

Risk Management Value Enhancement Practice



ECI

Risk Management

Value Enhancement Practice

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Source Document



European Construction Institute

Risk Management Value Enhancement Practice

Preface

Measurement is the precursor to enhancement. Thus, an important part of the work of both the ECI and its American counterpart, the Construction Industry Institute (CII), is the benchmarking of the effect on project performance of a number of value enhancing practices (VEPs). The VEPs selected are those which offer the greatest opportunity for performance enhancement on construction projects. To date, the following VEPs are being measured:

- Team Building
- Strategic Alliances
- Pre-Project Planning
- Design/Information Technology
- Constructability
- Safety
- Cost Estimating
- Project Controls
- Small Projects

As part of its continuous improvement work, ECI regularly reviews VEP development and identifies additional practices which can have a significant impact on project outcome. Risk Management was identified as one such practice.

The VEP was developed by a Risk Management Working Group which drew together participants from the Engineering Construction Industry with specialist knowledge of Risk Management. The objectives were to:

- distill the key practices used in Risk Management
- determine areas which can be benchmarked
- develop a source document providing guidance as to what is considered to be current best practice in Risk Management
- distill this guidance into a VEP Summary document, providing the essential core elements of Risk Management in guideline form.

This document contains the VEP Source Document.

Acknowledgements

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. **Introduction**

This document offers concise guidance to best practice in project risk management. It covers the need for risk management, its benefits, the process to be followed and advice on its application.

This is not a detailed manual: more detailed guidance is available from a number of sources and these are listed in section 7.

. **What is risk management and what can it offer?**

Risk is an uncertain event, feature, activity or situation that can have a positive or a negative effect on a project or business.

Risk management can therefore be defined as:

A formal process that identifies, assesses, plans and manages the uncertain factors that can have positive and negative impacts on a project and/or a business.

Risk management should protect the business and the project by maximising opportunity and value and minimising threat. It should provide a cost-effective, timely, logical, consistent and continuing framework to control risk at all levels of management decision-making. It should cover strategic, tactical and operational issues at all stages of a project.

The risk management process enables project teams to set achievable objectives and maximises the chances of meeting them. It supports decision making using the often limited information that may be available. Risk management does not remove the need for judgement or leadership, but seeks to make use of the individual and collective experience available to teams through a formal process of identification, quantification, prioritisation and appropriate action.

. Why risk management?

.. Risks are inherent in construction projects

Construction projects are inevitably subject to risk and its management is a central part of the activities of every project team. The issue is not whether to take risks, but how to manage them effectively.

Construction procurement has changed dramatically over the last 10 years and these changes continue. Figure 1 illustrates the shift in risk allocation from client to contractor over time. The introduction of alliancing, partnering, supply chain management and strategic relationship management provides a new basis for the allocation of risk, necessitating a shift in attitude by all parties.

The guiding principle is that the person who can best control the risk should own it. Alliancing strategies recognise that the more risk is properly devolved and shared on such a basis, the more benefit is realised.

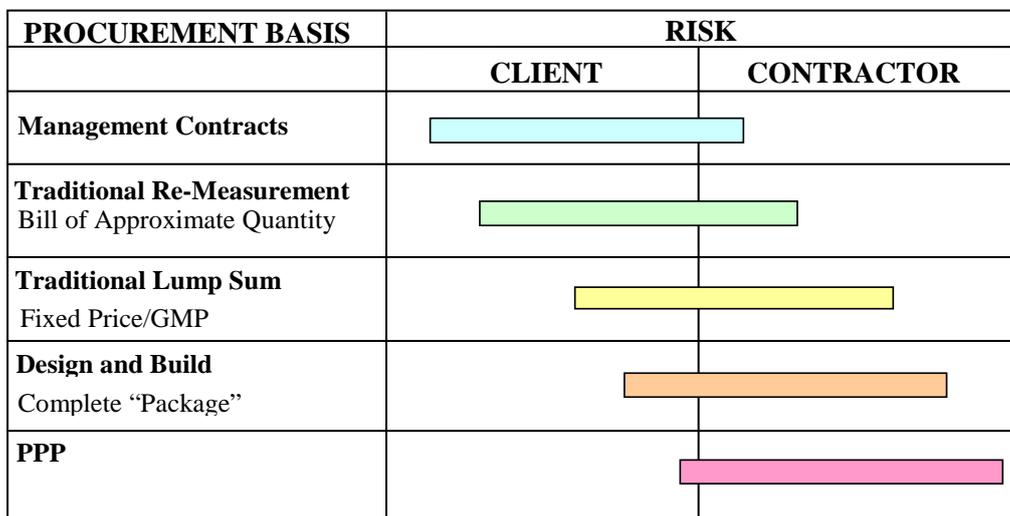


Figure 1 – Shift in risk allocation in relation to contract types

GMP Guaranteed Maximum Price
 DBFO Design Build Finance Operate
 PPP Public Private Partnerships

.. Corporate governance

All EU countries require effective systems of corporate governance for companies operating within their jurisdiction. Risk management is an essential component of such systems; in many countries it must be a part of every employee's responsibility.

Benefits of risk management

- Risk management benefits project outcome by maximising opportunity and value and minimising threat. It is a fundamental element of project management, allowing planning in an active rather than reactive manner.
- Risk management is a team-building process. It facilitates honest, clear and documented communication between the project parties. It offers a mechanism through which direct conflict can be avoided, thus reducing opportunities for confrontation and conflict.
- Risk management encourages open communication between all project parties. It allows project team members to understand, and act upon, each others' risks, moving beyond merely discussing progress or lack of it. It encourages an atmosphere of learning where an informed understanding of the project and its needs can be conveyed to the whole team. This allows orderly decision making, rather than simple crisis management.
- For complex, fast-track projects there are often long and complicated processes in the supply chain. This is particularly true at the construction stage. This phase can often be affected by:
 - late drawing issues
 - design holds
 - late vendor data
 - design changes
 - delayed procurement
 - inventory shortages
 - wasted materials
 - out-of-sequence working
 - re-work
 - shortages of construction equipment and temporary facilities
 - non-productive time
 - late manpower mobilisation
 - contractual arguments.

Risk management can help to minimise the impact of these factors by stabilising project supply chains. By shielding successive phases of work from the uncertainties created in the previous stages it can increase the productivity of subsequent operations. It can reduce and minimise the flow of uncertainty in decisions, information and equipment.

- Risk management can help ensure that work is of acceptable quality, minimising problems for later phases by creating as much schedule slack as is practicably possible. High quality design reduces the need for construction re-work. Having some slack allows time to think and to ensure proper work sequencing.

- . **The Risk Management Process**
- .. **The key stages of risk management**

There are a number of variations on the risk management process. Two that are commonly adopted are the UK Association of Project Management's Guides to Project Risk Analysis and Management (PRAM Guide) and Risk Analysis and Management for Projects (RAMP Guide), both of which are available from the Association for Project Management (www.apm.org.uk). The process usually involves seven key stages. These are shown in Figure 2:

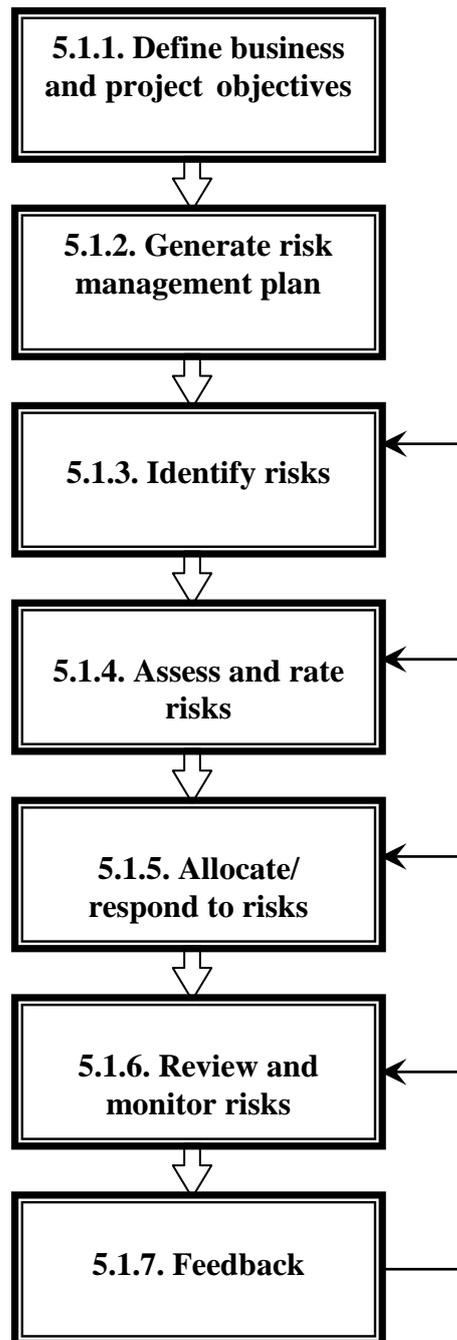


Figure 2 – Key stages of risk management

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Risk identification is best conducted through brainstorming by small teams in short bursts. A facilitator may be appointed to list the risks under suitable headings. Their categorisation into a structure, with each being rated and allocated to the risk owner, is usually the most time-consuming part of a brainstorming exercise. The list below shows the primary sources of risk that may affect a project. All or any of these elements may require its own risk management programme.

- Social
- Political
- Organisational
- Legal
- Environmental
- Consequential
- Economic
- Material/physical
- Marketing
- Technical

In allocating the owner, the primary principle is to assign the risk to those best able to control it, the major considerations being:

- Ability to control, bear, or provide contingencies for the risk when it occurs.
- Ability to control the events leading to the risk.
- Relationship between the risk and corporate objectives.
- Implications for safety, health and environment.
- Cost of passing the risk on to others.
- Potential for significant profit or loss.
- Timing of commitments.
- Novelty or repeatability of the risks to be taken.
- Legal and moral position.
- Effects on the decision-makers (authorities, responsibilities, competencies, morale).
- Consent of the people to whom the risk applies.

To allocate a risk that cannot be controlled means that a project has in fact retained the risk, but may have lost the opportunity to control it. Risk and responsibility are inevitably related.

... **Step 4 – Assess and rate risks**

This is the process of assigning probability and impact scores to the identified risks. The risk to delivery is the severity of impact (consequence) multiplied by the probability of occurrence. Both can be assigned at various levels; scoring can be as simple as high, medium and low, or at various levels of numerical precision.

Impacts can be measured in terms of cost, schedule, net present value (NPV) or other quantified elements. Scoring systems should be straightforward. A 1 to 5 scale could suffice for simple project needs. Scoring can be subjective and relative, as well as numeric.

A **Boston Grid** is a visual device that can help place risks in perspective. The figure below shows a Boston Grid used to illustrate the risk and manageability of laying a pipeline in a remote region. Presentation of risks in this manner helps management to focus on elements of high risk and impact.

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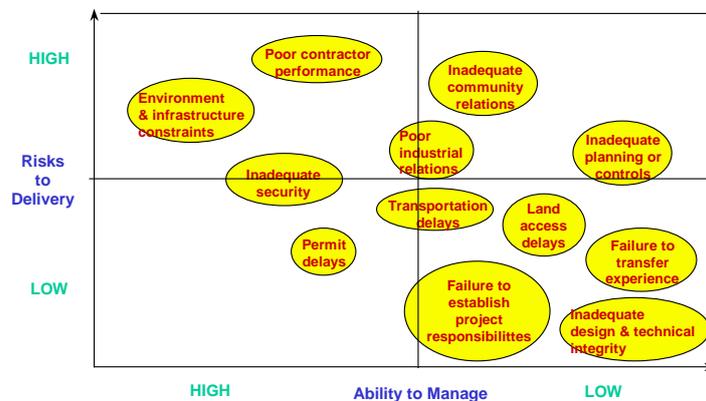


Figure 3 – Pipeline construction – risks to delivery

Other techniques for placing risks in perspective include simple lists, in descending order.

... **Step 5 - Allocate/respond to risks**

This is the process of deciding who does what and when about the risks. Ideally, the required actions should be incorporated within the suite of project programmes; progress against these actions should be reviewed regularly.

The primary principle here is to eliminate or control unacceptable risks and to ensure value for money. Actions should result in risks being balanced on a neutral basis. However, a project team may have to take a clear view as to whether it wants to be risk-averse or risk-seeking.

Risks may be avoided, reduced, transferred, shared or retained. The main options are listed below:

Avoidance:

- Review/clarify the objectives.
- Cancel whole or part of project.
- Do elsewhere.
- Do differently.
- Do nothing.
- Tender a high bid, or do not bid.

Reduction:

- Use risk management.
- Use proven people/contractors.
- Change methods.
- Change materials.
- Change contract strategy.
- Focus organisational competencies and priorities around high-risk areas.
- Acquire expertise.
- Provide contingency plans.

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- Adopt control measures (quality, frequency, detail and feedback for action).
- Use loss control measures to limit exposures.
- Re-package the work (reduce the scope).
- Hedge currencies.
- Avoid the worst weather.
- Train people - simulations, dry runs and trial fits.
- Consult second opinions, obtain more information.
- Carry out further study.
- Conduct independent auditing.
- Improve communications.

Transfer:

- To venture partner.
- To contractor.
- To sub-contractor.
- Adopt exclusion or conditional clauses - limited liabilities.
- Adopt indemnities, insurances, warranties, bonds, guarantees.

Share:

- Financing.
- Partnering, funding/profit and loss incentives.
- Contingencies.

Retain:

- Provide unallocated provision or contingency.
- Adopt control measures (quality, frequency, detail, decision points and feedback for action).
- Set up early warning systems (change control, claim control).
- Allow for project failure.
- Assess the added value of accepting the risk (to the current, and future projects).
- Set limits to financial authorities' delegation.

... Step 6 – Review and monitor risks

Monitoring of risks requires that the action plans be carried out through a continuous review of the risks with their owners. This should:

- Review existing risks with the owners
 - Current risk status – is it closed?
 - Changes in probabilities/impacts.
 - Are any new actions required?
 - Is the risk ownership still valid?
- Identify any new risks.
- Revise the overall assessment of the risks
 - Re-issue the risk register.
 - Produce a new list of top risks.
 - Reflect any changes or trends identified.

It is important to keep the review meetings focused on the important, active issues, otherwise boredom and complacency can step in and the whole process become a paper exercise.

... **Step 7 – Feedback**

This is a continuous process that feeds lessons back into the project and for more general application.

It requires accurate records of experience that are often extremely difficult to obtain. It is important to decide what information needs to be captured to provide relevant data for feedback at the very early stages of the project. It is even more important when using a risk management database across all projects.

A database will provide a wealth of information that can be used to assess trends and provide practical lessons learned across the company. However, for it to be of value, the information gathered must use common terminology and standard risk categorisation and rating criteria.

.. **Impact of external factors**

Risk management can be used at the strategic, tactical, and operational levels of control. External factors – that is, those which do not emanate from the project itself – must also be identified and managed. The main source of such external factors are:

- Government
- Employees
- Shareholders
- Suppliers
- Customers
- Financiers
- Competitors
- Public

Such risks are, in essence, of the same order as internal project risks, and they should be managed in the same way.

.. **Integrating risk management and risk analysis**

Risk management does not always need to be supported by a detailed risk analysis. However, in order to quantify risks rigorously, some analysis may be needed. Rating risks by assigning probability and consequence scores helps the important task of prioritisation.

With the widespread adoption of portable computers and the availability of software, it is easier to provide a risk analysis treatment to spreadsheet analysis or database analysis. Cost-effective risk analysis can be carried out using commercially available software. Modern IT facilitates sophisticated risk analysis at a reasonable cost.

. Implementing Risk Management

A range of issues must be considered when introducing risk management and these are explained below.

.. Implementation plan

Without a plan, progress cannot be measured, the structured process cannot be communicated within the company and commitment will be difficult to attain.

The plan should include, but not be limited to:

- Assessment of the current risk management capability of the company.
- Assessment of known best practice from the construction and other industries and professional bodies, such as the Institute of Risk Management and the Association for Project Management.
- Presentations to management setting out the process and its benefits, in order to identify champions and to gain support and commitment.
- Identification of the resources needed to embed the process within the company.
- Training of the relevant personnel.
- Setting of agreed lines of communication to report progress and to ensure that the company's requirements are understood and included within the process.
- A strong framework that will support corporate policies on project risks and will allow ease of communication up and down the reporting lines.

.. A structured process

The most important factors in providing a structured process are:

- A user-friendly system with detailed support, i.e. documents, detail and software for all levels.
- A flexible system that allows diverse companies to follow a generic format that can be adjusted for specific areas of work.
- A simple procedure with a range of tools that can be chosen to fit the specific situation (brainstorming sessions are not the only method of identifying risks and, in some circumstances, could be prohibitively expensive).
- A system that is not considered intrusive by those who use it.
- A process that can be embedded within the company and the project.
- Simple communication media that are easy to implement and understand.
- Adequate resources to implement the process.
- A process that reflects the policies adopted by the board.

These requirements call for a simple and effective system that will maximise opportunity and minimise threat in the given situation. It should rely on user-friendly and flexible procedures and processes and tools that will provide ease of use and maintain momentum.

.. When to use risk management

The value of risk management is greatest during the early days of a project and at the start of each phase. Starting off right is far easier, and more cost-effective, than trying to correct adverse trends on an existing project. Figure 4 shows how the ability to influence reduces as a project gets locked into its strategy. For a contractor, the maximum point of influence is when bidding for a contract.

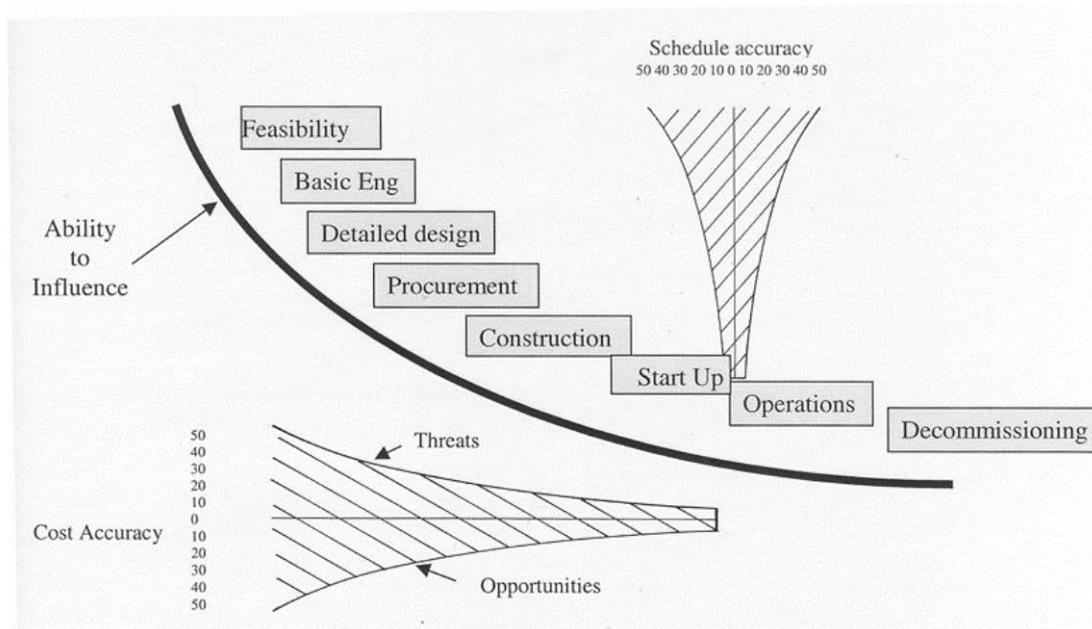


Figure 4 - 'Ability to influence' curve

Best practice in risk management is established by focusing efforts around the stages of project development as shown in Figure 4. There is no single way to achieve efficient risk management in each of these stages. Every project needs to develop processes appropriate to its size and complexity and taking into account fit with the other management processes already in place.

The greatest benefit is obtained by carrying out the process in advance of the key events. This also ensures that submissions to bodies such as contract committees and environmental agencies are properly considered.

As the project progresses, the risk range in terms of both cost and schedule impact reduces; this is also shown in Figure 4.

.. Responsibility for implementation

All team members are responsible for risk management. The process is formally driven by a risk management team which should include key members of the project. They should be experienced, influential and have a broad range of skills. Projects should consider the stewardship of the process and ensure that there is an effective chair. The personnel within the team may change during the life of the project, and as perceptions of risk change.

A large number of studies have shown that properly motivated and open-minded teams are able to identify all the relevant risks. Unbiased group decisions also tend to produce more accurate views than those of individuals.

Risk management actions will need to take account of changes in the business environment and objectives as well as progress with the project and with the risks themselves. It will be important to ensure that uncertainties are being actively managed, that all concerned on the project are taking their agreed actions and that new risks are identified.

Risk management is only one of the control tools a project can use and its usefulness should not be overstated. The basic principle is that the team is involved in a process that should identify and eliminate root causes of risk.

.. Risk management workshops

Risk management workshops can be a useful tool in facilitating implementation. Some guidelines are given below.

... Procedure for risk management workshops

Meeting time half-a-day to one day in length.

... Pre-meeting activity

- Manager to set terms of reference for risk workshops.
- Manager to decide timing, appoint facilitator, team leader and team.
- Team leader to provide venue, facilities and briefing materials.

... During meeting

- First period (half-an-hour to an hour) - establish focus and team building.
- Second period (one to two hours) - brainstorm risks.
- Third period (one to two hours) - assign consequences, probability and manageability scores and draw up rough Boston Grid, identify priority risks, eliminate unnecessary risks.
- Fourth period (one to two hours) - review possible risk responses, set levels of acceptability, suggest mitigation actions and owners. Actions during this period will depend upon the level of energy left in the workshop. It may be advisable to leave this period until later.

... Post meeting

- Facilitator and team leader produce short report.
- Manager to produce risk register.
- Risk managers to review progress periodically to develop and apply risk.
- Risk manager to set follow-up risk management workshops.

... Keeping up the energy during meetings

The first few risk management meetings can be fun and provide high value, with the vast majority of risks being identified and actioned. Subsequent reviews can get bogged down if they are carried out in the same way.

As risk rankings are essentially subjective, it adds little value to notch them up or down a fraction. The focus of subsequent meetings should be on whether new risks have occurred, whether risks or their consequences have changed significantly, or whether they have been closed by management action or by the passage of time.

.. Avoiding the obstacles to implementing risk management

Although risk management can yield results of high value, there are dangers:

- Risk management can become too involved, with an over-complex process offering no greater value than simple, robust approaches.
- The process can be misused by management to avoid their proper responsibilities.

The aim is to find the point where appropriate levels of effort are judged to achieve maximum benefits.

Several factors can greatly reduce the effectiveness of risk management, such as:

- The culture of an organisation, in which there is resistance to change, lack of commitment to the process, or inability to recognise the potential value or to commit the necessary resources.
- Poor training and facilitation, resulting in confused approach and lack of commonality.
- Use of an inappropriate risk management system.

.. Risk management culture

The commitment to risk management must be clear and firm throughout the company at all levels. It must be acknowledged that, by helping to manage the unknown, risk management is a tool to assist rather than threaten current project management methods.

Specific risk management processes need to be developed to suit company procedures, culture, expertise, resources, IT systems and risk management maturity. The timing, type of problem and value of management decision under consideration will also indicate the exact nature of the risk management process to be adopted.

The modern business environment is a constant challenge and demands shorter schedules, lower capital investments, tighter margins, lower operating costs and higher quality plants, with safety and environmental considerations paramount. There is also greater pressure to provide answers immediately. In this environment it should be recognised that projects and staff have to take risks. Hence, senior management need to ensure that staff work within a culture that gives them reasonable protection against unfavourable outcomes.

Appraisal of staff effectiveness should therefore be based on the way that people have carried out their work, i.e. the intelligence and energy with which they have approached risk mitigation efforts, as well as the results achieved. Given that general business culture has been somewhat risk-averse, this will require a high level of management understanding and competence.

A positive risk management culture can be promoted by the following:

- Assigning actions to those who can best control the identified risks.
- Being clear about what constitutes an acceptable risk. As noted above, there is no such thing as a risk-free project: the principle of *ALARP* -As Low As Reasonably Practicable - applies.
- Value for money trade-offs between managing the risk, and the cost of the effort needed to reduce the threat, or maximise the opportunity.
- Scheduling the risk management effort and, if needed, further quantified risk analysis activities.
- Demonstrating priorities and ensuring that risk management actions are timely.
- Clear timing of decision points, and the need for intervention or contingency planning.
- Agreeing appropriate risk management strategies with other interested parties such as customers, partners, contractors, subcontractors and vendors.

Managers need to ensure a balance between loss avoidance and over-managing a project.

.. Training and facilitation

Training in risk management is fundamental to its success and a number of essential considerations should be followed:

- Training should include clear success/failure criteria.
- Training should be offered at times that fit the project phases and the needs of the team.

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- The use of suitably qualified and experienced personnel as trainers is vital. They should have good knowledge of the process, of the business and of in-house procedures. They should be independent of the project and fair.

Depending upon the experience of the team and the complexity of the project, it may be useful to employ an experienced facilitator who can act as organiser and moderator. An outsider can often challenge previously-accepted assumptions and raise issues that project team members find difficult to discuss. To have the confidence of those involved, the facilitator needs to be experienced in risk management techniques, have an understanding of the technical and commercial issues involved and have good management and communication skills.

.. **Level of effort**

On small, simple, low-impact projects it is often enough to carry out risk management by using an informal but structured system. However, even on these projects the use of a simple risk management technique is being increasingly viewed as effective at critical stages.

More formal methods are required on complex projects. Those with difficult managerial, technical and contractual interfaces, conflicting objectives, novel technologies or untried elements, or where management identifies a lack of knowledge or data, may require more rigorous processes.

The efforts put into the risk management process on a project need to be consistent with its nature and value. The process set out in this report is only a guideline and individual projects need to adapt it to suit their needs. On a company-wide basis, consistency and commonality of process will help compare portfolio options.

.. **Level of detail and need to keep it simple**

Risk management can be carried out at different levels within a project and using different groups. Where required, risk management can be carried out with contractors, sub-contractors and vendors. Their level of involvement must be determined. The important principle is to keep the process simple and effective.

Risk management should include an audit of whether people are making errors of commission or omission. It is also vital to have the correct information for the control of the risks in question. For example, manpower productivity on a construction site may be identified as a key risk, but measuring it properly poses particular difficulties.

Timing of such an audit and the level at which it is carried out are critical. However, management should also avoid over-control and the proliferation of non-essential information.

References

ACTIVE workbook:

AP5	Effective Project Risk Management
VEP5.1	Project Risk Management
VEP5.2	Risk and Benefit Framework Agreements

All available from ECI at eci@lboro.ac.uk.

Chapman C and Ward S, 'Project Risk Management – Processes, Techniques and Insights', 1997. John Wiley. ISBN 0470853557.

Godfrey P S, 'Control of Risk: a guide to the systematic management of risk from construction' 1996. CIRIA special publication 125. ISBN 0 6017 4417.

Turner J R, 'The Manual of Project-Based Management, Second Edition, 1996. McGraw Hill. ISBN 007709161 2.

APPENDIX 1 Risk registers

When risks have been fully identified, a register should be drawn up. This can take a number of forms but is usually a hard copy of a spreadsheet or database. The register should be used to record elements of all of the stages of risk management. It is useful to align the register to the work breakdown structure (WBS) of the project where appropriate, although many risks are outwith the WBS.

The contents of a risk register are used to:

- Identify and record risks.
- Assess and quantify risks with regard to their probability, consequences and manageability. Consequences considered could cover cost, schedule, net present value, quality and technical risks etc.
- Identify ownership, or change of ownership.
- Sort actions in risk priority order.
- Identify mitigation actions and their timing.
- Record what would constitute acceptable residual risk levels.
- Provide a view of how risks could be subdivided into lower-level risk registers.
- Refer to other studies needed, i.e. cost benefit and risk analysis studies.
- Record actions taken.
- Record the residual risks after the risk reduction actions have been taken.

At its simplest, a register may be no more than a list of the risks, the mitigation actions necessary and those responsible for carrying the risk or mitigation actions. A good database will be required if a risk register is to be successful.

A typical risk register is shown overleaf.

APPENDIX 2 Sources of Risk

Externally Imposed Risks

Project No. Title Revision Date	Author
Economic Availability of material Availability of skilled labour	
Political/Regulatory Changes in regulation, standards and/or law Local customs Work permits, visas Planning/building permit approval Host government requirements (overseas projects) Training requirements Licenses and approvals Union actions Languages of project participants Stability of country Loss or damage by fire, flood, accident, landslide, hurricane	
Customer Organisation Timely availability of information, equipment etc. provided by customer Dependencies on other projects Availability of sufficient funding to support project programme	
Market Competition for resources Product approval trials	
Social and Cultural Education Demographics Religion, religious holidays Cultural norms Languages of participants Standards of workmanship Project labour (quantity, quality, supervision etc) Terrorism Vandalism/theft Sabotage	

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Risks Under Project Control

Project No. Title Revision Date	Author
Project Objectives Clarity, reasonableness and understanding of critical success factors (CSFs) Strategic fit of CSFs with business objectives Priority of objectives (is project schedule driven?)	
Project Strategy Reliability of data used for planning and scheduling	
Project Definition Size and complexity of project Critical success factors (CSFs) Changes in scope or CSFs Adequacy of scope definition Accuracy of site condition data Adequacy of agreed procedures for all projects stages Documentation requirements Commitment of stakeholders to scope, CSFs etc	
Project Organisation Strength/experience/skills of management team Authority of project manager Continuity of project manager and team Clarity of responsibilities of all project participants Interfaces with customer, associated projects etc Arbitrary interface from outside Likely effectiveness of project organisation Suppliers and sub-contractors Geographical spread of project team Communication problems	

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Risks Under Project Control

Project No. Title Revision Date	Author
Project Staff Availability of skills required Client and contractor availability (competing projects?) Dedicated or part-time staff Morale and team building Union representation Working teams and conditions Accommodation and subsistence requirements Personality clashes Resource build-up strategy	
Suppliers and Sub-contractors Extent of competition Bankruptcy or receivership Experience and capability Motivation Management skills and disciplines Patents and licensing agreements Contractual arrangements	
Technical Changes to process definition Need for process or product research or development Is this a new process? Is this a new product? Is new equipment included? Are there technology transfer issues?	

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Risks Under Project Control

Project No. Title Revision Date	Author
Project Design Adequacy of design to meet need Appropriateness of design for operating environment Site and ground conditions, ground contamination Unusual aspects or areas of limited previous experience Accuracy of existing as-builts/reference drawings Planning permission/operating licence constraints Experience/competence of designers Co-ordination between designers, customer, developers and sub-contractors Novelty and complexity of solution Re-use of redundant equipment Security aspects Environmental testing Reliability of scheduling data Training for maintainers and operators User involvement Design validation Prototyping Impact on current operations	
Project Development and/or Production Realism of timescale Timing and number of reviews Code and functionality testing User involvement Factory/site acceptance testing and design proving New techniques or technology in manufacturing/development/construction	
Acceptance Is the acceptance authority clearly defined for all aspects of system functionality? Is there more than one level of acceptance? Are the necessary facilities and supporting infrastructure available to achieve acceptance?	

APPENDIX 3 Other useful tools

Structured interviews

In order to address areas of particular concern, it can be useful for a facilitator to carry out structured interviews. The facilitator, under the direction of the project leader, will need to prepare a list of people to be contacted, as well as a questionnaire. It may be advisable to send the questions to the recipients in advance. The facilitator records all the outcomes, back-checks and revises answers between those involved, and confirms understanding of the answers. The facilitator should ensure confidentiality.

Risk assessment interviews

This process requires an experienced facilitator to hold interviews with specified people or groups. Risks can be identified by informal and confidential discussions. The facilitator may have to visit interviewees more than once to check answers as his or her knowledge develops. As an example of this process the risks seen by a contractor can be different to those seen by the project management team. Some interviewees could overlook risks or may choose to omit mentioning their actions (or mistakes) that could introduce risks to others. Team members may bring up personal concerns not shared by their line managers.

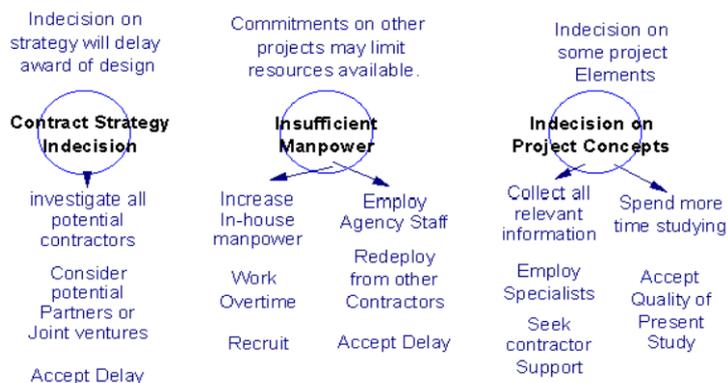
The Delphi technique

This method is designed to pool the expertise of many professionals in such a way as to gain their knowledge, whilst removing the influences of hierarchies and personalities on the derived forecast. The members of the expert risk group are kept physically separate and are asked not to communicate with each other. The risk facilitator asks the group members for their subjective probability estimates for the elements of the project, and collates them. The collated results are then given back to the group, (without attributing results to any of the members). The individual members can then change their forecasts in light of the new information. This process of forecast and feedback can go on until the group members no longer want to change forecasts.

Risk response diagrams

Where risks are complex and have knock-on effects, it can save time and paper to show risk on a risk response diagram. A typical portion of a possible risk response diagram is shown below.

Notional Risk Response Diagram



Risk scenarios

A technique which requires management to group common risks and produce views of the consequences of certain risks occurring in conjunction with each other. Scenarios provide descriptions and trend graphs of possible outcomes given different views of the future. Scenario views are generally limited to three or four views of possible future worlds. Scenarios are mostly used to describe highly uncertain situations where it may be difficult to ascribe probabilities to events.

SWOT analysis

This looks at the strengths, weakness, opportunities and threats presented by a situation. Worked as a group exercise it can consider all the relevant aspects.

Sensitivity analysis

Sensitivity Analysis is a tool which helps to identify which factors have the largest influence on a project. The results are often shown as spider diagrams or sensitivity tables.

Risk analysis

It is not always possible to identify all the risks on a job in a purely descriptive way. For complex problems a risk analysis is needed in order to quantify risks by modelling.

A number of techniques are available. The basic procedure is to model processes deterministically and then allow for variability in the model by assigning probability ranges to the important elements.

There are many possible types of model. These can include process simulations, decision trees, fault trees, flowcharts, influence diagrams, cost/risk estimation and enhanced critical path analysis.

Combining distributions can be carried out in a number of different ways. Although there are other mechanisms, the usual options are the parametric and Monte Carlo methods.

The parametric method of calculation is used for relatively simple risk problems. It involves calculating means and variances for the various inputs and combining them (on a root mean squared basis) to show the overall variance of the result.

The Monte Carlo Method is a computerised means of combining distributions by an iterative process. For each iteration, the model uses a different input value from across the ranges of the input variables. Generally something over 1000 iterations are required to simulate a full range of results. Modern Monte Carlo simulation devices also provide users with sensitivity analyses. These show the impact of each individual variable on the overall result and point the way to where accuracy improvement can best be achieved.

Crystal Ball, PREDICT and @Risk are three useful Monte Carlo risk analysis packages which can be used alongside spreadsheet packages.

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Successive estimating method

This involves brainstorming the risks, which are allocated into a 3 by 3 matrix for type (technical, people, economic), versus source (project, company, external).

For example:

RISK GRID	Technical	People	Economic
Project	XXX	XXX	XXXXX
Company	XXX	XXXXXX	XXXXXX
External	XXX	XXXXXX	XXXXX

The above process groups risks together. The assumptions in the estimate for each, together with extreme deviations, are noted. Extreme deviations are quantified based on group experience and opinion.

The risks are calculated and a report produced ranking their contribution to the overall picture. This requires a project net present value (NPV) model which is generally prepared in advance of the workshop. The process identifies the key contributors to overall risk. These are then broken down into more detail and re-modelled as appropriate until clear action plans can be made. This breaking down into detail is called successive estimating. Action plans are then drawn up to manage the key risks which can be brought within project control.

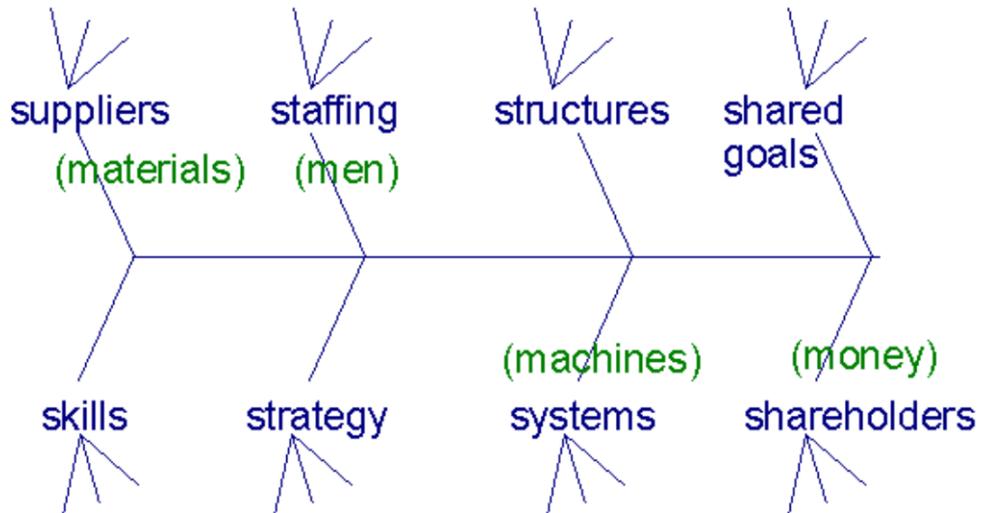
Force field analysis

This is another technique for analysing complex change situations. The first stage is to make a list of factors applying at present, compared to the desired future state. Following this a list of driving and restraining forces can be made for each factor. Arrows can be drawn against each, their lengths representing their strength. The large arrows represent the forces that need to be worked on.

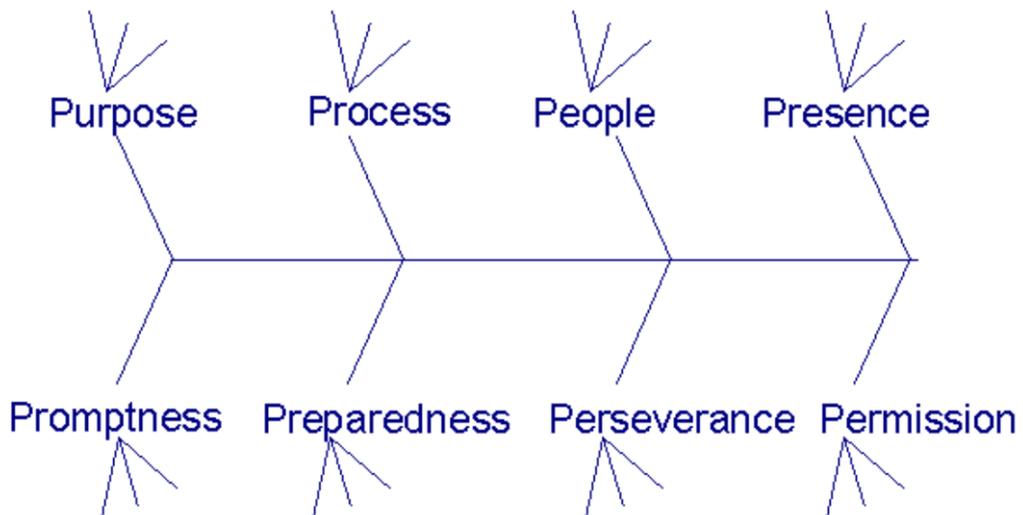
Fishbone diagrams

These are helpful to identify risks and a risk breakdown structure. The main spine of the fishbone is the major risk under discussion. As risks are identified branches can be added. Each branch represents a particular category or cause of risk. Two simple fishbone diagrams are shown overleaf:

Fishbone Structure For Risk Management



Fishbone Structure For Risk Management



APPENDIX 4

Glossary of Terms

Action plans	A description of the measures that will be implemented to manage the risk.
Action review	The date or period over which the action plan should be reviewed.
Assessment of risk	Assessment of the threats and opportunities affecting a project or organisation to gain an understanding of their individual significance and their combined impact upon defined objectives.
Avoidance	Elimination of uncertainty by direct means or the changing of strategy.
Cause	An event that produces an effect or consequence.
Closed-out risk	A risk that has already occurred can no longer occur or no longer impacts upon defined objectives.
Control	The acceptance of risk or the management of residual risk.
Existing controls	The measures already in place on the project to manage an identified risk, i.e. QA procedures.
Fallback/ Contingency plan	A pre-planned course of action that can be adopted to alleviate consequences of the risk should it occur, when the mitigating action and existing risk estimate fail to contain the impact (includes the carrying out of any advance activities that may be required to enhance the practicability of the plan).
Feedback	The provision of useful information that has been gathered in the course of risk management.
Risk identification	Identification of the threats and opportunities using a number of recognised techniques (e.g. brainstorming, SWOT analysis, interviews etc).
Mitigation	The reduction of risk exposure by diminishing probability of occurrence or severity of impact.
P/I Grid	The allocation of each risk within a matrix that pictorially represents the risk profile for the project.
Planning of risk	A formal process through which appropriate responses are identified to manage particular risks.
Priority rating	The rating derived from the P/I Grid (i.e. low/low (L/L) to high/high (H/H)). The risk register should be ordered by priority rating.
Qualitative assessment	Qualitative, descriptive tools for assessing risks, for example, structured interviews, questionnaires, workshops, checklists, flow and organisational charts.

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Quantitative assessment	Quantitative tools for measuring risks, for example probability trees, Mechanism to Ensure Resource Adequacy (MERA), Monte Carlo simulation.
Residual risk	The risk remaining after specific responses have been implemented to mitigate it.
Risk	A feature, activity or situation that has the potential to create an opportunity or produce a negative effect on the organisation or project.
Risk allocation	Assignment of risk to risk owner – ideally the person best able to control the risk.
Risk data sheets	Record of information on individual risks.
Risk estimate	The estimate of cost or time consequences of the risks on the project taking into account existing control measures and later action plans to respond to the risks.
Risk group	Generic source of risk, such as access, client, site parameters, financial, programme, etc.
Risk ID	The risk number. With the use of a risk database this is a unique number automatically allocated when the risk is inputted to the system.
Risk impact categories	Various areas in which risk can impact the project, i.e. cost, programme, functionality, security, aesthetics. This relates to the values set during the value management exercise.
Risk impact scores	Scoring impact to assist in the realistic assessment of risk. It gives more objectivity to the rating of the risks.
Risk management	The process of identifying, assessing and implementing measures to manage the factors that can have positive and negative impacts on the organisation and project.
Risk management plan	A document defining how risk management is to be implemented in the context of a particular project or business.
Risk perception	Value or concern with which stakeholders view a particular risk.
Risk rating (RR)	The product of the probability and impact ratings.
Risk register	An active document recording all identified risks, explaining the nature of each risk and recording information relevant to its assessment and management.
Risk review	The date or period over which the risk is to be reviewed.

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Risk review session	Sessions or meetings including appropriate personnel to provide a forum for monitoring and assessing the management of the project risks.
Risk workshop	Brainstorming session used to identify risks and then rate and allocate them to risk owners.
Secondary risk	A risk that may occur as a result of invoking a risk response or fallback/contingency plan.
Source of risk	The entity or activity with a potential for consequences.
Stakeholder	Any individual, group or organisation who may affect, be affected by, or perceive itself to be affected by, risk.
Transfer	Transfer of the liability and ownership of a risk by financial or contractual means.

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