

ICE Management Board and Commercial Management Board

Risk Assessment

Summary

Project risk occurs in the areas of health and safety, the environment and the activity itself. These three areas of risk are connected by cost. A joint working party of the Institution of Civil Engineers and the Faculty and Institute of Actuaries have developed a process for analysing and responding to risks that can affect the overall success of a project (or investment opportunity). In this context the whole investment lifecycle is covered, from inception to disposal. This process is described in the Risk Analysis and Management in Projects (RAMP)¹ handbook. The process comprises four main activities viz: Process Launch, Risk Review, Risk Management and Process Close-Down.

Introduction

This briefing paper deals with risks at project level. Guidelines on Risk Issues² identifies three areas of risk viz:-

1. Risks to the health and safety of people, including personal injury and loss of life.
2. Risks to the environment, including pollution, damage to flora and fauna (plants and animals) and soil erosion.

Risks to the activity (in this context a project or investment opportunity), including damage to equipment, loss of output, resultant contractual delays and penalties.



These three areas are connected by a cost that determines how much time and money should be spent in mitigating the risks to an acceptable level.

In the UK, the management of health and safety in construction is covered by the Construction (Design and Management) Regulations 1994, together with the accompanying Approved Code of Practice (ACOP)³. This

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document covers the identification, mitigation and elimination of risks to health and safety throughout the course of a project.

Similarly in the UK, Guidelines for Environmental Risk Assessment and Management⁴ describes general principles and provides case studies to demonstrate how environmental risk management can be applied across a diverse range of activities. This includes a framework for environmental risk assessment and management.

Modernising Construction⁵ states that risk assessment, allocation and management is essential and must be an ongoing process throughout the life of the project, as risks will be constantly changing. It should also drive the procurement route and contract strategy.

A joint working party of the Institution of Civil Engineers and the Faculty and Institute of Actuaries have developed a process for analysing and responding to risks that can affect the overall success of a project (or investment opportunity). In this context the whole investment lifecycle is covered, from inception to disposal. This process is described in the Risk Analysis and Management in Projects (RAMP)¹ handbook. In the context of the handbook, 'risk' is defined as the potential impact of all threats (and opportunities) which can affect the achievement of the objectives for an investment. It is only possible in the context of a briefing paper to give an overview of the process. References to the relevant section of the handbook are given in brackets.

Investment Lifecycle (Sections 2.3, 2.4, and Appendix 2)

The investment lifecycle is a description of the stages through which an investment progresses. The Table 1 below relates these stages to RAMP process activities:

The investment opportunity is normally analysed using a cost benefit analysis using Net Present Value (NPV) or other method.

The RAMP Process (Section 2.6 and Appendix 7)

The RAMP process consists of four activities these are shown in the process flowchart (Figure 1) and described below:-

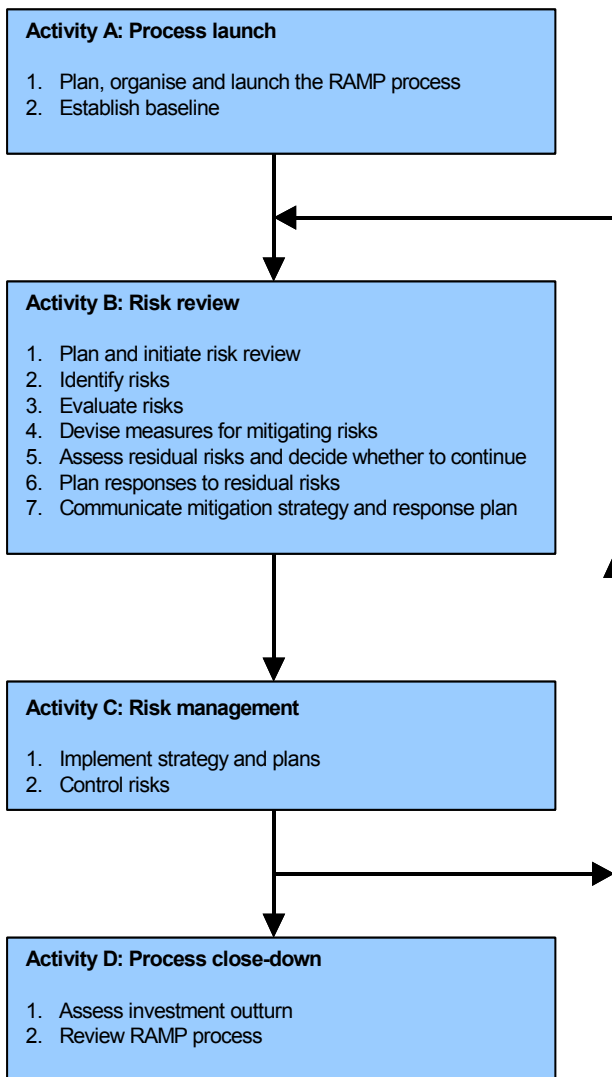
Activity A: Process Launch (refer to Chapter 3) At commencement of the process it is necessary to confirm the perspective from which the risk analysis and management is to be carried out, and the main stakeholders. A risk process manager (the manager) is then appointed to plan, lead and co-ordinate the process. The manager's first task is to prepare the *RAMP Process Plan*. A brief is then prepared and the strategy for risk reviews and management defined and agreed. A RAMP

process team is formed and a baseline established which covers the items listed below:-

- Investment definition
- Objectives
- Key parameters
- Overall measure of investment
- Investment life-cycle
- Principal activities
- Asset components and factors
- Baseline plans
- Underlying assumptions
- Investment model
- Discount rate
- Initial values and cash flows
- Initial overall values

At this stage the manager introduces a *Risk Diary*, which is maintained throughout the process.

Figure 1 : The Ramp Process



Activity B: Risk Review (refer to Chapters 4,5 and 6)
The aims, scope and level of the risk review are set out in a *Risk Review Plan* prepared by the manager. The aim is to identify all significant types and sources of risk and uncertainty associated with each of the investment

objectives, ascertain the cause(s) of each risk, assess how risks are related to other risks and how they should be classified or grouped for evaluation. Each ‘significant’ or ‘potentially significant’ risk identified is then evaluated. For each risk (other than those designated as negligible) the following options are considered for mitigating the risk:-

- Reducing or eliminating the risk
- Transferring the risk
- Insuring the risk
- Avoiding the risk
- Absorbing the risk
- Obtaining better information to reduce the uncertainty

Each risk is recorded in the *Risk Register* together with the mitigation option selected and the reason for the choice. An action plan is then devised to implement each action, common or related actions applicable to several risks being grouped together. A *Risk Mitigation Strategy* is compiled comprising the action plans and a risk account showing the costs and benefits of the mitigation measures. The NPV is recalculated using the investment model to reflect the mitigation measures adopted. The results are then reviewed to see if a better result can be obtained by excluding those measures that have a high cost and a limited beneficial effect. For risks that warrant an in depth study of possibilities for mitigation, options are re-evaluated within this activity.

The next step is to complete out a *Residual Risk Analysis*. This involves assessing the residual risks, allowing for the result of adopting the selected mitigation measures, bearing in mind secondary risks and the cost of the mitigation measures. The residual risks are sorted into order of significance for each investment parameter. Using judgement supported by Monte Carlo or other technique the risks for each parameter are aggregated and recorded in the Risk Register. For each major activity affecting each parameter in each stage of the investment life-cycle, an estimate is compiled of the potential impact of the unforeseen and unmeasured risks, based on experience and the complexity and uncertainty associated with the activity and the parameter. Using the contingency allowances the NPV is recalculated for each investment parameter, performing sensitivity analyses on the assumptions and estimates. The results are considered with respect to volatility, reliability of the estimates and the potential consequences of the major risks. A review is then carried out to determine whether the investment is still worthwhile. Consideration is also given as to whether there is an alternative investment that would achieve, or nearly achieve the same objectives with a higher NPV and less volatility. If so, the alternative is evaluated and the results recorded in the risk mitigation strategy. Finally formal approval is obtained from the client and other key stakeholders to proceed with the project and risk mitigation strategy.

A *Risk Response Plan* is then developed where responsibility for each residual risk is assigned to a ‘risk

custodian'. Responsibility for other actions which make up the mitigation strategy are also defined. The following are developed and included in the plan:-

- Containment plans to minimise the risks and their impacts.
- Contingency plans to deal with specific residual risks should they occur. Against each is recorded a 'trigger' event or circumstances in which the contingency plans will be implemented.
- Contingency budgets, for the potential impact of the residual risks on each of the principal parameters in the investment plan.

If the risk impacts or costs of containing or responding to the risks are significantly higher than previously calculated, then the NPV should be recalculated and the viability of the investment reassessed.

At the end of the risk review, a *Risk Review Report* is compiled to summarise the main results of the review, including the main risks, their likely effects and the overall riskiness of the investment. The report also comments on the effectiveness of the review, problems experienced, lessons learnt and recommends improvements for future reviews.

Activity C: Risk Management (refer to Chapter 7) The Residual Risk Analysis, Risk Mitigation Strategy and Risk Response Plan are then implemented with the main stream investment, project and operating management processes, with named individuals responsible for each action. Actions are then monitored, to ensure they are completed in a timely and satisfactory manner. Any significant changes or developments during implementation are reported to the manager. It is important that risks that occur later in the project life-cycle are monitored, and any new risks which arise as a result of external developments identified. The results of identification, analysis and monitoring are entered in *Trend Schedules*. These are reviewed at regular progress meetings. As progress is made through the project life-cycle the Residual Risk Analysis, Risk Mitigation Strategy and Risk Response Plan are revised and the contingency budget released, as risks materialise or the risk exposure changes or disappears. During this activity *Risk Review Reports* are submitted to the client's representative and other key stakeholders.

Activity D: Process Close-Down (refer to Chapter 8) At the end of the investment life-cycle or on prior termination of the project, a review is carried out of the effectiveness of the application of the RAMP process to the investment. The results of this review are recorded in a *RAMP Close-Down Report*. In the report the performance of the investment is compared with the original objectives. An assessment is also made of the risks and impact that occurred, in comparison with those

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anticipated. Lessons learnt and suggested improvements for future investments are also recorded.

Insuring Risk (Appendix 5)

The insurance market is shifting from coverage of individual risks to coverage of a package of risks over the lifetime of the project. The availability of insurance is generally dependant on the availability of data and the insurance market's knowledge of risks. Some of the areas of large project insured are listed below:-

The construction phase

The operational phase

Construction all risks (CAR)
Third party (public) liability
Professional indemnity
Employer's liability
Advance loss of profit

Material damage
Business interruption
Latent defects
Third party (public) liability
Employer's liability
Motor
Directors and officers liability
Other (project specific)

Further Information

In addition to the references below there is a website dedicated to RAMP, the address is www.ramprisk.com The site contains sections that cover Project Failures (including Titanic, the Channel Tunnel and Concorde), Concepts and Definitions and Methods and Analysis.

Source Documents

1. Risk Analysis and Management for Projects, Thomas Telford, London 1998, ISBN: 0 7277 2697 8.
2. Guidelines on Risk Issues, The Engineering Council, London 1993, ISBN: 0 9516611 7 5.
3. Managing Health and Safety in Construction, Construction (Design and Management) Regulations 1994, HSE, Norwich 2002, ISBN: 0 7176 2139 1.
4. Guidelines for Environmental Risk Assessment and Management, The Stationery Office, London 2000, ISBN: 0 11 753551 6.
5. Modernising Construction, The Stationery Office, London 2000, ISBN: 0 10 276901 X.

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Table 1: Activities, key parameters and RAMP process in each stage of investment life-cycle

Investment Stage/Objective	Principal Activities	Key Parameters	RAMP Process
Opportunity Identification To identify opportunity and decide whether it is worthwhile to conduct a full appraisal	Identify business need Define investment opportunity Make initial assessment Decide whether to proceed with appraisal	Broad estimate of capital cost and cash flows Cost appraisal	Preliminary review
Appraisal To decide whether the investment should be made	Define investment objectives, scope and requirements Define project structure and strategy Develop business case Identify funding options Conduct feasibility study Decide (in principle) whether to proceed with the investment	Refined estimates of capital cost and cash flows Cost of investment planning phase	Full risk review
Investment Planning To prepare for effective implementation of the project	Procurement of funding Obtaining planning consents Preliminary design work Compiling project implementation plan Place advance contracts (e.g. site preparation) Making final decision to proceed with investment	Financing cost Refined estimates of capital cost and cash flows	Risk review (prior to final decision)
Asset Creation To design, construct and commission the asset and prepare for operation	Mobilising the project team Detailed planning and design Procurement/tendering Construction Testing, commissioning and hand-over Ensuring safety Preparing for operation	Project objectives: scope* performance/quality* timing* capital cost	Risk reviews (during or towards end of each activity) and risk management between reviews
Operation To operate the asset to obtain optimum benefits for client and other principal stakeholders(including investors and customers)	Operating the service Deriving revenue and other benefits Maintaining and renewing the asset	Operating cost Maintenance cost Cost of renewals Revenue Non-revenue benefits	Risk reviews (periodically)
Close-down To complete investment, dispose of asset and related business, and review its success	Sale, transfer, decommissioning or termination of asset and related business Post-investment review	Decommissioning cost Cost of staff redundancies Disposal cost Resale or residual value	Final risk review and RAMP close-down
* These have a potential impact on one or more financial parameters			