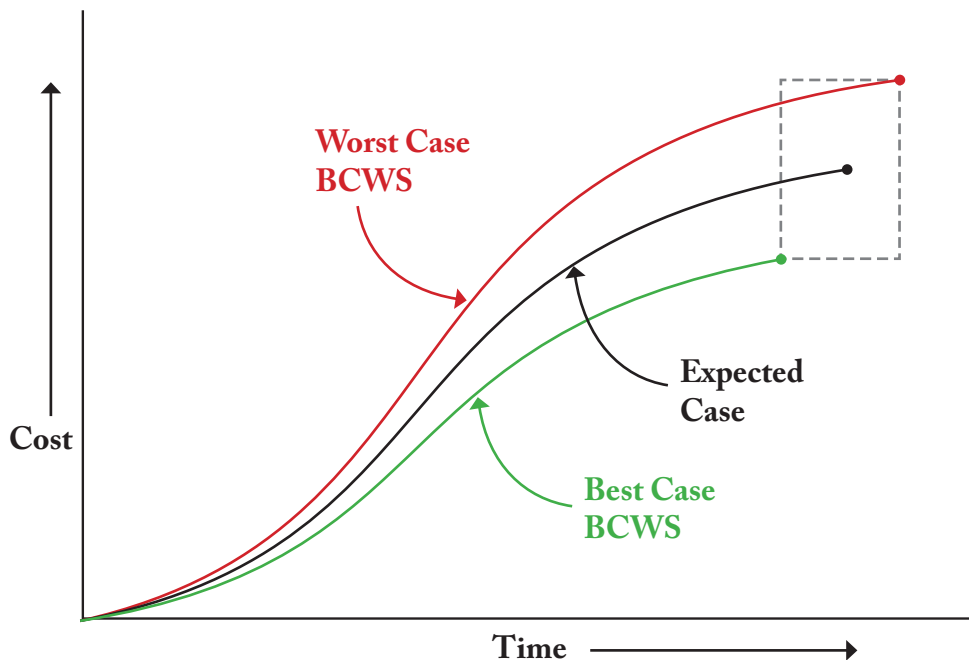
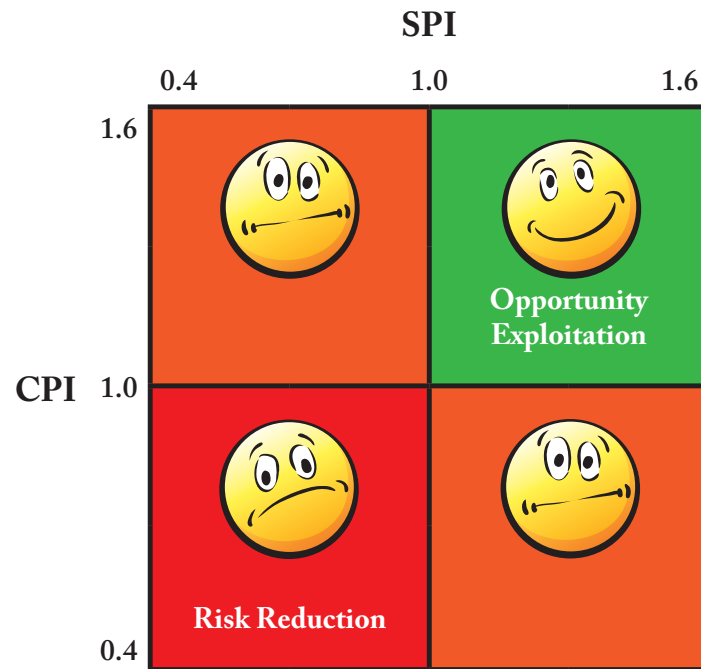


Figure 8.4 – EVA and risk



Risk reassessment

There are two main occasions when a risk reassessment is needed – when new risks are identified and when changes occur on the project. Some re-estimating may be needed when:

- New risks are identified.
- When new risk ratings are determined for existing risks.
- When the prioritisation of risks changes.
- To accommodate the time and cost for workarounds.
- When any refinement to risk response plans occurs.
- When reserves are used faster than expected.
- When the project has significant changes (variations).
- When the project has never been done before.
- When there is little confidence in the project management plan.
- When a new project manager takes over the project.
- When new previously unidentified risks arise.

Contingency plan check

Before implementing a contingency plan we need to check that it is achievable, is the instigation trigger for the plan clear, and does the plan properly address the situation in a timely, affordable and effective way? The contingency plan content is not too unlike that for a project plan; main items being:

- plan description
- information concerning the event that is the trigger for plan implementation
- network diagram and schedule information
- budgetary information
- resource requirements
- risks and issues
- plan owner.

The project team should not make the mistake of thinking that as long as there is a contingency then it is okay to let things slip or over expend. We justify the need for contingency planning due to the following realities:

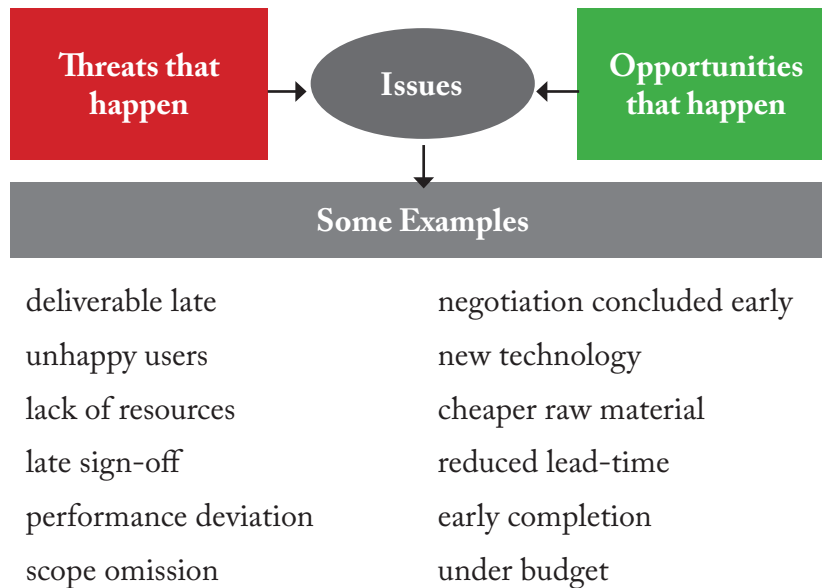
- At the start of the project, we often do not know the details of the entire work scope and it is always possible that something has been left out.
- The initial calculated project end date is often too optimistic. We might bow to sales pressures or promise anything to get the job. Also, the calculated end date probably has not considered risks. We might assume a risk-free project.
- Resources may not be available when needed, or in the right mix of skills.

The resultant contingency must be managed. Where an allowance has been made for time and budget, there should be an audit trail of the amounts that are moved from the contingency category to the project baseline. When identified risk does not occur, the project contingency should be reduced accordingly to discourage its improper use.

Issues

Issues management is the process of recording and handling any event or problem that either threatens the success of the project or represents an opportunity to be exploited. See Figure 8.5. As project manager we ultimately own the issues and must drive their resolution.

Figure 8.5 – Managing issues



The issue process usually follows this four-step sequence:

1. Issue is recorded in an issues log or register:
 - ♦ description of issue
 - ♦ record of who brought it up and when
 - ♦ issue priority.
2. Decide who will be accountable for managing issue resolution. Record in the register:
 - ♦ issue owner
 - ♦ date for issue resolution.

3. Regularly update resolution progress in the register.
4. Once the issue is resolved, record the method and date of resolution.

A large number of issues may be raised during the life of the project, particularly if risk management has been ineffective. Some will need immediate resolution and others can await regular meetings.

The power of the issues register is its ready accessibility. Some tips on using an issues register are:

- Write up the issue as a question since this helps focus us on solutions.
- Have only one issue per entry since grouping several issues makes it more difficult to identify solutions.
- Do not add to existing issues, rather record as a new issue.
- Keep all issues visible and share them with the project team and, where appropriate, with other stakeholders.
- As a minimum an issues register should include issue description, issue finder, date raised, priority, person responsible, target resolution date, and current status.

Resolving issues usually follows this sequence:

1. Declare we have an issue. Don't hide the issue. Putting it in the register is not enough.
2. Clarify the precise issue. Exactly what happened or didn't happen. Distinguish between facts and rumours.
3. Decide what the resolution of the issue would achieve. What would resolution make possible? Need it be resolved? Should it be rejected, deferred, escalated, resolved or further investigated?
4. What actions might be taken to resolve the issue. Also, think laterally. What's the true cause?
5. Decide appropriate action and assign responsibility for this. Record progress.

Rescue the problem project

Risk management may not prevent a project going off the rails to the point where we need to check the wisdom of proceeding further. When faced with a disaster us project managers may become recovery managers. Probably the biggest hurdle in rescuing a project is first recognising that there is a serious problem. Serious means that the project is red and the schedule, budget, and scope are all likely to be out of control. Without change, the project will continue to fail. A recovery plan needs to be developed and approved. A restarted project is best viewed as a new effort altogether. Recovering the motivation and the commitment of the team can be difficult. Although, somewhat outside the primary scope of this book, the audit, reappraisal, and repair process is shown at Figure 8.6. We rather hope with effective and proactive risk management that our project will never be so troubled.

Project cancellation and failure are not the same thing. To cancel a troubled project is usually a sign of strong management.

Summary

Risk monitoring and control is about keeping track of identified risks, residual risks, and new risks. We also monitor the execution of planned strategies in response to identified risks and evaluate their effectiveness. The main input to this step is the list of the major risks that have been identified for risk treatment action. The outcomes are revisions to the risk register and a list of new action items for risk treatment.

Risk monitoring and control continues for the life of the project. Our list of project risks changes as the project matures, new risks develop, or anticipated risks disappear. During the course of our project, either of the following can happen:

- A threat or opportunity occurs. This should then be noted in the risk register as closed and a corresponding entry made in the issues register.
- A threat or opportunity is passed. That is, the project proceeds and the risk event does not occur. This risk also needs to be recorded as closed.

Incidentally, control does not mean “staying on track” or trying to avoid “coming off the rails.” Instead we should be free to amend the project plan to avoid or reduce threats, exploit or maximise opportunities, and so achieve our project goal.

Typically during project execution there would be regularly held risk meetings during which all or part of the risk register is reviewed for the effectiveness of risk handling and new risks are discussed and assigned owners. Periodic project risk reviews repeat the process of identification, analysis, and response planning. We project managers ensure that risk is an agenda item at all project meetings. Risk ratings and their priorities may change during the project life cycle.

If an unanticipated risk emerges, or a risk’s impact is greater than expected, the planned response may not be adequate. Risk control involves:

- choosing alternative response strategies
- implementing contingency plans
- taking corrective actions
- re-planning the project as need be.

A risk’s severity (product of impact and probability) may change as our project proceeds and as risk proximity becomes imminent. Such trends need to be identified and monitored.

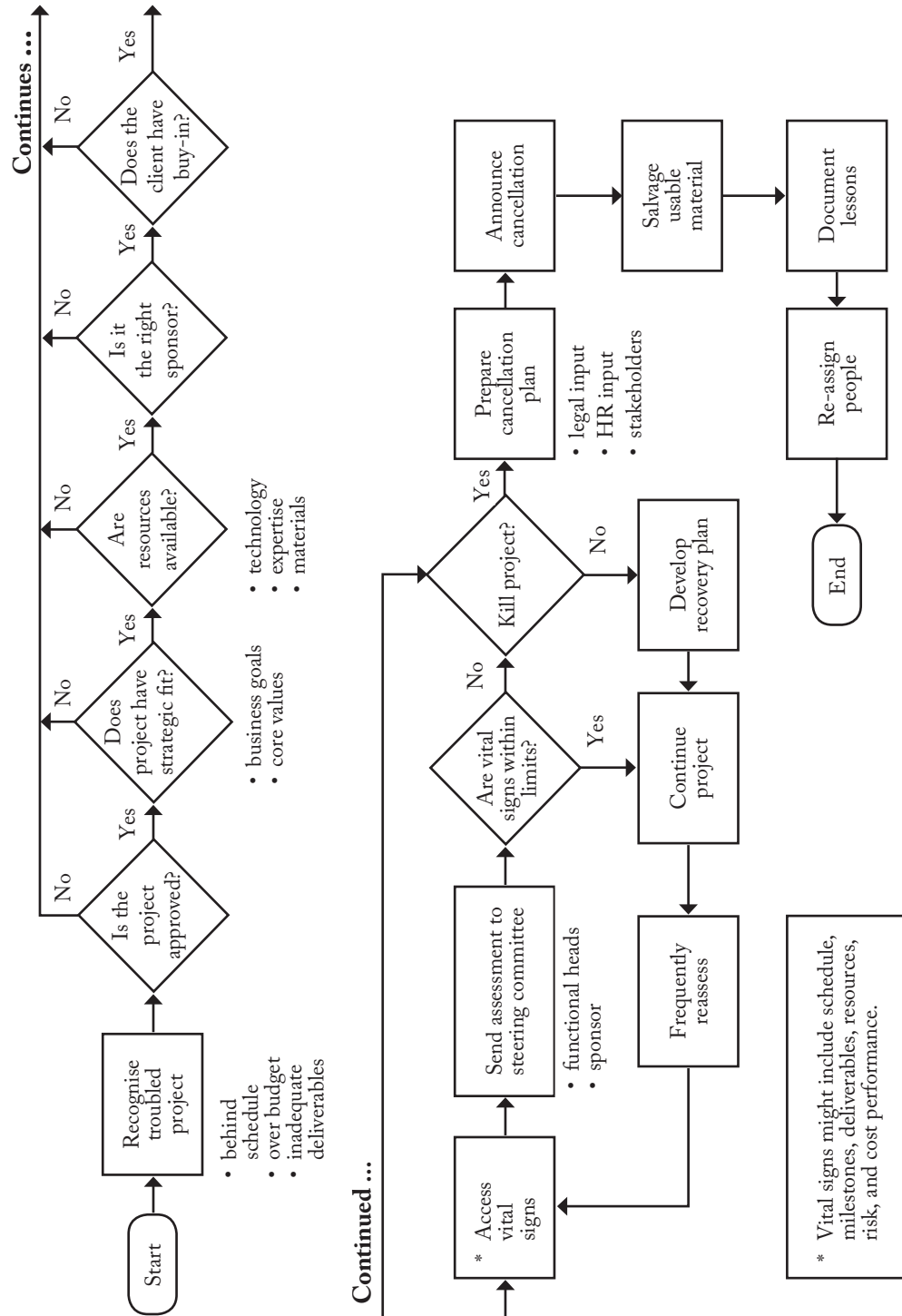
Continuous monitoring and review of risks ensures new risks are detected and managed, and that action plans are implemented and progressed effectively. Review processes are often implemented as part of the regular management meeting cycle, supplemented by risk reviews at significant milestones.

As we continue through our project the risk profile will change. Typically as we successfully respond to risks and our project knowledge increases our risk exposure will diminish. In effect we can retire risk reserves as risk events are successfully avoided or mitigated or we have passed the time during which the risk is active and it becomes retired.

Risk closure is appropriate when:

- A risk is raised and no further analysis is warranted.
- A risk is realised and risk response actions are successfully completed.
- The time or circumstances under which a risk can occur expires.
- The project is cancelled or completed.

Figure 8.6 – Rescue or kill process



The main input to risk monitoring and control is a list of major risks that have been identified for risk treatment action. The outcomes are in the form of revisions to the risk register, and a list of new action items for risk treatment.

The final step in the risk management process is to review and revise the effectiveness of the process to ensure its continuous improvement.

Reviewing and Revising

We should take advantage of our experience to benefit our own and others' future projects. This requires we spend time thinking about what worked well and what needs improvement. However, one of the most under-reported areas of project failure is risk management.

Often when the project ends, team members need to quickly move on to other projects. Going back to rehash the good and bad in a post-mortem session seems unproductive. Even our senior management respect for the practice can be a challenge.

Learning from experience is an important tool in project environments that are constantly changing. In order to successfully learn from experience, we need to take a regular and consistent approach that can be incorporated into any project management methodology. Here are a few ideas to help any project team learn from experience:

- **Establish a venue for sharing lessons learned.** It doesn't matter whether we call it a post-mortem, a project review or a project retrospective, most organisations don't do them – but they should. It's unfortunate that many project teams move from one project to another without even taking a breath, let alone taking the opportunity to capture lessons learned from the last project.

- **Share what has been learned.** Although many organisations don't take the time to do any kind of project risk management retrospective, very few of those that do share what they've learned. If lessons learned are captured and then filed somewhere, the exercise doesn't do any good. Not only our own team, but other teams within the organisation can benefit from a culture that freely shares lessons learned during and upon the completion of a project.
- **Learning doesn't work as a "corporate" initiative.** It's natural for organisations to try to formalise the learning process into a forced and somewhat contrived corporate project. Although a natural learning environment should be encouraged, "corporate" is all too often the same as "bureaucratic", which employees are more likely to avoid.
- **Don't make learning a one-time activity.** Project risk management learning should be ongoing and interactive. Don't let it become an isolated activity that happens rarely or just once on project completion.

It is very difficult to measure the effectiveness of risk management. Its probabilistic (ie, multiple possible outcomes) nature means we can never be sure the action we took did actually stop the risk occurring since it may not have occurred anyway. However, one way to measure the effectiveness of risk management is to check:

- number of identified risks that were not in the original risk evaluation
- number of workarounds needed
- number of issues that occurred.

Strictly speaking there is no risk in the past, since it has already occurred (although we may remain uncertain about what actually happened and what it means). But someone once said, "Those who cannot remember the past are condemned to repeat it." So we should review our project periodically in order to learn for the future. For risk management this means addressing the following questions:

- What types of risks were identified on my project? Are there any generic risks that might affect similar projects?
- Was the risk management plan implemented as planned and were risk management objectives achieved?
- Was our client satisfied with how risks were managed?

- Project and risk assumptions were all valid?
- Risk was always on our team meeting agendas?
- Were unidentified risks discovered?
- Were contingencies associated with given risks sufficient?
- Were risks properly recorded in the risk register and kept updated?
- How many risks were rated low initially but became issues later?
- Were risk management lessons learned, captured and distributed to the project team?
- Which identified risks actually occurred, and why? This includes problems that could have been foreseen as threats and missed opportunities that could have been captured.
- What preventative actions could have been taken to minimise or avoid threats and what proactive actions could have been taken to maximise or exploit opportunities?
- Which identified risks did not occur, and why not? Which responses were effective in managing risks, and which were ineffective?
- How much effort was spent on the risk process, both to execute the process, and to implement responses?
- Where contingency sums realistic?
- What specific benefits can be attributed to the risk process, such as reduced project duration or cost, increased business benefits or client satisfaction etc?
- Have we captured all relevant data? Such data might include the number of risks identified, number of significant risks as determined by quantitative analysis, dollar value of significant risks, cost of planned response actions, actual cost of response actions, and the estimated value of costs and delays avoided through risk management?

The results from this type of lessons-learned evaluation can be used to update risk identification tools such as checklists, to incorporate preventative risk response strategies into future projects, and to improve the overall effectiveness of our organisation's risk management methodology.

Usually, we acquire this learning by conducting a project retrospective review. The process is much like the risk identification step. We assemble a diverse group,

with a facilitator, and use a prompt list to elicit observations on what was or was not especially effective or time-consuming. We are usually looking for three types of situations:

- Items that could be added to or removed from our risk management process to make it work better.
- Modifications we could make to parts of our risk management process to render it more effective.
- Changes that we could make in how we develop project deliverables, such that we avoid certain risks that were experienced. There may be a need to improve standard project management forms and processes including those used for estimating, scheduling, procurement and contracts.

While we cannot run a project twice, and we have no control for proving risk management effectiveness, we can learn from experience over time. Organisations which have been tracking project performance over the years can demonstrate that as risk management maturity increases, so does project success. What gets measured gets improved. And nothing beats demonstrating success to get the attention of our management!

It is important to think of our project risk management methodology as an evolving one. To help ensure success we must keep track of what is working and what is not quite right yet, and make adjustments accordingly. Continual improvement is about reviewing our practices against a recognised maturity model.

In the absence of global standards, how can we assess our project risk management proficiency? How can an organisation tell whether its management of risk is good enough? Risk management is too important for us to do it poorly. We need to assess and monitor our risk management capability, compare ourselves with best practice, identify areas of shortcoming that require improvement and keep developing. Maturity models are useful as a reference that enables our organisation to benchmark its current risk management capability and understand how and where improvements should be made. With the aid of a maturity model, our organisations can set realistic goals for risk management improvement.

The Hillson's risk management maturity model provides a straightforward and useful insight on what constitutes best practice and at what level of maturity our organisation's project risk management has reached. The Hillson model has four

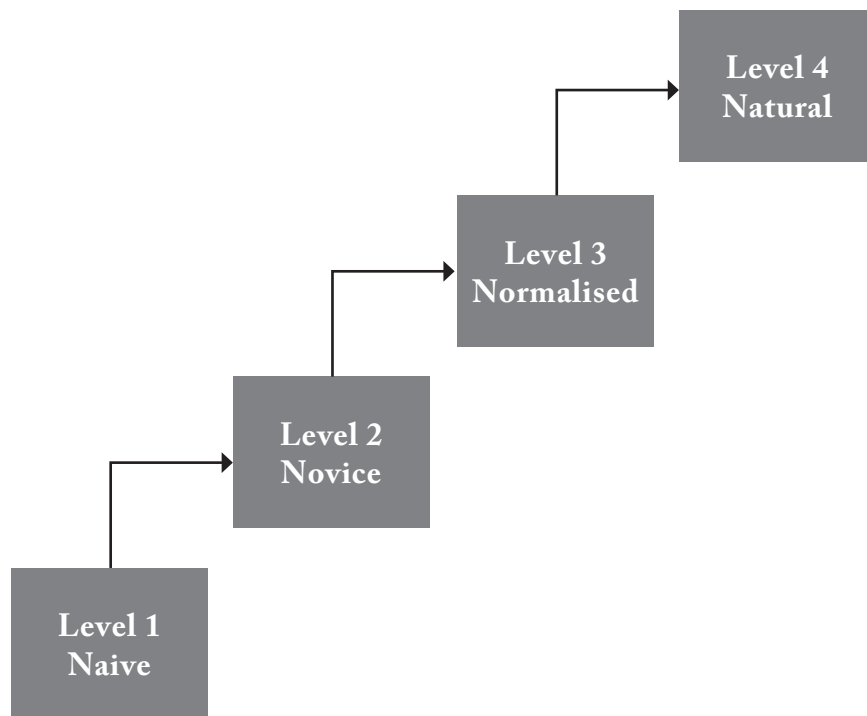
levels, whereas some models have five or six levels of competency or maturity. See Figure 9.1.

The four levels of risk management maturity in the Hillson model are described as follows:

1. **Naïve.** At this most basic or initial level, our organisation is pretty much unaware of the need for project risk management and we are probably suffering from an excess of failed projects. We don't talk about project risk, crisis management predominates, and firefighters proliferate. Risk management is reactive, with little or no attempt to learn from the past or to prepare for future threats or opportunities. The culture is resistant to change and the need for risk management is not recognised. Delivery is despite the organisation rather than because of it.
2. **Novice.** There is growing awareness of the need for project risk management and some individuals within our organisation are applying some project risk management practices, but in an ad hoc and mostly reactive manner. We have no consistent approach to project risk management. We rely on the competence of individuals and reactive crisis management. Identification of risks is sporadic and inconsistent. Risk meetings are infrequent, unstructured, poorly attended and unproductive. The organisation tends to see risk management as an overhead and is not fully convinced of its benefits.
3. **Normalised.** Our organisation's project risk management methodology is now defined and documented, and its application actively supported by senior management. A common language and some useful tools and techniques are in place. Anyone can deliver, not just heroes. Managing risk is a routine and integral part of project management. Most project people are formally trained in the discipline. Risk management is properly implemented on practically all of our projects and applied uniformly across our organisation. Application is routine and consistent.
4. **Natural.** At this top level of maturity, our organisation has a well-imbedded risk-aware culture with a predominantly proactive approach to successfully managing both threats and opportunities in all our projects. Our organisation is conscientiously learning from our own and others (benchmarking) project risk management experiences, we maintain a comprehensive central database

of risk information that is readily shared, regularly audit the effectiveness of our project risk management methodology and continually improve this to meet changing circumstances. Risk information is actively used to improve business processes and gain competitive advantage. An integrated multi-level risk process is used to manage opportunities and threats. We emphasise sensible risk-taking and exploiting of risk. Risk management training is organisation-wide. Application is widespread and second-nature. It is also about delivering benefits.

Figure 9.1 – Hillson project risk management maturity model



At present, most New Zealand organisations are at levels one or two, some are at level three, and very few are at level four. Once the risk maturity level within our organisation has been determined, steps can be undertaken to develop action plans to achieve the next level in the model. One essential is to practise what we preach. We can't hope to get buy-in to a new risk management process if its implementation goes overdue, over budget or fails to meet objectives. Some key

benefits of using such a model are:

- Provides a roadmap for improvement and a vehicle for benchmarking project risk management performance.
- Provides a staged basis for assessing the benefits of project risk management before committing resources to implement the next level of maturity.

The objective is to make risk management a core value, the essentials for which are communicate, lead, reinforce and integrate.

By having established a maturity model we also have a basis to measure organisational and individual performance of risk management. Yet it is unusual for risk management to be included as an individual performance measure. It is therefore not surprising that many people treat risk management as non-essential and something to do only when we have time for it.

Implementing any new process, such as risk management, is all about change. Accept that there will be some resistance simply because some people don't like change. The denial, resistance, exploration and commitment change model can help us understand the process that people go through. Sometimes the people who are most resistant to our proposals will be our strongest supporters when the benefits from risk management become evident.

Although it is hard to measure the return on investment for project risk management, it is certain that no benefits will be realised unless our organisation is prepared to pay these costs. Not paying this cost to implement effective risk management exposes our organisation to another cost – unmanaged risk. This cost includes threats which become problems and missed opportunities that could have delivered extra benefits.

I reiterate that it is not usually up to the project manager to justify a project from a business perspective. Normally the sponsor and the business client do that. If our organisation wants to determine business value, the project manager confirms that the deliverable was properly completed. The sponsor and the business client must then determine whether business benefits were achieved.

The final chapter is a comprehensive summary that is useful revision should you wish to tackle the quizzes at Appendix One.

Summary

“Expect the best, plan for the worst, and prepare to be surprised”

Dwight Eisenhower

It’s long been part of our New Zealand psyche that accidents just happen, which is possibly why we are so indulgent of them. This fatalistic or optimistic attitude is summed up in our national motto, “She’ll be right.” Our risk-taking is a cultural and historical phenomenon. In fact, we have at present an accident compensation scheme that compensates us for our injuries, regardless of how risky, reckless or stupid we are.

Risk can only be defined in relation to an objective. Project risk is an uncertainty that can have a negative or positive effect on meeting project objectives. Negative risks or threats make it more difficult to achieve these objectives, and positive risks or opportunities help us achieve or exceed these objectives. Projects, by virtue of their unique nature, always involve risk. Risks are not problems today, but they have the potential to become problems.

Many individuals and organisations do a poor job of project risk management, if they do any at all. Successful organisations recognise the value of good project risk management. They realise that it is an investment and that there are costs associated with identifying risks, analysing risks, and establishing plans to address those risks. Those costs must be included in the project budget.

The benefits of effective project risk management are of both the hard and soft variety:

- Enables better informed and more believable plans, schedules and budgets.

- Increases the likelihood of a project adhering to its schedule and budget.
- Leads to the use of most appropriate types of contracts.
- Enables a more meaningful assessment of contingencies.
- Discourages the acceptance of overly risky projects.
- Leads to a common understanding and improved communications on risk.
- Develops the ability of project team members to assess risk.
- Greater likelihood of future business.
- Better reputation as a result of fewer project failures.
- A less stressful project team work environment.

Risk utility is the amount of satisfaction or pleasure received from a potential payoff. Risk seekers enjoy high risks, risk-averse people do not like to take risks, and risk-neutral people or organisations seek to balance risk with potential payoff.

Project risk management is a process in which the project team continually identifies what may negatively or positively impact the project, determines the probability of such events occurring, and estimates the impact should such events occur. Risk has three dimensions:

- positive or negative
- degree of probability
- magnitude of the impact.

The process also involves analysing and determining alternate strategies to deal with risks. The main steps involved in risk management are risk management planning, risk identification, qualitative risk analysis, quantitative risk analysis, risk response planning and implementation, risk monitoring and control, and risk management review and revision.

All too often project risk management is seen as a standalone box-ticking exercise and a cost to the business rather than a value-adding process embedded in corporate culture. Other common risk management mistakes or misunderstandings are:

- Doing risk management at the wrong time.
- Ignoring opportunities.
- Not identifying enough risks.

- Not properly naming and describing risks.
- Missing entire categories of relevant risk.
- Using only one identification method.
- Spending too much time identifying and too little time responding to risk.
- Not clearly defining risk thresholds.
- Not putting a contingency plan in place before the risk occurs.
- Forgetting about risk once the project is implemented.
- Not mentioning risk at meetings or in reports.
- Neglecting risk control activities.
- Not holding risk reviews or reassessments.
- Finalising contracts without regard to risk management.
- Not pushing back against unrealistic objectives and stakeholder expectations that harbour risk.

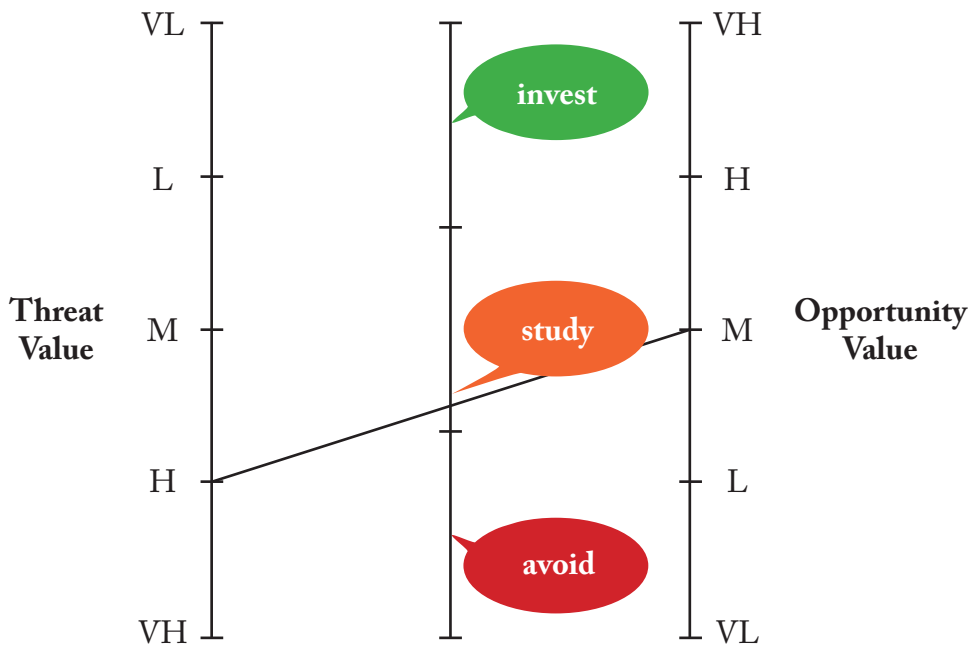
Risk management planning is the process of deciding how to approach and plan for risk management activities for a particular project. A risk management plan is the key input for the other risk management processes. Contingency plans are predefined actions that a project team will take if an identified risk event occurs. Fallback plans are developed for risks that have a high impact on project objectives, and are implemented if attempts to reduce the risk are not effective. Contingency reserves or allowances are provisions held by the project sponsor or organisation to reduce the risk of cost or schedule overruns to an acceptable level.

Information technology projects in particular might involve several risks such as lack of user involvement, lack of executive management support, unclear requirements, poor planning and so on. Commercially available published lists can help us identify potential risks on information technology projects. A risk breakdown structure is a useful tool that can help project managers consider potential risks in different categories. Lists of common risk conditions in project management knowledge areas can also be helpful in identifying risks, as can information-gathering techniques such as brainstorming, the Delphi technique, interviewing and SWOT analysis. A risk register is the document that contains the results of various risk management processes, usually displayed in a table or spreadsheet format. It is a tool for documenting potential risk events that may occur to the detriment or enhancement of our project.

Risk analysis is usually done by allocating names, numbers or ratings to describe risk impact and probability. Impact is described quantitatively, in terms of financial loss if the risk occurs, or qualitatively by using high/medium/low (HML) type scales. Probability is normally expressed as a percentage likelihood that the risk will occur (if no action is taken) but may also be allocated an HML type scale.

Perhaps the most significant recent change in project risk management is the concept that risk is neutral and in any project proposition we need to consider both threats and opportunities. See Figure 10.1, where VL is Very Low etc.

Figure 10.1 – Risk decision scale



Risk can be assessed qualitatively and quantitatively. Tools for qualitative risk analysis include and basic probability-impact matrix and the Top Ten risk items tracking technique. Tools for quantitative risk analysis include decision trees and Monte Carlo simulation. Expected monetary value (EMV) uses decision trees to

evaluate potential projects based on their expected value. Simulations are a more sophisticated method for creating estimates to help us determine the likelihood of meeting specific project schedule or cost goals. Sensitivity analysis is used to show the effects of changing one or more variables.

The four basic responses for threats are avoidance, acceptance, transference, and mitigation. Risk avoidance involves eliminating a specific threat or risk. Risk acceptance means accepting the consequences of a risk, should it occur. Risk transference is shifting the consequence of a risk and responsibility for its management to a third party. Risk mitigation is about reducing the impact of a risk event and/or reducing the probability of its occurrence. The four basic response strategies for positive risks or opportunities are risk exploitation, risk sharing, risk enhancement, and risk acceptance. Typically, there are more threats than opportunities in any project in part due to optimistic estimates of project costs and completion dates.

Risk monitoring and control involves executing the risk management plan in response to risks. Outputs of this process include requested changes, recommended corrective and preventive actions, updates to the risk register and project management plan, and ultimately improvements to the organisation's risk management methodology.

Several types of software can assist in project risk management. Monte Carlo – based simulation software is a useful tool for helping get a better idea of project risks and top sources of risk and risk drivers. Current software typically applies ISO31000, which is a recently approved global standard that sets out principles, a framework and a process for the management of risk that is widely applicable. This standard does not mandate a one-size-fits-all approach, but rather emphasises that to be effective the management of risk must be tailored to the specific needs, culture and structure of our particular organisation.

There are three main elements to the successful implementation of a project risk management methodology:

- The risk culture of the organisation.
- The risk management principles, policy framework and process documentation.
- The risk recording and sharing system.

Of these three points, establishing and driving the necessary cultural change is often the most neglected part of risk management. Many organisations see it as a side issue, when in truth it needs to be centre stage. Without the right risk culture, the policy, process and performance of risk management will run into difficulties.

Here are some further points that are worth reiterating:

- All risks have causes. For example, a project may take longer to complete than we estimated. This risk may for example be caused by delayed resource consent. All risks have uncertainty associated with them – they may or not occur – and all risks have an impact associated with them. Such impacts can decide project success.
- Risks are justified by the benefits that come as a result of taking them. And unless benefits exceed the risk, it's unlikely a project would be undertaken.
- The key purpose of project risk management is to increase the probability and impact of positive risks (opportunities), while decreasing the probability and impact of negative risks.
- Project stakeholders may be risk averse, risk neutral, or risk seeking.
- Risk categories might include external (predictable and non-predictable), internal predictable (nontechnical and technical) and legal.
- The key processes are:
 - ♦ Risk management planning, which is where it starts
 - ♦ Risk identification
 - ♦ Qualitative risk analysis
 - ♦ Quantitative risk analysis
 - ♦ Risk response planning and implementation
 - ♦ Risk monitoring and control
 - ♦ Review and revise (an extra step included by the author, recognising the need for continual improvement).
- Faster, cheaper and better is sure to exacerbate risk, but zero risk is unachievable and undesirable.
- Risks can have a positive or negative effect. They can produce loss or gain for the project. The PMBOK® defines a risk event as “a discrete occurrence that may affect the project for better or worse.”

- Another definition is that risks are uncertainties that, if they occur, would affect the achievement of project objectives either negatively (threats) or positively (opportunities).
- While risk is uncertainty that matters, remember different things matter to different stakeholders. A threat to one stakeholder may be an opportunity to another stakeholder.
- Risk identification (or risk assessment) begins during the project initiation (conception) phase and continues throughout the life of the project.
- If we don't identify and respond to risks at the beginning of our project, we will probably face them as issues later.
- There are a variety of types of risk often grouped according to their origins. Two common groupings are:
 - ◆ Business risks, which are threats that affect the organisation as a whole in some way that may impact the project success and the exposure of the organisation if the project fails. They particularly concern the project sponsor.
 - ◆ Project risks, which are inherent in the project that may directly impact project success, particularly concern the project manager.
- One problem with risks is that they can interact to create greater risk and other risks.
- When groups make decisions, they may well take more risk than the individuals themselves would – this is groupthink. Groupthink tends to occur when a group strives to reach consensus despite the fundamental concerns of the individuals.
- Despite a variety of terms, these are options to handle an identified threat:
 - ◆ Prevent (avoid, terminate, eliminate) or exploit.
 - ◆ Mitigate (reduce, control, counter, minimise, abate, treat) or enhance.
 - ◆ Transfer (shift, spread, allocate, deflect, insurance, contract out) or share.
 - ◆ Accept (retain, tolerate, assume) either passively or actively. To accept actively means we have a contingency plan. Acceptance can be passive (if it happens, it happens) or active (create a contingency plan). The accept response is for both threats and opportunities.

- The severity with which a risk event affects a project is determined mainly by its impact (significance, magnitude, consequence) and probability (likelihood), which is the usual basis for scoring, prioritising or ranking risks.
- Qualitative risk analysis uses adjectives and quantitative risk analysis uses mathematical models to further refine risk prioritisation and provide contingency time and cost reserves.
- Quantitative techniques include expected monetary value, Monte Carlo analysis, probability distribution, expert judgement and decision trees.
- Qualitative analysis is fast and easy, although not uniform in its application, whereas quantitative analysis is more accurate, but more time consuming.
- Risk triggers indicate that a risk is about to occur or has occurred. These can be tracked in the risk register.
- Companies and individuals have risk tolerance. We might tend to be gamblers (risk-takers) and are willing to take chances to achieve rewards, or we might tend to be conservative (risk-avoiders, risk-averse) and less willing to take chances. Most of us are risk-neutral. We take a balanced approach.
- Every estimate, forecast and project is based on assumptions (premises). Risks lurk in each assumption. Thus, we don't make assumptions when the facts are available, we ensure that assumptions are reasonable (low-risk), and we periodically confirm their validity.
- Insurance companies generally understand and practise risk management better than most project managers because they realise that it's their primary business. Not many project managers realise that it is also their primary business, but those who do have an edge. Mind you, AMI isn't looking too flash as a consequence of the Christchurch disaster. AMI reinsurance seems to be insufficient and the company may need a government bailout. Perhaps AMI gambled that a second earthquake of Christchurch's consequence was a distant likelihood. Of course other insurance companies see this as an opportunity. All premium will rise.
- The project management framework or methodology, and the purpose of all project management activities, tools and techniques can be seen as managing risk, since each in its own way tries to enhance the chances of success. Risk management is a more specific process we consciously apply to identify and manage project risks.

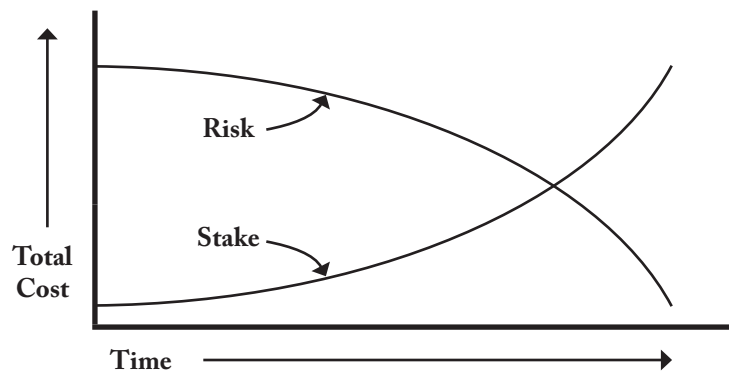
- We can't hope to identify all risks in a project. Also, it would be too expensive to do so. We would spend more than the risks would cost if they did happen. We are usually satisfied to find an acceptable level of risks (a practical number), which is a function of our risk tolerance.
- Remember that the project objectives or parameters (scope, cost, time and quality) are related to risk. For example, a strategy to change a parameter may increase or reduce project risk. When the sponsor has the project manager adopt a more aggressive schedule, that executive is asking the project manager to add risk. Thus, we usually classify risks as:
 - ♦ scope risks
 - ♦ budget risks
 - ♦ schedule risks
 - ♦ performance or quality risks.
- Another way to divide risks is between business risks and insurance (or pure) risks:
 - ♦ Business risk has the opportunity for gain as well as loss.
 - ♦ Insurance risk only has the likelihood for loss, and one obvious strategy for managing such pure risk is to buy insurance.
- Murphy's Law notwithstanding, we might expect random risk events to distribute themselves more or less evenly between good luck (opportunities) and bad luck (threats), but this is not what experience suggests. There is usually much more that will go wrong than will go better than expected.
- When issues cause project failure, instead of "fixing the blame" we do better to "fix the process" by which risks are managed. It's inevitable that some projects will be successful and others will not be.
- Projects are particularly susceptible to risk because each project is unique in some measure. The uniqueness can vary dramatically. Uniqueness means that the past is an imperfect guide to the future.
- The more significant the business or project risks, the higher should be the level of project governance.
- Sometimes distinction is made between theoretical risk, which is possible risk, and practical risk, which is probable risk.

- The opposite of risk management is crisis management whereby we react to events as they occur without any forethought regarding their probability of occurring or their impact. Effective risk management is primarily a proactive possess. It keeps us in control and prepared.
- Risks aren't problems. They are potential problems. Problems is present tense. Thus, a problem isn't a risk – it's an issue, some of which are crises. A threat or opportunity will become an issue if the risk event occurs.
- Communicating risk status is as important to the health of the project as is communicating schedule and cost status.
- Risk is concerned with variability. Thus standard deviation (a measure of dispersion or variability) can also be seen as a measure of risk. The larger the standard deviation of an estimate (of quantity, cost, time etc.), the greater its uncertainty.
- When information is lacking, as at the start of the project lifecycle, uncertainty is high, which leads to greater risk. Planning, which involves the identification and collection of relevant information, reduces uncertainty (which is the reciprocal of risk) and thus enhances the likelihood of success. With total certainty there is no risk, since there is no variability in results.
- A major feature of external or environmental risks is that they are largely uncontrollable. At best, we strive to identify them so that we can be prepared to deal with them. We still need to keep an eye open for them and consider their probability and impact on our project and what we might do should they occur.
- In general, there is a positive correlation between level of risk and projected time horizon. Longer-term projects have greater uncertainty given the exponential nature of change. In our own lives we can reasonably predict what's likely to happen tomorrow, but we are much less certain about what's likely to happen in 24 months' time. The same is true of projects.
- Uncertainty and risk decrease as the project progresses towards completion. However, due to resource commitments, project stake increases. The size of the stake is called risk-exposure. This interplay is shown graphically at Figure 10.2.

- Prioritising too highly the risk management process could potentially keep an organisation from ever completing a project or even getting started. And spending too much time analysing and managing unlikely risks can divert resources that could be used more profitably. Some methodologies suggest that:
 - ♦ 1-3% of the project budget should typically be spent on risk management prior to project execution.
 - ♦ 2-4% of the project budget should typically be spent on risk management following project implementation.

However, in practice, the percentage will mostly be influenced by the project's inherent riskiness and our organisation's tolerance for risk.

Figure 10.2 – Project risk and stake



Finally, some key points to remember are:

- Project risk management exists to help us manage the inbuilt uncertainty in projects and thus maximise the chances of project success.
- Risks are present in all projects – no exceptions.
- Risk management is a shared responsibility of all project team members.
- Risk management is a best practice for reducing the surprise factor.
- The key risk management principle is “prevention is better than cure.”

- Pure risk, has no opportunities, but can be deflected or transferred to another party through a contract or insurance policy.
- Business risk can result in profit and should be maximised.
- The risk management plan is an essential part of the project plan.
- The risk management plan is our framework for managing risk.
- The purpose of risk identification is to identify all risks that may impact the project, document them, and identify their characteristics.
- Qualitative risk analysis ranks risks through a subjective analysis of their impact and probability of occurrence.
- The ultimate aim is to manage risk, not simply to analyse it.
- Quantitative risk analysis evaluates the impacts of risk prioritised during the qualitative process and quantifies risk exposure by assigning numerical probabilities to each risk and its impact on project objectives.
- Risk management is an iterative process that continues for the entire duration of the project.
- We cannot identify and mitigate all risks in our project, so we focus on the top ten, which is sometimes called top-down risk management. And once our WBS is created, we then identify risks from a bottom-up perspective.
- We should reward project managers and others who communicate openly about project risk, and who recommend killing off projects whose risks are not commensurate with likely returns.
- Issues are problems that have already occurred. Risks are potential problems that have a potential to occur, but may not occur. Issue management is important, but is effectively fire-fighting. Issue management is minimised by effective risk management. Generally, the fewer the issues the more effective has been risk management.
- Not capturing lessons denies us the chance to learn and improve.
- Project risk management learning is a continuous process and not a one-time effort at project completion. Lessons need to be shared, not filed and forgotten.

Effective risk management commences at the initiation of our project, a risk management plan is developed and risk management continues throughout the project life cycle. Risk management is not a discrete stand-alone process, but is

integrated with other project management activities. Also, the implementation of project risk management is the responsibility of all project stakeholders and they must participate actively in the process.

While some projects have been put on hold until economic circumstances improve, such projects don't need to be totally dormant. We might take this opportunity, while things are slower, to make projects "spade ready" so that when funding becomes available there is no ramp-up time. The faster we can hit the ground running the more likely our project will be approved. In particular, the Christchurch rebuild provides us with an amazing chance at renewal. Christchurch resident Raf Manji says, "Such a chance doesn't come often, as cities are usually like walls, constantly plastered or painted over." Once the rebuild gathers pace, the job market will boom. Here in Wellington we can expect a flurry of earthquake strengthening projects and skyrocketing insurance premiums. Will we allow staff to work in earthquake-prone buildings? In fact, such buildings are likely to be a much larger problem than the leaky home saga, both physically and financially.

Standby for a nationwide earthquake-proofing tsunami. We are becoming deleteriously risk averse. I guess we need to keep in mind the cost of not reinforcing our buildings. And there seems to have been more anxiety about buildings than there has been about the plight of people - the dead, injured and red-zone refugees.

Yet the number of deaths is not the only measure. Earthquakes incur many other costs. They inflict many injuries and destroy numerous buildings, including precious homes and cultural treasures. Christchurch CBD is shutdown for a couple of years and there is a loss of tourism and industry. In addition, vast Government funds (doubtlessly at least twice the current \$10 billion estimate) will be diverted to getting the city back to normal, rather than advancing health, education or enterprise.

Finally, the good news is that project risk awareness is improving and most organisations are becoming more conscientious about its management for the betterment of their projects. This book aims to help.

Exercises and Quizzes

This appendix contains two team exercises that require participants to identify risks and determine suitable responses to them. The appendix also contains three risk management quizzes of various durations, which may be undertaken individually or in small groups, with this reference book either open or closed.

Relocation project – exercise one

Purpose. To practise the application of the risk management process.

Scenario. Your team is responsible for planning the opening of a new branch office in Wellington, which is one project in an organisation expansion programme. You have prepared the attached project schedule of tasks and decide to evaluate it from a risk perspective before finalising the project plan. Your CEO is very keen that the new office opens as soon as practicable with minimum disruption to business-as-usual. On-time completion of this project is important to ensure the programme is not delayed and expenses are thus contained.

Tasks. Your two tasks are:

1. To prepare an outline risk management plan for this project.
2. To identify ten project risks by brainstorming. Draw up a basic risk register template on the whiteboard or flipchart paper and fill out the columns for the selected risks. You may not have time to analyse all ten risks, but in this instance better to do a thorough job of those that you do analyse, and be prepared to briefly explain your analysis and proposed responses.

Approach

It should be practicable for some concurrent activity using two sub-groups. One sub-group could make a start on the outline risk management plan, and another sub-group could develop the network diagram to help enable the identification of risks.

Check that you are content task dependencies, which if wrong can possess risk. Given that this is primarily a time-driven project, check particularly critical tasks and near-critical tasks (ie, those with minimum float that may become critical during project implementation).

You have very limited information, so some reasonable assumptions will be needed. Mention these when you give your solution. You have 40 minutes to deliberate and 10 minutes to present your solution to the other team, who represent your programme manager and sponsor who will comment on the risks you identify and the acceptability of your proposed responses.

ID	Task	Immediate Predecessors	Duration (days)
1	Decide to open office (milestone)	Nil	0
2	Select and hire a commercial property broker	1	5
3	Find suitable office and arrange lease	2	10
4	Design interior changes	3	5
5	Undertake interior changes	4	15
6	Inspect and approve interior changes.	8	2

ID	Task	Immediate Predecessors	Duration (days)
7	Select and purchase computer and phone systems	4	10
8	Arrange hook up of utilities	5	1
9	Install phone system	7	2
10	Select and order office furniture	4	5
11	Office furniture delivered and installed	10	2
12	Select and order office equipment and supplies	4	5
13	Office equipment delivered and set up	12	2
14	Order and manufacture signs for new office	11, 13	15
15	Install signs	14	2
16	Order stationery and announcements	9	1
17	Deliver stationery and announcements	16	10
18	Send announcements to client base	17	5
19	Get business permits	3	10
20	Open new bank accounts	3	2

Project risk management plan – template

ITEM	DESCRIPTION
Version/Distribution and Amendment History	This plan is version one with today's date. Thus far there is no amendment history.
Project Description	Briefly describe the project purpose and goal.
Project Stakeholders	List principal stakeholders – individuals and/or groups who might affect the project or be affected by it.
Objective Priorities	The order of importance given scope, time, cost and quality.
Variance Thresholds	Specify the tolerance assigned time and cost objectives as plus/minus percentages.
Project Risk Management Methodology	Risk management process, principles and terminology. Might refer to an SOP.
Risk List or Risk Breakdown Structure	An initial list of ten higher priority risks that the project may encounter.
Risk Management Organisation	Responsibilities for risk management and risk reporting arrangements.
Tools and Techniques	List the various tools and techniques to be used for: <ul style="list-style-type: none"> • risk identification • qualitative and quantitative analysis
Templates	Risk report and risk register formats.
Other Matters	Any other relevant matters not separately addressed above.
Approvals/Authorisations	Sign-offs from appropriate people, including the project sponsor and project manager.

Sky Tower construction project – exercise two

Your firm, Ogel Company Limited, has secured a contract to construct a self-supporting model tower with not more than 95 Lego bricks. There are more than 95 bricks in your box.

Your project goal is to build the model given the following objectives/constraints:

1. At maximum possible profit. A price of \$3,000 has already been agreed with the project client. Each brick used will cost you \$10.
2. As high as possible, but at least 20cm. The customer has offered you a bonus of \$100 for every centimetre of tower height over 200mm.
3. Within 60 minutes. Each minute from the start of the exercise until you take the bricks from the container will cost you \$20. Each minute from when you take out the bricks will cost you \$60. Minimum planning time is 20 minutes. There will be some minor changes at this 20 minute milestone – that's reality!
4. The finished tower must withstand at least 14 degrees tilt in all directions without collapsing. That's a 1 in 4 gradient.
5. Blue bricks, if used, may only be used at the base of the tower (ie, first two layers of bricks). Only bricks may be used in the product.
6. The project leader is responsible for achieving the goal. The leader is to employ team members as appropriate, but is not to touch the bricks.

The purpose of this exercise is to practise you working as a team to optimise the cost, time and quality objectives for a project and manage associated risk. You must meet the material, height, colour, time and stability constraints, yet make maximum profit (the success criterion).

Your expectation is to make at least \$2000 profit. To help ensure this profit you will need to identify and respond to risks before (prevention) and during project implementation. Some possible risks are contained in the basic risk register on the next page. You should add two more, analyse all 12 risks, and determine appropriate responses, before building commences.

Exercise risk register

Some top ten risks are already included in this basic register. However, you may identify a couple of others. **Complete the analysis and response columns before starting construction.** In this instance no need to add further risks to the register as the project proceeds.

Serial number	Risk description	Qualitative analysis			Measures to prevent risks or reduce them to a tolerable level before project implementation.
		Impact HML	Probability HML	Priority H/H etc	
1	Dysfunctional team – little synergy or cooperation				
2	Tower falls over at 14 degrees				
3	Excessive use of expensive bricks				
4	Over-engineered tower withstands excessive tilt				
5	Excessive duration with diminished financial return				
6	Blue bricks not confined to base (first two layers)				
7	Tower less than 20cms doesn't meet specifications				
8	Overused/cheap brick(s) don't stick together well				
9	Tower too short to earn significant bonus				
10	Project prematurely closed off without final check				
11					
12					

Risk management quizzes

Ten minute quiz

Circle a, b, c or d as appropriate:

1. _____ is an uncertainty that can have a negative or positive effect on meeting project objectives.
 - a. risk utility
 - b. risk tolerance
 - c. risk management
 - d. risk
2. A person who is risk _____ receives greater satisfaction when more payoff is at stake and is willing to pay a penalty to take risks.
 - a. averse
 - b. seeking
 - c. neutral
 - d. aware
3. Which basic risk management process involves prioritising risks based on their non-numerical probability and impact of occurrence?
 - a. risk management planning
 - b. risk identification
 - c. qualitative risk analysis
 - d. quantitative risk analysis
4. Your project involves using a new release of a software application, but if that release is not available, your team has _____ plans to use the current release.
 - a. contingency
 - b. fallback
 - c. reserve
 - d. mitigation

5. Which risk identification tool involves deriving a consensus among a panel of experts by using anonymous input regarding future events?
 - a. risk breakdown structure
 - b. brainstorming
 - c. interviewing
 - d. Delphi technique
6. A risk _____ is a document that contains results of various risk management processes, often displayed in a table or spreadsheet format.
 - a. management plan
 - b. register
 - c. breakdown structure
 - d. probability/impact matrix
7. _____ are indicators or symptoms of actual risk events, such as a cost overrun on early activities being a symptom of poor cost estimates.
 - a. probabilities
 - b. impacts
 - c. watch list items
 - d. triggers
8. Suppose there is a 30 percent chance that you will lose \$100,000 on a particular project. What is the project's estimated monetary value (EMV)?
 - a. - \$30,000
 - b. \$70,000
 - c. \$67,000
 - d. - \$67,000
9. _____ is a quantitative risk analysis tool that uses a model of a system to analyse the expected behaviour or performance of the system.
 - a. simulation
 - b. sensitivity analysis
 - c. Monte Carlo analysis
 - d. cause and effect diagram

10. Your project team has decided not to use an upcoming release of software because it might cause the schedule to slip. Which negative risk response strategy are you using?
- a. avoidance
 - b. acceptance
 - c. transference
 - d. mitigation

Ten minute quiz answers

- 1. d
- 2. b
- 3. c
- 4. a
- 5. d
- 6. b
- 7. d
- 8. b
- 9. a
- 10. a

Twenty minute quiz

These 25 questions have been based on PMI exams for which a 60 percent pass rate applies. In this instance it is a small group exercise. You have 20 minutes.

1. A project manager discovers that there is a part of the project that contains some risk. His strategy with this risk is to subcontract the work to an outside supplier by using a firm fixed-price contract. Which of the following must the project manager do?
 - a. The project manager should make certain that the project team does not reveal the risk to the supplier before the contract is signed.
 - b. The project manager should make every effort to make sure that the supplier is made aware of the risk after the contract is signed.
 - c. The project manager should make sure that the supplier understands the risk before the contract is signed.
 - d. The project manager should assign a member of the project team to monitor the activity of the supplier to make sure that the supplier deals with risk properly if it occurs.

2. A project manager is faced with making a decision about a risk that the team has identified. The risk involves the design of a bicycle. It has been found that the neck of the bicycle, where the steering bearing is located and the two supporting bars of the frame come together, will corrode in a high salt environment. If this takes place the neck may fail and injure the rider. The project team decides that the design of the bicycle should be modified by using corrosion resistant materials in the design of the neck. This will eliminate the risk from consideration. This technique is called:
 - a. Risk avoidance.
 - b. Risk acceptance.
 - c. Risk rejection.
 - d. Risk deflection.

3. A problem occurs in the design of a grocery cart. In this case it is determined that the wheels will wear out much quicker in areas of heavy snow and ice because the salt used to help melt the ice will corrode the wheel bearings. Using sealed bearing wheels will significantly increase cost, and it is determined that the carts themselves will be rusty and damaged at about the same time the wheel bearings begin to fail. By injecting the wheel bearings with a high temperature grease the life of the wheel bearing is increased considerably. The project manager recommends using the high temperature grease. This is called:
 - a. Risk acceptance.
 - b. Risk avoidance.
 - c. Risk mitigation.
 - d. Risk deflection.
4. A project manager is reviewing the risks to her project. One of the risks she is reviewing has an impact of \$25,000 and an associated probability of 10%. What is the expected value of this risk? The project budget is \$100,000.
 - a. \$100,000
 - b. \$10,000
 - c. \$25,000
 - d. \$2,500
5. A project manager wants to give some guidelines to the project team as to how risk events should be described. Which of the following items would not be appropriate in fully describing a risk event?
 - a. Probability that the risk will occur.
 - b. The cost of the risk should it occur.
 - c. Expected timing of the risk when it is expected to occur.
 - d. The client's outsourcing method.

6. A project manager and the project team are analysing risk in their project. One of the things that they might do to help identify potential threats and opportunities would be to review:
 - a. The project budget.
 - b. The goals and objectives of the project.
 - c. Lessons learned from other similar projects.
 - d. The monetary value of changes for similar projects.
7. The management reserve for the project contains:
 - a. Money to offset missing cost objectives.
 - b. Money to offset missing schedule objectives.
 - c. Money to offset missing cost or schedule objectives.
 - d. Money to handle the effects of known risks in the project.
8. A project manager uses the breakeven point to justify his project. He presents this as a justification for buying a new machine. What risk does the project manager run by using this technique to justify buying a new machine for his company?
 - a. Breakeven point will favour buying a cheap, low-quality machine.
 - b. Breakeven point will favour buying a machine that is too expensive for the work required.
 - c. The company may not have the funds to buy the machine in spite of the justification.
 - d. The machine may not be available because the justification method takes a long time to calculate.
9. In managing the risk of the project schedule we are managing the risk that the project will not be delivered or completed on time. If we assume that the project's possible completion dates are normally distributed and we promise the client the most likely of the project's possible completion dates, what is the probability that the project will be delivered late?
 - a. 5%
 - b. 10%
 - c. 50%
 - d. 77%

10. A risk event in a project is something that can have an effect on the project:
 - a. For the better only, a positive effect.
 - b. For the worse, a negative effect.
 - c. Both better or worse, a positive or negative effect.
 - d. Neither better nor worse, neither a positive nor a negative effect.
11. The project team has put together a project plan for a project, and the plan has been approved by the stakeholders. The customer asks the project manager if the project can be delivered seven weeks sooner. The customer offers sufficient monetary incentive for the project manager. The project manager decides to fast track the project. This decision will:
 - a. Increase risk.
 - b. Decrease risk.
 - c. Not affect risk.
 - d. Risk change cannot be determined.
12. A project team evaluates risk in the project. As an outcome there are some positive and negative risks that are identified and evaluated. To evaluate the worst case for the project the project team should evaluate and summarise:
 - a. All of the risks affecting the project.
 - b. Only the negative risks.
 - c. The negative risks minus the positive risks.
 - d. The positive risks plus the negative risks.
13. The Project Management Institute decided to hold its annual meeting in New Orleans, Louisiana. This conference represents a substantial amount of PMI's operating budget for the year. PMI identified a risk of hurricanes during the month of September, when the conference was to be held. PMI decided to purchase convention insurance to offset the loss of convention revenue if a hurricane caused cancellation of the conference. This is a risk management strategy called:
 - a. Avoidance.
 - b. Deflection.
 - c. Acceptance.
 - d. Mitigation.

14. During the project, in which part of the life cycle will risk be lowest?
- a. Initiation.
 - b. Planning.
 - c. Execution.
 - d. Closeout.
15. Three activities are done in sequence. Each activity takes five days to do. There is a 90% probability that each activity will be completed on time and a 10% probability that each activity will be finished late. What is the probability that the last of the three activities will be finished on time?
- a. .90
 - b. .73
 - c. .27
 - d. .81
16. A project manager is managing a project when a risk occurs. There is no plan to respond to this risk. The response to a negative risk event that has no plan is called:
- a. Repair order.
 - b. Workaround.
 - c. Risk mitigation.
 - d. Risk deflection.
17. A project manager is dealing with risk analysis on a software development project. There is a risk that the module that creates the most important report that the system will create will not work properly and will require 200 person-hours to correct. The project manager decides to do nothing about this risk. Which of the following risk strategies is the project manager employing?
- a. Acceptance.
 - b. Avoidance.
 - c. Mitigation.
 - d. Deflection.

18. The project manager of a large project meets several times with the client for the project. During the meeting the project manager judges that the client has a very low risk tolerance. This means that the client will probably:
 - a. Be willing to take large risks to make large profits.
 - b. Be unwilling to take large risks to make large profits.
 - c. Understand when risks happen on the project.
 - d. Not understand when risks happen on the project.
19. A project manager managing any project should perform risk analysis with his or her project team:
 - a. Just before any major meeting with the client.
 - b. On a regular basis throughout the project.
 - c. Only when justified by the awareness of new risks becoming a possibility.
 - d. When preparing the project plan.
20. A project manager working on a large project finds that there are several risks that have a severity that is higher than the acceptable risk tolerance. They cannot be avoided or deflected. The project manager will need to use which of the following approaches?
 - a. Change the risk tolerance of the client.
 - b. Buy insurance for the risk.
 - c. Ignore the risk.
 - d. Mitigate the risk.
21. The project manager of a project evaluates the risks of the project by assessing the probability of the risk by categorising the risks as likely or not likely and assesses their impact as high impact, medium impact, or low impact. This would be which type of risk assessment?
 - a. Quantitative.
 - b. Qualitative.
 - c. General.
 - d. Characteristic.

22. A project manager must make a decision about a risk in his project. He examines the extent to which the uncertainty of each of the elements of the project affects the objective being examined when all other uncertain elements are held at their baseline values. This technique is called which of the following?
- a. Decision tree analysis.
 - b. Expected value analysis.
 - c. Sensitivity analysis.
 - d. Simulation.
23. A project manager is doing risk analysis with the project team members. They are concerned about evaluating the risks in such a way that the risks will be ranked according to their severity in relation to the project. What method should be used to rank the risks in the order of importance?
- a. Determine the expected value.
 - b. Determine the cost of the impact.
 - c. Determine the probability.
 - d. Use subjective analysis.
24. Using the risk analysis grid at Figure 5.4, what risk score would be assigned a risk event of medium impact and medium probability?
- a. 3
 - b. 5
 - c. 7
 - d. 9
25. Due to risk a task duration is uncertain. Its optimistic duration is 20 days, its pessimistic duration is 40 days, and its most likely duration is 25 days. What is the best estimate of duration to the nearest whole number?
- a. 25
 - b. 40
 - c. 30
 - d. 27

Answers – 20 minute quiz

1. Answer: c

In a fixed-price contract the supplier is obligated to deliver the contracted-for item at a fixed price. The supplier is aware of the risk and will put an allowance for the risk in the contracted price. This often means that the project team will pay the supplier for the cost of the risk regardless of whether the risk occurs.

2. Answer: a

Risk avoidance is eliminating the risk from consideration by doing something that will eliminate it as a possibility. Risk acceptance is allowing the risk to happen and dealing with it if it occurs. Risk deflection or transfer is transferring the risk to someone other than the project team, such as an insurance company or outside supplier.

3. Answer: c

Risk mitigation is the process of reducing a risk to acceptable levels. In risk mitigation the risk has either a reduced impact or probability or both. This reduces the risk severity to levels below the risk tolerance.

4. Answer: d

The expected value of the risk is found by multiplying the probability of the risk by the cost of the impact of the risk should it occur. $EV = 25,000 \times 10\%$. Used in calculating contingency sums.

5. Answer: d

The client's outsourcing method has nothing to do with risk management; all the other choices are items that could be included in the risk description.

6. Answer: c

The lessons learned document from other similar projects can be a great help in determining the new risks associated with this project. Many times risks repeat themselves from one project to another. This makes the lessons learned document very important for all projects.

7. Answer: c

The management reserve is time and money used to offset the effect of unknown risks affecting cost and schedule. These risks can only be approximated since none of them are specifically identified.

8. Answer: a

The breakeven-point justification technique predicts a point in time where the benefits equal the costs involved. It is a simple justification technique that takes into consideration a lot of assumptions. Since it predicts the point in time where the benefits equal the cost, given the choice of an expensive and a cheap machine, the cheap machine will usually have high short-term benefits, and the expensive machine will have higher long-term benefits.

9. Answer: c

In the normal probability distribution or any symmetric probability distribution, the most likely value of the distribution is the peak of the distribution curve. This is the value that has the highest probability of occurring. In a symmetric probability distribution this will be the centre of the curve as well. There is a 50% probability that the project will finish past the most likely date and a 50% chance that the project will finish earlier than that date.

10. Answer: c

Risks are events that affect a project for better or worse. Positive risks increase the positive cash flow or benefits to the project, and negative risks increase the negative cash flow or effects of the project.

11. Answer: a

Fast tracking is changing the project plan to schedule activities that were planned to be done in sequence so that they can be done completely or partially in parallel. This will increase risk, because more work will be done if a problem is discovered.

12. Answer: b

In determining the worst-case situation, all of the negative risks are included and none of the positive risks are included in the total. This makes the assumption of the worst case as being that all of the bad things happen and none of the good things happen.

13. Answer: b

Insurance transfers (deflects) the problem of the risk to someone else who takes the responsibility for the loss caused by the risk. In this case an insurance company agreed to compensate PMI if this loss occurred.

14. Answer: d

During project closeout much of the project work has been completed and many of the risks have passed the time in which they can occur. The total risk of the project is therefore lowest during closeout.

15. Answer: b

If any of the activities are late, the entire project of the three activities will be late. To state this as three mutually exclusive events we consider the probability of all three of the events occurring on time. This is .9 for each, and the probability of all three occurring is $.9 \times .9 \times .9 = .73$ (73%).

16. Answer: b

A workaround is the work that is not planned ahead of time to take care of a threat that occurs.

17. Answer: a

Risk acceptance is doing nothing about the risk until it happens. This is done with risks that are below the risk tolerance level.

18. Answer: b

Risk tolerance is the measure of the client's likelihood to take risks. A client with a low risk tolerance will not be willing to take very many or large risks even though they may produce considerable opportunities to make large profits.

19. Answer: b

Risk analysis should be done frequently throughout the project.

20. Answer: d

The risk option of mitigation means that the impact or the probability is reduced to a level below the risk tolerance level. This means that the risk is now acceptable.

21. Answer: b

Qualitative assessment of risks is often appropriate. When there is little impact from a risk or when little is known about the risk parameters it may only be practical to evaluate risks in a qualitative way.

22. Answer: c

This is the definition of sensitivity analysis in the Guide to the PMBOK.

23. Answer: a

The expected value of the risk is the probability of the risk multiplied by its cost. This is one method of ranking risks. Risks can also be ranked qualitatively by assigning them qualitative values like “very risky” and “not too risky” and ranking them in groups.

24. Answer: b

This score is determined by identifying on this basic table for risk analysis where medium impact and medium probability intersect:

		Impact		
		H	M	L
Probability	H	1	3	6
	M	2	5	8
	L	4	7	9

25. Answer: d

$$\text{BET} = \frac{20 + (4 \times 25) + 40}{6} = 26.6 \text{ (27)}$$

Thirty-five minute quiz

The following questions are typical of those included in the PMI Project Management Professional examinations. In each instance circle the answer (a, b, c or d. that you believe is correct or most correct. You have 35 minutes.

1. Which of these is not a valid risk management action?
 - a. Prevention.
 - b. Denial.
 - c. Reduction.
 - d. Transference.
2. The person best situated to keep an eye on a risk is called its...?
 - a. Supporter.
 - b. Monitor.
 - c. Owner.
 - d. Sponsor.
3. Future risk events that are favourable we call:
 - a. Threats.
 - b. Surprises.
 - c. Contingencies.
 - d. Opportunities.
4. The contingency budget will:
 - a. Reduce the probability of scope changes.
 - b. Reduce the probability of cost overruns.
 - c. Increase the probability of a cost overrun.
 - d. Increase the probability of scope changes.

5. A risk has four possible outcomes. Given the following information, what is the expected value of this risk?

PROBABILITY	RESULT OF RISK
0.4	- 10,000
0.3	- 7,500
0.2	- 5,000
0.1	+ 2,500

- a. -\$20,000
 - b. -\$14,500
 - c. +\$7,000
 - d. -\$7,000
6. The project team has done its risk analysis. In the process of risk identification the project team has determined that there are risks that will probably happen that have not been identified or evaluated except by noting that other projects of this type have historically had a certain amount of risk discussed in the lessons learned of the project. This project team should set aside money to handle these non-specific risks in which financial category?
- a. Risk management fund.
 - b. Contingency budget.
 - c. Management reserve.
 - d. Emergency fund.
7. A project manager observes that in one part of the project several tasks are being completed late. All of these tasks have several days of float associated with them. These are early warnings of the risk that the project will be late in completion. They are called:
- a. Risk symptoms.
 - b. Warning messages.
 - c. Risk forecasts.
 - d. Schedule risks.

8. The effect of risk on schedule dates for the project creates an array of dates that are possible for project completion. In typical projects the most likely date for the project will have which of the following relationships with the expected project completion date?
 - a. The most likely date will be earlier than expected date.
 - b. The most likely date will be later than the expected date.
 - c. Both dates will have the same likelihood.
 - d. The most likely date and the expected date will occur at the same time.
9. A project manager is reviewing the risks of the project. One of the risks she is reviewing has an impact of \$25,000 and a probability of 10%. The risk is associated with an activity that is the predecessor to seven other activities in the schedule. All eight activities are on the critical path. The seven other activities have a total budget of \$75,000. What is the expected value of this risk for contingency calculation purposes?
 - a. \$10,000
 - b. \$100,000
 - c. \$25,000
 - d. \$2,500
10. In probability theory, what is the probability that if we roll two dice (cubes with consecutive numbers 1 to 6 on each of the six faces) we will have at least one 6?
 - a. $\frac{1}{3}$
 - b. $\frac{11}{36}$
 - c. $\frac{1}{36}$
 - d. $\frac{1}{6}$

11. A project manager is looking at the risk associated with the project schedule. Realising that if the risk occurs the project will be delivered to the stakeholders late, the project manager decides to consider the risk and promise delivery later than the most likely project completion date. He then takes the time between the promised date and the most likely completion date and distributes it among the activities of the project schedule. This creates float in the schedule. This process is called:
- Schedule delay.
 - Critical chain scheduling.
 - Buffering.
 - Contingency scheduling.
12. Project risk management is primarily about reducing:
- Damage.
 - Time.
 - Cost.
 - Uncertainty.
13. A project manager and her project team are analysing risk in their project. One of the things that they might do to help identify potential threats or opportunities would be to review:
- The project budget.
 - The goals and objectives of the project.
 - Lessons learned from other similar projects.
 - The monetary value of changes for similar projects.
14. A project manager holds the first risk meeting of the project team. The client is present at the meeting. At the meeting several risks are identified, which will later be assigned to members of the project team for quantification. The result of the meeting is:
- Expected value of the risk events.
 - Strategies for the risk events.
 - A list of potential risk events.
 - General statements about risks for the project.

15. In the Monte Carlo technique, what is the criticality index?
 - a. The number of days the project will be late divided by the project duration.
 - b. The percent of time a given activity will be on the critical path.
 - c. The percent of time an activity will be late.
 - d. The sum of the duration of the critical path activities divided by the project expected value for duration.
16. Estimating the effect of the change of one project variable upon the overall project is known as:
 - a. Risk aversion quotient.
 - b. Total project risk.
 - c. Sensitivity analysis.
 - d. Expected monetary value (EMV).
17. The process of examining a situation and finding areas of potential risk is known as:
 - a. Risk quantification.
 - b. Risk response.
 - c. Lessons learned.
 - d. Risk identification.
18. Goldratt's critical chain theory says that in order to reduce risk in schedules we should:
 - a. Start activities in the feeder chains as early as possible.
 - b. Start activities in the feeder chains as late as possible.
 - c. Start activities in the critical chains as early as possible.
 - d. Add buffer to the critical chains.
19. The key reason for risk management is:
 - a. Analysis.
 - b. Mitigation.
 - c. Assessment.
 - d. Contingency planning.

20. Which type of contract has the least risk for the client?
- Cost plus/reimbursement.
 - Verbal agreement.
 - Firm fixed price.
 - Cost plus fixed fee.
21. The process of conducting an analysis to determine the probability of risk events and the consequences associated with their occurrence is known as:
- Risk identification.
 - Risk response.
 - Risk review.
 - Risk quantification.
22. Which of the following is the least likely consequence of effective risk management:
- Projects cost less and take less time to complete.
 - More projects will be completed on time and within budget.
 - Better project selection decisions will be made.
 - Overly risky projects will be more carefully managed.
23. Which of the following is the most important risk management principle?
- Most projects benefit from risk management.
 - Prevention is better than cure.
 - Risk management starts with project selection.
 - Assumptions are also risks.
24. Which of the following is not a risk factor:
- Project complexity.
 - Project novelty.
 - Project team inexperience.
 - Project popularity.

25. The Monte Carlo technique can be used to:
- Determine the amount of contingency budget needed for the project.
 - Determine the amount of the management reserve.
 - Determine the criticality index for an activity in the schedule.
 - Determine the risk index for a risk in the project.
26. In the PRINCE2 standard, qualitative and quantitative risk analysis are called:
- Risk evaluation.
 - Risk analysis.
 - Risk assessment.
 - Risk response.
27. The project manager has vital parts that are needed for the project. If the first order of parts is delivered late, the project will be late delivering an essential deliverable to the customer. The seller that has been selected to make these parts for the project has been used in the past and historically has failed to deliver on time 10% of the time. Another vendor can be found that has the same delivery record. The project manager decides to divide the order between the two vendors in hopes that at least one of them will deliver on time. What is the probability that at least one of the vendors will deliver on time?
- 0.81
 - 1.80
 - 0.99
 - 1.00
28. The creative process used to optimise the life cycle costs, save time, increase profits, improve quality, expand market share, solve problems, or use resources more effectively is called:
- Systems engineering.
 - Value engineering.
 - Project management.
 - Cost management.

29. Which of the following is not a recognised risk identification tool?
- a. Brainstorming.
 - b. Groupthink.
 - c. Document review.
 - d. Expert interview.
30. A project's schedule completion dates are distributed in an even probability distribution. The earliest that the project can be completed is June 1. The latest the project can be completed is June 29. What is the most likely date for project completion?
- a. June 1.
 - b. June 29.
 - c. June 15.
 - d. There is no most likely date in an even distribution.
31. When using PERT analysis on a project schedule, probabilistic or expected durations are used for activity durations. If there is a concern that the critical path may shift due to durations changing within the expected range, what technique can be used?
- a. CPM.
 - b. Monte Carlo.
 - c. Decision trees.
 - d. Finite element analysis.
32. What are the three main attitudinal categories concerning risk?
- a. Risk averse, risk taking, risk neutral.
 - b. Risk seeking, risk addicted, risk tolerant.
 - c. Risk avoiding, risk taking, risk neglect.
 - d. Risk acceptor, risk rejecter, risk content.

33. Which of the following project investment options is least risky?
- a. 150% gain to 100% loss.
 - b. 150% gain to 100% gain.
 - c. 400% gain to 100% loss.
 - d. 600% gain to 200% loss.
34. Monte Carlo analysis can best be described as:
- a. A deterministic scheduling method.
 - b. A probabilistic scheduling simulation method.
 - c. A probabilistic cost management technique.
 - d. A risk identification technique.
35. A project manager decides to create a model to represent the project risks. The model translates the uncertainties specified at a detailed level into their potential impact and probabilities. This technique is called a:
- a. Risk model.
 - b. Simulation.
 - c. Computer risk program.
 - d. Decision tree.
36. Risk analysis can be complicated by which of the following factors?
- a. Unsatisfactory mitigation measures.
 - b. Inability to brainstorm.
 - c. There are usually more threats than opportunities.
 - d. Threats for one stakeholder can be opportunities for others.
37. Which of the following is least likely to influence the effectiveness of risk analysis?
- a. Confirmation bias.
 - b. Recency effect.
 - c. Appeal of probability.
 - d. Risk root cause.

38. The project manager of a project evaluates the risks of the project by assessing the probability of the risk by categorising the risks as likely or not likely and assesses their impact as high impact, medium impact, or low impact, but does not identify specific impact costs or probability percentages. This would be which type of risk assessment?
- a. Quantitative.
 - b. Qualitative.
 - c. General.
 - d. Characteristic.
39. Which of the following is the most common cause of risk management ineffectiveness?
- a. Inappropriate attitudes.
 - b. Lack of relevant skills.
 - c. Insufficient time.
 - d. Unanticipated problems.
40. Which is the odd one out in this list of risk response strategies?
- a. Reduce.
 - b. Minimise.
 - c. Treat.
 - d. Accept

Answers – 35 minute quiz

1. Answer: B

Denial is not a valid risk management action, but is an attitude toward risks.

2. Answer: C

While all terms seem plausible, “owner” is the recognised expression. The risk owner is typically the person responsible for the task that possesses the risk.

3. Answer: D

Opportunities are the opposite of threats; both are risks. Threats are negative or unfavourable events and opportunities are positive or favourable events.

4. Answer: B

Including a contingency budget will set aside money for known, identified risks. This will give more control to the project and reduce the problem of known risks using budget that was set aside for the work of the project and causing a cost overrun in the project.

5. Answer: D

The expected value of a risk is the probability of the risk times the impact of the risk summed up for all possibilities.

6. Answer: C

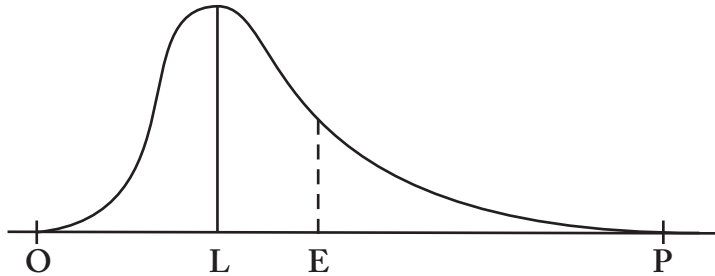
Management reserve is funds set aside to manage unidentified risks. PMI refers to these as the “unknown unknowns.” When the management reserve is used, it is moved from the management reserve to the cost or schedule baseline.

7. Answer: A

Risk triggers, sometimes called risk symptoms, are indications that a risk is about to occur. In this example there is a risk that the project will be delayed. There is a warning that this will occur because several activities are now overdue for completion. They do not affect the project completion date yet, but if this trend continues the project will be late.

8. Answer: A

Risks in most projects have a probability distribution that is positively skewed. This is because there are more things that will adversely affect schedules than there are that will improve them. If the probability distribution of the scheduled completion of the project is indeed skewed, then the most likely date (L) for project completion will be earlier than the mean value or the expected value (E).



9. Answer: D

The expected value is found by multiplying the probability of the risk by the cost of the impact of the risk should it occur. $EV = 25,000 \times 10\%$.

10. Answer: B

This is a matter of applying the probability rule of addition. This rule says that the probability of either one of two is equal to the probability of one event plus the probability of the second event minus the probability of both of the events occurring.

$$P(6 \text{ or } 6) = P(6) + P(6) - P(6 \text{ and } 6)$$

$$P(6 \text{ and } 6) = P(6) \times P(6)$$

$$P(6 \text{ and } 6) = 1/6 \times 1/6 = 1/36$$

$$P(6 \text{ and } 6) = 1/6 + 1/6 - 1/36 = 11/36$$

11. Answer: C

A buffered schedule is one where float is deliberately created in the schedule. Buffers are deliberately created between tasks on the critical path, and the activities are rescheduled to more closely approximate the schedule to the new promise date.

12. Answer: D

Risk management is aimed at reducing uncertainty, although responses may help ensure that damage is avoided or minimised, and time and cost is minimised.

13. Answer: C

The lessons learned document from other similar projects can be a great help in determining the new risks associated with this project. Many times risks repeat themselves from one project to another. This makes the lessons learned document very important for all projects.

14. Answer: C

The result of the first risk meeting of a project team is to identify as many risks as possible in the time allowed.

15. Answer: B

The Monte Carlo technique is a refinement of PERT. In the PERT process the range of values and the probability that they can occur is calculated for the project completion date or parts of the project. The Monte Carlo technique allows for shifts that may occur in the critical path during possible values of the durations of the activities of the project. It is a simulation technique that produces a value called the criticality index, which is the percent of simulations that a particular activity is on the critical path.

16. Answer: C

A sensitivity analysis is a technique used to show the effects of changing a project variable on a result. For example, a sensitivity analysis may involve assessing the impact on a project of applying different durations to a particular task.

17. Answer: D

Risk identification is about identifying risks. Risk quantification and responses are subsequent steps in the risk management process. Lessons learned is not necessarily confined to risk management.

18. Answer: D

In critical chain theory the feeder chains are activities that are not on the critical path. These tasks are scheduled to be done as late as possible and then buffered so that they start earlier than the late schedule dates. Buffer is also added to the critical path of the schedule to prove the probability that the project will finish on time. Feeder chain activities as well as critical chain activities are not started as early as possible or as late as possible. They are started as late as possible minus their buffer.

19. Answer: B

Mitigation, which involves reducing risk probability and/or impact, is the key reason for risk management.

20. Answer: C

A firm fixed-price contract provides the client with a guaranteed cost for the job and thus contains least risk for the client, although this could be a risky type of contract for the contractor.

21. Answer: D

Risk quantification is part of the risk analysis process. Risk response and identification are other steps in the risk management process, and risk review might be an audit of the process.

22. Answer: D

Overly risk projects will be eliminated rather than carefully managed. The other options are more likely consequences of effective risk management.

23. Answer: B

The key principle is that prevention is better than cure, although the other options are also relevant.

24. Answer: D

The popularity of a project is not a risk factor unless it leads to risk being disregarded.

25. Answer: C

The Monte Carlo technique is a refinement of PERT. In the PERT process the range of values and the probability that they can occur are calculated for the project completion dated or parts of the project. The Monte Carlo technique allows for shifts that may occur in the critical path during possible values of the durations of the activities of the project. It is a simulation technique that produces a value called the critically index, which is the percent of simulations that a particular activity is on the critical path.

26. Answer: A

Risk analysis is the collective expression for qualitative and quantitative risk analysis.

27. Answer: C

The probability is that at least one of the sellers will deliver the parts on time. This is the same as saying either vendor A or B must deliver. This is the addition rule in probability. The probability that the first seller will deliver is .9. The probability that the second seller will deliver is also .9, but the second seller delivering on time is only of consequence if the first seller fails to deliver on time, or .1. The calculation is then $.9 + (.1 \times .9) = .99$.

28. Answer: B

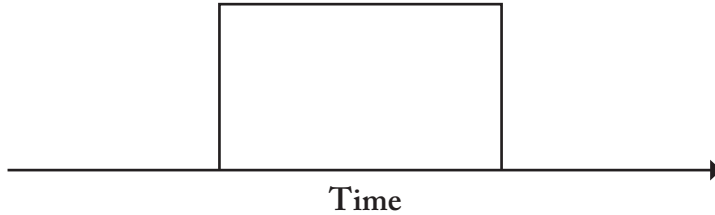
This is the definition of value engineering used in the Guide to the PMBOK Glossary.

29. Answer: B

Groupthink might be a cause of risk whereby people suppress their concerns in the interests of group cohesion.

30. Answer: D

In an even distribution any date in the distribution will have the same probability as any other date in the distribution.



31. Answer: B

The Monte Carlo technique is a simulation technique that assigns a value to the duration for each activity in the schedule. This assignment can be by user-selected probability distributions. Depending on the values of the duration for each activity the critical path may change from simulation run to simulation run.

32. Answer: A

This answer covers the three categories, the other answers either have repetitious expressions or inappropriate terms.

33. Answer: B

This answer ensures some gain. The other options all risk some loss.

34. Answer: B

The Monte Carlo technique is a computer simulation method that selects durations for schedule events according to a probability distribution on a random basis. For each set of selected durations the simulation is run and the schedule and critical path are calculated. The result is a probability distribution showing the probability of project completion dates that are possible. The criticality index shows the percent of simulations that any activity is on the critical path.

35. Answer: B

Simulations such as the Monte Carlo simulation are frequently used in risk management. It is far less expensive to model the real world than to actually do things in the real world.

36. Answer: D

The other options are part of the risk analysis process. They are concerned with risk identification and risk responses.

37. Answer: D

Risk root cause is not part of risk analysis, which is concerned with assessing risk impact and probability. A root cause analysis may help identify risks.

38. Answer: B

Qualitative assessment of risks is often appropriate. When there is little impact from a risk or when little is known about the risk parameters it may only be practical to evaluate risks in a qualitative way.

39. Answer: A

While all these factors could be culprits, risk attitude is generally regarded as the most common cause of risk management ineffectiveness.

40. Answer: D

The responses reduce, mitigate and treat are just different terms for the same strategy. Acceptance is therefore the odd one out.

Results:

36-40: truly outstanding

31-35: excellent

26-30: good

21-25: phew! (PMI minimum pass is 22 or 60%, and PRINCE2 is 20 or 50%)

16-20: emerging (NZQA speak)

15 or less: never read the book eh?

Glossary of Terms

Acceptance	A risk response strategy where we consciously accept the consequences should it occur. (Doesn't mean abdication, which for example is to give up hope of having a flat stomach.) Acceptable risks should continued to be monitored to ensure that they remain tolerable. Acceptance applies to both threats and opportunities.
Act of God	An accident or event that results from natural causes, without human intervention.
Aggregated risk	The overall level of risk to the project, when the effects of all risks are combined.
Assumptions	Events, actions or information taken to be true for the purposes of estimating and planning, but which could change or be untrue. Assumptions should be documented and periodically confirmed. They are a source of risk.
Assumption testing	Looking at the validity and stability of each assumption and the consequences if the assumption is false.

Avoidance	A risk response strategy to a threat that attempts to avoid or eliminate the risk event. Avoidance usually requires some replanning and possibly de-scoping of the project.
Benchmarking	Comparing against a standard, usually to identify possible improvements.
Brainstorming	A technique by which a group attempts to generate ideas or find a solution for a specific problem by amassing ideas spontaneously and without judgment. Useful for risk identification.
Business case	The information that describes the justification for a project, showing that expected benefits outweigh estimated costs and risks. Its validity needs to be rechecked periodically.
Business risk	Risk to business objectives rather than to project objectives.
Cause-risk-effect format	As a result of X, Y may occur, which would/could/may lead to Z, is one way to describe a risk.
Central limit theorem	The sum of several independent random variables will be normally distributed.
Conditional probability	The probability of an event, given that another event has happened.
Confidence level	Usually given as a percentage, where 50% is the level at which the predicted outcome is equally likely to more or less. To improve confidence we can add contingency.
Constraint	A restriction or limitation that the project is bound by, such as a fixed completion date.

Contingency plan	A risk response strategy to deal with specific risks should they occur.
Contingency reserve	Extra money and/or time kept aside to respond to anticipated risks – the known-unknowns. It is not normally assigned to specific project tasks.
Corrective action	Execution of a response to a problem, whether planned or unplanned.
Decision tree	A diagramming analysis technique used to help select the best course of action in situations in which future outcomes are uncertain.
Delphi technique	An approach used to derive a consensus from a panel of experts, to make predictions about future developments, including risk identification and analysis.
Earned Value Analysis (EVA)	A method to quantitatively measure and monitor overall project performance and projected performance against the project baseline.
Enhance	A risk response to an opportunity where proactive action is taken to improve the probability of the event occurring and the impact of the event should it occur.
Enterprise risk management	Managing the total risk to the enterprise.
Expected Monetary Value (EMV)	The risk score derived from multiplying risk impact value by risk probability value.
Exploit	A risk response to an opportunity by seizing the opportunity to ensure that it will happen and that the positive impact will be realised.

Fallback plans	Plans developed for risks that have a high impact on project objectives, to be implemented if attempts to reduce the risk are not effective. Used when contingency plans are ineffective.
Force majeure	Catastrophic risks outside the scope of risk management planning. Such risks usually require disaster recovery action rather risk management.
Frequency	The likelihood that a risk will occur.
Groupthink	When groups or teams tend to take more risk than the individuals would themselves.
Impact	Consequence of a risk event. Sometimes expressed as cost or time. The total loss or gain should the risk occur.
Inherent risk	The exposure arising from a specific risk before any action has been taken to manage it.
Insurance	Assigns liability for a risk to someone else.
Issue	An unplanned event (actual problem) that requires management action. An existing problem.
Lessons learned	What went right, wrong or could have been done differently from past projects.
Management reserve	An amount of time and/or cost added to the project to deal with unknown-unknowns (unidentified risks).
Mitigation	A proactive risk response strategy that reduces risk probability and/or impact to an acceptable level.
Monte Carlo analysis	A computer-assisted statistical technique that uses simulation to calculate a distribution of probable results, such as project duration and cost.

Nominal Group Technique (NGT)	A process for collecting and ranking risks.
Opportunity	The potential for a positive impact on the project's objectives.
Probability	The likelihood that a risk event will occur. May be expressed as a percentage.
Probability/impact matrix	A matrix or chart that lists the relative probability of a risk occurring on one side of a matrix or axis on a chart and the relative impact of the risk occurring on the other side.
Programme	Related projects.
Programme risk management	Managing the total risk to a programme.
Project constraints	Anything that limits the project team's options, such as scope, time, cost, quality, risk, resources, customer satisfaction, and business as usual.
Proximity (of risk)	The time when the risk may occur, which might affect risk severity (priority).
Pure risk	Risk that possesses the possibility of loss, but no chance of gain. It is usually insurable.
Qualitative risk analysis	A process to assign generic probabilities to each risk and estimate their potential impact on project parameters. Uses non-numerical measures.
Quantitative risk analysis	Measuring the probability and consequences of higher priority risks and estimating their effects on project objectives. Numbers are used.

Reserves	A provision in the project plan to mitigate cost and/or schedule risk. The term might be further described as management reserve, contingency reserve, schedule reserve, or budget reserve.
Residual risk	Risk that remains after implementing a risk response strategy.
Risk	An event that poses a threat or an opportunity to the project.
Risk appetite	An organisation's tolerance to risk. A limit or threshold to risk exposure.
Risk audit	A method of examining the effectiveness of the risk management plan and risk processes.
Risk averse	Having a low tolerance for risk.
Risk breakdown structure	A hierarchy of risk categories for a project. Helps with risk identification.
Risk categories	Common areas or sources of risk on similar projects.
Risk champion	Senior person who leads the risk management process.
Risk description	A written description of a risk, often in three parts – cause (source of risk), event (threat or opportunity), consequences (impact on project objectives).
Risk enhancement	Changing the size of an opportunity by identifying and maximising key drivers of positive risk.

Risk escalation	Formal process by which risks are transferred to the next management level because they cannot be managed or have wider impact.
Risk event	Description of a risk. The more specific the description the better.
Risk exploitation	Doing whatever we can to make sure that positive risk happens.
Risk exposure	Product of risk probability and risk impact.
Risk factors	Probability, impact, expected timing, frequency of the risk event.
Risk governance	Oversight of the entire risk management process.
Risk identification	A process that identifies project risks and documents them.
Risk log	Another term for risk register.
Risk management	Formal process by which risks are identified, analysed, responded to, and controlled.
Risk management plan	Details how the risk management processes will be implemented, monitored and controlled during the life of the project.
Risk management planning	Deciding how to approach and plan the risk management activities for a project by reviewing the project charter, WBS, roles and responsibilities, stakeholder risk tolerances, and the organisation's risk management policies and plan templates.
Risk map	A graphic depiction of risks on a two-dimensional grid.

Risk mitigation	Taking action to reduce risk impact and/or probability.
Risk monitoring and control	The process of implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risk, and evaluating the risk process.
Risk neutral	A balance in attitude between risk averse and risk seeking.
Risk owner	The team member responsible for managing an identified risk. Watches for triggers and manages the risk response. May delegate response to an Action Owner.
Risk proximity	The timing of a risk. The impact of a risk may vary depending on when it occurs.
Risk rating	Product of risk impact and probability, typically expressed as high, medium or low.
Risk register	A record that contains all the information about risks, often displayed in a table or spreadsheet format. It is used for the management and reporting of project risk. Also referred to as a risk log.
Risk response plan	The risk response plan identifies risk response strategies and how they will be implemented.
Risk score or severity	The product of risk probability and impact.
Risk seeking	Having a high tolerance for risk.
Risk sharing	Sharing ownership of the risk with another party.
Risk status	Categorising the risk as new, ongoing, or closed.

Risk symptoms	Sometimes called triggers, are indirect manifestations of actual risk events. For example, poor project team morale may be an early warning signal of an impending schedule delay or cost overrun.
Risk tolerance	The risk threshold than an organisation or individual is prepared to accept, which if exceeded, will trigger a response. Also referred to as risk appetite, risk utility and risk threshold. It is not constant and is influenced by a variety of factors.
Risk transfer	When risk is reduced by passing it to a third party.
Risk utility	The amount of satisfaction or pleasure received from a potential payoff.
Secondary risks	Risks that are generated by a response to another risk.
Sensitivity analysis	A technique used to show the effects of changing one or more variables on an outcome.
Threats	Possible events that may negatively impact the project's objectives.
Three-point estimate	Describes uncertainty by identifying optimistic, most likely, and pessimistic values, shown as a triangular distribution. An input for quantitative risk analysis.
Tranche funding	The process of releasing the project budget to the project manager in tranches (portions) linked to the achievement of pre-set milestones.
Transference	A risk response strategy that transfers the consequences of a risk to a third party, such as through insurance or contracting.

Triggers	Risk symptoms, warning signs or indicators for actual risk events. A triggering event identifies when a contingency plan must be invoked.
Uncertainty	Doubtfulness that arises from incomplete, inaccurate, undependable or contradictory information.
Watch list	A list of risks that are low priority, but are still identified as potential problems. Their priorities might change as the project proceeds.
Workaround	An unplanned risk response to an unknown, unidentified or previously accepted risk that occurs. It is a response to a problem that has not been planned for.

Project Management Checklist

Proper project management is the top way to minimise risk and thus help ensure project success.

Should we answer “no” to any of these questions, we may reveal some risk to our project management endeavour. Not all questions will be relevant to all projects and a perfect score does not necessarily ensure a successful project and certainly not a risk-free project. Nevertheless, if our project meets these criteria, we have considerably increased the likelihood of project management success.

1.	Clearly defined objectives	Yes	No
A	Is there a clear and written down goal for the project?		
B	Are all main tasks identified?		
C	Has the scope of the project been agreed?		
D	Does the team know and agree with the objectives?		
E	Are there clear milestones along the way?		

2.	Project Manager Ability	Yes	No
A	Is the project manager skilled and experienced?		
B	Does the project manager have a plan and budget?		
C	Does the project manager have technical knowledge in the area of the project?		
D	Does the project manager have sound leadership skills?		
E	Can the project manager motivate the team?		
3.	Team Member Skills	Yes	No
A	Do we know what skills are required on this project?		
B	Does the team have all these skills?		
C	Is there a training programme for team members?		
D	Is there a range of experience on the project?		
E	Are people there because of what they bring to the project and not due to their position in the organisation?		
4.	Top Management Support	Yes	No
A	Is there support from top management for the project?		
B	Does the project have a champion in top management?		
C	Have adequate resources been allocated to the project?		
D	Does top management have a stake in the outcome of the project?		
E	Does the project fit with organisation objectives and core values?		

5.	Project Planning	Yes	No
A	Is there a clear method for achieving the project?		
B	Has a plan for the project been prepared based on this method?		
C	Is there provision for variations?		
D	Is progress measured against plan?		
E	Is the plan adjusted to match progress?		
6.	Communication	Yes	No
A	Are there clear methods for achieving effective communications?		
B	Can team members discuss risks and issues openly?		
C	Can team members communicate their opinions on decisions?		
D	Do team members get feedback on their performance?		
E	Do team members trust each other enough to communicate freely at all times?		
7.	User Involvement	Yes	No
A	Do we know the end users of the project?		
B	Have the end users been involved in setting the project outcomes?		
C	Is it easy for end users to get involved in the project?		
D	Do the end users give feedback on progress?		
E	Do the end users have ownership of the solution?		

8.	Commitment of Team	Yes	No
A	Are team members behind the project goal?		
B	Do the team members own the project output?		
C	Are team members involved in decision making?		
D	Can team members make suggestions about improving and changing the project?		
E	Do team members go beyond their job description for the good of the project?		
9.	Control Systems	Yes	No
A	Does the project have a control system?		
B	Do we check planned time and cost against actual duration and expenditure?		
C	Are checks carried out early, and often enough to detect problems and correct them?		
D	Do we feedback progress to the team?		
E	Do we check that action on feedback is effective?		
10.	Risk Management	Yes	No
A	Have key risks on the project been identified?		
B	Has the effect of each risk been estimated?		
C	Have responses been decided for key risks?		
D	Have action plans been prepared for each response?		
E	Does the team have a plan for managing unexpected risks?		

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