

CHAPTER 1

Overview — Prudence, Principles and Practice

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1. Introduction

Risk is always with us. Whatever we do, there is a chance that something will go wrong. Every decision has its uncertainties. But whereas at one time people regarded the future as purely a matter of chance, known only to the gods, now we can work with uncertainty. We can manage risk, and manage it rationally. This book gives an overview of risk management, its principles and practice. It is a mix of theory and of practical examples taken from a range of applications.

The wide-ranging nature of this book is its central feature. There are two reasons why it is a book, not just on risk management, but on integrated risk management, with an emphasis on the “integrated”.

The first reason is that in any organisation, risk management is not a separate activity to be applied on top of or in parallel with everything else. It must be integrated into the activities and goals of the whole organisation. There are actually two ideas here: permeation and integration. Risk management must thoroughly permeate the organisation and involve management, legal, financial and safety issues as well as the organisation’s response to its commercial, social and physical environment. Moreover, the responsibility for risk management must also permeate the organisation. It is not just the responsibility of a single risk manager: it must be widespread. However, it is not enough for risk management simply to be distributed across processes and people. It is also necessary for it to be integrated, so that all aspects of risk management work together. They must be connected and structured. The individual aspects of risk management are like the bricks of a house. A house is more than a pile of bricks: the bricks must be ordered and integrated, with each in its right place.

The second reason for the emphasis on integration is quite different. It is that, as risk management and the rational treatment of risk have grown historically, development has occurred independently in a number of different areas. Each area has its own approaches and techniques, some very sophisticated, but there has been little interchange between them. Experts in one are unaware of another, and practitioners have lived in their own closed worlds. In this there is both a danger and a loss of opportunity. The danger arises when an expert in one area of risk management is called to work in another. Many of the techniques that have been developed are strictly applicable to only one type of problem. To apply them to problems in other areas, whose nature and needs might be quite different, might lead to results that are misleading at best and at worst, disastrous.

Quite apart from disasters, for different groups to be unaware of the activities and approaches of the others can be a significant loss of opportunity. Cross-pollination of ideas can lead to deeper insights, increased capability and a better opportunity to focus on the actual problem being addressed.

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Hence, one of the central messages of this book is the need to focus on the problem and the situation in hand, and not on the methods that might be used. It is a matter of problem-focus rather than technique-focus.

For these reasons the book is aimed at two readers: the non-expert who wants to use risk management in his or her organisation or approve its use, and the expert in one aspect of risk management who wants to know in general terms the methods and approaches used in others.

The broad areas covered by the book are the management of organisational risk, physical risk and financial risk. However, each of these areas has a number of subcategories. Organisational risk management, for instance will be significantly different in a private corporation than in local or national government. Physical risks can arise from many sources ranging from natural hazards (earthquakes, avalanches) to man-made disasters (transportation accidents, explosions) or the introduction of unwanted diseases (rabies, for example). There are different ways of analysing and categorizing risk, and there are many strategies for treating it; for example, physical protection, insurance, legal protection or financial instruments.

To make sense of it all, it is best to start with history.

2. Background

Risk has been with us since the first development of human consciousness. For as long as we have been able to look into the future and wonder and worry, we have been aware of hazards and of what could go wrong. Some took a fatalistic view. What was to happen was the will of the gods. Others sought to manage the risk, and reduce it.

There were two main approaches. One could try to discern the future and sidestep fate, or one could take prudent measures against the possibility of disaster. People consulted fortune tellers, oracles, prophets or the *I Ching*, but they would also be prudent and wear armour, build their house upon a rock, or lay up stores against the future.

The first written evidence of systematic risk management dates from about 1800 BC. The Code of Hammurabi, King of Babylon, contained primitive forms of both building codes and insurance legislation. The building regulations were simple and to the point. If a building collapsed and killed the owner's son then the builder's son would be put to death, and so on. An eye for an eye, a tooth for a tooth. The regulations were a simple and effective way of minimising the risk to inhabitants and society. As to insurance, a number of the sections of Hammurabi's code dealt with, in effect, a primitive forerunner of insurance in which an investor takes on the risk of a voyage in exchange for a share of the profits.

The Code of Hammurabi thus began two of the main historical threads of risk management: physical risk and commercial risk. It contained, however, no reference to environmental risk — surprising, perhaps, as the earlier and nearby civilisation in Lower Mesopotamia had suffered environmental disaster and depopulation due to ill-managed irrigation.

No fully rational approach to risk management was possible, though, until a theory of probability had been developed. The point is well made by Peter Bernstein in his

entertaining and readable book *Against the Gods: The Remarkable Story of Risk* (1996)¹.

The development of probability received its main impetus not from physical or commercial risk but from a different area of risk entirely: gambling. The probability that a future event might occur is a number between 0 and 1 indicating the degree of belief in the likelihood the event's occurrence. The support for the belief stems from one of three main sources. These are sufficiently different that they can be thought of as three different types of probability: structural probability, frequentist probability and subjective probability.

Structural probability was the first to be well-understood and used systematically. It grew from mathematical investigations into the nature of games of chance. A structural probability is so called because it derives from the structure or nature of the situation giving rise to it. The probability is *a priori*: it is inherent in the problem and there from the beginning. The probability of a tossed coin showing heads is 0.5 because the possibilities of a head or a tail showing are equally likely for physical reasons. The chance that a card drawn at random from a pack will be the ace of spades is 1 in 52 simply because there are 52 cards in a pack and there is only one ace of spades. The theory of this type of probability was finally worked out by Pascal and Fermat in 1654, although, according to Bernstein, it had been developed but not published by Cardano in Italy a century earlier.

Frequentist probability has its roots in insurance. Although insurance has had a long history, stretching back, as we have seen, to Hammurabi, premiums could not be assessed rationally until the probability of loss could be quantified. For this to happen, people had to be able to count systematically. This was the forerunner of statistics. It began in Britain in the 17th Century, with a notable contribution by Sir Edmund Halley who produced a series of life tables in 1693; that is, tables of the likelihood of dying in a year for any person of a particular age. Such tables are the basis of annuities and life insurance. The idea of counting, of quantifying historical losses as a basis for understanding and decision-making, grew as the insurance business grew in strength throughout the 18th Century. In 1771, the "Society of Lloyds" was founded, while 1720 saw the establishment of the Royal Exchange Insurance Corporation and the London Insurance Corporation (Bernstein 1996).

Counting became particularly fashionable in the 19th Century, when naturalists and others sought data wherever they could. The related science of statistics developed apace from its beginnings in the 18th Century, and with it grew a concentration on the frequentists' definition of probability. Such a view of probability became almost an obsession with some statisticians in the first half of the 20th Century.

However, statistics looks backwards in time while probability looks forward. Both meet in the present, and it is there that a connection must be made. To say that probability can only depend on statistics is to say that nothing can be said about the future unless it has already happened in the past, many times. The position is untenable, and for this reason most modern workers in risk understand probability in its third form, as a subjective degree of belief based on whatever evidence seems to be pertinent and at hand.

¹Much of the discussion in this section is based on Bernstein's book.

This position is known as Bayesian after the Rev. Thomas Bayes, who proposed, in a paper published posthumously in 1764, a method of updating an initial estimate of probability in the light of new data. Although Bayes' ideas received little attention at the time, eventually his theorem came to be seen as one of the most important foundation stones of the modern approach to risk.

Since the Second World War there have been remarkable advances in the techniques of risk management and risk assessment. Some major contributions such as utility theory (where "utility" or perceived value becomes the basis of risk assessment, rather than monetary value) and game theory (where risk-related decisions have to take into account countermoves by competitors) are closely related to operations research methods. Technical risk assessment methods burgeoned in aerospace, telecommunications, nuclear, chemical and civil engineering (Elms 1992), though there are still practitioners in some areas who are not fully aware of methods used in others. Psychologists became interested in the human causes of accidents and in subjective perceptions of risk (Reason 1990). Standards and regulations began to demand more sophisticated analyses. Financial players have also become more sophisticated in risk management, especially helped by widespread computer use. Finally, organisational risk management has come into prominence, leading to the development of the Risk Management Standard, AS/NZS 4360:1996, discussed in Chapter 6.

Growing up as it has from so many sources and developing in so many directions, it is scarcely surprising that risk management is many-faceted. To make sense of it all, it is helpful to stand back a little and recognise that an overview of risk management shows that there are only a very few broad classifications of risk management problems. To these we now turn.

3. Risk Management Problem Types

To be able to use risk management effectively, it helps to first understand the nature of one's problem in risk terms. This is not always easy, though. The many manifestations of risk management can be confusing. However, the difficulty can be reduced by using a framework for classifying problems.

Risk management problems can be classified in three ways: by context, by objective and by usage.

The first classification, by context, reflects the distinction made in the Code of Hammurabi. It can be thought of as an axis contrasting physical risk and commercial risk. The two, of course, overlap. An organisation may well have to protect itself against both physical and commercial risk. Risk assessment techniques used in the two areas tend to be very different. In part this is because physical risk has more easily described problems. It is easier to put a quantitative measure on the strength of a beam than on the soundness of a business investment. Therefore two sets of expertise have developed, and two bodies of knowledge with little in common between them. The difficulty is that in many cases real problems have no boundaries, and both sets of expertise are needed.

The second classification, by objective, is the distinction between avoiding catastrophe on the one hand, and reducing uncertainty on the other. For both physical and organisational risk management, the aim is generally to avoid catastrophe; that is, to avoid

unacceptable or unsustainable loss. Generally the approach to such problems is either to follow a process of first assessing risk and then treating it where necessary to reduce it to an acceptable level, or alternatively to design and plan such that the risk is small in the first place. The Risk Management Standard AS/NZS4360 elaborates the first approach (Chapter 6). Another risk management strategy used in catastrophe-avoidance problems is the strategy of risk balancing, which aims to optimise resource use by balancing the risks against the costs of their treatment.

In contrast, for many problems the objective is not to avoid catastrophe but to reduce uncertainty. The idea is to improve predictability. This is the problem faced by the gambler, who needs to know the odds. Farmers, too, need to reduce uncertainty as much as they can, and they can reduce the uncertainty of future income for their crops by selling a crop ahead of time at an agreed price. Futures exchanges are based on this approach. A financial investor, too, needs to reduce uncertainty, and does so by investing in a broad portfolio.

The third major classification of risk management problems is by usage. It contrasts the management *of* risk on the one hand with managing *with* risk on the other. The two appear similar, but are in reality quite different. One focuses on protection, the other on progress (Figure 1). The managing *of* risk is internal, and is concerned generally with reducing the risk faced by an organisation and controlling its acceptable limits. For this one needs to know the processes for reducing risk, but the risk need not be quantified precisely. The focus is more on process than on quantification.



Figure 1

A good example of managing *with* risk is given by Kathy Boardman in Chapter 7. For a company to grow, investments must be made, and there is always risk associated with them. Proper management with risk quantifies the risk associated with any investment as precisely as possible. Only then can one proceed with confidence. It is a question of moving ahead with prudence, balancing risk against return. The best strategy is seldom the most cautious one. It is really a question of accepting as much risk as one is comfortable with.

The three fundamental classifications of risk management tend to overlap in any practical situation. Life is never simple. Particularly, reducing uncertainty tends to go with managing with risk, while avoiding catastrophe aligns with the managing of risk. Together, the three classifications give a useful framework for understanding risk problems and for choosing the right approach.

A more detailed description of risk management problems is given in Chapter 4.

4. Organisation of the Book

The book has three main sections; or rather, themes, as they flow one into another. It

begins with general ideas and approaches to give an overview. Next come examples of general experience in specific areas, followed by a broad-ranging series of case studies. The book concludes with a short comment on topics not covered.

The first section, on general ideas, begins with an overview by Tony Taig. He gives a context to risk management and shows how risk pervades everything we do. There follow three chapters on general concepts, theory and techniques by Mark Tweeddale and David Elms. More specific topics come next, with Roger Keey discussing the Risk Management Standard (AS/NZS 4360), Kathy Boardman describing the process of decision-making under risk, and Janet Gough outlining current knowledge in the field of risk perceptions.

Next come contributions on general experience with risk management from both users and practitioners. The three chapters by John McDonald, Ian Maynard and Francis Small discuss corporate risk management. They are high-level case studies outlining some of the approaches taken by Fletcher Challenge and Tranz Rail. Aspects of high-level risk management by the New Zealand Government are discussed by Simon Murdoch. The section concludes with four more narrowly-focused chapters giving overviews of risk management from the point of view of insurance (George Walker), legal issues (Justin Smith), financial institutions (Ray Armstrong) and occupational safety and health (Chris Peace).

The next group of chapters deal with case studies covering a wide range of application. Sir John Scott discusses risk management in the health sector, while Stuart MacDiarmid and Kevin Corrin talk about responses to the risk of importing rabies into the country through dogs. Stephen Hom and Mark Ellis give a case study on physical risk management, followed by a more general discussion on the management of natural hazards by Patrick Helm. William Peet and Ray Ryan talk about risk management in a network operation, specifically referring to Tranz Rail, while Peter Weir deals with avalanche risk on the road to Milford Sound. Roger Estall gives an overview of the many aspects of fire risk management, while Kent Stephens shows how it is more important to avoid failure than to ensure success.

A final chapter by David Elms puts the book in perspective by outlining some of the aspects of risk management, which for various reasons could not be covered here.

5. References

Bernstein, P L (1996) *Against the Gods: The Remarkable Story of Risk*, Wiley, New York.

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