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APM BODY OF KNOWLEDGE

5th EDITION

APM

Body of Knowledge

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Fifth edition

Association for Project Management

Association for Project Management
Ibis House, Regent Park
Summerleys Road, Princes Risborough
Buckinghamshire
HP27 9LE

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The Association would like to thank the many contributors to this work for waiving their moral rights to any or part of the complete work and for their continued support of the charitable aims of the Association.

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Preface

Welcome to the world of project management knowledge. Whether you have picked this up for the first time or you are a knowing reader, you are now engaged with the well-established *Association for Project Management Body of Knowledge*, now in its fifth edition.

It is a clear, simple guide for the journey through the growing collection of worldly project management knowledge which will progressively be revealed and which can be accessed in layers.

This latest edition of the *APM Body of Knowledge* is an up-to-date representation of the topics in which practitioners, experts and academic scholars in the UK consider professionals in project management should be knowledgeable and competent. Essentially it defines the topics that comprise modern professional project management – it encapsulates the breadth of project management and demonstrates its depth. In itself the *APM Body of Knowledge* is not and does not pretend to be a self-contained textbook, neither is it a set of competencies for a project manager, nor an exam syllabus, nor a specific methodology.

In this fifth edition the authors and editors have retained many aspects from previous editions but we have also made changes. We have reviewed all the text and made it consistent in content and style. We have reviewed and updated the further reading – and recognise that this is a growing field. We have enhanced reader accessibility to the *APM Body of Knowledge* by improving the presentation of the book and by providing electronic formats.

We believe that these structural, content and presentation revisions will maintain the *APM Body of Knowledge* as a cornerstone of the project management community in the UK and further afield.

Thank you.

Tom Taylor, Vice President of APM

Acknowledgements

The production, processing and maintenance of a body of knowledge is a complex, time-consuming and intellectually stimulating collection of activities – a series of concurrent and sequential complementary 'projects' that make up a 'programme', and this needs managing.

This enterprise would not be possible without extensive and diverse contributions from many people and organisations, most of them on a voluntary, altruistic basis.

It is important that their contributions are recognised not just as a way of saying thank you but also to convey to the reader the project management community's ownership of the material and the status of the ongoing products that arise from their endeavours.

Firstly, we recognise all the authors of the reference materials and sources that have enriched the words and diagrams provided and that are integral layers within this *APM Body of Knowledge*.

Secondly, we would like to thank the many parties from a wide range of locations and industry sectors who responded to interviews and/or completed (extensive) questionnaires with thoroughness and patience.

Thirdly, we wish to acknowledge the many individuals who have contributed by writing or checking or commenting on draft sections. They have done this as individuals, on behalf of their organisations or in steering groups or working parties during 2004 and 2005.

Fourthly, we would also like to acknowledge the many organisations that have permitted or encouraged their staff to contribute as individuals and have provided collected corporate views and contributed funding to the process.

Fifthly, there are the editorial and production teams who have assembled and made available this edition and its supporting promotional and back-up material in attractive and accessible formats both in hard copy and electronic versions.

Finally, we thank Professor Peter Morris and his team for their continuing academically rigorous work from the fourth edition onwards through to this fifth edition. The APM sponsor for recent research efforts has been Miles Shepherd, currently vice president of APM and previous chairman.

Perhaps we should also acknowledge the diverse collection of end user people and organisations for the *APM Body of Knowledge*, who are addressed later in the Introduction and provide the essential demand to keep this material up to date and available.

Thank you to all participants and stakeholders in the *APM Body of Knowledge*.

Introduction

WELCOME

The *APM Body of Knowledge* is a well-established collection of project management knowledge, now in its fifth edition. Divided into sections and topics it provides introductions and common guides to those areas considered essential to the discipline of managing projects, and it is clearly structured with definitions, explanations and suggested further reading material. This information will direct and assist those interested in project management in their work, studies and learning for recognised qualifications.

In this fifth edition the authors and editors have retained many aspects familiar from previous editions but they have also made some changes. While the established primary structure remains the same, all topics have been reviewed and updated.

The *APM Body of Knowledge* identifies 52 areas of knowledge, each of which is covered in a topic. We have added 10 new topics and changed 16 topic titles in order to reflect current thinking. In this new edition we have made a change to the topic numbering system in order to improve clarity. Topics are thus numbered decimally by section (1.1, 1.2 and so on). Figures are numbered consecutively within each of the seven sections (6.1, 6.2, 6.3).

All the sections and topics have been reviewed to bring them up to date, to be consistent in the weighting and style of explanations, and to exist as standalone topics. Illustrations have been added as appropriate.

Multiple-author books and useful websites are listed in the first topic (1.1 – Project management) and have been suggested to provide an overview of the entirety of project management. The references for further reading within each topic have been updated, limiting the number for each topic and including only those that are readily available.

In presentation terms improvements have been made to ease access and navigation through the *APM Body of Knowledge* by the provision of a glossary, a list of acronyms and an index, as well as cross-referencing, section-coding and a word search facility (in the digital version).

The overall approach reflects the needs and understandings within the UK and for those interested in adopting a UK approach wherever they may live and work. However, we have tried to avoid creating undue difficulties for those living and working in other parts of the world or from other cultures.

The content retains the APM philosophy of a pan-sector approach for explanations and further reading. We fully recognise the interest in particular sectors and the growth of sector specific reference material and this is something we will continue to monitor and address for future knowledge provision.

The use of project management as a vehicle for change is becoming much more widespread and popular, in ever-widening applications. The historically established sectors of project management are also reassessing and developing their needs and contexts – in construction, information technology, engineering, energy, transport and defence. Many 'new' industries and sectors have been discovering and adapting project management more widely to suit their needs – banking, entertainment, human resources, leisure, event management, retail supply, disaster recovery, product launches, political conferences, legal processes and more.

APM has long recognised that project management is not simply a matter of applying some tools and techniques or a 'one-size-fits-all' formula.

It is within this broadening of project management applications, the deepening of project management related knowledge and increasing speed of access that a firm initial project management knowledge base is required. The *APM Body of Knowledge* aims to provide this initial base.

THE STRUCTURE OF THE *APM BODY OF KNOWLEDGE*

The primary structure of the text is well established in the following seven sections:

1 Project management in context
2 Planning the strategy
3 Executing the strategy
4 Techniques
5 Business and commercial
6 Organisation and governance
7 People and the profession

There is nothing absolutely fixed about this structure in its format or sequence; it does, however, have clarity and logic. Many of the topics addressed in each section are closely linked with others elsewhere, or are interdependent. However, they are treated separately due to their significance and to aid simplicity of presentation.

In reality many of the topics may fit into more than one section – as they may also be applicable to more than one phase of a project. For example, project risk management and project quality management are not to be treated as topics in isolation.

FROM GENERAL, TO DETAILED

The *APM Body of Knowledge* endeavours to convey the knowledge appropriate to the discipline of managing projects, rather than the processes and practices of project management.

Within the *APM Body of Knowledge* the topics are those that are 'generic' to project management; correspondingly the way they are presented here is also generic, and at a high level. Detailed descriptions and explanations of the topics can be found in the lists of suggested further reading, in teaching and research institutions and their outputs, in the libraries and collections of business and professional libraries – in the UK and around the world. The principal aim is to give an introduction and scoping guide to each of the topics that professionals in project management consider to be essential components of the discipline. The characteristics of project, programme and portfolio management are explored in Section 1; thereafter the topics pursue 'mainstream' project management scenarios. However, many aspects can be interpreted and applied to programme and portfolio management and specialisms by niche services or particular industry circumstances.

Despite established definitions for these three 'Ps', in, for example, the British Standard Project Management vocabulary, there is still a range of understandings on the similarities and differences between them:

- A *project* is a unique, transient endeavour undertaken to achieve a desired outcome.
- A *programme* is a group of related projects, which may include related business-as-usual activities, that together achieve a beneficial change of a strategic nature for an organisation.
- A *portfolio* is a grouping of projects, programmes and other activities carried out under the sponsorship of an organisation.

APM BODY OF KNOWLEDGE – NOT A SET OF RULES OR PRACTICES

This is a body of knowledge. It is not a fixed set of rules or practices, or a prescriptive method that will guide people, organisations and teams from A to Z, leading them to an inevitable achievement of their targets and success criteria, such as 'on time, within budget, to the agreed quality'. The range of applications of project management in the UK means that it is not credible to produce a universal guidebook that in a step-by-step, phase-by-phase mechanical manner will drive towards success in an assured fashion.

The *APM Body of Knowledge* adopts a consistent approach across all topics. The explanations for each topic are deliberately short, general and high level. This recognises that the context of the need for knowledge is variable, reflecting a wide spectrum of interests and needs by industry, sector, location, relationships, stages, complexity, value, criticality and so forth. The contents of the *APM Body of Knowledge* do not provide or seek to imply a mechanistic set of rules, processes or practices that must be followed or must be fully known about in order to deliver projects successfully (one can never be so assured) or to demonstrate unquestionable professional capability.

KNOWLEDGE, EXPERIENCE AND COMPETENCIES

Good effective project management requires appropriately balanced combinations of knowledge, experience and behaviour. Experience generates both explicit and tacit knowledge which is clearly reflected in this *APM Body of Knowledge*. Competencies can be assessed against the various sections and those in Section 7 in particular. Expertise can be readily assessed and measured against all the sections and their descriptions – areas of strength can be made stronger, less strong or weak areas can be identified and remedied, and efforts towards continuing professional development (CPD) can be prioritised.

USERS OF THE *APM BODY OF KNOWLEDGE*

The range of users of the *APM Body of Knowledge* continues to grow. We recognise the following users:

- **Front line practitioners** and consultants/advisors undertaking project activities who wish to keep up to date with knowledge generally or to investigate particular elements to assist themselves or their teams.
- **Senior managers** of project-driven or project aware organisations who also want to keep abreast of current thinking and advise their teams and staff accordingly.
- The **Association for Project Management** itself uses the body of knowledge to maintain the currency of syllabuses for qualifications and to provide a structure for all project management knowledge collection and development.
- **APM-approved providers of development programmes (trainers)** will use the *APM Body of Knowledge* as a guide to assess students and construct courses for APM (and other) examinations and qualifications. Similarly, project management tool developers may use the structure or aspects of the *APM Body of Knowledge* for product development.
- **'Students'** of project management, including scholars and examination candidates of all ages, and the APM membership generally, at school, college, university or thereafter (not forgetting that seasoned practitioners are all always learning too) who will be assisted with their understanding of APM examinations and qualifications and provided with a reliable source of knowledge.
- **Researchers** at a higher level who are studying aspects of project management for academic or commercial purposes or by location, sector or subject and are searching for definitive reference materials will find them directly or indirectly via the *APM Body of Knowledge* (and the ever-growing collection of articles in APM's collection of periodicals, publications and referenced websites).
- **Authors and publishers** of books and articles who wish to reference their material within a recognised source.

- **Fellow member bodies of the International Project Management Association (IPMA)** and their individual members, and other bodies with an interest in project management will find the *APM Body of Knowledge* valuable as an explanation of a UK approach.
- **Librarians, information and knowledge managers** will find the *APM Body of Knowledge* useful as a source of classification and definition and as a wider reference tool.
- **Potential project managers** and potential members of the APM will find the *APM Body of Knowledge* to be an accessible introduction and indispensable primer.

CONTRIBUTORS TO THE *APM BODY OF KNOWLEDGE*

One of the main attributes of the *APM Body of Knowledge* is that it has been written by the project management community for the project management community.

The contributors to this latest edition are as knowledgeable as ever and now represent even greater diversity and wider consultation.

Contributors include cross-sectional representatives of:

- experienced practitioners;
- academic scholars;
- current authors and researchers;
- front line training providers;
- established project management organisations.

Specifically there have been:

- extensive peer group reviews of individual sections and of the document overall, including over forty structured interviews and data-gathering meetings from a range of industry sectors;
- a web-enabled questionnaire, that received over 400 responses, and which has been considered and incorporated as appropriate;
- workshop reviews with senior executives.

All of these resources have been combined to produce a strong, well-established, up-to-date *APM Body of Knowledge*.

AND FINALLY

On the inside of the front cover of this book there is some guidance on how to use this *APM Body of Knowledge*.

On the reverse of the back flaps of this book there are itemised lists of topics which can be folded out to provide easy navigation in using the document.

Best wishes to all readers, users, interested parties and organisations.

Section 1

Project management in context

Project management fits within the general framework of business and management, and is used to bring about change. Project management is a management discipline that is differentiated from the management of an organisation's business-as-usual by the fact that a project has a clear objective and deliverables,[1] with a defined start and end, that must be completed on time, within budget (cost) and to the agreed quality[2] and, of course, it must deliver the agreed benefits.

In order to understand project management in context it is important to appreciate:

- the boundaries of project management and where it fits in the general framework of business and management (Topic 1.1 – Project management);
- how projects can be delivered within a programme (Topic 1.2 – Programme management);
- how organisations manage projects, programmes and related operational activities as a portfolio of investment opportunities (Topic 1.3 – Portfolio management);
- that projects are not undertaken in vacuums and there needs to be an awareness of the environment in which they are undertaken (Topic 1.4 – Project context);
- that projects need direction and support from within an organisation, which is provided by a sponsor (Topic 1.5 – Project sponsorship);
- that within organisations there can be centres of project management expertise that assist both the organisation and the project manager (Topic 1.6 – Project office).

[1] Deliverable is the term used to describe the outputs of the project both during the project and at the end. To many people, deliverables and products are synonyms. A deliverable may not be a physical outcome.

[2] Quality is the term used to describe the performance of the delivery and the deliverables (outputs) of the project. To many people, quality and performance are synonyms.

1.1
Project management

Project management is the process by which projects are defined, planned, monitored, controlled and delivered such that the agreed benefits are realised. Projects are unique, transient endeavours undertaken to achieve a desired outcome. Projects bring about change and project management is recognised as the most efficient way of managing such change.

Organisations[1] have structures in place for the ongoing and routine management of business-as-usual.[2] Project management works across these structures drawing on the expertise and knowledge of the organisation, as well as external third parties if appropriate, to deliver a project. Essentially, project management achieves this by:

- understanding the need, problem or opportunity that the project will address;
- determining the business case, success criteria and benefits of the proposed project;
- defining what has to be accomplished and delivered, typically stated in terms of scope, time, cost and quality;
- developing a plan[3] to achieve the deliverables and then implementing the plan, ensuring that progress is maintained in line with objectives;
- utilising resources[4] as and when required in a team environment, under the direction of a project manager who is accountable for the successful delivery of the project in terms of time, cost and quality;
- ensuring that the sponsor is accountable for achievement of the defined benefits;
- using appropriate mechanisms, tools and techniques.

Project management should be applied throughout the project life cycle[5] (Topic 6.1). There are generic project management processes that need to be applied to each phase of the project life cycle. These may be described as:

[1] Organisation is used to describe an entity that is undertaking the project or providing services to a project.
[2] Also referred to as day-to-day business or operations.
[3] In the *APM Body of Knowledge* a plan is the project management plan – see Topic 2.4. In some industries and business sectors a plan is another way of referring to the schedule, which is incorrect.
[4] Resources are all those items required to undertake a project and include people, finance and materials.
[5] A project life cycle is a series of phases that all projects pass through.

- a starting or initiating process;
- a defining and planning process;
- a monitoring and controlling process;
- a learning and closing process.

The project management process provides the single point of integrative responsibility. It achieves this by defining the required inputs and outputs while taking into account all relevant constraints and mechanisms, as illustrated in Figure 1.1.

Project management expertise is spread across the project team. Project management capability and maturity exist at an individual and an organisational level. At an organisational level various project management capability maturity models have been developed that allow organisations to continuously improve their project management processes and procedures. Such models typically define the lowest level as an organisation that uses project management in an *ad hoc* manner through to an organisation that continually improves its project management capability.

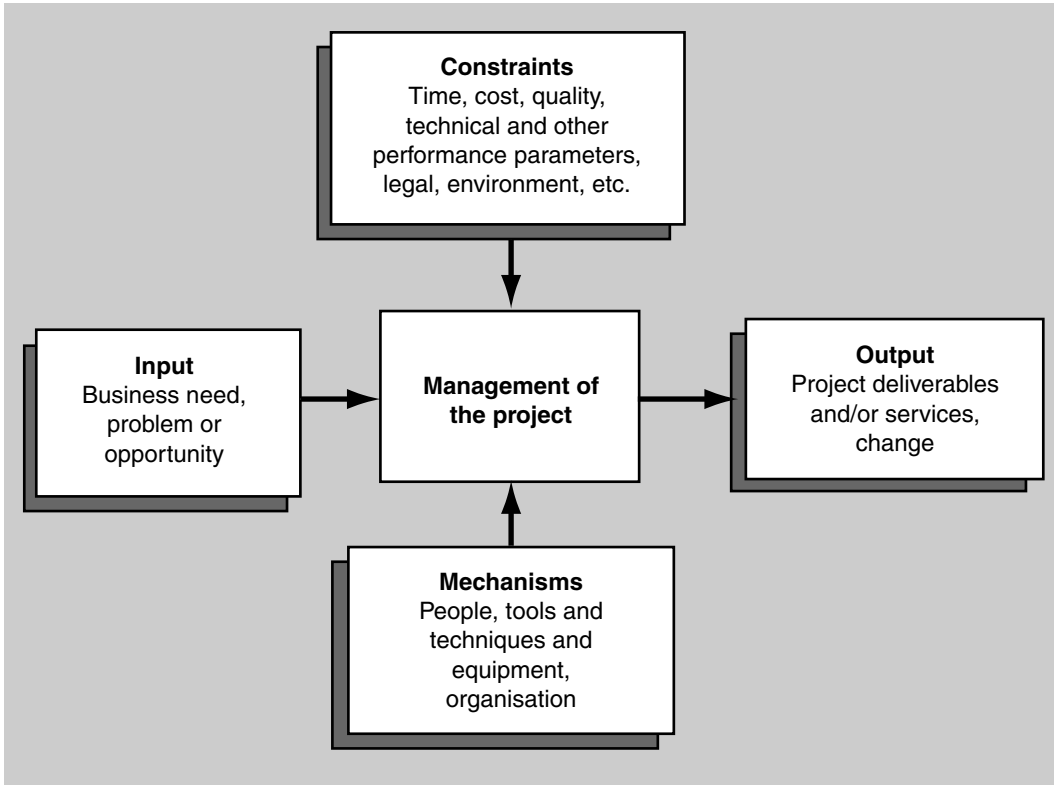

Figure 1.1 The project management process

A large project may be divided into subprojects each with their own unique deliverables that contribute to the overall project deliverable. It is possible for several projects to each produce their own unique deliverables, which then collectively contribute to a greater goal or benefit. Such projects are brought together under a programme and managed using programme management (Topic 1.2).

Further reading

British Standards Institution (2000–2002) BS 6079–1–3 Project Management. Guides, BSI, London

Buttrick, R. (2005) *The Project Workout*, 3rd edn, FT Prentice Hall, London, ISBN 0–273–68181–8

Hamilton, A. (2004) *Handbook of Project Management Procedures*, Thomas Telford, London, ISBN 0–72773258–7

Meredith, J. R. and Mantel, S. M. (2003) *Project Management: A Managerial Approach*, Wiley, Chichester, ISBN 0–471–07323–7

Office of Government Commerce (2005) *Managing Successful Projects with PRINCE2*, Stationery Office, London, ISBN 0–11–330946–5

Turner, J. R. (1998) *The Handbook of Project-Based Management*, 2nd edn, McGraw-Hill Education, New York, ISBN 0–07709161–2

The books and websites cited here are relevant to most, if not all, of the topics in the *APM Body of Knowledge* and have been placed in the first topic simply for convenience.

Multiple-author books

Cleland, David I. and Ireland, Lewis R. (eds) (2002) *Project Management: Strategic Design and Implementation*, 4th edn, McGraw-Hill, New York, ISBN 0–07–139310–2

Morris, P. W. G. and Pinto, J. K. (eds) (2004) *The Wiley Guide to Managing Projects*, Wiley, Chichester, ISBN 0–471–23302–1

Stevens, M. (ed) (2002) *Project Management Pathways*, Association for Project Management, Princes Risborough, ISBN 1–903494–01–X

Turner, J. R. and Simister, S. J. (eds) (2000) *The Gower Handbook of Project Management*, 3rd edn, Gower, Aldershot, ISBN 0–566–08138–5

Useful websites

Association for Project Management – www.apm.org.uk

International Project Management Association – www.ipma.ch

Office of Government Commerce – Successful Delivery Toolkit – www.ogc.gov.uk/sdtoolkit

Project Management Institute – www.pmi.org

UK Ministry of Defence – Acquisition Management System – www.ams.mod.uk

1.2

Programme management

Programme management is the co-ordinated management of related projects, which may include related business-as-usual activities that together achieve a beneficial change of a strategic nature for an organisation. What constitutes a programme will vary across industries and business sectors but there are core programme management processes.

Senior management defines an overall strategy for the organisation. This will set a number of objectives and targets for the organisation. Members of the management team will identify how the objectives and targets will be achieved. This may lead to the initiation of projects and programmes.

Senior management will analyse, select and prioritise the programmes and projects through portfolio management[1] (Topic 1.3) to make an optimal contribution to the achievement of the organisation's strategic objectives.

Those programmes that are selected will be undertaken through the definition, delegation and delivery of related projects. The programme manager must monitor the projects in terms of time, cost, quality, risks and issues, and interdependencies with other related projects and business-as-usual activities, and delegate responsibility for the successful completion of individual projects to project managers.

Individual projects should have a benefits management function. A distinctive feature of programmes is that the related projects must be managed together if the desired strategic benefits are to be achieved. Therefore a principal responsibility of the programme manager is to maintain a focus on the delivery of agreed strategic benefits, as illustrated in Figure 1.2. Individual projects outside a programme may also contribute to a strategic benefit.

Typically, the desired benefits will be identified within a business case, which includes a specification of what the programme is expected to achieve. Programmes will evolve over time and therefore will have to be redefined to take account of the changing business environment.

There are differences of opinion as to what constitutes programme management. However, applicable to all programmes are:

- accelerating, decelerating, redefining, terminating and initiating projects within the programme;
- managing interdependencies between projects and between projects and business-as-usual activities;
- managing resources available to the programme and resource conflicts;

[1] Portfolio management is the selection and management of all projects' programmes and related business-as-usual activities within an organisation.

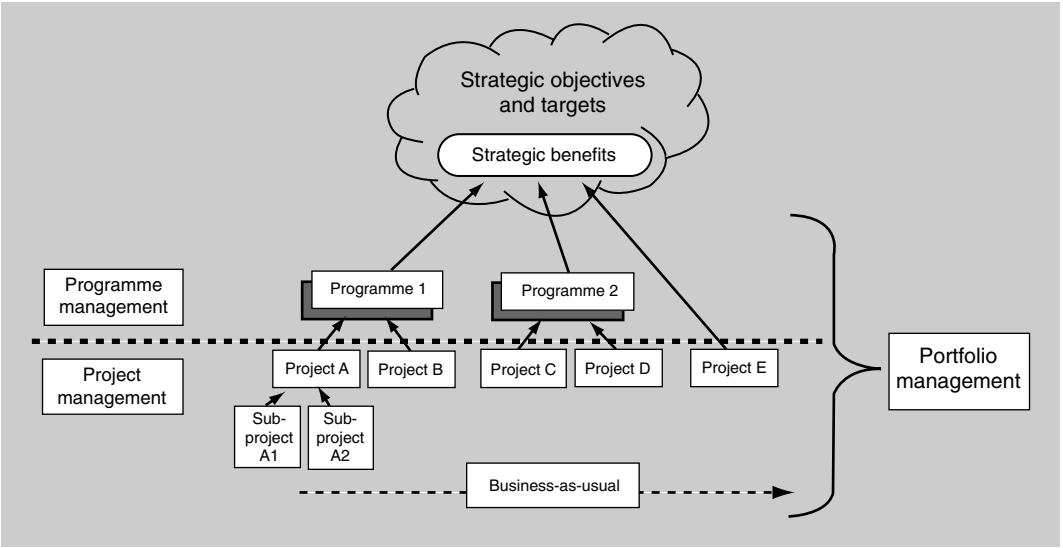

Figure 1.2 The relationship between project, programme and portfolio management

- managing risks, issues and changes at a programme level;
- defining and realising the strategic benefits.

Further reading

Bartlett, J. (2002) *Managing Programmes of Business Change*, Project Manager Today Publications, Bramshill, Hants, ISBN 1–900391–08–2

British Standards Institution (2004) BS EN 9200: 2004 Programme Management. Guidelines for project management specification, BSI, London

Office of Government Commerce (2002) *Managing Successful Programmes*, Stationery Office, London, ISBN 0–11–330016–6

Reiss, G. (1996) *Programme Management Demystified*, Spon, London, ISBN 0–419–21350–3

Springer, M. (2005) *A Concise Guide to Program Management: Fundamental Concepts and Issues*, Purdue University Press, ISBN 1–55753–376–8

Williams, D. and Parr, T. (2004) *Enterprise Programme Management: Delivering Value*, Palgrave Macmillan, Basingstoke ISBN 1–4039–1700–0

1.3
Portfolio management

Portfolio management is the selection and management of all of an organisation's projects, programmes and related business-as-usual activities taking into account resource constraints. A portfolio is a group of projects and programmes carried out under the sponsorship of an organisation. Portfolios can be managed at an organisational, programme or functional level.

There are differences of opinion as to what constitutes portfolio management. However, the common theme is that portfolio management within the context of project management involves:

- screening, analysis and financial appraisal of project and programme characteristics (resources, schedules, cash flows, risks, benefits and so on) in relation to the organisation's strategy;
- prioritisation and/or selection of projects or programmes within the organisation's portfolio, given the resources available, likely returns and risks;
- continued monitoring of the portfolio characteristics as projects and programmes develop;
- adjustment of the portfolio with regard to the constraints, risks and returns anticipated, and in the light of developing circumstances around the portfolio.

Portfolio management is particularly concerned with the interdependencies between projects and programmes in terms of:

- scarce or limited resources;
- balance within the portfolio between risks and return;
- timing;
- capacity bottlenecks.[1]

Organisations seek a mixture of projects and programmes that fulfil their strategic objectives. When a fixed resource pool has to be shared amongst a number of projects and programmes some form of prioritisation has to take place. This allows the more important projects and programmes to access the required resources and to move forward in accordance with their plans. Projects and programmes that are deemed low priority may have to revise their plans to take account of the reduced level of resources they potentially might receive, and those that no longer support the portfolio may need to be

[1] The term 'capacity bottleneck' is used to describe a situation where several projects all need access to a limited resource at the same time.

terminated. This aspect of portfolio management is often a subset of corporate governance (Topic 6.10) and thus is the responsibility of senior management. Senior management may be assisted in its deliberations by a project office (Topic 1.6) which collects and presents appropriate information on all projects and programmes to allow meaningful comparisons to be made.

Project and programme management have an important role to play in ensuring that portfolio management is provided with accurate up-to-date information, particularly on status. Project and programme managers may also have a significant role in influencing the portfolio prioritisation process, vying for the resources their projects or programmes may need at various stages of their life cycles.

Further reading

Benko, C. and McFarlane, W. (2003) *Connecting the Dots: Aligning Your Project Portfolio with Corporate Objectives*, Harvard Business School Press, Boston, MA, ISBN 1–57851–877–6

Dye, L. D. and Pennypacker, J. S. (eds) (1999) *Project Portfolio Management*, Center for Business Practices, Havertown, PA, ISBN 1–92957616–1

Kendall, G. I. and Rollins, S. C. (2003) *Advanced Project Portfolio Management and the PMO: Multiplying ROI at Warp Speed*, J. Ross Publishing, Fort Lauderdale, FL, ISBN 1–932159–02–9

Pennypacker, J. S. and Dye, L. D. (eds) (2002) *Managing Multiple Projects: Planning, Scheduling, and Allocating Resources for Competitive Advantage*, Marcel Dekker, New York, ISBN 0–8247–0680–3

1.4
Project context

Project context refers to the environment within which a project is undertaken. Projects do not exist in a vacuum and an appreciation of the context within which the project is being performed will assist those involved in project management to deliver a project.

A project will be managed differently according to a wide range of factors, including the industry or business sector in which it is based, geographical location, use of virtual teams, technical complexity or financial impact. The tools and techniques of project management should be applied in a manner that is appropriate to their context. Context covers both the external and internal environments and must consider the interests and influences of stakeholders (Topic 2.2). The major elements of the environment are often based on the acronym PESTLE (**P**olitical, **E**conomic, **S**ociological, **T**echnical, **L**egal and **E**nvironmental). Other factors to consider are organisational capability and maturity, structure and processes and individual resource capability and availability.

Industry and business sector practices provide some of the context within which project management is practised. The following are examples of context:

- Procurement practices, such as the various standard forms of construction contract or the application of partnering, can shape organisational structures and ways of working.
- Project management in drug development or the nuclear sector is strongly shaped by the regulatory requirements of licensing approval processes as well as by the scientific culture of the industry.
- Projects within the UK government sector have to follow particular practices such as OGC Gateway®[1] and take account of political influences.
- The use of publicly available methods such as PRINCE2 can have a huge effect on practice.

Variations in context make the application of appropriate project management practices challenging. Their appropriateness will vary according to the contextual variables described above.

All the above affect the context of the project and shape the environment that the sponsor, project manager and project team have to deal with, and may assist or restrict the attainment of the objectives, deliverables and

[1] The Office of Government Commerce examines a programme or project at critical points in its life cycle to provide assurance that it can progress successfully to the next phase.

benefits of the project. The successful accomplishment of a project generally requires a significant sensitivity to, and understanding of, the context in which it is based.

Further reading

Crawford, L., Hobbs, J. B. and Turner, J. R. (2005) Project Categorization Systems and their Use in Organisations: An Empirical Study, in *Innovations: Project Management Research 2004* (eds D. P. Slevin, D. I. Cleland and J. K. Pinto), Project Management Institute, Newton Square, PA, ISBN 1–930–69959–X

Davies, A. and Hobday, M. (2005) *The Business of Projects*, Cambridge University Press, Cambridge, ISBN 0–521–84328–6

Newton, R. (2005) *The Project Manager: Mastering the Art of Delivery*, FT Prentice Hall, London, ISBN 0–273–70173–8

1.5
Project sponsorship

Project sponsorship is an active senior management role, responsible for identifying the business need, problem or opportunity. The sponsor ensures the project remains a viable proposition and that benefits are realised, resolving any issues outside the control of the project manager.

Projects implement change and that allows organisations to fulfil their business objectives. This emphasises benefits realisation, rather than delivery of deliverables. Consequently, the role of the sponsor[1] is to direct a project with benefits in mind, as opposed to the project manager, who manages the project with delivery in mind with consideration of the benefits to be realised. Project sponsorship is therefore more pertinent to project effectiveness while project management is more concerned with project efficiency.

The sponsor is the primary risk taker and owner of the project's business case. The sponsor is tasked with ensuring that the benefits of a project are realised and therefore needs to ensure that any obstacles faced by a project are dealt with.

There should be only one sponsor per project. The sponsor chairs the steering group[2] (Topic 6.8) and is the person to whom the project manager is accountable. The relationship between sponsor and project manager is based on a continuous dialogue, with a common understanding of the project context, the benefits sought and the costs and risks of achieving those benefits.

The sponsor needs to be:

- a business leader and decision maker who is able to work across functional boundaries within an organisation;
- an advocate for the project and the change it brings about;
- prepared to commit sufficient time and support to undertake the role;
- sufficiently experienced in project management to be able to judge whether the project is being managed effectively.

Without clear goals, direction and business leadership provided by the sponsor even the best project manager and project team can struggle to succeed. Similarly, without clear, timely decisions and support a project will falter.

[1] Also referred to as the project executive, senior responsible officer, project director, project champion or project owner.

[2] The steering group oversees a project and provides strategic guidance. Alternatively called the steering committee or project board.

The more a project changes the status quo, the more likely it is that organisation boundaries will be crossed and the greater the likelihood that organisational politics will become apparent (Topic 1.4). The sponsor has to understand what motivates the various stakeholders and be prepared, empowered and capable of addressing their interests. Interpersonal skills are paramount, especially those concerned with influencing people.

The effectiveness of a sponsor is related to the project management maturity of an organisation. The more mature an organisation, the more likely it is that the sponsorship role and hence benefits-driven projects will succeed.

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1.6
Project office

A project office serves the organisation's project management needs. A project office can range from simple support functions for the project manager to being responsible for linking corporate strategy to project execution.

A project office[1] provides supporting project management services. Not all organisations or projects will have a project office. Where a project office does not exist the services it provides must be undertaken by project managers.

As a minimum the project office should provide:

- administrative support and assistance to project managers;
- collection, analysis and reporting of project information;
- assurance of project management processes.

A project office can fulfil a number of additional roles:

- Where the project office is the functional home for project managers the project office allocates project management resources to projects and is responsible for the professional development of project management professionals.
- Where the project office contains project support experts it provides a service to projects by ensuring they have the tools, techniques and information they need. This can be in the form of either coaching and mentoring sponsors and project managers or doing the support work for them.
- Where the project office instigates improvements to the way the organisation runs projects it enables and drives lessons learned from projects to be implemented on future projects.
- Where the project office is responsible for excellence in project execution this frees the sponsor and the organisation's senior management to make business decisions and concentrate on exception management for the projects.
- Where the project office has a strategic role it is responsible for the execution of corporate strategy through projects and programmes. This project office acts as developer and repository of the standards, processes and methods that improve individual project performance. It also facilitates the organisation's ability to manage its entire collection of projects and programmes as one or more portfolios and serves as a single source of information on project activity and data across the enterprise. This type of

[1] Project office has been used as a generic term. Specific terms include project support office, project management office, project and programme support office, portfolio support office, enterprise programme management office.

project office can be referred to as the enterprise project management office (EPMO).

Additionally, a project office can provide the infrastructure to support communities of practice. These are informal networks of individuals within an organisation who have an interest in learning and best practice of a particular area of project management.

The main advantage in the drawing together of project management talent into any form of project office is the development of a centre of excellence allowing the organisation to learn, lead, grow and develop its project management potential.

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Section 2

Planning the strategy

The unique, transient nature of projects means that a strategy, and a plan for their execution, has to be developed. A project that is properly planned will have a far greater chance of success than a poorly planned project. A number of processes can be used to enable a project to be planned that will allow the sponsor to achieve the agreed benefits.

In order to plan the strategy, consideration should be given to:

- the need to understand how the success of the project will be measured from the project manager's, sponsor's and stakeholders' perspectives (Topic 2.1 – Project success and benefits management);
- the importance of managing all those with an interest in the project (Topic 2.2 – Stakeholder management);
- how the project will deliver value (Topic 2.3 – Value management);
- how the plans for implementing the project should be combined and then approved (Topic 2.4 – Project management plan);
- the importance of proactive risk management (Topic 2.5 – Project risk management);
- the need for a quality management process that is applied throughout the project (Topic 2.6 – Project quality management);
- the working environment and health and safety factors (Topic 2.7 – Health, safety and environmental management).

2.1
Project success and benefits management

Project success is the satisfaction of stakeholder needs and is measured by the success criteria as identified and agreed at the start of the project. Benefits management is the identification of the benefits at an organisational level and the monitoring and realisation of those benefits.

The sponsor may view success as the project having achieved stated benefits as defined in the business case. From the project manager's perspective success may mean meeting agreed scope, time, cost and quality objectives as defined in the project management plan (Topic 2.4). However, stakeholders will have differing views of the project's success which must be taken into account.

It is possible to have a successful project that fails to deliver expected benefits or a project that delivers significant benefits but is considered a failure. Therefore project success and benefits need to be considered together because it is the organisational impact of deliverables that produces benefits. Stakeholders must agree how success for the project is defined, and the benefits the organisation wants to achieve by investing in the project.

Benefits management involves identifying and agreeing the benefits and how they will be measured, monitored and managed throughout the project until they are realised. Benefits can be measured quantitatively, such as financially, by market share or by output capacity, and qualitatively, such as improving security, increasing staff satisfaction or achieving a higher brand position.

At handover and closeout, it will be known whether a project has achieved its success criteria,[1] whereas benefits may not be realised until after handover and closeout. Therefore ownership of benefits realisation rests with the sponsor rather than with the project manager.

For the project manager to understand what success is, success criteria must be agreed with stakeholders during the concept phase (Topic 6.2) but may be changed at any time in the project's life cycle via change control (Topic 3.5). Success criteria require quantitative measures against which to judge their success. Key performance indicators (KPIs) are measures of success criteria. Tracking KPIs ensures that the project is progressing towards achievement of success criteria, enabling corrective action to be taken. Examples of success criteria are the achievement of deliverables on time or

[1] Terminology in this area is fluid. Success criteria can be called many things in different environments including key result areas (KRAs) or critical success factors (CSFs).

the recruitment of skilled resources; associated KPIs might be performance against the schedule and rate of recruitment.

Success factors are elements of the project context or management process that should be controlled or influenced, and will increase the likelihood of a successful project. The presence of these factors does not guarantee project success, but their absence may contribute to failure. Examples of success factors include senior management support, clear goals and objectives or a motivated project team.

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2.2

Stakeholder management

Stakeholder management is the systematic identification, analysis and planning of actions to communicate with, negotiate with and influence stakeholders. Stakeholders are all those who have an interest or role in the project or are impacted by the project.

Stakeholders have a key role in defining the success criteria used to judge the success of the project and their interest and power should not be overlooked. Stakeholders must be identified, their level of interest (positive or negative) and power to influence the success of the project analysed, and plans devised for their management. Stakeholder management is an iterative process which starts during project concept.

Stakeholder identification requires consideration of who is involved in, affected by or can affect the project. Brainstorming of potential stakeholders may identify:

- resources needed for the project;
- organisations or people who will be affected by the project;
- organisations or people on the sidelines of the project who will influence attitudes and behaviours;
- statutory and regulatory bodies.

Once stakeholders have been identified stakeholder analysis is used to establish their position in relation to the project. Questions to consider are as follows:

- Do they have an interest in the project succeeding?
- Will they be openly supportive of the project as it progresses?
- Is the stakeholder ambivalent about the project?
- Could the stakeholder have a negative view about what the project will deliver?
- What are their expectations and how can these be managed?

A tool to further understand a stakeholder's position in relationship to the project is a stakeholder grid (Figure 2.1). Considering a stakeholder's placement on this grid will help to determine stakeholder management actions.

The stakeholder analysis will need to be validated against the project context as it often provides a good pointer towards how organisations and people will relate to the project outcomes. Stakeholders must be managed to ensure that their positive interest in the project is utilised and maintained or that their negative interest is removed or minimised. Stakeholders who are 'for' the project and in a position of high power can be used to influence stakeholders who are 'against' the project.

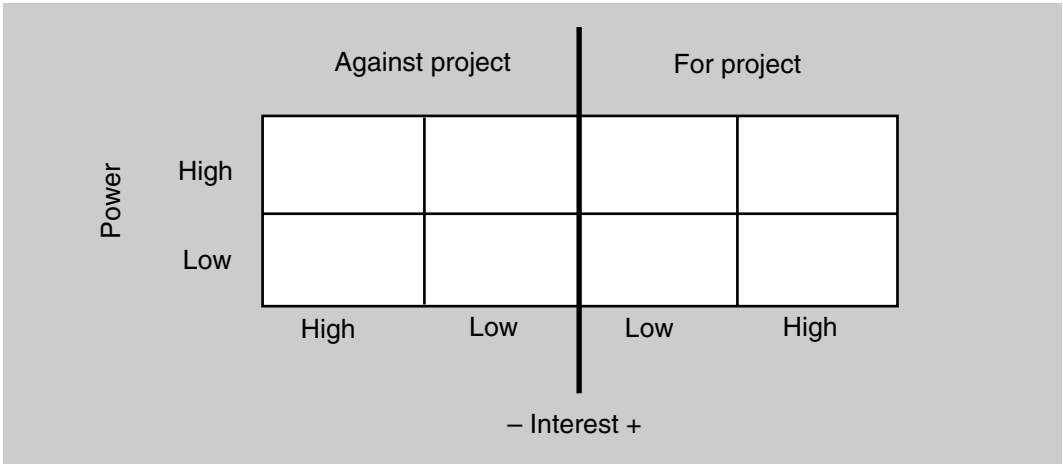

Figure 2.1 A stakeholder grid

Stakeholder management becomes more complex when stakeholders' views are not consistent throughout the life cycle of the project as changes occur in their opinions, roles, views regarding the project and allegiances. The stakeholder analysis will need to be reviewed throughout the life cycle.

The project's communication plan should be employed as a tool for stakeholder management. It may include who the stakeholders are and their communication needs, and who is responsible for their management and planned responses.

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2.3
Value management

Value management is a structured approach to defining what value means to the organisation and the project. It is a framework that allows needs, problems or opportunities to be defined and then enables review of whether the initial project objectives can be improved to determine the optimal approach and solution.

Value management uses proven methods that are systematically brought together to identify and deliver better value from projects. The key to the process is the involvement of stakeholders and their understanding of the function and value a project must deliver. Value management is concerned with motivating people, developing skills, advancing teams and promoting innovation, in order to optimise the overall performance of a project. For project managers, value management is concerned with improving the decision-making framework for the project within the project context.

Value is subjective and may be defined in a number of ways, such as worth, satisfaction of needs and benefits. In BS EN 12973:2000 value is defined as the ratio of 'satisfaction of needs' over 'use of resources', as shown in Figure 2.2: the fewer the resources used or the greater the function achieved, the greater the value.

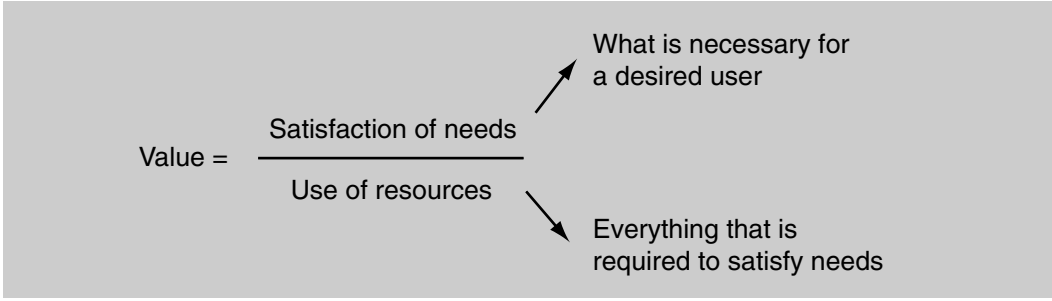

Figure 2.2 The definition of value as per BS EN 12973:2000

Value management has evolved out of a number of techniques, such as value analysis and functional analysis and system technique (FAST), that are based on the concept of value and functional approach. The value management approach[1] involves three root principles:

[1] BS EN 12973:2000 Value Management defines this approach.

- A continuous awareness of value for the project, establishing measures or estimates of value, monitoring and controlling them.
- A focus on the objectives and targets before seeking solutions.
- A focus on function, providing the key to maximise innovative and practical outcomes.

The structured approach of value management is used to define what value means in the process of delivering the specified project deliverables. This is undertaken by gaining a consensus about the project deliverables and how these will be achieved by the project. The process is strategic and iterative and involves challenging the requirements and confirming the project's success criteria.

While value management is concerned with the optimisation of the strategy and business objectives, value engineering is concerned with optimising the conceptual, technical and operational aspects of a project's deliverables (Topic 4.5).

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2.4
Project management plan

The project management plan brings together all the plans for a project. The purpose of the project management plan (PMP) is to document the outcomes of the planning process and to provide the reference document for managing the project. The project management plan is owned by the project manager.

The project management plan[1] (PMP) confirms the agreements between the sponsor and other stakeholders and the project manager. It is approved by the sponsor, representing the organisation, and the project manager, representing the project team. Sharing the PMP with stakeholders is important in establishing common agreement of the contents, especially as the stakeholders' expectations of the project may have changed during the planning process. Although the project manager owns the PMP it should be developed with the project team; this removes ambiguity, develops commitment and assists in effective handover of the project.

The PMP documents how the project will be managed in terms of why, what, how (and how much), who, when and where:

- The 'why' is a statement of the change to be delivered by the project which includes a definition of the need, problem or opportunity being addressed. This is frequently developed in the business case.
- The 'what' describes the objectives, a description of the scope, the deliverables and their acceptance criteria. It also describes the success criteria for the project and the KPIs used to measure success. The 'what' needs to take into account the project's constraints, assumptions and dependencies.
- The 'how' defines the strategy for management, the handover of the project, the tools and techniques, monitoring and control, and reporting arrangements.
- 'How much' defines the project budget and the budgeting and cost management process.
- The 'who' includes a description of key project roles and responsibilities and the plan for all the resources that will be required.
- 'When' defines the timescales, including milestones and any arrangement for phasing, which must also then be reflected in the 'how much'.
- 'Where' defines the geographical location(s) where the work is performed, which impacts on costs and personnel factors.

[1] The project management (PMP) plan is sometimes referred to as a project execution plan, a project implementation plan, a project plan or simply a plan. In PRINCE2 the PMP is called the project initiation document (PID). It also brings together all the plans in one document allowing formal project authorisation.

The PMP also describes the policies and plans for managing changes, communication, configuration, governance, health, safety and environment issues, procurement, quality and risk.

The PMP is progressively developed during the planning process and is managed as a live, configuration-controlled document. In order to develop the PMP, scope management (Topic 3.1), scheduling (Topic 3.2), resource management (Topic 3.3) and budgeting and cost management (Topic 3.4) will be required. Once agreed, the PMP provides a baseline description of how the project will be managed, which is then periodically reviewed and updated through change control. The PMP will itself be the baseline document upon which changes are considered.

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2.5
Project risk management

Project risk management is a structured process that allows individual risk events and overall project risk to be understood and managed proactively, optimising project success by minimising threats and maximising opportunities.

All projects are inherently risky, because they are unique, constrained, complex, based on assumptions and performed by people. As a result, project risk management must be built into the management of projects, and should be used throughout the project life cycle.

Traditionally risk has been viewed as exclusively negative, but in project management it is defined as 'an uncertain event or set of circumstances that, should it occur, will have an effect on achievement of one or more project objectives', with the clear understanding that risks can affect achievement of project objectives either positively or negatively. The term 'risk event' is therefore used to cover both opportunities and threats, and both can be managed through a single risk management process.

It is also possible to define a higher level of 'project risk' which is 'exposure of stakeholders to the consequences of variation in outcome', arising from an accumulation of risk events together with other sources of uncertainty to the project as a whole.

The risk management process as illustrated in Figure 2.3 requires an initiation step to define scope and objectives, after which risks can be identified. The relative significance of identified risks is assessed using qualitative techniques to enable them to be prioritised for further attention. Quantitative risk analysis may also be used to determine the combined effect of risks on overall project outcome. A range of techniques are available, such as Monte Carlo simulation, decision trees and influence diagrams.

The process continues with risk response planning, aiming to avoid, reduce, transfer or accept threats as well as to exploit, enhance, share or accept opportunities, with contingency[1] for risks which cannot be handled proactively. The next step is implementation of agreed responses, followed by iterative identification, review and update throughout the project life cycle to maintain awareness of current risk exposure.

It is also important to identify and manage behavioural influences on the risk process, both individual and group, since these can have a significant impact on risk management effectiveness.

Risk management within a project must not be conducted in isolation, but must interface with the organisation. This includes escalation of risks to programme and portfolio levels, as well as contributing to business risk assessments and corporate governance requirements.

[1] Contingencies can include time, cost, resources and course of action.

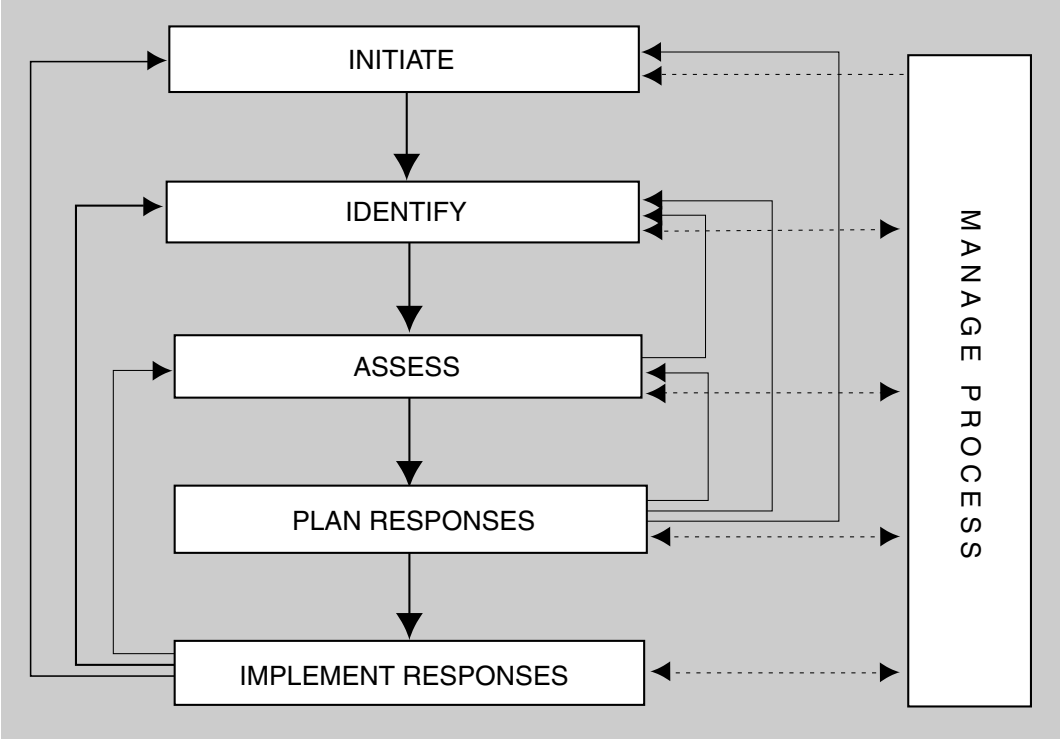

Figure 2.3 The risk management process (Source: APM (2004) *Project Risk Analysis and Management Guide*, 2nd edition)

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2.6
Project quality management

Project quality management is the discipline that is applied to ensure that both the outputs of the project and the processes by which the outputs are delivered meet the required needs of stakeholders. Quality is broadly defined as fitness for purpose or more narrowly as the degree of conformance of the outputs and process.

Quality management covers four processes: quality planning, quality assurance, quality control and continuous improvement.

The requirements for quality, expressed in measurable terms as acceptance criteria, form the foundation for quality management for the project. Quality planning prepares to achieve those requirements, enabling the project manager to manage the trade-off between scope, time, cost and quality. Outputs and processes can only be fit for purpose if the purpose is understood.

Quality assurance (QA) provides confidence to stakeholders that requirements for quality will be achieved. QA validates the consistent use of procedures and standards, supported by independent reviews and quality audits. QA will also be a source of lessons learned and ideas for improvement.

Quality control (QC), consisting of inspection, testing and quality measurement, verifies that the project deliverables conform to specification, are fit for purpose and meet stakeholder expectations.

The success of QA and QC can be enhanced by using a number of tools and techniques including project risk management (Topic 2.5), modelling and testing (Topic 4.6) and configuration management (Topic 4.7). Configuration management will support the effective control of documentation and physical items.

Concepts that further define quality are 'right first time' and 'zero defects', for re-work costs the project time and money and reduces stakeholder confidence. Accepting outputs to a reduced specification may allow the project to meet requirements for time and cost, but is poor project quality management. Delivering results to a higher specification, sometimes called 'gold-plating', is also poor quality.

Organisations that achieve project quality demonstrate a continual systematic approach to improvement, i.e. continuous improvement, that is focused on specifying requirements tightly and meeting them without wasting time or resources in the process. The practices encompassed in 'total quality management' (TQM), 'six sigma' and 'lean' are designed to achieve results as efficiently and effectively as possible.

The drive for 'total' quality has led to the development of maturity models designed to measure attainment and provide the motivation and a mechanism for objectively achieving improvement. Models such as the EFQM

excellence model, the project excellence model, and a wide range of other capability maturity models also allow benchmarking between organisations and wider improvement across an organisation or sector.

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2.7

Health, safety and environmental management

Health, safety and environmental management is the process of determining and applying appropriate standards and methods to minimise the likelihood of accidents, injuries or environmental impact both during the project and during the operation of its deliverables.

The management of health, safety and environmental factors is important in projects. It is a major component of construction, communications, energy, nuclear, food, pharmaceutical, transportation, waste and other sectors that operate under strict regulatory control. For example safety management impacts on the quality requirements of safety-critical software in many industries.

At a project level such management requires a working knowledge of the legal and organisational policies and procedures that apply to the project, including an understanding of the requisite health, safety and environmental regulations.

Legislation[1] influences the project manager's responsibility towards the people in the project team. For example the project manager may have to ensure that reasonable adjustment to physical premises has been made in order to avoid discrimination against an employee in their project team.

Organisations also have a legal duty to ensure employees are not made ill by their work. This includes taking steps to prevent physical and mental illness brought about by stress. The project manager must be aware of how the organisation's policy impacts on their project, for example by monitoring that excessive hours are not worked.

Environmental legislation is subject specific. Requirements for noise, dust, protection of flora and fauna, waste and sustainability, for example, must be proactively incorporated within project planning, including any disposal activities, to comply with these regulations.

UK and EU legislation demands that health and safety risk assessment and management is carried out for most commercial activities, including projects, in order to reduce health and safety risk to an acceptable level. There are a number of techniques and processes that cover these activities, including hazard and operability (HAZOP), hazardous condition (HAZCON), defect

[1] Examples of UK legislation and regulations include the Health and Safety at Work Act, the Management of Health and Safety at Work Regulations, Construction (Design and Management) Regulations, Display Screen Regulations and the Disability Discrimination Act.

reporting and corrective action (DRACAS) and as low as reasonably practicable (ALARP).

The project manager is expected to ensure that the project has a plan or plans including health, safety and environmental management, organisation, health and safety risk management, training, auditing and reporting.

The project manager owes a duty of care[1] to all those involved in the project. Likewise all those involved in the project have a duty of care to themselves and others to act responsibly and upon the project manager's instructions.

Further reading

British Standards Institution (2004) BS EN ISO 14001:2004 Environmental Management Systems. Requirements with guidance for use, BSI, London

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[1] Duty of care in many instances is a legal responsibility.

Section 3

Executing the strategy

After the strategy and plan for the project have been agreed the strategy can be executed. Execution is far more than just implementing the project management plan (PMP). The context in which the project is executed has to be monitored and controlled. The constituent plans contained within the PMP have to be developed further and then used to monitor and control the project. Any changes to the plans whether internal or external to the project must be formally managed by change control.

The first four topics in this section are used in preparation of the PMP and have to be performed before it is baselined. After approval of the PMP these topics may be further performed to develop the plans to the level required to implement the project. These topics are performed in order that:

- the complete scope of the project is defined (Topic 3.1 – Scope management);
- the schedule within which the scope must be delivered is determined (Topic 3.2 – Scheduling);
- the resources required to deliver the scope are understood (Topic 3.3 – Resource management);
- the necessary budget to deliver the scope is agreed (Topic 3.4 – Budgeting and cost management).

The final four topics deal with change, monitoring and control:

- The need to allow for and formally manage change against an agreed baseline is fundamental to project success (Topic 3.5 – Change control).
- The ongoing measurement and management of the project's performance is essential (Topic 3.6 – Earned value management).
- Projects create large volumes of information which need to be managed. This management includes formal reporting (Topic 3.7 – Information management and reporting).
- Project managers need to ensure that issues are managed (Topic 3.8 – Issue management).

3.1
Scope management

Scope management is the process by which the deliverables and work to produce them are identified and defined. Identification and definition of the scope must describe what the project will include and what it will not include, i.e. what is in and out of scope.

The scope comprises the project deliverables and the work associated with producing those deliverables. It is important to also define what is outside of scope, i.e. the deliverables that the project will not provide. Scope management is continually applied throughout the project life cycle.

A high-level statement of scope is documented in the business case. This will describe the breadth of the scope. The depth of the scope is described at differing levels of detail as the project progresses. Scope is refined as part of requirements management (Topic 4.1) and also in the production of the project management plan (PMP) (Topic 2.4).

The scope in the PMP is refined using a product breakdown structure (PBS) and work breakdown structure (WBS):

- The PBS defines all the products (deliverables) that the project will produce. The lowest level of a PBS is a product (deliverable).
- The WBS defines the work required to produce the deliverables. The lowest level of detail normally shown in a WBS is a work package.[1] Acceptance criteria for each work package must be established as part of the ongoing project quality management process.

The organisational breakdown structure (OBS) is created to reflect the strategy for managing and handover of the project. The OBS shows the hierarchical management structure for the project, the communication routes and reporting links.

The WBS and OBS can be combined to create a responsibility assignment matrix (RAM), which correlates the work packages in the WBS to the people, organisations or third parties responsible for accomplishing the assigned work.

The cost breakdown structure (CBS) shows either the costs assigned to work packages using the WBS, or the costs assigned to functional areas and third parties using the OBS. The scope is used as input to the estimating and scheduling processes.

[1] In BS 6079 the lowest level of detail is an activity. Activities may not be shown on the WBS if this is considered to be too great a level of detail.

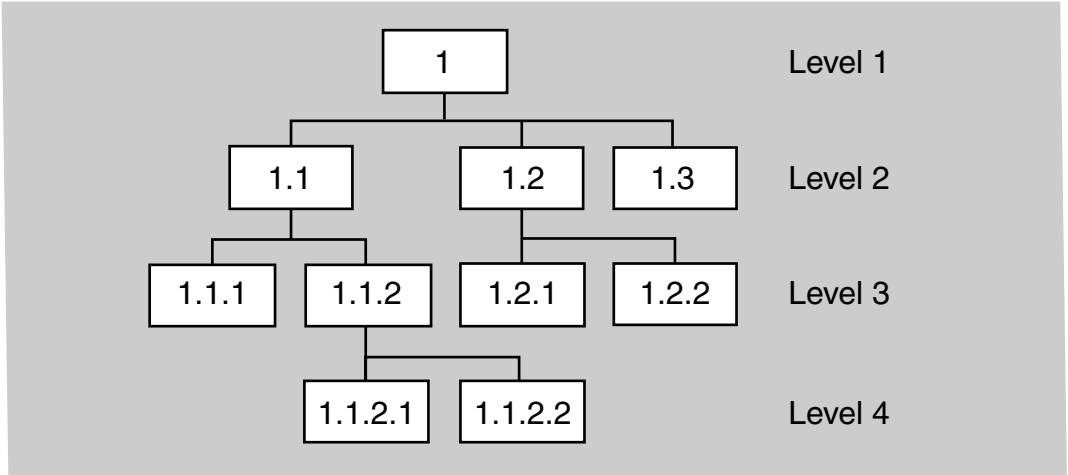

Figure 3.1 An example of a hierarchical structure

The PBS, WBS, OBS and CBS are hierarchical structures. An example is shown in Figure 3.1, where sequential numbering is used to differentiate the levels of detail.

When the final scope has been agreed with the sponsor it is baselined. This baseline is used to measure any changes and for the effective implementation of earned value management (Topic 3.6). The scope is monitored to ensure that scope creep does not occur. Change control (Topic 3.5) is used to manage any required changes in the scope.

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3.2
Scheduling

Scheduling is the process used to determine the overall project duration and when activities and events are planned to happen. This includes identification of activities and their logical dependencies, and estimation of activity durations, taking into account requirements and availability of resources.

Scheduling[1] requires the identification of the activities in a project. These are all the activities necessary to complete the work packages as defined in the work breakdown structure (WBS) (Topic 3.1). The granularity of the schedule allows activities to be shown at differing levels of detail. A high-level schedule is often called a master schedule, which would highlight project milestones.

The logical dependencies between the activities must be defined. There are two principal methods of illustrating output: network diagrams and Gantt charts.[2] Activity-on-node[3] network diagrams show activities at the nodes and the links between the nodes represent the dependencies, also called logic.

Estimates of activity durations are produced taking account the resources required and their availability and productivity. Incorporation of activity durations into the network allows the overall project duration, critical path and float[4] to be determined. The critical path is the longest sequence of activities through a network from start to finish, the sum of whose durations determines the overall project duration. There may be more than one such path. Activities on the critical path must be completed on time or the project end date will be delayed. As part of an iterative process the overall project duration can be reduced using techniques such as fast-tracking and concurrent engineering.

A refinement of the network diagram is the program evaluation review technique (PERT) which uses a weighted three-point estimate of activity duration in place of a single-point estimate.

The network diagram can be displayed as a Gantt chart. A Gantt chart allows the activities to be represented against a calendar and the length of the

[1] The schedule is sometimes wrongly referred to as the plan (project plan).
[2] Gantt charts are sometimes referred to as bar charts.
[3] Also called precedence diagrams. An alternative notation used for a network diagram is activity-on-arrow.
[4] There are two main types of float: total float, i.e. the amount of time by which an activity can be delayed or extended without affecting the end date of the project, and free float, i.e. the amount of time by which an activity can be delayed or extended without affecting the start date of any subsequent activity. Float is also called slack.

bar represents the activity duration with logic links shown between the bars. Software tools have caused a rise in the use of the Gantt chart at the expense of the network diagram.

In addition to the detailed scheduling of activities, the project's overall time constraints have to be considered and the schedule revised until these can be met. This is an iterative process until the project manager and sponsor reach agreement when the schedule is then baselined. This baseline can be used to measure any changes and for the effective implementation of earned value management (Topic 3.6).

Scheduling continues throughout the project life cycle. Changes to the schedule that have an impact on milestones should only be undertaken as part of change control (Topic 3.5).

An innovation to the scheduling process is the critical chain approach, which combines:

- a more integrated approach to resourcing;
- centralised management of contingencies as a buffer;
- avoidance of multi-tasking.

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3.3
Resource management

Resource management identifies and assigns resources to activities so that the project is undertaken using appropriate levels of resources and within an acceptable duration. Resource allocation, smoothing, levelling and scheduling are techniques used to determine and manage appropriate levels of resources.

Resource management ensures that an appropriate level of resources is used on the project. Two types of resources are used on projects:

- Replenishable: when absent or used up, fresh supplies can be obtained. Raw materials and money are common examples.
- Re-usable: when no longer needed, these resources become available for other uses. Accommodation, machines, test equipment and people are re-usable.

Projects consume resources that have to be available at the right time, in the right quantities and of the right quality. The challenge for resource management is determining what is 'right'. It is often the case that projects do not own resources; they have to work with resource providers to obtain the resources needed by the project. Resource management includes resource allocation, resource smoothing, resource levelling and resource scheduling.

Resource allocation is the process by which resources are mapped against activities, often shown as aggregated resource histograms against a timescale.

Resource smoothing[1] can be applied to ensure that resources are used as efficiently as possible. This involves utilising float within the project or increasing or decreasing the resources required for specific activities, so that any peaks and troughs of resource usage are smoothed out. It does not affect the project duration.

Resource levelling[2] can be applied when there are resource constraints. Resource levelling forces the amount of work scheduled to not exceed the limits of resources available. This results in either activity durations being extended or entire activities being delayed to periods when resources are available. Resource levelling often results in a longer project duration.

Resource scheduling ensures that resources are available when needed and where possible are not underutilised.

Resource allocation and resource smoothing or levelling are iterated until a balance between resource availability and required project duration is achieved.

[1] Also called time-limited scheduling.
[2] Also called resource-limited scheduling.

Changes to the project will require the impact on resources to be considered as part of change control (Topic 3.5).

Effective resource management ensures:

- efficient utilisation of resources;
- confidence that the schedule is realistic in terms of the required and available resources;
- the early identification of resource capacity bottlenecks and conflicts.

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3.4

Budgeting and cost management

Budgeting and cost management is the estimating of costs and the setting of an agreed budget, and the management of actual and forecast costs against that budget.

An initial cost estimate is included in the business case, and used as part of the investment appraisal of the project. This initial cost estimate is refined in line with scope, schedule and resources. The results of this refinement will produce an overall cost estimate that should include an allowance for risk and contingency. The cost estimate will need to be iteratively revised to suit the constraints of the business case. When the cost estimate has been agreed with the sponsor, this becomes the budget.

For effective cost management, costs incurred should be directly attributable to a budget item. This alignment between budget and cost is usually achieved through the use of a cost breakdown structure (CBS).

The budget is phased over time to give a profile of expenditure. This is an important part of the budgeting process as the profile of expenditure is used in project financing and funding. It will allow a cash flow forecast for the project to be developed, and a drawdown of funds to be agreed with the organisation.

Cost management is the monitoring and control of costs against the budget. Cost management will require the recording and monitoring of the following:

- Commitment: this reflects the placement of an order for work to be done, and is the amount of money removed from the budget represented by this order.
- Accrual: work done for which payment is due but has not been made.
- Actual expenditure: the money that has already been paid.
- Forecast out-turn cost: the total of actual expenditure, accruals, commitments and the estimate of the costs to complete the work to the end of the project.

As part of monitoring, the performance of a project is reviewed at regular intervals. Reviews should consider non-financial information such as scope and schedule, to assist with the assessment of cost performance. By comparing actual cost against total budget and the expenditure profile, trends may be identified that can be extended to determine the forecast out-turn cost. Identifying and taking corrective action to minimise adverse variances against budget is necessary for effective control. Such reviews form part of earned value management (Topic 3.6).

The budget should be reviewed at appropriate points, for example as part of periodic reporting and at gate reviews, and any change to the budget should only be undertaken as part of change control (Topic 3.5).

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3.5
Change control

Change control is the process that ensures that all changes made to a project's baselined scope, time, cost and quality objectives or agreed benefits are identified, evaluated, approved, rejected or deferred.

Robust procedures are used to produce a baseline definition of project plans, which are encompassed in the project management plan (PMP). Any proposed changes to this baseline need to go through a similarly robust procedure to ensure that changes to the project are identified, evaluated, approved, rejected or deferred.

A change may be proposed by any project stakeholder. Change may be unavoidable or highly desirable; it may equally be unnecessary and not useful. Any proposed change to the project must be formally controlled. The project team, with the appropriate support of relevant stakeholders including the sponsor, should therefore review changes fully before their approval and actioning. The impact of changes on all aspects of the project should be carefully assessed as well as their impact on business-as-usual and other projects. All approved changes should be fully documented and efficiently communicated.

The project must have an effective change control process in operation and the project team should be familiar with its operation. It is the project manager's responsibility to ensure that a change control process is used in the project.

A change control process should include the following:

- Change request: a stakeholder who is requesting change provides relevant information on the nature of the change.[1] The change is entered into a change log, which is[2] a register of all changes that have been requested whatever their status, for example pending, approved, rejected or deferred.
- Initial evaluation: the change is reviewed to consider if it is worthwhile evaluating it in detail. The evaluation of change consumes resources, which in itself is a deviation from the project plan. The proposed change may be rejected without further evaluation.
- Detailed evaluation: the change is evaluated to consider the impact on the project's baselined scope, time, cost or quality objectives or agreed benefits.

[1] This may be described on a change request form.
[2] In PRINCE2 all potential changes are entered into an issue log not a change log.

- Recommendation: a recommendation is made as to whether the change should be approved, rejected or deferred. The sponsor has ultimate authority to act on the recommendation. The decision must be communicated.
- Update plans: if a change is approved, all plans are updated to reflect the change.
- Implement: the necessary actions to implement the change are undertaken.

If an unauthorised change is identified it should be retrospectively put through the change control process.

Change control is intrinsically linked to configuration management. Any changes will need to be fed back into the project's configuration (Topic 4.7).

In certain circumstances, it is appropriate to have a change freeze on a project where no further changes will be considered as to do so would jeopardise the achievement of the project objectives.

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3.6
Earned value management

Earned value management (EVM) is a project control process based on a structured approach to planning, cost collection and performance measurement. It facilitates the integration of project scope, time and cost objectives and the establishment of a baseline plan for performance measurement.

EVM is used to inform management decisions on a project. It necessitates the integration of project scope, time and cost objectives and the establishment of baselined plans against which physical performance can be measured during the execution of a project. Furthermore, it provides a sound basis for problem identification, corrective actions and replanning as required.

The fundamental elements of project management that need to be in place for EVM to be used are as follows:

- A work breakdown structure (WBS) to define the work.
- Organisational responsibility for work accomplishment defined in an organisational breakdown structure (OBS), drawing information from the WBS.
- The budget distributed in the WBS.
- All authorised work scheduled.
- A method of measuring achievement.
- The budget phased over time against the schedule to provide a profile of expenditure.
- Baselined plans: this may require an integrated baseline review (IBR) to be held following the establishment of the initial baseline.
- Costs identified as either direct or indirect costs, and all direct costs recorded.[1]
- Performance data collected and analysed on a periodic basis.
- Forecasts for the remaining work produced.
- Any changes to the baseline managed through a change control process.

Conventional scheduling and also budgeting and cost management will inform the project manager what budget has been spent and what activities have been completed or are in progress. However, this does not provide a performance measure. EVM provides this measure of performance and allows future performance to be predicted based on current variances and trends.

The purpose of measuring earned value is to provide information in order to determine:

[1] Earned value management is associated with physical work and therefore only direct costs are relevant.

- what has been achieved of the planned work;
- what it has cost to achieve the planned work;
- whether the work achieved is costing more or less than was planned;
- whether the project is ahead or behind the planned schedule.

Using this measure of earned value, EVM will provide:

- ongoing performance measurement;
- variance and trend analysis;
- measures of efficiency;
- prediction of outturn cost and final duration;
- information to assess whether corrective actions are required.

EVM will accurately show deviations from the baselined plans, but it may not be immediately evident that the plan is flawed. Accurate management information can only be extracted if accurate management information is in place from the start of the project.

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3.7

Information management and reporting

Information management is the collection, storage, dissemination, archiving and appropriate destruction of project information. Information reporting takes information and presents it in an appropriate format which includes the formal communication of project information to stakeholders.

Projects generate, utilise and absorb significant quantities of information. It is important that there is an appropriate process in place to manage the information. In managing information, consideration also needs to be given to communication (Topic 7.1) and formal reporting to stakeholders.

Without the availability of appropriate, timely and accurate information,[1] projects would necessarily be chaotic and any decisions taken would be merely arbitrary, even capricious.

Information is collected in order to provide a central repository for the project, and a means of controlling information flow. Information may need to be actively sought, rather than being automatically delivered into the project.

A decision is made as to what information it is appropriate to store, and how to store it so that it can be readily accessed and retrieved by relevant people or systems. Information that is collected but does not need to be stored is destroyed in accordance with an agreed procedure.[2]

Dissemination involves the distribution of existing information and the conversion of data to information for distribution. Data converted into information and disseminated in the form of reports is part of reporting. Reporting is the process by which stakeholders are kept informed about the project, as included in the communication plan (Topic 7.1). Reports will include reports of progress, quality, audit, project reviews, risk assessment and finances. To reduce the burden of reporting the use of exception reports should be considered.

Information is archived throughout the project life cycle. This allows for information to be removed from immediately accessible storage to an archive where it is no longer as readily accessible.

Information management changes during the project life cycle in terms of understanding what is needed, who to disseminate information to, when to

[1] A distinction can be made between document management, i.e. how information is created and shared, and records management, which is ensuring that the project observes necessary policy, legislative or regulatory requirements.

[2] Careful consideration should be given to the destruction of information; for example, can paper be recycled or must it be destroyed to protect confidentiality?

issue information and when to destroy it. However, pertinent information must adhere to the communication plan.

Further complexity arises when considering commercial confidentiality and statutory obligations such as information security and freedom of information. Information management in a project needs to integrate with the organisation's information management process.

A decision must be made as to the granularity of information that should be collected, stored and archived. Information that is no longer required can be destroyed in accordance with an agreed procedure.

The use to which information will be put post-project should be considered. It will be the case that some information generated during the project will be beneficial to the organisation in its following business-as-usual activities and when undertaking similar projects.

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3.8

Issue management

Issue management is the process by which concerns that threaten the project objectives and cannot be resolved by the project manager are identified and addressed to remove the threats they pose.

An issue[1] is defined as a threat to the project objectives that cannot be resolved by the project manager. Issues should be differentiated from problems, which are concerns that the project manager has to deal with on a day-to-day basis. Risks should not be confused with issues. Risks are uncertain in that an event may not occur, whereas issues have already occurred and are therefore not uncertain (Topic 2.5).

The importance of issue management in projects is that issues are outside the direct control of the project manager. The project manager must ensure that issues are escalated to the sponsor who may in turn escalate them to the project steering group so that resolution can be reached. Issues that remain unaddressed or unresolved are the cause of many project failures. Consequently, the project manager must ensure that issues are identified, escalated appropriately and resolved. Stakeholder management (Topic 2.2) is used to formulate and present issues in ways that the owner (not necessarily the project manager) of the issue can recognise and thus assists them in issue resolution.

An issue log is used to track the progress of the issue from identification to resolution. For each issue, the issue log should describe the issue, who raised it, the date the issue was formally raised, possible consequences or impacts on the project, possible resolution and the resolution owner, the final outcome and date the issue is closed.

Issue resolution is one of the fundamental purposes of a project steering group (Topic 6.8). The appropriateness of the constituency of the project steering group can be judged by whether its members are capable of dealing with the issues as they arise. Monitoring and reporting to the project steering group the 'ageing' of issues is an activity performed by or for the project manager.

Common failures in the management of issues are:

- wrongly identifying as issues project problems that are the responsibility of the project manager. This diverts attention away from handling genuine issues;

[1] There are alternative definitions of an issue, for example 'any major problem that the project team has to deal with'. In PRINCE2 an issue is a term used to cover any concern, query, request for change, suggestion or off-specification raised during a project, and an issue can be about anything to do with the project.

- failing to further escalate an issue when the owner of the issue resolution has not resolved it in a timely manner.

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Section 4
Techniques

In project management a number of techniques are used to assist in the successful delivery of project objectives. Some of these techniques are equally applicable to all projects while others are more suited to specific types of projects.

The techniques that are described here enable the project manager to:

- fully define users' requirements (Topic 4.1 – Requirements management);
- take an initial, preferred solution and refine it into an optimal solution (Topic 4.2 – Development);
- estimate the project's cost and time objectives (Topic 4.3 – Estimating);
- use technology appropriately throughout the project life cycle (Topic 4.4 – Technology management);
- ensure the continued application of best value (Topic 4.5 – Value engineering);
- model and test deliverables prior to handover and closeout of the project (Topic 4.6 – Modelling and testing);
- ensure that a project's deliverables are developed in such a way that their configuration is clearly controlled (Topic 4.7 – Configuration management).

4.1
Requirements management

Requirements management is the process of capturing, analysing and testing the documented statement of stakeholder and user wants and needs. Requirements are a statement of the need that a project has to satisfy, and should be comprehensive, clear, well structured, traceable and testable.

In a project, the stakeholders' and, in particular, users' wants and needs are documented as requirements. A clear and agreed expression of requirements and their acceptance criteria is essential for success as this manages stakeholder expectations and provides a measure against which project success can be judged.

Requirements should have an emphasis on 'what' is required, rather than 'how' it will be achieved. High-level requirements are documented during the concept phase of the project life cycle; they are further developed and agreed during the definition phase. The preferred solution that meets the need, problem or opportunity is tested against the requirements' acceptance criteria for fitness for purpose or conformance.

Requirements management includes the following:

- Capture: eliciting, structuring and documenting the requirements and related acceptance criteria.
- Analysis: agreeing the priority of requirements, taking into consideration benefits, business priorities, availability of resources and budget. The prioritised requirements should be evaluated to ensure that they meet the project objectives and will deliver the benefits that justify proceeding with the project.
- Testing: the structure and content of the documented requirements need to appeal to different people, with an expectation that testing of the requirements through reviews will be undertaken.

The primary factors used to structure the content of the requirements are as follows:

- Value – the size of the benefit associated with each requirement.
- Priority – stakeholders agree the priority ordering of requirements.
- Time – business time imperatives drive the ordering of the requirements.
- Process – the way the solution is to be built, particularly important where subcontractors will be used to build some components.

The agreed requirements are used as a baseline for change control, and as the basis for implementing the solution. Proposed changes should be

reviewed and documented, where accepted as a change. Configuration management needs to take into account changes in requirements.

A common understanding of the requirements by the project manager and project team is fundamental to ensuring that the wants and needs are captured and clearly articulated, and that solutions are developed to meet those needs.

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4.2
Development

Development is the progressive working up of a preferred solution to an optimised solution during the definition and implementation phases. The optimised solution is refined with the stakeholders against the requirements.

Alternative designs to meet the preferred solution will be developed using an iterative approach. The project team should work to shape the proposed solution in ways that optimise satisfaction of the requirements and their acceptance criteria, and help to achieve project success. The project manager should ensure that the correct processes and practices are being followed and that the impact on scope, time, cost and quality is being managed.

Engagement with stakeholders and users throughout the development process is essential to maintain commitment and manage expectations as the solution develops.

Uncertainties and technical innovations in the solution need to be considered. These can increase risk and may result in delays, increased cost or unworkable solutions. Strategies to support innovation include: pilots or prototyping, where the innovation is explored without impacting the operational environment and to minimise risk to the project; the use of modelling and simulations; and phased implementations of new technology.

As the project proceeds from definition to implementation, application of a phased development approach should be used with design documentation reviews, quality reviews, lessons learned reviews and validations against the requirements.

There are a number of structured methodologies to assist in the development of an optimised solution. For example development of information systems offers a variety of development methodologies:

- The structured systems analysis and design methodology (SSADM) uses modelling techniques to identify, model and document the solution in a waterfall model.
- The dynamic systems development method (DSDM) advocates an iterative approach. An iteration involves timeboxing, prototyping, workshops and testing.
- Agile development methodologies are a family of methodologies where the development emphasises real time communication and software.

In the construction industry[1] the development approach is iterative. A client brief containing requirements and high-level solutions is prepared and

[1] The Office of Government Commerce has produced a series of guides called Achieving Excellence in Construction which aims at improving government performance.

agreed. The project team uses techniques such as value management and value engineering to optimise the solutions into detailed design drawings and specifications. Optimisation will be undertaken on an iterative basis, with solutions being refined with the stakeholders.

For all projects, progressive testing of the emerging solution against the requirements ensures continual management of the solution development. Validation against overall requirements and verification against specifications and designs are both important. Verification ensures the deliverable is being built right; validation ensures that the right deliverable is being built.

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4.3
Estimating

Estimating uses a range of tools and techniques to produce estimates. An estimate is an approximation of project time and cost targets that is refined throughout the project life cycle.

At the concept phase of a project establishing cost and time targets is difficult due to lack of detailed information. It is important that targets are based on a rationale that is informed by a structured reasoning process or methodology.

There are three primary methods of estimating:

- bottom-up;
- comparative;
- parametric.

The bottom-up (analytical) method uses the project work breakdown structure (WBS) derived to a level of detail that allows estimates of cost and time for the project activities to be provided. Once estimates for each activity have been agreed and contingencies applied the overall project targets can be established.

Comparative or analogous estimating uses historic data from similar projects to determine the most appropriate cost and time. The data are compared by scaling of size, complexity and type of technology employed to determine a more informed estimate of the project's budget and schedule parameters.

Parametric estimating uses defined parameters by which a project can be measured, for example the cost or time to build a single deliverable, with this figure then being multiplied depending on the number of such parameters required. This method of estimating is typically used in statistical modelling.

Estimating can be presented in different ways. Single or deterministic estimates do not account for estimating error, human influence or data inconsistencies. A three-point estimate accepts variation in project values starting with the most likely mid-range value, setting an aggressive optimistic target as the minimum end of range value and a pessimistic view as the maximum end of the range.

An estimate is about a future event and therefore involves uncertainty. Some estimates have a contingency associated with them to cover risks and uncertainties. As the project develops and additional information about the requirements and circumstances become available, uncertainty will decrease, the estimate can be refined[1] and contingencies may be released.

[1] This progressive reduction in uncertainty may be described using the concept of the estimating funnel.

Estimating is not an activity restricted to the early phases of a project life cycle. Estimates of the impact of change requests, the cost and time to complete the project and risk responses will be required later in the project life cycle.

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4.4
Technology management

Technology management is the management of the relationship between available and emerging technologies, the organisation and the project. It also includes management of the enabling technologies used to deliver the project, technologies used to manage the project and the technology of the project deliverables.

Technology and its uses evolve at a rapid pace and there are multiple types of technologies, for example computer operating systems, mobile telephones, and Web enabled business processes. Different technology can create opportunities for new approaches and products but can also introduce threats, both of which must be managed.

The organisation's strategic objectives take account of available and emerging technologies both inside and outside the organisation. Organisational strategy will determine how best to align with these technologies.

Technology management for projects can occur at different levels, for example:

- as part of the organisation's strategic objectives, and the translation of these into the project's objectives;
- to deliver the project, for example enabling technology such as software and equipment used by the project;
- to manage the project, for example tools for reporting, scheduling and risk management;
- as the technological deliverables resulting from the project and written into its requirements.

Failure in technology management at any of these levels may have an impact on the project and organisation.

If the project has not been aligned to the organisation's strategic objectives for technology management, the project may achieve its acceptance criteria, but will not realise long-term benefits for the organisation.

An initial assessment will be made as to the most suitable enabling technologies to use on a project. This selection will take into account factors such as cost, time and availability of skills to use the technology. Any failure in the enabling technology may result in the project not meeting its objectives. For example scarcity of skills may result in the technology being unusable or used incorrectly.

Technologies used to manage the project can be important in monitoring and controlling progress, information management and reporting. Failure in these managerial technologies can also result in the project being poorly managed and the organisation not recognising the project's true status.

All projects plan for success. However, when using innovative technologies there is uncertainty as to whether success can be achieved. At handover the deliverables may not be able to enter the operational phase due to a failure of technology. When a new technology product is the deliverable of the project, a failure of the technology generally results in a failure overall.

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4.5
Value engineering

Value engineering is concerned with optimising the conceptual, technical and operational aspects of a project's deliverables. Value engineering utilises a series of proven techniques during the implementation phase of a project.

Value engineering is a subset of value management (Topic 2.3) and deals with the generation or revision of technical solutions, i.e. the 'how' as in how to achieve the desired functionality at an appropriate cost. Value management is concerned with the optimisation of strategic requirements issues and the 'what', i.e. what needs to be improved, what change is required.

The value engineering process, as illustrated in Figure 4.1, incorporates the following activities:

- Functional analysis: to identify and select the functional attributes of different solutions.
- Detailed design: to evolve a small number of alternative solutions for delivering the functional attributes.

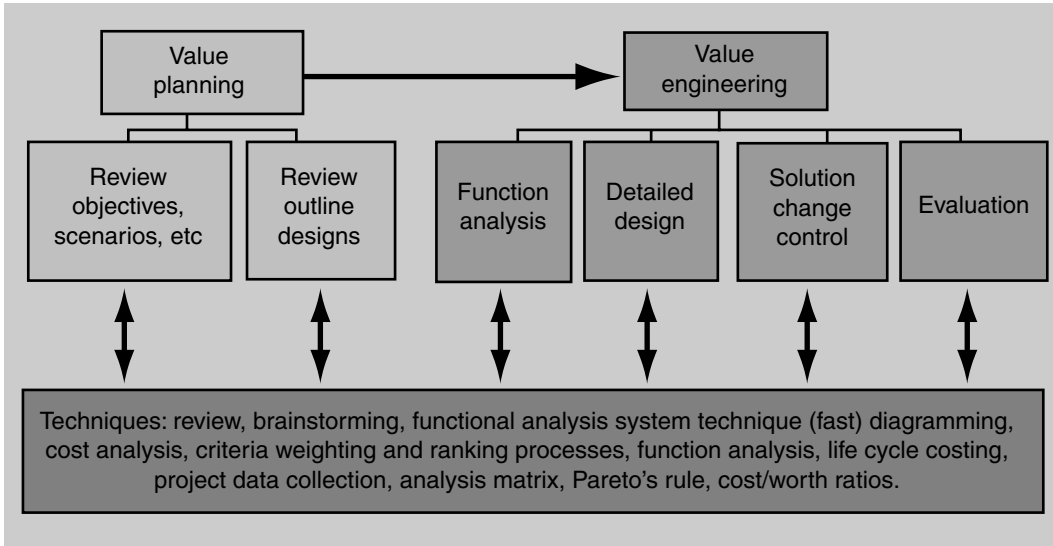

Figure 4.1 The value management process BS EN 12973:2000 (*reproduced with the permission of the BSI*)

- Solution change control: analysis and evaluation of alternative solutions that arise during the implementation stage as new information becomes available, and the control of any solution changes.
- Evaluation: of the outcome and the contribution of the value management process, including whether the objectives defined were achieved, where the most improvements were made in functionality and identification of any lessons for the future.

The process may be applied as a series of workshops or studies at key points in the project. Considered, rightly, as an attitude of mind, formal value engineering involves a formal approach to the improvement of solutions (see requirements management (Topic 4.1) and development (Topic 4.2)). It is achieved through teamwork in a workshop environment, using a plan of work based on problem-solving and creative thinking. The format of each of these workshops can be subdivided into the following distinct value engineering phases:

- Information – confirm the project time, cost and quality objectives.
- Function analysis – agree the project function and available resources.
- Speculation – idea generation to identify value opportunities.
- Idea evaluation – rank the identified opportunities according to their appropriateness.
- Idea development – develop the evaluated opportunities to understand their benefits and costs.
- Implementation – decision building and action-planning to establish the way forward.

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4.6
Modelling and testing

Modelling and testing are used to provide a representation and assurance of whether the project objectives can be achieved. Modelling is the process of creating and using a device that duplicates the physical or operational aspects of a deliverable. Testing is the process of determining how aspects of a deliverable perform when subjected to specified conditions.

Modelling may be either physical or virtual. Physical models represent the three-dimensional, solid aspects of a deliverable and can be used to display its features or potentially test aspects of it. Virtual models provide a visual representation of a deliverable and can also be used to test its operational performance. Virtual models can be essential to the development of dynamic systems particularly if continuous human interaction with a computerised system is required, for example a flight simulator. Models can also be useful when communicating the appearance or functioning of a deliverable to a wide audience whose support or contribution may be necessary for the project to succeed.

Testing is the activity performed to ensure that the deliverables will meet their acceptance criteria. Testing may be performed on the actual deliverable, on a test deliverable or on a model. Testing can be used to verify whether deliverables meet requirements and to validate that the final deliverable is fit for purpose.

Testing will not provide a complete answer to uncertainty. Test plans are normally designed around the extremes of certain aspects and conditions that a deliverable might have to perform and be subjected to, and other aspects based on a reasoned assessment of what might occur. Failures in operation can still happen if conditions arise that are outside of those considered reasonable or were not recognised as significant at the time tests were conducted.

All project plans must include the need for testing in terms of criteria, responsibilities, budgets and time provisions where areas of uncertainty exist. A project plan must ensure that knowledge is gained through testing in a logical manner and that design decisions taken at one stage are based on information discovered in earlier stages. A robust and logical approach can be generated to manage technical, cost and schedule risks.

Modelling and testing may not be a matter over which the project manager has discretion; for many projects, certain testing is mandatory or regulatory.

Modelling and testing are fundamental aspects of quality management. They form an integral part of quality control and quality assurance (Topic 2.6).

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4.7
Configuration management

Configuration management comprises the technical and administrative activities concerned with the creation, maintenance and controlled change of the configuration throughout the project life cycle.

A configuration is the functional and physical characteristics of the final deliverable as defined in technical documents and achieved in the execution of project plans. These plans should contain all items that can be identified as being relevant to the project and that should only be modified after relevant authorisation.

Configuration management can therefore be regarded as asset control and is essential whether one or more versions of a deliverable will be created. At its simplest, configuration management must involve version control.

Five activities are performed within a configuration management process:

- Configuration management planning: a configuration management plan should describe any project-specific procedures and the extent of their application during the life cycle of the project. The plan should also identify roles and responsibilities for carrying out configuration management.
- Configuration identification: involves breaking down the project into component parts or configuration items and creating a unique numbering or referencing system for each item, and establishing configuration baselines.
- Configuration control: ensures that all changes to configuration items are controlled. An important aspect is being able to identify the interrelationships between configuration items.
- Configuration status accounting: provides records and reports that relate to a deliverable and its configuration information during the life cycle of the project. It also enables traceability of configuration items throughout their development.
- Configuration audit: is used to determine whether a deliverable conforms to its requirements and configuration information. Typically an audit is a review undertaken at the end of a phase or stage and at the end of the handover and closeout phase of the project.

The configuration management process must be closely aligned to the change control process (Topic 3.5) as a key aspect is the ability to identify, track and protect different versions of a deliverable. Together, these aspects will have a significant impact on the quality of a project's deliverables (Topic 2.6).

Configuration management is an invaluable tool to the project manager to provide control of the project deliverables and to avoid mistakes and misunderstandings. It is an integral part of a project's quality plan.

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Section 5

Business and commercial

It is important to take account of the business and commercial environment within which a project operates. This environment can be set by the project or imposed on it by the organisation's standard practices.

The business and commercial environment is established by considering and understanding a number of aspects:

- How an organisation ensures that the benefits generated by a project will be commensurate with their investment (Topic 5.1 – Business case).
- How project management professionals can market and sell their project to decision makers to secure a competitive advantage (Topic 5.2 – Marketing and sales).
- How a project can acquire the necessary financing and funding (Topic 5.3 – Project financing and funding).
- How to develop and implement a strategy to procure resources for the project (Topic 5.4 – Procurement).
- An awareness of a range of legal issues (Topic 5.5 – Legal awareness).

5.1
Business case

The business case provides justification for undertaking a project, in terms of evaluating the benefit, cost and risk of alternative options and rationale for the preferred solution. Its purpose is to obtain management commitment and approval for investment in the project. The business case is owned by the sponsor.

The business case sets out the justification and the strategic rationale for the project, and provides a framework for informed decision-making in planning and managing the project and its subsequent benefits realisation. Its basis is an evidence-based evaluation of the benefit, costs and risk of a solution to a need, problem or opportunity identified by the sponsor and approved by the funding organisation.

The business case must clearly articulate the balance between the benefits sought and the costs and risks of achieving those benefits. The benefits should relate to the level of risk and the cost of the project that the organisation is willing to accept. A high-risk project is only worth doing if the benefits are proportionally high: for a given level of benefits there is a limit on the level of risk that could be sustained and the cost of the project should be proportional to the expected benefits.

The business case is owned by the sponsor and is created during the concept phase of the project life cycle. It should be kept up to date and used as the basis for decisions as to whether to continue with the project at gates and project reviews.

The contents of the business case will include:

- reason for the project;
- high level description of the project scope;
- evaluation of options, including the 'do nothing' option;
- benefits;
- risks;
- estimated costs;
- target schedule;
- investment appraisal;
- assumptions;
- constraints;
- dependencies;
- project success criteria;
- impact on business-as-usual.

In practice it is good to evaluate more than one viable alternative solution and compare the benefits capable of being delivered by each solution. The

evaluation process may include the use of investment appraisal techniques such as payback, internal rate of return (IRR), discounted cash flow (DCF) and net present value (NPV) to provide a like-for-like comparison of options.

The project manager may not be involved in the preparation of the business case but should have an understanding of it and be able to convey this understanding to the project team.

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5.2
Marketing and sales

Marketing involves anticipating the demands of users and identifying and satisfying their needs by providing the right project at the right time, cost and quality. Sales is a marketing technique used to promote a project. Marketing and sales needs to be undertaken internally and possibly externally to an organisation.

The project team will be involved in both marketing and selling the project to the organisation. If there is a need to market and sell the project outside the organisation, team members may again be involved.

As the advocate for the project the sponsor must market and promote the project to the organisation. This could require influencing a project's position in the organisation (Topic 1.3) or assisting in securing appropriate resources (Topic 3.3).

The project manager needs to use selling techniques to achieve buy-in from stakeholders, the project team and users for the project's approach and decisions made. In selling the project strategy to the organisation the project manager will use negotiation and influencing skills. Effective communication is fundamental, and consideration must be given to the audience, objectives, timing and method of communication, which will be described in the communication plan.

The project may need to be marketed outside the organisation to sell the deliverables to the external market. The project manager may need to draw on marketing expertise available within the organisation or externally to do this work. One of the deliverables of the project may then be a marketing strategy.

The marketing strategy may be based on market research, and empirical knowledge of the environment. The external and internal environment is understood in terms of project context (Topic 1.4). The marketing strategy defines the emphasis and allocation of resources to best meet the objectives of the organisation within project constraints, for example time, cost, quality and resources.

Marketing and sales activities are helpful in understanding the organisation and its relationship to the project. These activities can assist in satisfying the needs of internal and external stakeholders. The success of many of the deliverables of a project relies on their performance within a competitive environment. Understanding how marketing can be applied facilitates the promotion of these deliverables throughout the project's life cycle.

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5.3
Project financing and funding

Project financing and funding is the means by which the capital to undertake a project is initially secured and then made available at the appropriate time. Projects may be financed externally, funded internally or a combination of both.

Securing the finance or funds for a project is usually the sponsor's responsibility. The project manager and project team should know, and be sensitive to, how the project is financed and the particular requirements imposed on the project by its financing.

The organisation will have to balance cash flow across its portfolio of projects and programmes in order to meet the commitments it has made to provide funding. Individual projects within the portfolio need to plan how they drawdown monies against the agreed funding. Deviations from the plan need to be reported to the organisation so that cash flow at portfolio level can be adjusted. An understanding of the relationship between management accounting and project budgeting and cost management is necessary.

Potential currency fluctuations may affect the cash flow and drawdown where some or all of the financing is in a foreign currency. For example the project may receive funding in one currency and make payments to suppliers in another currency.

During the concept phase the development of a business case will consume resources that must be secured and financed. The ability of projects to acquire initial or 'seed corn' financing during this phase is important.

Projects can be financed from many sources. They can be internally funded or financed by external capital or a combination of both, which may be in the form of loans or investment in the project's outcome. In the UK public sector there are a number of financial arrangements that have been put in place by government. These include the *private finance initiative* (PFI), *public private partnership* (PPP) and *build, own, operate, transfer* (BOOT).

In circumstances where an organisation obtains a loan to undertake a project, a bond may be required to secure the loan. The requirements of the bond may be defined in terms of financial and performance measures. Guarantees can be provided so that if certain events occur, compensation becomes due from those providing the bond.

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5.4
Procurement

Procurement is the process by which the resources (goods and services) required by a project are acquired. It includes development of the procurement strategy, preparation of contracts, selection and acquisition of suppliers, and management of the contracts.

A procurement strategy should be prepared as part of the project management plan (PMP). The procurement strategy will set out how to acquire and manage the internal or external resources (goods and services) needed for the project.

The procurement strategy includes consideration of factors such as:

- the make-or-buy decision;
- use of a single integrated supplier or multiple discrete suppliers;
- required supplier relationships;
- supplier selection and sources;
- conditions and form of contract;
- types of pricing or methods of reimbursement.

In order to execute the procurement strategy various types of contractual arrangements can be used, for example:

- one comprehensive contract;
- a sequence of contracts;
- parallel contracts;
- sub-contracts.

When formulating the procurement strategy, consideration must be given as to what terms, including payment, are likely to motivate suppliers to achieve the objectives of the project. When preparing the contracts, terms and conditions must be agreed, including dispute resolution, termination, confidentiality, intellectual property rights (IPR) and contract payment methods such as fixed price, unit rate-based and cost-reimbursement.

Selection and acquisition of suppliers involves tendering and bidding. Suppliers should be chosen on a combination of capability, quality and price. Tendering is the preparation of tender documents, the solicitation of bids, the evaluation of bids and the award of contracts. Bidding is the submission of a bid by a potential supplier in response to a request for proposal (RFP).[1] Procured resources can represent the highest proportion of the project cost. Negotiation and subsequent acceptance of the tender or the bid locks these costs into the project as commitments.

[1] Also called invitation to tender (ITT) or invitation for bidding (IFB).

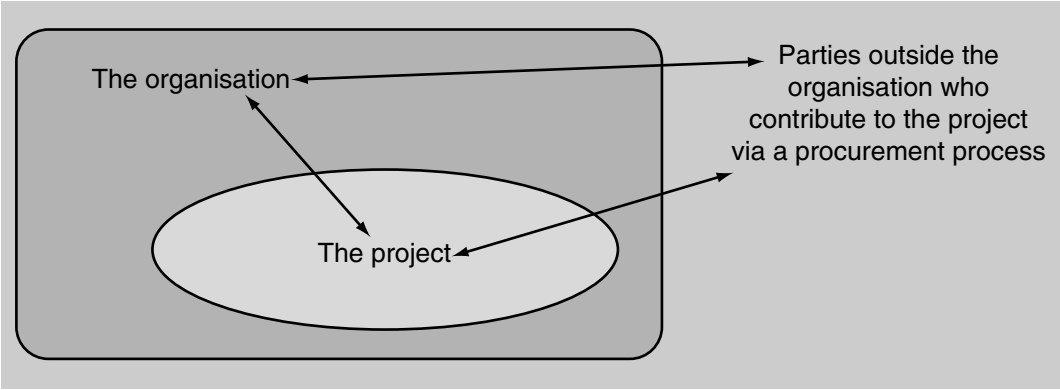

Figure 5.1 The interaction between the organisation and the project procurement process

The organisation's procurement process includes consideration of partnering and alliances, and e-commerce. Partnering and alliancing are ways of creating long-term relationships for the mutual benefit of all parties involved in the arrangement. E-commerce is the use of internet-led IT to facilitate the buying and selling of goods and services, on either a business-to-business (B2B) basis or a business-to-consumer (B2C) basis.

A project needs to take into account the organisation's overall procurement policies and processes when developing its own project-specific procurement strategy (Figure 5.1). For example the project may only be able to use a supplier from the organisation's preferred list.

Ethical procurement is important. A project needs to be able to demonstrate that its procurement practices are ethical and transparent and that good governance, corporate accountability and probity are being observed, for example sustainability and employment practice.

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5.5
Legal awareness

Legal awareness provides project management professionals with an understanding of the relevant legal duties, rights and processes that should be applied to projects.

Legal awareness includes an appreciation of the potential causes of claims, disputes (and the means of resolving them), liabilities, breaches of contract and the legal basis of industrial relations. This awareness entails knowing when to seek appropriate legal advice.

Essentially, there are two types of law – statute and common law.[1] Statute law is the written 'law of the land' consisting of Acts of Parliament (including those enacted under European legislation). Common law is based on precedent and provides a means of compensation for the failure of another party to comply with the requirements of statute law and for the failure to observe any duties that have been established by common practice. In both types, cases are judged by the facts and the law is determined by the interpretation of the courts and announced by way of a judgement.

A contract is an agreement between two parties under which one party promises to do something for the other in return for a consideration, usually a payment. A valid legal contract requires agreement (offer and unqualified acceptance), an intention to be legally bound, a consideration, competent parties, legality of purpose and certainty of terms. Commercial contracts will include:

- the contract agreement;
- a general specification and scope of work;
- general and special conditions of contract;
- administrative and coordination procedures.

Key provisions under the contract that a project manager may need to manage include:

- time – commencement, schedule, suspension and completion;
- payment provisions;
- incorporating change;
- performance indicators;
- liquidated damages;

[1] Within the UK there are two distinct bodies of law: English and Scottish. There are fundamental differences as to how these bodies of law operate and for the purposes of brevity only English law will be considered here. Similarities with Scottish law do exist but alternative material should be consulted with regard to the specifics of the law in Scotland and indeed in other legal systems outside the UK.

- termination;
- bonds, guarantees and insurances;
- giving valid instructions and decisions;
- remedies for breach of contract including claims and disputes.

A claim is an assertion under the contract of a right or entitlement that may lead to a demand or request, usually for extra payment and/or time. There should be clear processes described in the contract for the management of claims.

Disputes arise when the parties to a contract have a disagreement concerning a particular event. The contract should contain provisions for settling such disputes. There are a number of ways of settling disputes:

- Litigation: the dispute is heard in a court of law.
- Alternative dispute resolution (ADR) is the collective term for settling disputes with the help of an independent third party without a court hearing, for example arbitration, adjudication and mediation.
- Negotiation between the parties.

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Section 6

Organisation and governance

A project and its roles and responsibilities must be set out in a structured manner. This structure covers both the project life cycle and the organisational hierarchy and includes the procedures that must be followed.

The first five topics deal with the life cycle of a project from an initial idea through to the operational use of the deliverables it produces:

- The importance of the project life cycle and the description of a generic life cycle: concept, definition, implementation, handover and closeout (Topic 6.1 – Project life cycles).
- The identification of the need, problem or opportunity and the business case (Topic 6.2 – Concept).
- Planning the project and creating the project management plan (Topic 6.3 – Definition).
- Realising and delivering the plan (Topic 6.4 – Implementation).
- Putting the deliverables into operational use (Topic 6.5 – Handover and closeout).

It is important to review a project throughout its life cycle and at its completion (Topic 6.6 – Project reviews).

Project management needs to take into account the structure of the organisation carrying out the project (Topic 6.7 – Organisation structure) and how the project will work within that structure (Topic 6.8 – Organisational roles).

Successful project management is underpinned by structured and repeatable methods and procedures (Topic 6.9 – Methods and procedures). A further important aspect concerns the governance of project management (Topic 6.10 – Governance of project management).

6.1
Project life cycles

Project life cycles consist of a number of distinct phases. All projects follow a life cycle and life cycles will differ across industries and business sectors. A life cycle allows the project to be considered as a sequence of phases which provides the structure and approach for progressively delivering the required outputs.

Projects will always have a beginning and an end, as do phases, and how these points are defined will vary.[1] The project life cycle phases[2] will follow a similar high-level generic sequence: concept, definition, implementation and handover and closeout. In specific circumstances the project life cycle is replaced by an extended form. This extended life cycle[3] includes two further phases: operations and termination (Figure 6.1).

The concept phase (Topic 6.2) establishes the need, problem or opportunity for the project. The project's feasibility is investigated and a preferred

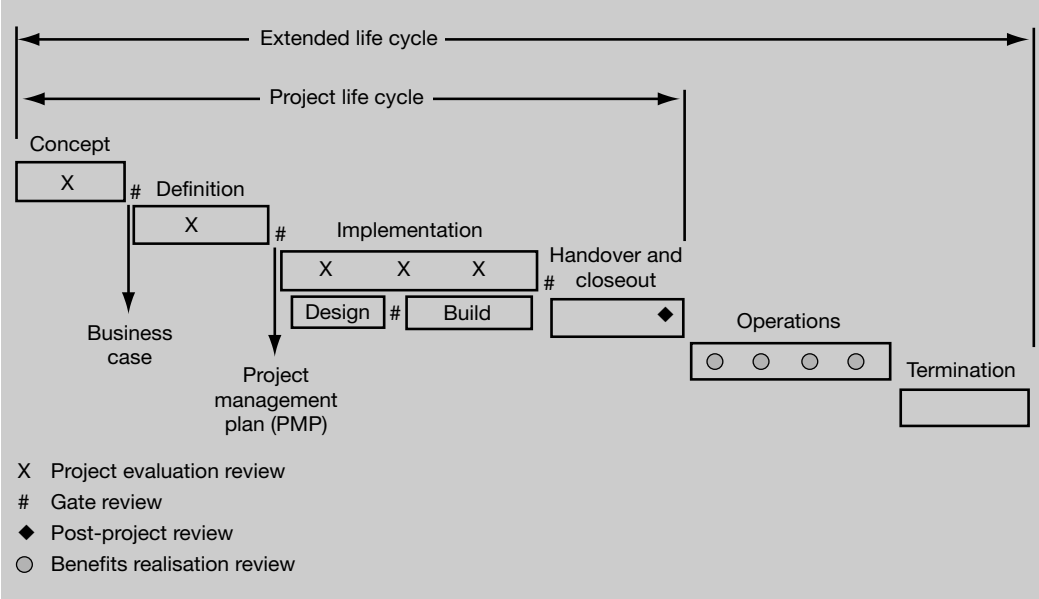

Figure 6.1 The project and extended life cycles

[1] There are also other life cycles such as those used in PFI and PPP arrangements.
[2] Each project life cycle phase needs to go through its own project management phases, such as starting or initiating, defining and planning, monitoring and controlling, learning and closing.
[3] The extended life cycle is also called a product life cycle or acquisition life cycle and is often the basis for through life-costing.

solution identified; if supported, the project continues to the definition phase.

The definition phase further evaluates the preferred solution and options to meet that solution, and prepares the plans necessary for implementation of the project (Topic 6.3).

The implementation phase implements the project strategy and plan (Topic 6.4). This phase can be divided into two or more stages.

The handover and closeout phase delivers the project to the sponsor and the organisation. The project is now complete in terms of delivery of a capability that will allow benefits to be achieved (Topic 6.5).

In the extended life cycle the operations phase will include the ongoing support and maintenance of the project's deliverables. The termination phase concludes the operational life of the deliverables and completes their disposal in an effective manner.

When considering the project life cycle the following must be taken into account:

- The potential to add value to the project reduces as the project progresses, and the cost of making changes or correcting errors increases.
- During the implementation phase, the consumption of resources will accumulate at their greatest rate.
- Planning and estimating should be carried out at an appropriate level to suit the phase.
- Resources should be identified early and therefore effectively utilised.
- Risks should be identified and responses targeted at distinct phases.
- Gates[1] should be established to allow effective end of phase reviews and to confirm that sufficient planning and preparation are in place to commence the next phase (Topic 6.6).
- Early phase successes should be used to reinforce stakeholder commitment.
- Lessons can be learned from earlier phases and applied to improve future performance and future projects.

All phases of the life cycle are important. No phase should be omitted but they may overlap.

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[1] Also called stage gates and control gates. In UK Central Government there is a broader process known as OGC Gateway®.

6.2
Concept

Concept is the first phase in the project life cycle. During this phase the need, opportunity or problem is confirmed, the overall feasibility of the project is considered and a preferred solution identified. The business case for the project will be produced in this phase.

Organisational strategy and planning trigger and capture new needs, problems or opportunities. This pre-project activity is performed within organisational functions or departments as appropriate. The resources required to undertake the definition phase will be identified. Senior management will make a decision (possibly at a formal gate) to move the need, problem or opportunity into a project life cycle and authorise the resources required.

Concept is the first phase of the project life cycle. The need, problem or opportunity is confirmed and investigated. The project's feasibility is assessed and, if supported, the project continues to the definition phase.

As part of feasibility the project's fit with the organisation's strategic objectives is considered. The project's alignment with the organisation's portfolio or a programme will be reviewed if relevant. High-level risks will be identified and assessed to understand the impact on the organisation and the project.

A number of options are identified and evaluated at a high level to propose a preferred solution. Stakeholders will be identified and analysed. They will contribute to the high-level requirements that will be used in the consideration of options and the proposal of the preferred solution. The 'do nothing' option must always be considered. In proposing a preferred solution a financial appraisal may be undertaken to include payback and the discounted cash flow (DCF) method: net present value (NPV) and internal rate of return (IRR).

The rationale for the project is made in the business case (Topic 5.1) which is produced during this phase either by the sponsor or on behalf of the sponsor. The sponsor owns the business case. The level of detail in the business case needs to be sufficient for the organisation to formally sanction the project. If the business case is approved by the organisation the project will move into the definition phase. This decision is often taken at a formal gate through which the project must pass.

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6.3
Definition

Definition is the second phase of the project life cycle. During this phase the preferred solution is further evaluated and optimised. Often an iterative process, definition can affect requirements and the project's scope, time, cost and quality objectives. As part of this phase the project management plan (PMP) is produced and the resources required during the implementation phase will be identified.

Information created during the concept phase is used as input to the definition phase. In the definition phase the preferred solution that meets the need, problem or opportunity is tested against the high-level requirements for fitness for purpose or conformance. Alternative designs to meet the preferred solution can be developed using an iterative approach. These alternatives can be modelled and tested and what-if assessments carried out as appropriate. The preferred solution will be agreed with the sponsor and stakeholders.

Plans are prepared, for example a risk management plan, a quality plan, a communication plan, a health and safety plan, based on the preferred solution. The level of detail in the plans and the tolerance level of the estimates need to be sufficient for the organisation to formally sanction the project. The plans are drawn together and form the project management plan (PMP) (Topic 2.4). At this point the business case may require updating based on the plans produced. The updated business case may be incorporated in the PMP. The project manager owns the PMP.

If the PMP is agreed by the sponsor and other stakeholders and approved by the organisation then the project will move into the implementation phase. This decision is often taken at a formal gate through which the project must pass. Once approved the PMP becomes the baseline for the project.

A process will be put in place to allow for the resources required during implementation to be secured. If external suppliers are used the process can be used to provide confirmation of estimates.

At the end of the definition phase there is a gate at which the organisation approves the project to move into the next phase, implementation. From this point the cumulative expenditure on the project increases at its greatest rate. This gate is the last point in the life cycle where the project can be terminated or modified without incurring further and more significant costs.

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6.4
Implementation

Implementation is the third phase of the project life cycle, during which the project management plan (PMP) is executed, monitored and controlled. In this phase the design is finalised and used to build the deliverables.

A start-up meeting at the beginning of this phase ensures a shared understanding of the project objectives, plans and how the project team will work together.[1]

There are two stages in this phase: design and build. In the design stage, the design is optimised and completed. The output of the design stage is the appropriate documentation, for example drawings, specifications, contracts, at the level of detail that is required to move into the build stage.

Once the design is substantially complete the sponsor will have the design approved at a gate and the project will move into the build stage and relevant activities undertaken.

The project manager monitors all implementation activities to ensure that the project remains on plan and will achieve its agreed scope, time, cost and quality objectives. Control actions are implemented by the project manager to correct deviations from the plan. Regular reports are produced by the project manager and communicated to the project team and stakeholders. A tool that can be used to monitor performance is earned value management (Topic 3.6).

The volume of activities and number of people involved are greatest during the implementation phase, which typically accounts for a high proportion of the total project budget and activity.

Risks identified in earlier phases that may occur during implementation need to be monitored. Issues that cannot be managed by the project team are more likely to arise and the project manager needs to escalate these to the sponsor for resolution. Configuration management is used to ensure that the integrity of the project's deliverables is maintained. Change control is the process used to manage the acceptance, rejection, or deferral of change to the project.

Ongoing procurement of external resources may be required throughout implementation. Procurement may also be required as a control action where a planned internal resource becomes unavailable.

The sponsor reviews the business case against the organisation and external environment on an ongoing basis. This will ensure that the benefits are still valid and the project should continue.

[1] The way that the project team will work together can be formally documented in a project charter.

The component deliverables are tested against agreed acceptance criteria as described in the quality plan. In this phase the component deliverables are not tested as an entity. Testing of the completed set of deliverables takes place during handover and closeout. The decision to enter the next phase of handover and closeout and enter an operational environment is taken at a gate.

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6.5
Handover and closeout

Handover and closeout is the fourth and final phase in the project life cycle. During this phase final project deliverables are handed over to the sponsor and users. Closeout is the process of finalising all project matters, carrying out final project reviews, archiving project information and redeploying the project team.

The most important aspect of this phase is allowing the project to enter into an operational environment. This decision will be based on the successful testing of the project to ensure deliverables meet the agreed acceptance criteria.

As part of the handover process the deliverables of the project are prepared for passing over to the sponsor and the user. Testing of component deliverables will have taken place as part of implementation in a safe, non-operational mode. Testing of the complete set of deliverables is carried out in an operational mode, usually with the people involved in business-as-usual activities. The purpose of this process is to set the deliverables to work safely in their final operational mode. If the deliverables meet the acceptance criteria, the project is ready to be formally accepted.

The sponsor and users accept responsibility for the project deliverables. This may be an instantaneous, gradual or phased process, depending on the nature of the deliverables. The purpose is to demonstrate that the deliverables meet performance requirements and are acceptable. Plans for acceptance and handover should be prepared and agreed in the project management plan.

The handover process may also include:

- acceptance of all pertinent documentation (containing all prescribed information relative to the deliverables, including guarantees and warranties);
- acceptance certificate(s) signed by the sponsor or users to confirm acceptance;
- transfer of responsibility for the deliverables from the project team to the sponsor or users;
- formal transfer of ownership.

The remaining project personnel must be redeployed in a controlled manner. Once the project deliverables have been handed over, the project manager needs to ensure that:

- any surplus project materials and facilities are disposed of;
- all contracts and purchase orders are finalised;
- all project accounts are finalised;

- all project documentation and records are completed and archived;
- a post-project review is undertaken in order that lessons are learned (Topic 6.6);
- performance appraisals of the project team are undertaken, which should include recognition of individual and team performances.

The capability is now in place for the benefits to be realised. The realisation of the benefits is the responsibility of the sponsor (Topics 1.5 and 2.1).

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6.6
Project reviews

Project reviews take place throughout the project life cycle to check the likely or actual achievement of the objectives specified in the project management plan (PMP) and the benefits detailed in the business case. Additional reviews will take place following handover and closeout to ensure that the benefits are being realised by the organisation.

Reviews should be planned throughout the project life cycle. They allow the project manager and project team to reflect on the project and objectively review their work.

Project evaluation reviews are planned in the project life cycle by the project manager and are in addition to the ongoing monitoring and control process. The prime document to review against is the project management plan, although any impacts on the business case must be considered.

The aims of a project evaluation review are to:

- evaluate the project management processes used;
- establish lessons learned and actions arising from them;
- raise any concerns and agree corrective actions;
- review the likely technical success of the project;
- validate overall progress against the plan: schedule, budget, resources, quality;
- consider stakeholder relationships and perceptions.

A gate review will be undertaken at the end of a phase or stage of the life cycle to determine whether the project should move into the next phase or stage. This is a decision point for senior management to authorise continued investment in the project. The decision will be informed by outputs from the most recent project evaluation review, the completed deliverables of the current phase or stage, robust plans to perform the subsequent phase or stage, and any external changes of circumstance.

Audits are undertaken by a group outside the project team. This can be the project office, internal audit or a third-party organisation. The purpose of an audit is to provide an objective evaluation of the project.

The post-project review is undertaken after the project deliverables have been handed over but before final closeout. The purpose of this review is to learn lessons that will enable continuous improvement. All project documentation can be used as part of the review. The aims of the review are to:

- evaluate the project against its success criteria;
- determine what went right and what went wrong, distinguishing between causes and effects;

- recognise individual and team performance;
- evaluate the project management processes and any tools or techniques used.

A benefits realisation review is undertaken after a period of business-as-usual. The purpose of the review is to establish that the project benefits have or are being realised. The review is the responsibility of the sponsor. There may be a need for further benefits realisation reviews.

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6.7
Organisation structure

The organisation structure is the organisational environment within which the project takes place. The organisation structure defines the reporting and decision-making hierarchy of an organisation and how project management operates within it.

Organisations have a number of functional departments within them such as finance, IT and human resources. These functions provide the structure within which resources and processes are brought together to perform work. Project management cuts across functional boundaries and the ease or difficulty with which this occurs is influenced by the way the organisation is structured.

Organisational structures lie on a continuum with functional at one extreme and project at the other (Figure 6.2). The relative level of authority between a functional manager and a project manager determines where the organisation lies on the continuum. In practice, organisations rarely adopt the extreme structures.

A functional organisation structure is used by organisations involved in routine operations and provides a stable structure for managing routine work.

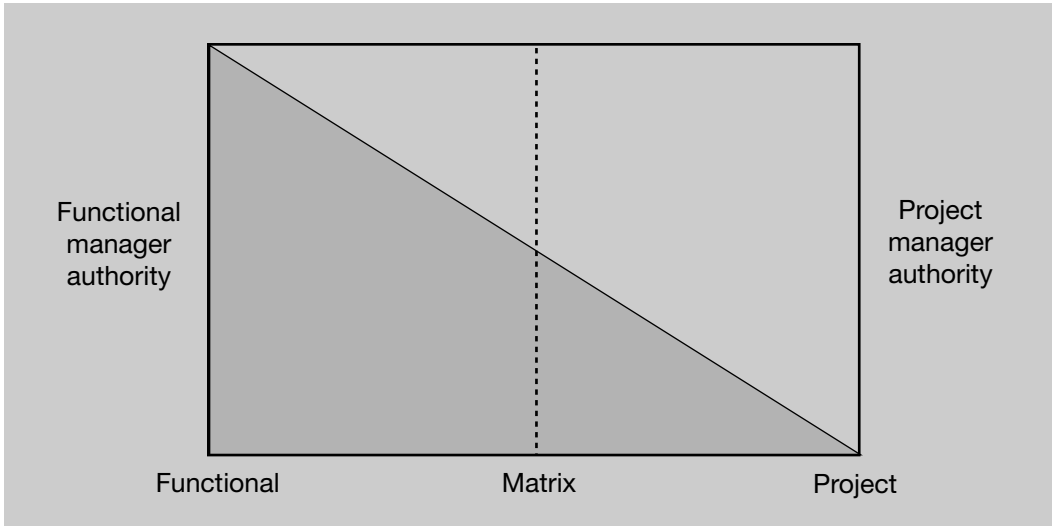

Figure 6.2 The organisational continuum

It supports the development of individuals and the growth of functional capabilities. However, this hinders integration in cross-functional projects.

In matrix organisation structures individuals stay within their functional departments while performing work on one or more projects. This provides a means of balancing project and functional objectives. However, people report to both functional heads and project managers, which can lead to conflict. This can be overcome by clear definition and understanding of roles, responsibilities and authority within the matrix. The project office can play a vital role in aiding communication, prioritisation and integration across projects.

The project organisation structure will afford the maximum authority to the project manager. This provides integration of functional capabilities within projects. However, this leads to duplication of facilities, and less efficient use of resources.

The organisation structure does not define who does the work in the project. This is the purpose of the project's organisational breakdown structure (OBS). The OBS is created to reflect the strategy for managing and handover of the project. It shows the hierarchical management structure for the project, the communication routes and reporting links. The project's work breakdown structure (WBS) and OBS can be combined to create a responsibility assignment matrix (RAM), which correlates the work packages in the WBS to the people, organisations or third parties responsible for accomplishing the assigned work (Topic 3.1).

The organisation structure for a project may change as the project progresses through its life cycle.

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6.8
Organisational roles

Organisational roles are the roles performed by individuals or groups in a project. Both roles and responsibilities within projects must be defined to address the transient and unique nature of projects and to ensure that clear accountabilities can be assigned.

Roles have to be defined for the unique circumstances of a project. These roles may differ from those that the individuals hold within the organisation. For example, a project manager's boss in the functional organisation may be a member of the project team and report to the project manager on all matters relating to the project.

There are a number of principal roles that may need to be defined on a project.

A steering group[1] provides overall strategic direction for the project. The steering group is chaired by the sponsor and consists of representatives from users and suppliers. Where a steering group is not required, the sponsor provides overall direction and management of the project.

The sponsor's role is to own the business case and be ultimately accountable for the project and for delivering the benefits.

The project manager manages the project on a day-to-day basis and is responsible for delivering the capability that allows the benefits to be realised.

Users represent the group of people who will benefit from the project. Users may also be subject matter experts who contribute to defining requirements and acceptance criteria.

Suppliers represent the people or organisations that will provide resources to the project. Suppliers can be internal or external to the organisation. They are responsible for producing the project's deliverables.

The project office provides support to the project manager and sponsor. The degree of this support may vary considerably (Topic 1.6).

Stakeholders are those with an interest in the project. A stakeholder may be an individual or group, either internal or external to the organisation. Stakeholders contribute to defining fitness for purpose for the project.

Project team members are accountable to the project manager. Team members ensure that the work assigned to them by the project manager is performed either by themselves or by others within a working group. In a working group work is delegated to individuals and the interrelationship between activities is managed through a single person, perhaps a member of the project team.

[1] The steering group may also be called the steering committee or project board.

Project assurance is the independent monitoring and reporting of the project's quality and deliverables. This role may report directly to the sponsor or steering group.

Further managerial roles that may be required are configuration manager, cost manager, project accountant, project planner, procurement manager, quality manager and resource manager.

It is the sponsor's and the project manager's responsibility to design an appropriate organisational structure for the project and keep it up to date.

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6.9
Methods and procedures

Methods and procedures detail the standard practices to be used for managing projects throughout a life cycle. Methods provide a consistent framework within which project management is performed. Procedures cover individual aspects of project management practice and form an integral part of a method.

The use of a standard method or procedures has a variety of benefits, including:

- providing a consistent approach to all projects within the organisation, leading to better development of projects and governance of project management (Topic 6.10);
- an environment for developing continuous improvement in project management processes (Topic 2.6);
- common understanding of roles within the project team and stakeholders (Topic 6.8).

Without methods or procedures, project management is practised in an unpredictable manner and project managers will develop and use their own ways of working, leading to inefficiencies at an organisational level.

A method embodies best practice and provides consistent guidelines for people involved in the project. An example of an open method is PRINCE2, developed and maintained by the UK Government, which is used extensively in public and private sector projects. Many large organisations develop and utilise bespoke methods.

A method may be based around a project life cycle and includes:

- process descriptions for each phase of a project life cycle;
- inputs and outputs for each process;
- documentation guidelines and templates;
- guidelines for organisational design, accountability, responsibility and communication (Topics 6.7 and 6.8);
- role definitions for all those involved in the project, including the project team (Topic 6.8);
- procedures to be used throughout the life cycle, for example value management (Topic 2.3), project risk management (Topic 2.5) and project quality management (Topic 2.6), issue management (Topic 3.8), change control (Topic 3.5) and configuration management (Topic 4.7).

A procedure sets out the steps to follow in order to perform project management processes. Organisations that are new to project management may

choose to develop a small number of procedures and add to these as their expertise grows.

The development and maintenance of methods and procedures may fall under the remit of the project office (Topic 1.6).

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6.10
Governance of project management

Governance of project management (GoPM) concerns those areas of corporate governance that are specifically related to project activities. Effective governance of project management ensures that an organisation's project portfolio is aligned to the organisation's objectives, is delivered efficiently and is sustainable.

Effective governance of project management (GoPM) will align the interests of board directors, project teams and wider stakeholders, help improve corporate performance and reduce surprises at both boardroom level and for stakeholders.

Figure 6.3 illustrates that the governance of project management is a subset of the activities involved within corporate governance. It also shows that most of the activities involved with the management of projects lie outside the direct concern of corporate governance.

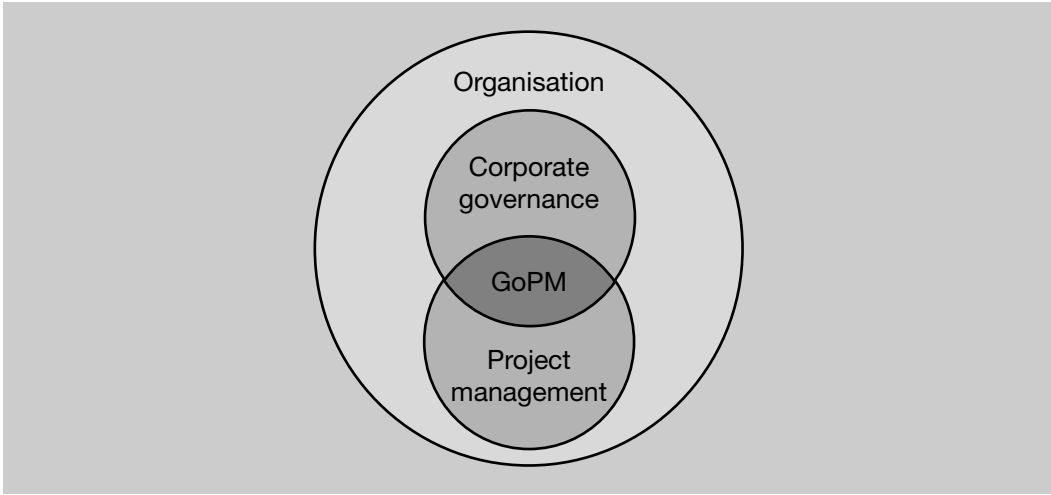

Figure 6.3 Governance of project management

The best results from the governance of project management will come from the intelligent application of the principles set out below, combined with proportionate delegation of responsibility and the monitoring of internal control systems.

- The board[1] has overall responsibility for governance of project management.
- The roles, responsibilities and performance criteria for the governance of project management are clearly defined.
- Disciplined governance arrangements, supported by appropriate methods and controls, are applied throughout the project life cycle.
- A coherent and supportive relationship is demonstrated between the overall business strategy and the project portfolio.
- All projects have an approved plan containing authorisation points at which the business case is reviewed and approved. Decisions made at authorisation points are recorded and communicated.
- Members of delegated authorisation bodies have sufficient representation, competence, authority and resources to enable them to make appropriate decisions.
- The business case is supported by relevant and realistic information that provides a reliable basis for making authorisation decisions.
- The board or its delegated agents decide when independent scrutiny of projects and project management systems is required, and implement such scrutiny accordingly.
- There are clearly defined criteria for reporting project status and for the escalation of risks and issues to the levels required by the organisation.
- The organisation fosters a culture of improvement and of frank disclosure of project information.
- Project stakeholders are engaged at a level that is commensurate with their importance to the organisation and in a manner that fosters trust.

One method of examining the extent of application of these principles through an organisation is to ask a comprehensive set of questions in four component areas: portfolio direction, project sponsorship, project management, and disclosure and reporting. Positive answers to these key questions would indicate that current practice broadly fulfils the principles and meets appropriate governance requirements applied to the discipline of project management.

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[1] Board here refers to board of directors, rather than project board.

Section 7

People and the profession

People are the integral part of projects and project management. They both manage the project and perform the work and therefore projects succeed or fail through their involvement.

Important factors relating to people in project management are:

- the need for effective communication (Topic 7.1 – Communication);
- the contribution of teamwork (Topic 7.2 – Teamwork);
- the role of leaders (Topic 7.3 – Leadership);
- resolving conflict and how it can be managed to the benefit of the project (Topic 7.4 – Conflict management);
- negotiation between those involved in the project (Topic 7.5 – Negotiation);
- the understanding of human resource management practices (Topic 7.6 – Human resource management);
- the behavioural characteristics that a project management professional should ideally demonstrate (Topic 7.7 – Behavioural characteristics);
- the need for people and the organisation to learn and develop (Topic 7.8 – Learning and development);
- the professionalism of project management professionals and the ethics they should exhibit (Topic 7.9 – Professionalism and ethics).

7.1
Communication

Communication is the giving, receiving, processing and interpretation of information. Information can be conveyed verbally, non-verbally, actively, passively, formally, informally, consciously or unconsciously.

Effective communication is fundamental to project management. The primary objective of communication in project management is to gain a common understanding. Communication related to the project will be with different audiences, for example the project team, the sponsor, stakeholders, senior management and the organisation. The project manager should recognise that these different audiences have different communication needs in terms of volume, content, style, tone and medium, and tailor their communication to meet these needs.

Communication can affect understanding and feelings. The recipient's viewpoint, interests and cultural background[1] will affect how they interpret the communication. A communication may be open to different interpretation. Careful thought must be given to the choice of medium and its likely impact.

Active listening is a way of seeking feedback on the understanding of the transmitted communication. Confirming understanding assures that clarity is achieved.

Anticipating the impact of a communication is key. Communication is constant, and people continually interpret what they observe and experience.

Paying close attention to language, tone and body language can provide feedback regarding the impact of a communication on knowledge, understanding and feelings. Effective management of body language and verbal expression can enhance empathy and rapport where candour and a trusted and open exchange of views is encouraged.

Information that may be critical to the well-being of the project is often informally available before it is available through formal channels. The project manager must be sensitive to this and identify opportunities to exploit informal communication.

The project manager should be conscious of the project's context and communicate within the boundaries of what is sensitive or confidential to the organisation, and understand the effect of timing in the organisation.

Effective communication management throughout the life cycle is fundamental to the project. The project manager can choose to share, mask or

[1] Culture embraces social, organisational and ethnic considerations.

promote certain information. However, inappropriate style, tone, message and timing can have a negative impact on the project.

Formal and informal project communications should be captured in a communication plan which identifies what is to be communicated, why, the desired impact, when, how, where, through what channel and to whom (see stakeholder management (Topic 2.2)).

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7.2
Teamwork

Teamwork is when people work collaboratively towards a common goal as distinct from other ways that individuals can work within a group.

A project team consists of a number of people committed to a common goal that none can achieve alone, and where interrelationships between tasks are managed by collaboration. The project team can be supported by a working group. Within a working group, work is delegated to individuals and the interrelationship between activities is managed through a single person. It must be determined whether work is allocated to a team or to individuals within a working group; a distinction needs to be made as to whether at any one time people work as a member of a team or in a working group.

Regardless of whether they have input into team selection, the project manager should invest in building the team, ensuring appropriate communication to keep team members informed and motivated, and demonstrating leadership that the team can follow.

A group of people pass through a number of stages[1] of development before they can function as an effective team. The team may not evolve naturally or quickly so it is necessary to determine when action needs to be taken to promote transition through the stages. As the team develops it gathers a shared experience, language and culture, creating a high-performing, supportive and collaborative team environment.

The team may be cross-functional,[2] with varied experience and specialist skills. The project team will change throughout the project life cycle, with specialist skills required at certain phases and people continually joining or leaving the team. The team will be transient, being formed to create the project deliverables that will deliver the benefits to the organisation and disbanded when the project has completed its handover and closeout phase.

The project manager may facilitate the development of a charter that describes how the team will work together and their behaviours. The project manager must consider geographical, cultural and knowledge barriers that can disrupt team harmony, and use team discussions, communication, events, physical or virtual meetings to overcome these. The structure of the project team may be predefined by the organisation structure.

[1] There are a number of models of team development, such as Tuckman (forming, storming, norming, performing), Katzenbach and Smith (working group/high-performing team).
[2] The team may be drawn from different functions or departments of an organisation.

Individuals will perform better in a team context if they are performing in a role that plays to their strengths. Recognising and filling a variety of roles will strengthen the team.

The project manager needs to build and maintain a positive and effective team that encourages involvement, flexibility, efficiency, innovation and productivity to contribute to project success.

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7.3
Leadership

Leadership is the ability to establish vision and direction, to influence and align others towards a common purpose, and to empower and inspire people to achieve project success. It enables the project to proceed in an environment of change and uncertainty.

The role of leadership in a project is to maintain and promote the project vision, reinforce positive relationships, build an environment that supports effective teamwork, raise morale and empower and inspire the individual. Leaders require followers; leaders must also themselves be able to follow.

A leader ensures that exceptional events during the project life cycle are properly addressed and resolved. Projects do not always go well, and a leader who can see an opportunity rather than a threat will help to motivate the team through a challenging period.

Leadership should be exercised at all levels within the project. Team members will lead their colleagues to a successful result, which adds to the success of the project and has a positive impact on the functional area of the organisation that is providing resources. Within the context of a project team, responsibility for leadership can be exercised by all or some of the team all or some of the time. This presents those with nominated leadership roles the challenge of supporting and nurturing this attribute within the team.

A leader provides constructive and immediate feedback on the performance of individuals in the project, and encourages feedback on their own performance. To enable continual improvement, lessons learned will be shared, and success celebrated. Leaders can act as a coach and mentor to people working on the project in order to promote personal growth.

The leader represents and provides service to those they lead. Sensing what people need in order for them to perform most effectively is key to selecting which leadership style and activity is most appropriate. Projects have to respond to critical scrutiny. The leader protects the interests of the project and its people.

The project manager as leader has an impact on the organisation, in that they inspire trust, confidence and commitment when escalating or communicating upwards.

The project manager should focus on different aspects of leadership throughout the project life cycle and set the pace accordingly. Early phases of the project require expertise in influencing stakeholders and creating vision. As the project progresses, the leadership focus shifts to maintaining momentum, responding to ambiguity and change.

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7.4
Conflict management

Conflict management is the process of identifying and addressing differences that if unmanaged would affect project objectives. Effective conflict management prevents differences becoming destructive elements in a project.

There are differences of opinion and interpretation in projects, which are often resolved with discussion. New ideas and practices result from such debate. When agreement is not possible, differences must be resolved through conflict management. The project manager needs to recognise when a conflict may have a critical impact on the project and therefore requires a conflict management approach.

Conflict can arise among individuals, teams, stakeholders or at an organisational level, internally to the project or externally affecting the project. It may relate to interpersonal issues, interests, values, organisational cultures, technical opinion, politics and finance. The project manager needs to recognise the material and behavioural components of conflict.

A trend towards conflict is often identifiable. Indications may be obvious, such as open hostility or challenge, or more subtly expressed through changes in style or volume of communication, opting out, passive resistance, rumour-mongering or asides. An effective approach to conflict management can be to resolve differences before they give rise to conflict. The project manager's role is to anticipate and prepare, avoiding conflict escalation through skilful negotiation or appropriate use of authority.

Conflict management methods include:

- collaborating (confronting);
- compromising;
- accommodating (smoothing);
- competing (forcing);
- avoidance (withdrawal).

Conflict in a project can be constructive. Managed conflict brings concerns into the open, raises otherwise suppressed viewpoints and can clear up misunderstandings and uncertainty. This can enable positive working relationships to evolve.

Unresolved conflict can become expensive, increasing uncertainty and damaging morale. The project manager needs to identify the appropriate moment to intervene.

Distinguishing between the person and the position being taken can defuse tension and make the discussion more objective. While facts are easy to identify and address objectively, feelings are not. Conflict arising from

people's feelings needs handling with sensitivity and empathy. The use of non-confrontational language and understanding the perspectives of adversaries are key. The project manager may have to adopt a position as advocate of one of the parties involved, or be perceived to be neutral.

Where conflict cannot be resolved, escalation to a higher authority may be required or specialists may be engaged to broker a resolution. If the effort required to resolve the conflict is disproportionate to the impact on the project, it may be necessary to reach a pragmatic resolution which may include agreeing to disagree.

Regardless of the approach used to manage and resolve conflict, the project manager should ensure that the outcome is communicated to all relevant stakeholders.

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7.5
Negotiation

Negotiation is a search for agreement, seeking acceptance, consensus and alignment of views. Negotiation in a project can take place on an informal basis throughout the project life cycle, or on a formal basis such as during procurement, and between signatories to a contract.

A project has constraints such as time, cost and quality, and areas such as scope, requirements and technical discussions where people may have different agendas and interests and need to negotiate to reach agreement.

The project manager should be certain of their role in any negotiation, i.e. whether they are:

- the negotiator trying to reach agreement between two parties;
- a participant negotiating for their own desired situation; or
- an observer of the negotiation within the project.

To conclude a successful negotiation that maintains or enhances the relationship between the people involved, the project manager should aim to understand and address the underlying motivation, wants and needs of all parties, and separate the different views from the people involved. The people involved may be part of the project team or stakeholders whose ongoing support is essential.

The project manager prepares for a negotiation by understanding the different views involved, their authority, the relative power and influence of the parties involved, and the rationale for the tolerance or limit that is acceptable within the context of the project.

Resolution within tolerance may be deemed acceptable, whereas agreement outside this tolerance may require additional support (financial, time) from the sponsor or steering group. The project manager needs to select from a range of negotiating stances from adversarial through alliances to partnering.

The consequences of a failure to negotiate an agreement must be understood, such as the impact on time, cost and quality. The project manager must clarify the escalation route to use in the event of being unable to resolve the negotiation.

The negotiation itself can proceed through planning, discussing, proposing, trade-offs, bargaining and agreeing; this may be an iterative process. The project manager should consider fairness and ethics in the negotiation, as this helps to preserve the relationship between the people involved. The influence of culture on the people involved in the negotiation should also be considered. A specialist negotiator may be required where agreement is critical but difficult to achieve.

On resolution the outcome must be reviewed with the participants to achieve clarity and agreement, to clearly record the outcome to all parties and to incorporate the consequences into the project management plan.

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7.6
Human resource management

Human resource management (HRM) is the understanding and application of the policy and procedures that directly affect the people working within the project team and working group. These policies include recruitment, retention, reward, personal development, training and career development.

The project manager should understand the scope of their responsibility and authority to implement and conform with the human resource management (HRM) policies of the organisation, and any legal obligations. These include recruitment, redeployment and reduction of both permanent and contracted personnel, rewards and incentives, disputes, discipline, personal development, training, health and safety, and other conditions of work.

Many of these policies will be defined, owned by and supported elsewhere in the organisation. The project manager should identify the relevant functions and work effectively with them. Active pursuit of information relating to HRM is a primary duty of the project manager throughout the project life cycle. Effective collaboration between the project and HRM both leads to project success and enhances the human resources available to the organisation in the longer term.

HRM has a wider impact on the project than ensuring compliance with policies. Misuse or avoidance of policies can unsettle the people involved and result in disruption in the project team, with subsequent impact on time and performance, and a lack of confidence in the project from the stakeholders.

An induction process prepares people joining the project so that they will understand their roles and responsibilities, the goals and ethos of the project, and its working arrangements.

The transient nature of a project brings particular challenges for HRM. Among these are the need to manage information effectively, provide input to performance management processes and engage in long-term development of people and the organisation.

HRM specialists in the organisation may be available to the project. Their knowledge of employee relations, resourcing, organisation and legal factors can contribute to project success.

The development of human resources from the learning and experience gained by involvement in projects is also a source of competitive advantage. In this way the project manager contributes to HRM policies in their responsibility for talent management and social capital.

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7.7
Behavioural characteristics

Behavioural characteristics are the elements that separate and describe a person's preferred way of acting, interacting and reacting in a variety of situations. Behaviours complement knowledge and experience and are a function of values, beliefs and identity. They can be used in assessment, engagement and career advice.

Successful project management requires a combination of knowledge, experience and behaviour. Behaviours are closely associated with personality, but are not the same. It is far more difficult to understand or change personality than behaviour, which can be openly recognised and learned. Behaviour relates to use of language, perceptions from senses and movement (body language).

There are eight readily identified behavioural characteristics important for project management:

- *Attitude*: an open, positive 'can-do' attitude builds confidence and credibility both within the team and with other stakeholders, and sets the environment where collaboration can take place.
- *Common sense*: the ability to spot and adopt sensible, effective, straightforward solutions, i.e. 90 per cent right on time may be better than 100 per cent far too late! Common sense seeks to simplify rather than overcomplicate or over-engineer.
- *Open mindedness*: openness to new ideas, practices and methods, and in particular giving consideration to the plurality of views involved on the project.
- *Adaptability*: this is pragmatism, a propensity to be flexible where necessary and avoid rigid patterns of thinking or behaviour, to adapt to the requirements of the project, the needs of its sponsor, its environment and the people working on it – to ensure a successful outcome.
- *Inventiveness*: an ability to articulate innovative strategies and solutions either solo or with other members of the project, and to identify ways of working with disparate resources and interests to achieve project objectives.
- *Prudent risk taker*: a willingness and ability to identify and understand threats and opportunities.
- *Fairness*: a fair and open attitude, which respects all human values and reflects contract particulars, appointment conditions, legal agreements and legislation.
- *Commitment*: a focus on the project's objectives, user satisfaction and teamworking. A strong orientation towards achievement of goals, targets and benefits, including scope, time, cost, and quality criteria.

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7.8
Learning and development

Learning and development involves the continual improvement of competencies in the organisation. The identification and application of learning within projects develops the organisation's capability to undertake current and future projects.

The project manager should provide an environment that supports learning and development opportunities that meet the needs of the project, people and the organisation. People are responsible for their own learning and development and should ensure that the project manager is aware of their needs. In addition the project manager should also identify gaps in people's competencies and how best to address them.

The project manager needs to be aware of and comply with the organisation's policy on learning and development, collaborate with specialists that are responsible for learning and development, or share responsibility for the learning and development of people in the project.

Learning and development needs are determined through a process of performance management that relates people's ability to the organisation's expectation of performance. Performance management considers the immediate needs for capability to support projects and the longer term career development of people. Feedback on performance and behaviour contributes to the learning and development of people involved in the project. Feedback for the organisation, project manager and project team is frequently obtained and shared as lessons learned at a project evaluation review. Prompt and direct feedback has an immediate impact on the learning and development of the project team.

Coaching is a process for addressing a person's development needs and enhancing performance while fulfilling the work needed to complete the project. Coaches are sensitive to preferred learning styles. Mentoring is support, guidance and advice provided by one person that is not specific to particular work, but instead is related to a person's development in terms of significant transitions in knowledge, work or thinking.

Everyone in the project will encounter and should work towards creating opportunities for knowledge creation. In a project, knowledge is created by means of individual and organisational learning, achieved through socialisation, articulating what we and others know, embodying that through individual skills and work, and combining this into the technologies and other explicit expressions of knowledge that are common during projects.

Formal and informal networks offer the opportunity for sharing experience, tacit knowledge and lessons learned with peers. Project managers are part of a community of practice, which develops, promotes and advances

best practice and standards. A community may be sector-specific, reflecting the fact that many project managers have or need specialist knowledge.

Learning is a lifelong activity. The project manager must be aware of the need to undertake continuing professional development (CPD) and keep pace with changing standards, techniques and methods.

Consideration of time and resources required to support learning and development must be taken into account in the project plans.

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7.9
Professionalism and ethics

Professionalism and ethics both relate to proper conduct. Professionalism is demonstrable awareness and application of qualities and competencies covering knowledge, appropriate skills and behaviours. Ethics covers the conduct and moral principles recognised as appropriate within the project management profession.

The features of a profession and professionalism may be summarised as follows:

- A profession creates and owns a distinctive, relevant body of knowledge.
- Members of the profession need to continue to practise and apply themselves to ongoing learning in order to maintain appropriate skills.
- Individual members should follow standards of professional ethics and behave in a manner appropriate to the profession.
- A profession should award certificates-to-practise based on examination of individuals' competence.

Project management has many of these features. A project manager who behaves in accordance with the features of a profession will provide a consistent, predictable standard and quality of work, have a responsibility to colleagues in project management to maintain these standards and will act as advocate for the profession.

The position of the project manager may be influenced by contractual requirements, but professionalism indicates that there remains a fiduciary relationship with the client which covers acting in equity, good faith and good conscience with due regard to the interests of the organisation or client.

The trust and respect of those they work for and with are key to the success of a project manager who wants to be regarded as a professional. This trust is gained by displaying a morally, legally and socially appropriate manner of behaving and working.

Ethical requirements are an integral part of the project manager's professional behaviour and require a fundamental understanding of the norms of the organisation's expectations, moral values and legal boundaries, which in turn vary by location, culture and sector. The ethics of the process by which the project deliverables are produced and the use to which the deliverables could be put should be considered. If a project manager believes that they have conflicts of interest or difficulties with professionalism or ethics in their activities then this should be escalated to a relevant authority, typically the sponsor or professional association for advice and direction.

The trend in recent decades has been for project management knowledge to become more comprehensive, formalised and recognised as a discipline.

Organisations who have acknowledged this have expectations that project managers will behave professionally and ethically, to a consistent level of performance, creating a relationship that nurtures trust between the organisation and project manager in ways that transcend commercial agreements.

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Appendices

Comparison with the fourth edition of the *APM Body of Knowledge*

Fourth Edition 2000	Fifth Edition 2006	Comments
1 General	*1 Project management in context*	All topics renumbered. Section name changed
10 Project management	1.1 Project management	
11 Programme management	1.2 Programme management	
12 Project context	1.3 Portfolio management	New topic – Portfolio management split out of Programme management
	1.4 Project context	
	1.5 Project sponsorship	New topic
	1.6 Project office	New topic
2 Strategic	*2 Planning the strategy*	Section name changed
20 Project success criteria	2.1 Project success and benefits management	Topic name changed – benefits management added
21 Strategy/project management plan	2.2 Stakeholder management	New topic – previously covered within other topics
22 Value management	2.3 Value management	
23 Risk management	2.4 Project management plan	Topic name changed
24 Quality management	2.5 Project risk management	Topic name changed
25 Health, safety and environment	2.6 Project quality management	Topic name changed
	2.7 Health, safety and environmental management	Topic name changed
3 Control	*3 Executing the strategy*	Section name changed
30 Work content and scope management	3.1 Scope management	Topic name changed
31 Time scheduling/phasing	3.2 Scheduling	Topic name changed
32 Resource management	3.3 Resource management	
33 Budgeting and cost management	3.4 Budgeting and cost management	
34 Change control	3.5 Change control	
35 Earned value management	3.6 Earned value management	
36 Information management	3.7 Information management and reporting	Topic name changed – Reporting added
	3.8 Issue management	New topic

4 Technical	*4 Techniques*	Section name changed
40 Design, implementation and handover management	4.1 Requirements management	Topic name changed; emphasis of topic changed also
41 Requirements management	4.2 Development	New topic added. Emphasis of topic changed
42 Estimating	4.3 Estimating	
43 Technology management	4.4 Technology management	Emphasis of topic changed
44 Value engineering	4.5 Value engineering	
45 Modelling and testing	4.6 Modelling and testing	
46 Configuration management	4.7 Configuration management	
5 Commercial	*5 Business and Commercial*	Section name changed
50 Business case	5.1 Business case	
51 Marketing and sales	5.2 Marketing and sales	
52 Financial management	5.3 Project financing and funding	Topic name changed
53 Procurement	5.4 Procurement	
54 Legal awareness	5.5 Legal awareness	
6 Organisational	*6 Organisation and Governance*	Section name changed
60 Life cycle design & management	6.1 Project life cycles	Topic name changed
61 Opportunity	6.2 Concept	Topic name changed
62 Design and development	6.3 Definition	Topic name changed
63 Implementation	6.4 Implementation	
64 Hand-over	6.5 Handover and closeout	Topic name changed
65 (Post) project evaluation review [O&M/ILS]	6.6 Project reviews	Topic name changed
66 Organisation structure	6.7 Organisation structure	
67 Organisational roles	6.8 Organisational roles	
	6.9 Methods and procedures	New topic
	6.10 Governance of project management	New topic
7 People	*7 People and the Profession*	Section name changed
70 Communication	7.1 Communication	
71 Teamwork	7.2 Teamwork	
72 Leadership	7.3 Leadership	
73 Conflict management	7.4 Conflict management	
74 Negotiation	7.5 Negotiation	
75 Personnel management	7.6 Human resource management	Topic name changed
	7.7 Behavioural characteristics	Transferred from 4th edition preface
	7.8 Learning and development	New topic
	7.9 Professionalism and ethics	New topic

Glossary of project management terms

This glossary is made up of terms used in the fifth edition of the *APM Body of Knowledge* plus many other terms used in the wider application of project management. Terms in bold within the definition are also listed.

Accept A response to a risk (**threat** or **opportunity**) where no course of action is taken.

Acceptance The formal process of accepting delivery of a **deliverable** or a product.

Acceptance criteria The requirements and essential conditions that have to be achieved before project **deliverables** are accepted.

Acceptance test* A formal, predefined test conducted to determine the compliance of the **deliverable**(s) with the **acceptance criteria**.

Accrual Work done for which payment is due but has not been made.

Accrued costs* Costs that are earmarked for the project and for which payment is due, but has not been made.

Acquisition strategy The establishment of the most appropriate means of procuring the component parts or services of a project.

Activity* A task, job, operation or process consuming time and possibly other resources. (The smallest self-contained unit of work used to define the logic of a project).

Activity duration The length of time that it takes to complete an activity.

Activity ID A unique code identifying each activity in a project.

Activity network *See* **network diagram.**

Activity-on-arrow network* Arrow diagram – a **network diagram** in which the arrows symbolise the activities.

Activity-on-node network* Precedence diagram – a **network diagram** in which the nodes symbolise the activities.

Activity status The state of completion of an activity.

Actual cost* The incurred costs that are charged to the project budget and for which payment has been made, or accrued.

Actual cost of work performed (ACWP)* A term used in **earned value management**. Cumulative cost of work accrued on the project in a specific period or up to a specific stage. Note: for some purposes cost may be measured in labour hours rather than money. *See* **actual cost**.

Actual dates The dates on which activities started and finished as opposed to planned or forecast dates.

Actual expenditure The money that has already been paid.

Actual finish The date on which an activity was completed.

Actual start The date on which an activity was started.

Actual time expended The elapsed time from the beginning of an activity to date.

Adjudication The legal process by which an arbiter or other independent third party reviews evidence and argumentation, including legal reasoning, set forth by opposing parties to come to a decision or judgement which determines rights and obligations between the parties involved.

Agile development A family of methodologies where the development emphasises real time communication and software.

Alliancing An arrangement whereby two or more organisations agree to manage a contract or range of contracts between them jointly. *See* **partnering**.

Alternative dispute resolution (ADR) The collective term for settling **disputes** with the help of an independent third party without a court hearing. For example **arbitration**, **adjudication** and **mediation**.

Arbitration The process of using a third party appointed to settle a **dispute**.

Arrow* A direct connecting line between two nodes in a network.

Arrow diagram* *See* **activity-on-arrow network**.

Arrow diagram method (ADM) One of two conventions used to represent an activity in a **network diagram**. Also known as activity-on-arrow method.

As late as possible (ALAP) An activity for which the early start date is set as late as possible without delaying the early dates of any successor.

Associated revenue* That part of a project cost that is of a revenue nature and therefore charged as incurred to the profit and loss account.

As soon as possible (ASAP) An activity for which the early start date is set to be as soon as possible. This is the default activity type in most project scheduling systems.

Assumptions Statements that will be taken for granted as fact and upon which the project business case will be justified.

Assurance The process of examining with the intent to verify. *See* **quality assurance**.

Audit* The systematic retrospective examination of the whole, or part, of a project or function to measure conformance with predetermined standards.

Authorisation points The points at which the business case is reviewed and approved.

Avoid A response to a **threat** that eliminates its probability or impact on the project.

Backward pass* A procedure whereby the latest event times or the latest finish and start times for the activities of a network are calculated.

Balanced matrix An organisational matrix where **functions** and projects have the same priority.

Bar chart* A chart on which activities and their durations are represented by lines drawn to a common timescale. *See* **Gantt chart**.

Base date A reference date used as a basis for the start of a project **calendar**.

Baseline* The reference levels against which the project is monitored and controlled.

Baseline cost(s) The amount of money a project or activity was intended to cost when the project plan was baselined.

Baseline date(s) The original planned start and finish dates for a project or an activity when the schedule was baselined.

Baseline plan The fixed **project plan**. It is the standard by which performance against the project plan is measured.

Baseline schedule The fixed **project schedule**. It is the standard by which project schedule performance is measured.

Behavioural characteristics The elements that separate and describe a person's preferred way of acting, interacting and reacting in a variety of situations.

Benchmarking A review of what other organisations are doing in the same area. For those organisations who appear to be particularly successful in what they do and how they do it and are taken to be examples to be emulated, i.e. used as benchmarks.

Benefit The quantifiable and measurable improvement resulting from completion of project **deliverables** that is perceived as positive by a **stakeholder**. It will normally have a tangible value, expressed in monetary terms, that will justify the investment.

Benefits framework An outline of the expected benefits of the project (or **programme**), the business operations affected and current and target performance measures. The totality of plans and arrangements to enable the organisation to realise the defined benefits from a project or programme of projects.

Benefits management The identification of the benefits (of a **project** or **programme**) at an organisational level and the tracking and realisation of those benefits.

Benefits management plan A plan that specifies who is responsible for achieving the benefits set out in the **benefits profiles** and how achievement of the benefits is to be measured, managed and monitored.

Benefits profile A representation of when the benefits are planned to be realised.

Benefits realisation The practice of ensuring that the outcome of a project produces the projected benefits.

Benefits realisation review A review undertaken after a period of operations of the project **deliverables**. It is intended to establish that project benefits have or are being realised.

Bid A tender, quotation or any offer to enter into a contract.

Bid analysis An analysis of bids or tenders.

Bidding The process of preparing and submitting a bid or tender.

Bid list A list of contractors or suppliers invited to submit bids for goods or services.

Blueprint A document defining and describing what a **programme** is designed to achieve in terms of the business vision and the operational vision.

Body of Knowledge An inclusive term that describes the sum of knowledge within the profession of **project management**. As with other professions, such as law and medicine, the body of

knowledge rests with the practitioners and academics that apply and advance it.

Bond Security against a loan or investment.

Bottleneck A process constraint that determines the capacity or capability of a system and restricts the rate, volume or flow of a process.

Bottom-up estimating An estimating technique based on making estimates for every work package (or activity) in the **work breakdown structure** and summarising them to provide a total estimate of cost or **effort** required.

Brainstorming The unstructured generation of ideas by a group of people in a short space of time.

Branching logic* Conditional logic. Alternative paths in a **probabilistic network**.

Breaches of contract A legal concept in which a binding agreement (contract) is not honoured by one of the parties to the contract, by non-performance or interference with the other party's performance.

Breakdown structure A hierarchical structure by which project elements are broken down, or decomposed. *See* **cost breakdown structure** (CBS), **organisational breakdown structure** (OBS), **product breakdown structure** (PBS), **risk breakdown structure** (RBS) **and work breakdown structure** (WBS).

Brief A high–level outline (strategic specification) of **stakeholders**' (customers/clients) needs and requirements for a project.

Budget* The agreed cost of the project or a quantification of resources needed to achieve an activity by a set time, within which the activity owners are required to work.

Budget at completion (BAC) The sum total of the time-phased budgets.

Budget cost The cost anticipated at the start of a project.

Budgeted cost of work performed (BCWP) A term used in **earned value management**. The planned cost of work completed to date. BCWP is also the 'earned value' of work completed to date. *See* **earned value**.

Budgeted cost of work scheduled (BCWS) A term used in **earned value management**. The planned cost of work that should have been achieved according to the project **baseline** dates. *See* **planned cost**.

Budget element Budget elements are the same as resources, the people, materials or other entities needed to do the work. They are typically assigned to a **work package**, but can also be defined at the **cost account** level.

Budget estimate An approximate estimate prepared in the early stages of a project to establish financial viability or to secure resources.

Budgeting Time-phased financial requirements.

Budgeting and cost management The estimating of costs and the setting of an agreed budget and the management of actual and forecast costs against that budget.

Buffer A term used in **critical chain** for the centralised management of **contingencies**.

Build, own, operate, transfer (BOOT) A situation whereby a private operator builds, owns, operates and then transfers a facility to another party after a specific period.

Build (stage) A stage within the **implementation** phase where the

project **deliverables** are built or constructed.

Business-as-usual An organisation's normal day-to-day operations.

Business case The business case provides justification for undertaking a project, in terms of evaluating the benefit, cost and risk of alternative options and the rationale for the preferred solution. Its purpose is to obtain management commitment and approval for investment in the project. The business case is owned by the **sponsor**.

Business change manager(s) The role responsible for **benefits management** from identification through to realisation and ensuring the implementation and embedding of the new capabilities delivered by projects. May be more than one individual.

Business objectives The overall objectives of the business as opposed to the project.

Business risk assessment The assessment of risk to business objectives rather than risk to achieving project objectives.

Business to business (B2B) The exchange of services, information and products from a business to another business – generally undertaken electronically using the World Wide Web.

Business to consumer (B2C) The exchange of services, information and products from a business to a consumer – generally undertaken electronically using the World Wide Web.

Calendars A project calendar lists time intervals in which activities or resources can or cannot be scheduled. A project usually has one default calendar for the normal workweek (Monday through Friday, for example), but may have other calendars as well. Each calendar can be customised with its own holidays and extra work days. Resources and activities can be attached to any of the calendars that are defined.

Capability A project capability (or outcome) that enables a benefit to be achieved. Alternatively having the necessary attributes to perform or accomplish.

Capability maturity models An organisational model that describes a number of evolutionary levels in which an organisation manages its processes, from *ad hoc* use of processes to continual improvement of its processes.

Capital Monetary investment in the project. Alternatively wealth used or available for use in the production of more wealth.

Capital cost* The carrying cost in a balance sheet of acquiring an asset and bringing it to the point where it is capable of performing its intended function over a future series of periods. *See* **revenue cost**.

Capital employed* The amount of investment in an organisation or project, normally the sum of fixed and current assets, less current liabilities at a particular date.

Capital expenditure (CapEX) The long-term expenditure for property, plant and equipment.

Cash flow* Cash receipts and payments in a specified period.

Cash flow forecast A prediction of the difference between cash received and payments to be made during a specific period or for the duration of the project.

Central repository A central location where data and information is stored. This can be a physical location, such as a

filing cabinet, or a virtual location, such as a dedicated drive on a computer system.

Champion An end user representative often seconded into a **project team**. Someone who acts as an advocate for a proposal or project. Someone who spearheads an idea or action and 'sells it' throughout the organisation. A person within the parent organisation who promotes and defends a project.

Change A change to a project's baseline **scope**, cost, time or quality objectives.

Change authority An organisation or individual with power to authorise changes on a project.

Change control A process that ensures that all changes made to a project's baseline **scope**, cost, time or quality objectives are identified, evaluated, approved, rejected or deferred.

Change control board A formally constituted group of **stakeholders** responsible for approving or rejecting changes to the project **baselines**.

Change freeze A point on a project after which no further changes will be considered.

Change log A record of all project changes, proposed, authorised, rejected or deferred.

Change management The formal process through which changes to the project plan are approved and introduced. Also the process by which organisational change is introduced.

Change register *See* **change log**.

Change request A request to obtain formal approval for changes to the **scope**, design, methods, costs or planned aspects of a project.

Charter A document that sets out the working relationships and agreed behaviours within a **project team**.

Claim A written demand or assertion by a contracting party seeking as a matter of right financial adjustment or interpretation of an existing contract subject to the terms of the contract's dispute clause.

Client The party to a contract who commissions work and pays for it on completion.

Client brief *See* **brief**.

Closeout The process of finalising all project matters, carrying out final project reviews, archiving project information and redeploying the remaining project team. *See* **handover** and **closeout**.

Closure The formal end point of a project, either because it has been completed or because it has been terminated early.

Code of accounts Any numbering system, usually based on corporate code of accounts of the primary performing organisation, used to monitor project costs by category.

Commissioning* The advancement of an installation from the stage of static completion to full working order and achievement of the specified operational requirements. *See* **mechanical completion** and **pre-commissioning**.

Commitment A binding financial obligation, typically in the form of a purchase order or contract. The amount of money removed from the budget by this obligation.

Committed costs* Costs that are legally committed even if delivery has not taken place with invoices neither raised nor paid.

Common law Common law is the tradition, custom and especially precedent of previous judgements.

Communication The giving, receiving, processing and interpretation of information. Information can be conveyed verbally, non-verbally, actively, passively, formally, informally, consciously or unconsciously.

Communication plan A document that identifies what information is to be communicated to whom, why, when, where, how, through which medium and the desired impact.

Communication planning The establishment of project **stakeholders**' communication and information needs.

Comparative estimating An estimating technique based on the comparison with, and factoring from, the cost of a previous similar project or operation.

Competitive tendering A formal **procurement** process whereby vendors or contractors are given an equal chance to tender for the supply of goods or services against a fixed set of rules.

Completion When it is agreed that a project or part of a project has been completed in accordance with all requirements.

Completion date The calculated date by which the project could finish, following careful estimating and scheduling.

Community of practice A special type of informal network that emerges from a desire to work more effectively or to understand work more deeply among members of a particular speciality or work group.

Concept (phase) Concept is the first phase in the **project life cycle**. During this phase the need, opportunity or problem is confirmed, the overall feasibility of the project is considered and a preferred solution identified.

Concession The acceptance of something that is not within specified requirements.

Concurrent engineering The systematic approach to the simultaneous, integrated design of products and their related processes, such as manufacturing, testing and supporting.

Configuration* Functional and physical characteristics of a **deliverable** (product) as defined in technical documents and achieved in the product.

Configuration audit A check to ensure that all **deliverables** (products) in a project conform with one another and to the current specification. It ensures that relevant **quality assurance** procedures have been implemented and that there is consistency throughout project documentation.

Configuration control A system to ensure that all changes to **configuration** items are controlled. An important aspect is being able to identify the interrelationships between configuration items.

Configuration identification The unique identification of all items within the **configuration**. It involves breaking down the project into component parts or configuration items and creating a unique numbering or referencing system for each item and establishing configuration **baselines**.

Configuration item A part of a **configuration** that has a set function and is designated for **configuration management**. It identifies uniquely all items within the configuration.

Configuration management* Technical and administrative activities concerned with the creation, maintenance and

controlled change of **configuration** throughout the project or product **life cycle**. See BS EN ISO 10007 for guidance on configuration management, including specialist terminology.

Configuration status accounting A record and report of the current status and history of all changes to the **configuration**. It provides a complete record of what has happened to the configuration to date.

Conflict management The process of identifying and addressing differences that if unmanaged would affect **project objectives**. Effective conflict management prevents differences becoming destructive elements in a project.

Conformance audit An audit of the operation of the **programme** or project management or other process to identify whether the defined processes are being adhered to.

Consideration In contract law – something of value. It may be money, an act or a promise. It is one of the key elements required to have a binding contract.

Constraints Things that should be considered as fixed or must happen. Restrictions that will affect the project.

Consumable resource A type of resource that only remains available until consumed (for example a material). *See* **replenishable resource**.

Context *See* **project context**.

Contingency The planned allotment of time and cost or other resources for unforeseeable risks within a project. Something held in reserve for the unknown.

Contingency budget The amount of money required to implement a **contingency plan**.

Contingency plan* Alternative course(s) of action to cope with project risks or if expected results fail to materialise.

Continuing professional development (CPD) A personal commitment made by an individual to keep their professional knowledge up to date and improve their capability, with a focus on what the person learns and how they develop throughout their career.

Continuous improvement Continuous improvement is a business philosophy popularised in Japan where it is known as Kaizen. Continuous improvement creates steady growth and improvement by keeping a business focused on its goals and priorities. It is a planned systematic approach to improvement on a continual basis.

Contract A mutually binding agreement in which the contractor is obligated to provide services or products and the buyer is obligated to provide payment for them.

Contractor A person, company or firm who holds a contract for carrying out the works and/or the supply of goods or services in connection with the project.

Contract price The price payable by the customer under the contract for the proper delivery of supplies and services specified in the **scope of work** of the contract.

Contract target cost The negotiated costs for the original defined contract and all contractual changes that have been agreed and approved, but excluding the estimated cost of any authorised, unpriced changes.

Contract target price The negotiated estimated costs plus profit or fee.

Control charts Control charts display the results, over time, of a process. They

are used in quality management to determine if the process is in need of adjustment.

Coordination Coordination is the act of ensuring that work carried out by different organisations and in different places fits together effectively.

Corrective action Changes made to bring future project performance back into line with the plan.

Cost account A cost account defines what work is to be performed, who will perform it and who is to pay for it. Another term for cost account is control account.

Cost account manager (CAM) A member of a functional organisation responsible for cost account performance, and for the management of resources to accomplish such activities.

Cost–benefit analysis* An analysis of the relationship between the costs of undertaking an activity or project, initial and recurrent, and the benefits likely to arise from the changed situation, initially and recurrently.

Cost breakdown structure* (CBS) The hierarchical breakdown of a project into cost elements.

Cost budgeting The allocation of cost estimates to individual project activities or **deliverables**.

Cost centre* A location, person, activity or project in respect of which costs may be ascertained and related to cost units.

Cost code* A unique identity for a specified element of work. A code assigned to activities that allows costs to be consolidated according to the elements of a code structure.

Cost control system Any system of keeping costs within the bounds of budgets or standards based upon work actually performed.

Cost curve A graph plotted against a horizontal timescale and cumulative cost vertical scale.

Cost estimating The process of predicting the costs of a project.

Cost incurred A cost identified through the use of the accrued method of accounting or a cost actually paid. Costs include direct labour, direct materials and all allowable indirect costs.

Cost management *See* **budgeting and cost management**.

Cost performance index (CPI)* A term used in **earned value management**. A measure, expressed as a percentage or other ratio of actual cost to budget plan. The ratio of work accomplished versus work cost incurred for a specified time period. The CPI is an efficiency rating for work accomplished for resources expended.

Cost performance report A regular cost report to reflect cost and schedule status information for management.

Cost plan A budget that shows the amounts and expected dates of incurring costs on the project or on a contract.

Cost plus fixed fee contract A type of contract where the buyer reimburses the seller for the seller's allowable costs plus a fixed fee.

Cost plus incentive fee contract A type of contract where the buyer reimburses the seller for the seller's allowable costs and the seller earns a profit if defined criteria are met.

Cost-reimbursement type contracts A category of contracts based on payments to a contractor for allowable

estimated costs, usually requiring only a 'best efforts' performance standard from the contractor.

Cost/schedule planning and control specification (C/SPCS) The United States Air Force initiative in the mid-1960s which later resulted in their cost/schedule control systems criteria, C/SCSC.

Cost–time resource sheet (CTR) A document that describes each major element in the **work breakdown structure** (WBS), including a **statement of work** (SOW) describing the work content, resources required, the time frame of the work element and a cost estimate.

Cost variance* A term used in **earned value management**. The difference (positive or negative) between the actual expenditure and the planned/budgeted expenditure.

Critical activity An activity is termed critical when it has zero or negative **float**. Alternatively an activity that has the lowest float on the project.

Critical chain A networking technique based on Goldratt's **theory of constraints** that identifies paths through a project based on resource dependencies as well as technological precedence requirements.

Criticality index Used in **risk analysis**, the criticality index represents the percentage of **simulation** trials that resulted in the activity being placed on the critical path.

Critical path* A sequence of activities through a **project network** from start to finish, the sum of whose durations determines the overall project duration. There may be more than one such path. The path through a series of activities, taking into account interdependencies, in which the late completion of activities will have an impact on the project end date or delay a **key milestone**.

Critical path analysis* (CPA) The procedure for calculating the **critical path** and **floats** in a network.

Critical path method (CPM) A technique used to predict project duration by analysing which sequence of activities has the least amount of scheduling flexibility.

Critical success factor *See* **success factors**.

Culture The attitudes and values that inform those involved in a project.

Current dates The planned start and finish dates for an activity according to the current schedule.

Cut-off date The end date of a reporting period.

Dangle An activity in a **network diagram** that has either no predecessors or no successors. If neither, it is referred to as an isolated activity.

Decision tree A pictorial (tree-like) representation of the alternatives and outcomes in a decision situation.

Definition (phase) Definition is the second phase of the **project life cycle**. During this phase the preferred solution is further evaluated and optimised. Often an iterative process, definition can affect requirements and the project's **scope**, time, cost and quality objectives.

Delegation The practice of getting others to perform work effectively that one chooses not to do oneself. The process by which authority and responsibility is distributed from **project manager** to subordinates.

Deliverables* The end products of a project or the measurable results of intermediate activities within the project organisation. *See* **product**.

Delphi technique A process where a consensus view is reached by consultation with experts. Often used as an estimating technique.

Demobilisation The controlled dispersal of personnel when they are no longer needed on a project.

Dependencies* Something on which successful delivery of the project critically depends, which may often be outside the sphere of influence of the **project manager**, for example another project. Alternatively, dependency, a precedence relationship: a restriction that means that one activity has to precede, either in part or in total, another activity.

Dependency arrow* A link arrow used in an **activity-on-node network** to represent the interrelationships of activities in a project.

Design authority The person or organisation with overall design responsibility for the products of the project.

Design (stage) A stage within the **implementation** phase where the design of project **deliverables** is finalised.

Detailed design The in-depth design of the chosen solution, ready for full implementation.

Deterministic Something that is predetermined, with no possibility of an alternative outcome.

Deterministic estimate A predetermined estimate with no possibility of an alternative outcome.

Development The working up of a preferred solution to an optimised solution during the **definition** and **implementation** phases of a project.

Deviations Departure from the established plan or requirements.

Direct costs* Costs that are specifically attributable to an activity or group of activities without apportionment. The cost of resources expended in the achievement of work that are directly charged to a project, without the inclusion of **indirect costs**.

Direct labour Labour that is specifically identified with a particular activity. It is incurred for the exclusive benefit of the project.

Discipline An area of expertise. *See* **function**.

Discounted cash flow (DCF)* The concept of relating future cash inflows and outflows over the life of a project or operation to a common base value thereby allowing more validity to comparison of projects with different durations and rates of cash flow.

Dispute A dispute is where parties disagree concerning a particular event.

Dispute resolution The process of resolving disputes between parties.

'Do nothing' option The result or consequence of taking no action, i.e., doing nothing to correct a problem, satisfy a need or seize an opportunity.

Drawdown The removal of funds from an agreed source resulting in a reduction of available funds.

Dummy activity (in activity-on-arrow network) A logical link that may require time but no other resource. An activity representing no actual work to be done but required for reasons of logic or nomenclature.

Duration The length of time needed to complete the project or an activity.

Duration compression Often resulting in an increase in cost, duration compression is the shortening of a project schedule without reducing the project **scope**.

Duty of care A duty of care is owed to persons who are so closely and directly affected by an individual's acts that they ought reasonably to have had them in contemplation as being affected when directing their mind to the acts or omissions that are called into question.

Dynamic systems development method (DSDM) A non-proprietary, **agile development** method for developing business solutions within tight time frames commonly used in IT projects.

Earliest finish date The earliest possible date by which an activity can finish within the logical and imposed constraints of the network.

Earliest start date The earliest possible date when an activity can start within the logical and imposed constraints of the network.

Earned hours The time in standard hours credited as a result of the completion of a given activity or a group of activities.

Earned value* The value of the useful work done at any given point in a project. The value of completed work expressed in terms of the budget assigned to that work. A measure of project progress. Note: the budget may be expressed in cost or labour hours.

Earned value analysis An analysis of project progress where the actual money, hours (or other measure) budgeted and spent is compared to the value of the work achieved.

Earned value management A project control process based on a structured approach to planning, cost collection and performance measurement. It facilitates the integration of project **scope**, time and cost objectives and the establishment of a **baseline plan** for performance measurement.

E-commerce Business that is conducted over the Internet using any of the applications that rely on the Web, such as e-mail, instant messaging, shopping carts and Web services.

Effectiveness A measure of how well an action meets its intended requirements.

Effort The number of labour units necessary to complete the work. Effort is usually expressed in labour hours, labour days or labour weeks and should not be confused with **duration**.

Effort-driven activity An activity whose duration is governed by resource usage and availability.

Effort remaining The estimate of **effort** remaining to complete an activity.

EFQM Excellence Model A model for diagnosing organisational excellence.

Elapsed time The total number of calendar days (excluding non-work days such as weekends or holidays) that is needed to complete an activity.

End activity An activity with no logical successors.

End user The person or organisation that will use the facility produced by the project or the products produced by such a facility.

Enhance A response to an **opportunity** that increases its probability, impact or both on the project.

Environment The project environment is the context within which the project is formulated, assessed and

realised. This includes all external factors that have an impact on the project.

Escalate *See* **escalation**

Escalation The process by which aspects of the project such as issues are drawn to the attention of those senior to the project manager, such as the sponsor, steering group or project board.

Estimate An approximation of project time and cost targets, refined throughout the **project life cycle**.

Estimate at completion (EAC) A value expressed in money and/or hours to represent the projected final costs of work when completed. (Also referred to as projected **outturn cost**.)

Estimated cost to complete (ECC) The value expressed in either money or hours developed to represent the cost of the work required to complete an activity.

Estimating The use of a range of tools and techniques to produce estimates.

Ethical procurement Procurement that is in accordance with established ethics or moral values.

Event* State in the progress of a project after the completion of all preceding activities, but before the start of any succeeding activity. (A defined point that is the beginning or end of an activity).

Exception management An approach to management that focuses on drawing attention to instances where planned and actual results are expected to be, or are already, significantly different. Exceptions can be better than planned or worse than planned.

Exception report* A focused report drawing attention to instances where planned and actual results are expected to be, or are already, significantly different.

Exceptions Occurrences that cause deviation from a plan, such as **issues**, **change requests** and **risks**. Exceptions can also refer to items where the **cost variance** and **schedule variance** exceed predefined thresholds.

Expected monetary value The product of an event's probability of occurrence and the (financial) gain or loss that will result. Hence if there is a 50 per cent probability of rain and the rain will result in a £1000 increase in cost, the EMV will be $0.5 \times$ £1000, i.e. £500.

Expediting The facilitation and acceleration of progress by the removal of obstacles (particularly used in **procurement** management).

Expended hours The hours spent to achieve an activity or group of activities.

Expenditure A charge against available funds, evidenced by a voucher, claim or other document. Expenditures represent the actual payment of funds.

Exploit A response to an **opportunity** that maximises both its probability and impact on the project.

Extended life cycle A **life cycle** model that includes the operational life and termination, including disposal of the project **deliverables**.

External constraint A **constraint** from outside the project.

External environment The environment in which the project must be undertaken that is external to the organisation carrying out the project.

External suppliers Suppliers external to the organisation carrying out the project.

Facility The final result, outcome or **deliverable** of the project.

Factors Situations that affect or influence **outcomes**.

Fast-tracking* The process of reducing the duration of a project usually by overlapping phases or activities that were originally planned to be done sequentially. The process of reducing the number of sequential relationships and replacing them typically with parallel relationships, usually to achieve shorter overall durations but often with increased risk.

Feasibility study* An analysis to determine if a course of action is possible within the terms of reference of the project. Work carried out on a proposed project or alternatives to provide a basis for deciding whether or not to proceed.

Final account The account that finally closes a purchase order or contract.

Financial appraisal An assessment of the financial aspects of a project or programme.

Financing and funding *See* **project financing and funding**.

Finish-to-finish lag The finish-to-finish lag is the minimum amount of time that must pass between the finish of one activity and the finish of its successor(s).

Finish-to-start lag The finish-to-start lag is the minimum amount of time that must pass between the finish of one activity and the start of its successor(s).

Firm fixed price contract A contract where the buyer pays a set amount to the seller regardless of that seller's cost to complete the contract.

Fitness for purpose The degree to which the project management process and project deliverables satisfy stakeholder needs. *See* **quality.**

Fixed date A calendar date (associated with a schedule) that cannot be moved or changed during the project.

Fixed price contracts A generic category of contracts based on the establishment of firm legal commitments to complete the required work. A performing contractor is legally obligated to finish the job, no matter how much it costs to complete.

Float *See* **free float** and **total float**.

Flow diagram A graphic representation of workflow and the logical sequence of the work elements without regard to a timescale. It is used to show the logic associated with a process rather than duration for completion of work.

Force-field analysis A technique used to identify the various pressures promoting or resisting change.

Forecast Estimates or prediction of future conditions and events based on information and knowledge available when the estimate was prepared.

Forecast costs A projection of future costs that the project will incur.

Forecast final cost *See* **estimate at completion**.

Forecast out-turn cost The cost of actual expenditure, accruals and the estimate of the costs to complete the work to the end of the project.

Form of contract The type of contract to be used. This could be a standard form of contract relevant to the business or industry sector.

Forward pass* A procedure whereby the earliest event times or the earliest start and finish times for the activities of a network are calculated.

Free float* Time by which an activity may be delayed or extended without affecting the start of any succeeding activity.

Function A specialist department that provides dedicated services, for example accounts department, production department, marketing department or IT.

Functional analysis The identification and analysis of the functional attributes of different solutions.

Functional analysis and system technique (FAST) An evolution of the value analysis process. FAST permits people with different technical backgrounds to effectively communicate and resolve issues that require multi-disciplined considerations. FAST builds on value analysis by linking the simply expressed, verb-noun functions to describe complex systems.

Functional departments *See* **function.**

Functional manager The person responsible for the business and technical management of a functional group.

Functional organisation (structure) A functional management structure where specific functions of a business are grouped into specialist departments that provide a dedicated service to the whole of the organisation, for example accounts department, production department, marketing department or IT.

Functional specification A document specifying in some detail the functions that are required of a system and the constraints that will apply.

Funding The actual money available for expenditure on the project.

Funding profile An estimate of funding requirements over time.

Gantt chart* A particular type of **bar chart** used in project management showing planned activity against time. A Gantt chart is a time-phased graphic display of activity durations. Activities are listed with other tabular information on the left side with time intervals over the bars. Activity durations are shown in the form of horizontal bars.

Gate review A formal point in a project where its expected worth, progress, cost and execution plan are reviewed and a decision is made whether to continue with the next phase or stage of the project.

Goal A one-sentence definition of specifically what will be accomplished, incorporating an event signifying completion.

Gold plating Completing deliverables to a higher specification than required to achieve acceptance criteria. Exceeding specification or grade and therefore adding cost that does not contribute to value.

Governance of project management (GoPM) GoPM concerns those areas of corporate governance that are specifically related to project activities. Effective governance of project management ensures that an organisation's project **portfolio** is aligned to the organisation's objectives, is delivered efficiently and is sustainable.

Guarantees Legally enforceable assurance of performance of a contract by a supplier or contractor.

Hammock* An activity joining two specified points that span two or more activities. Its duration is initially unspecified and is only determined by the durations of the specified activities. A group of activities, **milestones** or other hammocks aggregated together for analysis or reporting purposes. This term is sometimes used to describe an activity such as management support that has no duration of its own but derives one from the time difference between the two points to which it is connected.

Handover The point in the **life cycle** where **deliverables** are handed over to the **sponsor** and users. *See* **handover and closeout**.

Handover and closeout (phase) Handover and closeout is the fourth and final phase in the **project life cycle**. During this phase final project **deliverables** are handed over to the **sponsor** and users. Closeout is the process of finalising all project matters, carrying out final project reviews, archiving project information and redeploying the **project team**.

Hazards Potential sources of harm.

Health and safety plan The plan that identifies the health and safety strategies and procedures to be used on the project.

Health and safety risk assessment A legislative requirement placed on all employers and the self-employed.

Health, safety and environmental management The process of determining and applying appropriate standards and methods to minimise the likelihood of accidents, injuries or environmental damage both during the project and during the operation of its **deliverables**.

Hierarchical coding structure A coding system that can be represented as a multi-level tree structure in which every code except those at the top of the tree has a parent code.

Hierarchy of networks* Range of networks (**network diagrams**) at different levels of detail, from summary down to working levels, showing the relationships between those networks.

High-level requirements A high-level statement of the need that a project has to satisfy.

Histogram A graphic display of planned and/or actual resource usage over a period of time. It is in the form of a vertical **bar chart**, the height of each bar representing the quantity of resource usage in a given time unit. Bars may be single, multiple or show stacked resources.

Holiday An otherwise valid working day that has been designated as exempt from work.

Human resource management (HRM) The understanding and application of the policy and procedures that directly affect the people working in the **project team** and **working group**.

Hypercritical activities Activities on the **critical path** with **negative float**.

Idea development Develop evaluated opportunities to understand their benefits and costs.

Idea evaluation Rank the identified opportunities according to their appropriateness.

Impact The assessment of the effect on an objective of a risk occurring.

Impact analysis An assessment of the merits of pursuing a particular course of action or of the potential impact of a requested change.

Implementation (phase) Implementation is the third phase of the **project life cycle** where the **project management plan** (PMP) is executed, monitored and controlled. During this phase the design is finalised and used to build the **deliverables**.

Imposed date* A point in time determined by external circumstances.

Imposed finish A finish date imposed on an activity by external circumstances or constraints.

Imposed start A start date imposed on an activity by external circumstances or constraints.

Incentive A contribution to motivation (usually in the form of financial or other reward).

Incurred costs* The sum of actual and committed costs, whether invoiced/paid or not, at a specified time.

Indirect cost* Costs associated with a project that cannot be directly attributed to an activity or group of activities. Resources expended that are not directly identified to any specific contract, project, product or service, such as overheads and general administration.

Influence diagram A pictorial representation of the logic and sequence with which a set of variables have an effect on one another.

Information management The collection, storage, dissemination, archiving and appropriate destruction of project information.

Initiation The process of committing the organisation to begin a project. The beginning of a project at which point certain management activities are required to ensure that the project is established with clear reference terms and adequate management structure.

In progress activity An activity that has been started, but not yet completed.

Integrated baseline review (IBR) A review held following the establishment of the initial **baseline**.

Integration The process of bringing people, activities and other things together to perform effectively.

Intellectual property rights (IPR) The rights associated with intangible property that is the result of creativity.

Interdependencies An aspect of programme and portfolio management. The management of dependencies between projects, and projects and business-as-usual activities.

Interface management The management of the relationships between the work of different departments or organisations on a project or between the project and external organisations.

Interface management plan A plan identifying the interfaces internal and external to the projects and showing how they are to be managed.

Internal environment The environment in which the project must be undertaken that is internal to the organization carrying out the project.

Internal rate of return (IRR)* A discount rate at which the **net present value** of a future cash flow is zero. Note: IRR is a special case of the **discounted cash flow** procedures.

Interrelationship Used to describe the relationship between activities that need to be managed by a team or by a single person.

Investment The outlay of money or time usually for income, profit, or other benefit, such as the capital outlay for a project.

Investment appraisal The appraisal of the value of a project.

Invitation to tender (ITT) An invitation to a supplier to tender or bid for the supply of goods or services.

Island of stability A review point at the end of a programme **tranche** when progress is reviewed and the next tranche is planned.

Issue A threat to the project objectives that cannot be resolved by the **project manager**.

Issue log A log of all **issues** raised during a project or programme, showing details of each issue, its evaluation, what decisions were made and its current status.

Issue management The process by which concerns that threaten the **project objectives** and cannot be resolved by the **project manager** can be identified and addressed to remove the threats that they pose.

Issue register *See* **issue log**.

Joint venture (JV) A joint ownership of a firm by two or more persons or other firms, or a partnership between two or more companies mutually engaged in a particular venture such as a major project.

Just in time (JIT) A philosophy in which goods, services or actions are provided on demand as needed and without waiting, queuing or storage.

Key events Major events, the achievement of which is deemed to be critical to the execution of the project.

Key events schedule *See* **master schedule**.

Key milestone A **milestone**, the achievement of which is considered to be critical to the success of the project.

Key performance indicators (KPI) Measures of success that can be used throughout the project to ensure that it is progressing towards a successful conclusion.

Ladder* A device for representing a set of overlapping activities in a **network diagram**. The start and finish of each succeeding activity are linked to the start and finish of the preceding activity only by lead and lag activities, which consume only time.

Lag* In a **network diagram**, the minimum necessary lapse of time between the finish of one activity and the finish of an overlapping activity. The delay incurred between two specified activities.

Latest finish date The latest possible date by which an activity has to finish within the logical activity and imposed constraints of the network, without affecting the total project duration.

Latest start date The latest possible date by which an activity has to start within the logical and imposed constraints of the network, without affecting the total project duration.

Law of the land A slang term for existing laws.

Lead* In a **network diagram**, the minimum necessary lapse of time between the start of one activity and the start of an overlapping activity.

Leadership The ability to establish vision and direction, to influence and align others towards a common purpose, and to empower and inspire people to achieve project success. It enables the project to proceed in an environment of change and uncertainty.

Lean Lean (construction, engineering, manufacturing) is concerned with identifying the underlying principles by which environments can become more responsive, flexible, productive, reliable and cost effective.

Learning and development The continual improvement of competencies in the organisation. The identification and application of learning within projects develops the organisation's capability to undertake current and future projects.

Legal awareness An understanding of the relevant legal duties, rights and

processes that should be applied to projects.

Legal duties The statutory laws that need to be followed and adhered to by all those involved in the project.

Lessons learned The identification of activities associated with the project that went well, those that could have been better, to recommend improvements applied in the future and to future projects.

Letter of intent A letter indicating an intent to sign a contract, usually so that work can commence prior to signing that contract.

Levelling *See* **resource levelling**.

Level one plan The master plan for the project. Level two and level three plans are given in successively more detail.

Liabilities Amounts owed under obligations for goods and services received and other assets aquired; includes accruals of amounts earned but not yet due and progress payments due on contract.

Life Cycle *See* **project life cycles.**

Life cycle cost The cumulative cost of a project over its whole **life cycle**.

Linked bar chart A **bar chart** that explicitly shows the dependency links between activities.

Liquidated damages The liability in a contract to pay a specified sum for a breach of contract such as late delivery of goods or services.

Litigation Any lawsuit or other reason to resort to court to determine a legal question or matter.

Logic *See* **network logic**.

Logical dependency A logical dependency is based on the dependency between two project activities or between a project activity and a **milestone**.

Logic diagram *See* **network diagram.**

Make or buy decision The decision to make a deliverable internally or to buy a finished deliverable from a supplier, for example, develop a software application in-house or purchase an existing application.

Management by exception A term used to describe management of problem or critical areas only.

Management development All aspects of staff planning, recruitment, development, training and assessment.

Management reserve* A central **contingency** pool. The sum of money held as an overall contingency to cover the cost impact of some unexpected event occurring.

Marketing Marketing involves anticipating the demands of users, and identifying and satisfying their needs by providing the right project at the right time, cost and quality.

Master network* A network showing the complete project, from which more detailed networks are derived.

Master schedule A high-level summary **project schedule** that identifies major activities and **milestones**.

Material Property that may be incorporated into or attached to an end item to be delivered under a contract or may be consumed or expended in the performance of a contract.

Material take-off A list of materials required to build an item that is derived from a drawing.

Matrix organisation (structure) An organisational structure where the **project manager** and the **functional managers** share responsibility for assigning priorities and for directing the work. Individuals stay in their functional departments while performing work on one or more projects.

Maturity The sophistication and experience of an organisation in managing projects.

Mechanical completion The point at which a facility has been fully installed and individual components have been inspected and tested using safe techniques and inert materials. Ready to start **pre-commissioning** or **commissioning**.

Mediation An attempt to settle a legal dispute through active participation of a third party (mediator) who works to find points of agreement and make those in conflict agree on a fair result.

Method A method provides a consistent framework within which project management is performed.

Methods and procedures The standard practices to be used for managing projects throughout a **life cycle**.

Method statement A plan detailing how a piece of work is to be carried out.

Milestone* A key event. An event selected for its importance in the project.

Milestone plan A plan containing milestones that highlight key points of the project.

Milestone schedule A schedule that identifies the major **milestones**. *See* **master schedule**.

Mission statement A brief summary, of approximately one or two sentences, that sums up the background, purpose and benefits of the project.

Mobilisation The bringing together of project personnel and securing of equipment and facilities.

Model A way of looking at reality, usually for the purpose of abstracting and simplifying it, to make it understandable in a particular context. Models may be either **physical** or **virtual**.

Modelling The process of creating and using a device that duplicates the physical or operational aspects of a deliverable.

Monitoring The recording, analysing and reporting of project **performance** as compared to the plan in order to identify and report deviations.

Monte Carlo simulation A technique used to estimate the likely range of outcomes from a complex process by simulating the process under randomly selected conditions a large number of times.

Near-critical activity An activity with low **total float** that may become critical under adverse conditions.

Need, problem or opportunity The underlying reason for undertaking a project. Without a definable need, problem or opportunity a project should not go ahead.

Negative (total) float* The time by which the duration of an activity or path has to be reduced in order to permit a limiting imposed date to be achieved.

Negotiated contract cost The estimated cost negotiated in a **cost plus fixed fee contract** or the negotiated contract target cost in either a fixed price incentive

contract or a **cost plus incentive fee contract**. *See* **contract target cost**.

Negotiation A search for agreement, seeking acceptance, consensus and alignment of views. Negotiation in a project can take place on an informal basis throughout the **project life cycle**, or on a formal basis such as during **procurement**, and between signatories to a contract.

Net present value* (NPV) The aggregate of future net cash flows discounted back to a common base date, usually the present.

Network analysis* A method used for calculating a project's critical path and activity times and **floats**. *See* **critical path analysis, project network techniques**.

Network diagram A pictorial presentation of project data in which the project logic is the main determinant of the placements of the activities in the drawing. Frequently called a flowchart, PERT chart, logic drawing, activity network or logic diagram.

Network logic The collection of activity dependencies that show logical relationships between the various activities and make up a project network.

Network path *See* **path**.

Nodes* The points in a network at which arrows start and finish.

Non-recurring costs Expenditures against specific activities that are expected to occur only once on a given project.

Non-splittable activity* An activity that, once started, has to be completed to plan without interruption.

Not earlier than A restriction on an activity that indicates that it may not start or end earlier than a specified date.

Not later than A restriction on an activity that indicates that it may not start or end later than a specified date.

Objectives Predetermined results towards which effort is directed.

Operational life As part of an extended life cycle, the operational life is part of the operations phase. It is when the deliverables are operated and maintained.

Operations phase The period during which the completed **deliverable** is used and maintained in service for its intended purpose.

Opportunity A positive risk; a risk that if it occurs will have a beneficial effect on the project. A positive aspect of project uncertainty, it may also help to negate threats.

Order of magnitude estimate An estimate carried out to give a very approximate indication of likely **outturn costs**.

Organisation A single corporate entity that is undertaking a project or providing services to a project.

Organisational breakdown structure (OBS)* A hierarchical way in which the organisation may be divided into management levels and groups, for planning and control purposes.

Organisational roles The roles performed by individuals or groups in a project. Both roles and responsibilities within projects must be defined to address the transient and unique nature of projects, and to ensure that clear accountabilities can be assigned.

Organisation chart A graphic display of reporting relationships that provides a general framework of the organisation.

Organisation design The design of the most appropriate organisation for a project.

Organisation structure The organisational environment within which the project takes place. It defines the reporting and decision-making hierarchy of an organisation and how project management operates within it.

Original budget The initial budget established at or near the time a contract was signed or a project authorised, based on the negotiated contract cost or management's authorisation.

Original duration The duration of activities or groups of activities as recorded in the **baseline schedule**.

Other direct costs (ODC) A group of accounting elements that can be isolated to specific activities, other than labour and material. Included in ODC are such items as travel, computer time and services.

Outcome The result of a project, the result of a deliberation concerning part of a project or an individual issue.

Out-of-sequence progress Progress that has been reported even though activities that have been deemed predecessors in project logic have not been completed.

Outputs Deliverables that are the result of a process. ***See* deliverables.**

Outsourcing* The contracting-out, or buying in of facilities or work (as opposed to using in-house resources).

Outturn cost The expected final cost of a project.

Overhead Costs incurred in the operation of a business that cannot be directly related to the individual products or services being produced. *See* **indirect cost**.

Overrun Costs incurred in excess of the contract target costs on an incentive type contract or of the estimated costs on a fixed fee contract. An overrun is that value of costs needed to complete a project, over that value originally authorised by management.

Owner The person or organisation for which the project is ultimately undertaken and who will own, operate and benefit from the facility in the long term.

Parallel activities Two or more activities than can be done at the same time.

Parametric estimating An estimating technique that uses a statistical relationship between historic data and other variables (for example square metreage in construction, lines of code in software development) to calculate an estimate.

Pareto diagram A **histogram** ordered by frequency of occurrence that shows how many results were generated by each identified cause.

Partnering An arrangement between two or more organisations to manage a contract between them cooperatively, as distinct from a legally established partnership. *See* **alliancing**.

Path* An activity or unbroken sequence of activities in a **network diagram**.

Payback An investment appraisal technique.

Percent complete A measure of the completion status of a partially completed activity. It may be aggregated to sections of a project or the whole project.

Performance The term used to describe the quality of the delivery and the deliverables (outputs) of the project.

Performance appraisal A review of the performance of individual people and teams on the project.

Performance management Techniques used in the management of individual and team performance. Performance management is also a term used in **earned value management** which is itself a performance management technique when applied to project performance.

Performance measurement techniques Performance measurement techniques are the methods used to estimate **earned value**. Different methods are appropriate to different **work packages**, either due to the nature of the work or due to the planned duration of the work package.

Performance specification* A statement of the totality of needs expressed by the benefits, features, characteristics, process conditions, boundaries and constraints that together define the expected performance of a **deliverable**.

Phase (of a project)* Part of a project during which a set of related and interlinked activities are performed to attain a designated objective. One of a series of distinct steps in carrying out a project that together constitute the **project life cycle**.

Phase reviews A review that takes place at the end of a life cycle phase. *See* **gate review.**

Physical models A representation of the three-dimensional, solid aspects of a deliverable which can be used to display its features or potentially test aspects it.

Physical percent complete The percentage of the work content of an activity that has been achieved.

Physical performance Actual performance of work on a project that can be measured; for example, the number of drawings produced or lines of code written.

Pilot A form of testing a new development and its implementation prior to committing to its full release.

Plan A plan is an intended future course of action. *See* **project management plan**.

Planned activity An activity not yet started.

Planned cost* The estimated cost of achieving a specified objective. *See* **budgeted cost of work scheduled**.

Planning The process of identifying the means, resources and actions necessary to accomplish an objective.

Portfolio A grouping of an organisation's projects, programmes and related business-as-usual activities taking into account **resource constraints**. Portfolios can be managed at an organisational, programme or functional level.

Portfolio management The selection and management of all of an organisation's projects, programmes and related operational activities taking into account **resource constraints**.

Portfolio prioritisation process The evaluation and prioritisation of projects within a portfolio to enable the more important projects and programmes to access the required resources and to move forward in accordance with their plans.

Post-project review Undertaken after the project **deliverables** have been

handed over and before final **closeout**, this review is intended to produce lessons learnt that will enable continuous improvement.

PRAM Pram is an abbreviation of the APM Risk Management SIG's publication *Project Risk Analysis and Management Guide*.

Precedence diagram method One of the two methods of representing project as networks, in which the activities are represented by nodes and the relationships between them by arrows.

Precedence network* A multiple dependency network. An **activity-on-node** network in which a sequence arrow represents one of four forms of precedence relationship, depending on the positioning of the head and the tail of the sequence arrow. The relationships are:

finish to start
- start of activity depends on finish of preceding activity, either immediately or after a lapse of time;

finish to finish
- finish of activity depends on finish of preceding activity, either immediately or after a lapse of time;

start to start
- start of activity depends on start of preceding activity, either immediately or after a lapse of time;

start to finish
- finish of activity depends on start of preceding activity, either immediately or after a lapse of time.

Pre-commissioning The work that is carried out prior to **commissioning** in order to demonstrate that commissioning may be safely undertaken.

Predecessor An activity that must be completed (or be partially completed) before a specified activity can begin.

Predecessor activity In the **precedence diagram** method this is an activity that logically precedes the current activity.

Prime or lead contractor A main supplier who has a contract for much or all of the work on a contract. The prime contractor is responsible for managing projects that involve a number of subsystem contracts. It is responsible for coordinating the activities of subcontractors, integrating their **deliverables** and managing risks to meet the client's requirements.

PRINCE2 A project management method created for government projects. It is an acronym standing for **PR**ojects **IN** **C**ontrolled **E**nvironments (second version). It is intended to be generic.

Private finance initiative (PFI) In PFI, the public and private sectors enter into a contract which shares between them the risk of undertaking an investment project, typically to provide a major capital asset for the public services such as a school or a hospital and related services such as repairs and maintenance.

Probabilistic network A network containing alternative paths with which probabilities are associated.

Probability The likelihood of a risk occurring.

Problem In project management terms these are problems which are concerns that the project manager has to deal with on a day-to-day basis.

Procedures Procedures cover individual aspects of project management practice and form an integral part of a method.

Procedures manual A book of reference describing standard project procedures.

Process* A set of interrelated resources and activities that transform inputs into outputs.

Procurement The process by which the resources (goods and services) required by a project are acquired. It includes development of the procurement strategy, preparation of contracts, selection and acquisition of suppliers, and management of the contracts.

Procurement strategy A procurement strategy sets out how to acquire and manage resources (goods and services) required by a project.

Product *See* **deliverable**. (Note that in the PRINCE2 method product is used synonymously with deliverable).

Product breakdown structure (PBS) A hierarchy of deliverables that are required to be produced on the project. This forms the base document from which the execution strategy and product-based **work breakdown structure** may be derived. It provides a guide for **configuration control** documentation.

Product description The description of the purpose, form and components of a product. It should always be used as a basis for acceptance of the product by the customer.

Product flow diagram This diagram represents how the products are produced by identifying their derivation and the dependencies between them. It is similar to a **network diagram** but uses products rather than activities.

Productivity factor The ratio of earned hours against expended hours.

Professional development *See* **continuing professional development**.

Professionalism and ethics This relates to proper conduct. Professionalism is demonstrable awareness and application of qualities and competencies covering knowledge, appropriate skills and behaviours. Ethics covers the conduct and moral principles recognised as appropriate within the project management profession.

Profile of expenditure A project's budget is phased over time to give a profile of expenditure. This will allow a cash flow forecast for the project to be developed and a **drawdown** of funds to be agreed with the organisation.

Program evaluation and review technique (PERT) PERT is a project management technique for determining how much time a project needs before it is completed.

Programme A group of related projects, which may include related business-as-usual activities, that together achieve a beneficial change of a strategic nature for an organisation.

Programme benefits review A review to assess if targets have been reached and to measure the performance levels in the resulting business operations.

Programme brief A description of the capability that the organisation seeks from changes to its business and/or its operations. Delivery of this capability is the end goal of the **programme**.

Programme director The senior manager with the responsibility for the overall success of the **programme**.

Programme directorate A committee that directs the **programme** when circumstances arise where there is no individual to direct the programme.

Programme management The coordinated management of related projects, which may include related business-as-usual activities, that together achieve a beneficial change of a strategic nature for an organisation.

Programme management office The office responsible for the business and technical management of a specific **programme**.

Programme manager The individual with responsibility for managing a **programme**.

Programme mandate What the **programme** is intended to deliver in terms of new services and/or operational capability.

Programme support office A group that gives administrative support to the **programme** manager and the programme executive.

Progress The partial completion of a project, or a measure of the same.

Progress payments Payments made to a contractor during the life of a fixed-price type contract, on the basis of some agreed-to formula, for example **budget cost of work performed** or simply costs incurred.

Progress report A regular report to senior personnel, sponsors or stakeholders summarising the progress of a project including key events, **milestones**, costs and other issues.

Project A unique, transient endeavour undertaken to achieve a desired outcome.

Project appraisal The discipline of calculating the viability of a project. May be conducted at any time throughout the project.

Project assurance Independent monitoring and reporting of the project's performance and **deliverables**.

Project base date* *See* **base date**.

Project board *See* **steering group**.

Project brief* *See* **brief**.

Project budget *See* **budget**.

Project calendar *See* **calendars**.

Project champion* *See* **champion**.

Project charter *See* **charter**.

Project closure* *See* **closure**.

Project context The environment within which a project is undertaken. Projects do not exist in a vacuum and an appreciation of the context within which the project is being performed will assist those involved in project management to deliver a project.

Project coordination* *See* **coordination**.

Project culture *See* **culture**.

Project director The manager of a very large project that demands senior level responsibility or the person at the board level in an organisation who has the overall responsibility for project management.

Project environment *See* **environment**.

Project evaluation review A documented review of the project's performance, produced at predefined points in the **project life cycle**.

Project excellence model The basis of this model is the European Foundation for Quality Management **(EFQM) Excellence Model**. In 1997 the German Project Management Association developed the Project Excellence Model and used it as an evaluation tool to judge the annual German Project Management Awards.

Project file A file containing the overall plans of a project and any other important documents.

Project financing and funding The means by which the capital to undertake a project is initially secured and then made available at the appropriate time. Projects may be financed externally, funded internally or a combination of both.

Project initiation *See* **initiation**.

Project initiation document (PID) A document approved by the project board at project **initiation** that defines the terms of reference for the project. This document is similar and in some cases the same as the **project management plan** (PMP).

Project life cycles All projects follow a life cycle and life cycles will differ across industries and business sectors. A life cycle allows the project to be considered as a sequence of distinct phases that provide the structure and approach for progressively delivering the required outputs.

Project life cycle cost* *See* **life cycle cost**.

Project log* A project diary. A chronological record of significant occurrences throughout the project.

Project management The process by which projects are defined, planned, monitored, controlled and delivered so that agreed benefits are realised.

Project Management Body of Knowledge *See* **Body of Knowledge**.

Project management information system (PMIS) The systems, activities and data that allow information flow in a project, frequently computerised, but not always.

Project management maturity A model that describes a number of evolutionary levels in which an organisation's project management processes can be assessed, from *ad hoc* use of processes to continual improvement of its processes.

Project management plan (PMP) A plan that brings together all the plans for a project. The purpose of the PMP is to document the outcome of the planning process and to provide the reference document for managing the project. The project management plan is owned by the **project manager**.

Project management processes The generic processes that need to apply to each phase of the project life cycle. These may be described as a starting or initiating process, a defining and planning process, a monitoring and controlling process, and a learning or closing process.

Project management software Computer application software designed to help with planning and controlling projects.

Project management team Members of the **project team** who are directly involved in its management.

Project manager* The individual responsible and accountable for the successful delivery of the project.

Project mandate The initial terms of reference for the project – as defined in PRINCE2.

Project master schedule *See* **master schedule**.

Project network* A representation of activities and/or events with their interrelationships and dependencies.

Project objectives Those things that are to be achieved by the project, which usually include technical, time, cost and quality objectives but may include other items to meet **stakeholder** needs.

Project office This serves the organisation's project management needs. A

project office can range from simple support functions for the **project manager** to responsibility for linking corporate strategy to project execution.

Project organisation (structure) The project organisation structure provides the maximum authority to the project manager. It provides integration of functional capabilities within projects. However, this leads to duplication of facilities, and less efficient use of resources.

Project plan *See* **project management plan**.

Project planning The development and maintenance of a project plan.

Project portfolio *See* **portfolio**.

Project procedures manual *See* **procedures manual**.

Project progress report* *See* **progress report**.

Project quality management The discipline that is applied to ensure that both the outputs of the project and the processes by which the outputs are delivered meet the required needs of **stakeholders**. Quality is broadly defined as fitness for purpose or more narrowly as the degree of **conformance** of the outputs and process.

Project review calendar* A calendar of **project evaluation review** dates, meetings and issues of reports set against project week numbers or dates.

Project risk The exposure of **stakeholders** to the consequences of **variation** in outcome.

Project risk management A structured process that allows individual **risk events** and overall **project risk** to be understood and managed proactively, optimising project success by minimising threats and maximising opportunities.

Project roles and responsibilities The roles and responsibilities of those involved in the product; for example, the sponsor and project manager.

Project schedule* The timetable for a project. It shows how project activities and **milestones** are planned over a period of time. It is often shown as a milestone chart, Gantt or other **bar chart**, or as a tabular listing of dates.

Project scope management *See* **scope management**.

Project sponsor *See* **sponsor**.

Project sponsorship An active senior management role, responsible for identifying the business need, problem or opportunity. The sponsor ensures the project remains a viable proposition and that benefits are realised, resolving any issues outside the control of the **project manager**.

Project start-up The creation of the **project team** and making it effective.

Project status report A report on the status of accomplishments and any **variances** to spending and schedule plans.

Project steering group *See* **steering** group.

Project strategy A comprehensive definition of how a project will be developed and managed.

Project success The satisfaction of **stakeholder** needs measured by the **success criteria** as identified and agreed at the start of the project.

Project success criteria *See* **success criteria**.

Project support experts Individuals with expertise in particular aspects of project

support such as scheduling, budgeting and cost management or reporting.

Project support office *See* **project office**.

Project team A set of individuals, groups and/or organisations responsible to the **project manager** for working towards a common purpose.

Project variance Changes to cost or schedule that are within the current work plan or **scope**.

Public private partnership (PPP) Public private partnerships (PPPs) are a generic term for the relationships formed between the private sector and public bodies often with the aim of introducing private sector resources and/or expertise in order to help provide and deliver public sector assets and services. The term PPP is used to describe a wide variety of working arrangements from loose, informal and strategic partnerships to design build finance and operate (DBFO) type service contracts and formal joint venture companies. The private finance initiative (PFI) is a form of PPP.

Public relations (PR) An activity meant to improve the project organisation's environment in order to improve project performance and reception.

Punch list A list of outstanding activities to be completed prior to final acceptance of the **deliverables**.

Qualitative risk analysis A generic term for subjective methods of assessing risks that cannot be identified accurately.

Quality The fitness for purpose or the degree of **conformance** of the outputs of the process.

Quality assurance (QA) The process of evaluating overall project performance on a regular basis to provide confidence that the project will satisfy the relevant quality standards.

Quality assurance plan A plan that guarantees a quality approach and conformance to all customer requirements for all activities in a project.

Quality audit An official examination to determine whether practices conform to specified standards or a critical analysis of whether a **deliverable** meets **quality criteria**.

Quality control (QC) The process of monitoring specific project results to determine if they comply with relevant standards and identifying ways to eliminate causes of unsatisfactory performance.

Quality criteria The characteristics of a product that determine whether it meets certain requirements.

Quality guide The quality guide describes quality and **configuration management** procedures and is aimed at people directly involved with **quality reviews**, configuration management and technical exceptions.

Quality management system The complete set of quality standards, procedures and responsibilities for a site or organisation.

Quality plan (for a project)* That part of the project plan that concerns **quality management** and **quality assurance** strategies (see also ISO 10006).

Quality planning The process of determining which quality standards are necessary and how to apply them.

Quality review A review of a product against an established set of **quality criteria**.

Quantitative risk analysis The estimation of numerical values of the

probability and impact of risks on a project usually using actual or estimated values, known relationships between values, modelling, arithmetical and/or statistical techniques.

Rapid application development (RAD) A method of minimising the time necessary to complete development projects.

Reactive risk response An action or set of actions to be taken after a **risk event** has occurred.

Recurring costs Expenditures against specific activities that would occur on a repetitive basis. Examples are hire of computer equipment and tool maintenance.

Reduce A response to a **threat** that reduces its probability, impact or both on the project.

Regulatory A restriction due to the need to conform to a regulation or rule designed to control or govern conduct.

Reimbursement Method by which a contractor will be paid for the work they have undertaken.

Relationship A logical connection between two activities.

Remaining duration The time needed to complete the remainder of an activity or project.

Replanning Actions performed for any remaining effort within project **scope**.

Replenishable resource A resource that when absent or used up fresh supplies of which can be obtained. Raw materials and money are common examples. *See* **consumable resource**.

Reporting Reporting takes information and presents it in an appropriate format which includes the formal communication of project information to **stakeholders**.

Reports The presentation of information in an appropriate format. Alternatively a written record or summary, a detailed account or statement or a verbal account.

Request for change (RFC) A proposal for a change to the project.

Request for proposal (RFP) A bid document used to request proposals from prospective sellers of products or services.

Request for quotation (RFQ) Equivalent to a request for proposal but with more specific application areas.

Requirements A statement of the need that a project has to satisfy. It should be comprehensive, clear, well structured, traceable and testable.

Requirements definition* Statement of the needs that a project has to satisfy.

Requirements management The process of capturing, analysing and testing the documented statements of **stakeholder** and user wants and needs.

Reserve Similar to a contingency, a reserve is the planned allotment of time and cost or other resources for unforeseeable elements with a project.

Residual value The written-down value of a capital item at the end of the period, used in the **business case** to assess the financial integrity of the **programme** or project.

Resource aggregation* A summation of the requirements for each resource, and for each time period.

Resource allocation* The process by which resources are mapped against activities which are often shown as

aggregated **resource histograms** against a timescale.

Resource availability The level of availability of a resource, which may vary over time.

Resource calendar A calendar that defines the working and non-working patterns for specific resources.

Resource constraint* A limitation due to the availability of a resource.

Resource-driven activity durations Activity durations that are driven by the need for scarce resources.

Resource histogram A view of project data in which resource requirements, usage and availability are shown using vertical bars against a horizontal timescale.

Resource level A specified level of resource units required by an activity per time unit.

Resource levelling Resource levelling can be applied to projects when there are **resource constraints**. Resource levelling forces the amount of work scheduled not to exceed the limits of resources available. This results in either activity durations being extended or entire activities being delayed to periods when resources are available. This often results in a longer project duration. It is also known as resource limited scheduling.

Resource limited scheduling *See* **resource levelling**.

Resource loading The amount of resources of each kind devoted to a specific activity in a particular time period.

Resource management A process that identifies and assigns resources to activities so that the project is undertaken using appropriate levels of resources and within an acceptable duration.

Resource optimisation A term for **resource levelling** and **resource smoothing**.

Resource plan A part of the **project management plan** that states how the project will be resource loaded and what supporting services, infrastructure and third party services are required.

Resource planning A process that evaluates what resources are needed to complete a project and determines the quantity needed.

Resource pool The available resources to a project. Alternatively, a group of people who can generally do the same work, so they can be chosen randomly for assignment to a project.

Resource requirement The requirement for a particular resource by a particular activity.

Resources Resources are all those items required to undertake a project and include people, finance and materials.

Resource scheduling A process that ensures that resources are available when needed and where possible are not underutilised.

Resource smoothing* A process applied to projects to ensure that resources are used as efficiently as possible. It involves utilising **float** within the project or increasing or decreasing the resources required for specific activities, such that any peaks and troughs of resource usage are smoothed out. This does not affect the project duration. It is also known as time limited scheduling.

Responsibility assignment matrix (RAM) A diagram or chart showing assigned responsibilities for elements of

work. It is created by combining the **work breakdown structure** with the **organisational breakdown structure**.

Responsibility matrix *See* **responsibility assignment matrix**.

Responsible organisation A defined unit within the organisation structure that is assigned responsibility for accomplishing specific activities, or cost accounts.

Retention A part of payment withheld until the project is completed in order to ensure satisfactory performance or completion of contract terms.

Re-usable resource A resource that when no longer needed becomes available for other uses. Accommodation, machines, test equipment and people are re-usable.

Revenue cost* Expenditure charged to the profit and loss account as incurred or accrued due.

Reviews Project reviews take place throughout the project life cycle to check the likely or actual achievement of the objectives specified in the project management plan.

Re-work Repeating work already completed in producing a deliverable in order to remove defects and meet acceptance criteria.

Right first time Completing a deliverable which, on first testing, meets the agreed acceptance criteria with no defects and no re-work required.

Risk* *See* **project risk** and **risk event**.

Risk analysis* An assessment and synthesis of the risks affecting a project to gain an understanding of their individual significance and their combined impact on the project's objectives.

Risk assessment The process of quantifying the likelihood of risks occurring and assessing their likely impact on the project.

Risk avoidance *See* **avoid** (a threat).

Risk breakdown structure (RBS) A hierarchical breakdown of the risks on a project.

Risk evaluation* A process used to determine risk management priorities.

Risk event An uncertain event or set of circumstances that should it or they occur would have an effect on the achievement of one or more of the **project objectives**.

Risk exposure The degree to which a risk taker could be affected by an adverse outcome.

Risk identification* The process of identifying project risks.

Risk log A document that provides identification, estimation, impact evaluation and countermeasures for all risks to the project. It is normally maintained throughout the life of the project.

Risk management *See* **project risk management**.

Risk management maturity A measure of the extent to which a project or organisation formally applies effective risk management to support decision-making and the treatment of risk.

Risk management plan A document defining how risk management is to be implemented in the context of the particular project concerned.

Risk manager The person who is put in charge of matters connected with risk, or certain aspects of risk, on a project.

Risk monitoring The process of observing the state of identified risks (also referred to as risk tracking).

Risk owner The person who has responsibility for dealing with a particular risk on a project and for identifying and managing responses.

Risk prioritising Ordering of risks according first to their risk value, and then by which risks need to be considered for **risk reduction**, risk avoidance and **risk transfer**.

Risk ranking The allocation of a classification to the probability and impact of a risk.

Risk reduction Action taken to reduce the likelihood and impact of a risk.

Risk register* A body of information listing all the risks identified for the project, explaining the nature of each risk and recording information relevant to its assessment, possible impact and management.

Risk response An action or set of actions to reduce the probability or impact of a threat or to increase the probability or impact of an opportunity.

Risk response planning The planning of responses to risks.

Risk transfer A contractual arrangement between two parties for delivery and acceptance of a product where the liability for the costs of a risk is transferred from one party to the other.

Rolling wave planning The process whereby only the current phase of a project is planned in detail, future phases being planned in outline only. Each phase produces the detailed plan for the next phase.

Roll out The process of delivering a number of nearly identical products to a number of users, usually after the product has been tested and shown to meet requirements.

Safety plan The standards and methods that minimise to an acceptable level the likelihood of accident or damage to people or equipment.

Sales A marketing technique used to promote a project.

Sanction Authorisation for the project or part of a project to proceed.

Schedule A schedule is the timetable for a project. It shows how project activities and **milestones** are planned over a period of time. It is often shown as a milestone chart, Gantt or other **bar chart**, or as a tabular listing of dates.

Schedule dates Start and finish dates calculated with regard to resource or external constraints as well as project **logic**.

Scheduled finish The earliest date on which an activity can finish, having regard to resource or external constraints as well as project **logic**.

Scheduled start The earliest date on which an activity can start, having regard to resource or external constraints as well as project **logic**.

Schedule performance index (SPI) A term used in **earned value management**. It is the ratio of work accomplished versus work planned, for a specified time period. The SPI is an efficiency rating for work accomplishment, comparing work achieved to what should have been achieved at any point in time.

Schedule variance (cost) A term used in **earned value management**. The difference between the budgeted cost of work performed (or **earned value**) and

the budgeted cost of work scheduled at any point in time.

Scheduling Scheduling is the process used to determine the overall project duration. This includes identification of activities and their logical dependencies, and estimating activity durations, taking into account requirements and availability of resources.

Scope The scope is the sum of work content of a project.

Scope change Any change in a project **scope** that requires a change in the project's cost or schedule.

Scope creep The term sometimes given to the continual extension of the **scope** of some projects.

Scope management The process by which the **deliverables** and the work to produce these are identified and defined. Identification and definition of the **scope** must describe what the project will include and what it will not include, i.e. what is in and out of scope.

Scope of work A description of the work to be accomplished or resources to be supplied.

Scope verification A process that ensures that all identified project **deliverables** have been completed satisfactorily.

Scope statement A documented description of the project that identifies the project boundaries, its output, approach and content. It is used to provide a documented basis to help make future project decisions and to confirm or develop a common understanding of the project's **scope** by **stakeholders**.

S-curve A graphic display of cumulative costs, labour hours or other quantities, plotted against time. This curve tends to be flat at the beginning and end and steep in the middle, reflecting the lower expenditure of resources at the beginnings and ends of projects. It is usual to plot planned, actual and predicted values on the same chart.

Secondary risk The risk that may occur as a result of invoking a **risk response** or fallback plan.

Sensitivity analysis An investigation of the effect on the outcome of changing parameters or data in procedures or models.

Sequence Sequence is the order in which activities will occur with respect to one another.

Share A response to an **opportunity** that increases its probability, impact or both on the project by sharing the risk with a third party.

Simulation A process whereby some dynamic aspect of a system is replicated without using the real system, often using computerised techniques.

Six sigma Six sigma is a quality management programme to achieve 'six sigma' levels of quality. It was pioneered by Motorola in the mid-1980s.

Slack Slack is an alternative term for **float**. *See* **free float** and **total float**.

Slip chart A pictorial representation of the predicted completion dates of **milestones** (also referred to as a trend chart).

Slippage The amount of **float** time used up by the current activity due to a delayed start or increased duration.

Snagging The process of identifying minor small deficiencies that have to be rectified before acceptance of the work on a project or contract.

Social capital The pattern and intensity of networks among people and the shared values which arise from those networks.

Sole source The only source known to be able to supply particular equipment or services, or undertake a particular contract. It may be a source specified by the client for reasons not necessarily connected to the project.

Solicitation The process by which bids or tenders are obtained for the provision of goods or services to the project.

Source selection Choosing from potential contractors.

Spiral model A management model used particularly for development projects.

Splittable activity* An activity that can be interrupted in order to allow its resources to be transferred temporarily to another activity.

Sponsor The individual or body for whom the project is undertaken and who is the primary risk taker. The sponsor owns the **business case** and is ultimately responsible for the project and for delivering the benefits.

Stage A subdivision of the **life cycle** phase into a natural subsection with well-defined **deliverables**.

Stage payment* A payment made part way through a project at some predetermined **milestone**.

Stakeholder The organisations or people who have an interest or role in the project or are impacted by the project.

Stakeholder analysis The identification of stakeholder groups, their interest levels and ability to influence the project or **programme**.

Stakeholder grid A matrix used as part of a stakeholder analysis to identify the relative importance of stakeholders to a project; for example, by considering their relative power.

Stakeholder identification The process of identifying stakeholders in a project.

Stakeholder management The systematic identification, analysis and planning of actions to communicate with, negotiate with and influence **stakeholders**.

Starting activity A starting activity has no predecessors. It does not have to wait for any other activity to start.

Start-to-start lag Start-to-start lag is the minimum amount of time that must pass between the start of one activity and the start of its successor(s).

Start-up The formal process of making a new **project team** effective *or* the commissioning of a completed facility.

Start-up meeting The initial meeting with the **project team** at the start of a project or phase of a project.

Statement of scope *See* **scope statement.**

Statement of work* (SOW) A document stating the requirements for a given project activity.

Status report A description of where the project currently stands, usually in the form of a written report, issued to both the **project team** and other responsible people on a regular basis, stating the status of an activity, **work package** or whole project. It may be a formal report on the input, issues and actions resulting from a status meeting.

Statute law Statute is the written law consisting of Acts of Parliament (including those enacted under European directives), and the rules, regulations and orders made under the powers conferred by those Acts.

Statutory approval An approval that is required by law.

Statutory obligations Relevant legal obligations.

Steering group A group, usually comprising the **sponsor**, senior managers and sometimes key **stakeholders**, whose remit is to set the strategic direction of a project. It gives guidance to the sponsor and **project manager**. Often referred to as the project board.

Strategy The high-level plan that will enable the project to reach a successful conclusion. It describes how the project is to be executed. This is the long-term plan.

Subcontract A contractual document that legally transfers the responsibility and effort of providing goods, services, data or other hardware from one firm to another.

Subcontractor An organisation that supplies goods or services to a supplier.

Subject matter experts Users with subject matter knowledge and expertise who may contribute to defining requirements and acceptance criteria.

Subproject A group of activities represented as a single activity in a higher level of the same project.

Success criteria The qualitative or quantitative measures by which the success of the project is judged.

Success factors Factors that when present in the project **environment** are most conducive to the achievement of a successful project. The success factors that if absent would cause the project to fail are sometimes termed critical success factors (CSFs).

Successor A successor is an activity whose start or finish depends on the start or finish of a predecessor activity.

Sunk costs Costs that are unavoidable, even if the project were to be terminated.

Super-critical activity An activity that is behind schedule is considered to be super-critical if it has been delayed to a point where its **float** is calculated to be a negative value.

Supplier A supplier is a contractor, consultant or any organisation that supplies resources to the project.

Supply chain management The management of the chain of organisations through which goods pass on their way from raw materials to the ultimate purchaser.

Surety An individual or organisation that has agreed to be legally liable for the debt, default or failure of a principal to satisfy a contractual obligation.

System The complete technical output of the project including technical products.

Systems analysis The analysis of a complex process or operation in order to improve its efficiency.

Systems engineering A systematic approach to realising a project that takes account of all related systems and subsystems.

Systems management Management that includes the prime activities of systems analysis, systems design and engineering, and systems development.

Talent management The development of project talented people in the organisation each of whom is capable of filling a number of roles.

Target completion date The date planned to complete an activity or project.

Target start date The date planned to start work on an activity or the project.

Task The smallest indivisible part of an activity when it is broken down to a level best understood and performed by a specific person or organisation.

Team A team is made up of two or more people working interdependently towards a common goal and a shared reward.

Team building The ability to gather the right people to join a **project team** and get them working together for the benefit of a project.

Team development The process of developing skills, as a group and individually, that enhance project performance.

Team leader The person responsible for leading a team.

Team member A person who is accountable to and has work assigned to them by the project manager to be performed either by themselves or by others in a working group.

Teamwork The process whereby people work collaboratively towards a common goal as distinct from other ways that individuals can work within a group.

Technology management The management of the relationship between available and emerging technologies, the organisation and the project. It also includes management of the enabling technologies used to deliver the project, technologies used to manage the project and the technology of the project **deliverables**.

Tender A document proposing to meet a specification in a certain way and at a stated price (or on a particular financial basis), an offer of price and conditions under which a supplier is willing to undertake work for the client. *See* **bid**.

Tender document The document issued to prospective suppliers when inviting bids or quotations for supply of goods or services.

Tendering The process of preparing and submitting a tender, quotation or bid.

Tender list A list of approved suppliers to whom a specific enquiry may be sent.

Termination (phase) The disposal of project **deliverables** at the end of their life.

Terms and conditions All the clauses in a contract.

Terms of reference A specification of a team member's responsibilities and authorities within the project.

Testing The process of determining how aspects of a **deliverable** perform when subjected to specified conditions.

Theory of constraints A theory expounded by Goldratt, which lead to the **critical chain** schedule management technique.

Threat A negative risk; a risk that if it occurs will have a detrimental effect on the project.

Three-point estimate An estimate in which the most likely mid-range value, an optimistic value and a pessimistic, worst case value are given.

Time analysis The process of calculating the early and late dates for each activity on a project, based on the duration of the activities and the logical relations between them.

Timeboxing The production of project deliverables in circumstances where time and resources including funding are fixed and the requirements are prioritised and vary depending on what can be achieved in the timebox.

Time limited scheduling* *See* resource smoothing.

Time now* A specified date from which the forward analysis is deemed to commence. The date to which current progress is reported. Sometimes referred to as the status date because all progress information entered for a project should be correct as of this date.

Time recording The recording of **effort** expended on each activity in order to update a project plan.

Time sheet A means of recording the actual **effort** expended against project and non-project activities.

Time variance The scheduled time for the work to be completed less the actual time.

Top down cost estimating The total project cost is estimated based on historical costs and other project variables and then subdivided down to individual activities.

Total float* Time by which an activity may be delayed or extended without affecting the total project duration or violating a target finish date.

Total quality management (TQM) A strategic, integrated management system for customer satisfaction that guides all employees in every aspect of their work.

Traffic light reports A type of progress report that explains the current status of the programme or project in the form of a traffic light colour, for example red = problems, amber = some concerns, green = no problems.

Tranche A group of projects that represent the delivery of all or a recognisable part of a new capability. It is used to assist the management and control of a programme.

Transfer A response to a **threat** that reduces its probability, impact or both on the project by transferring the risk to a third party.

Trend chart (*See* **slip chart**.)

Trends A general tendency observed on a project.

Turnaround report A report created especially for the various managers responsible to enter their progress status against a list of activities that are scheduled to be in progress during a particular time window.

Turnkey contract A comprehensive contract in which the contractor is responsible for the complete supply of a facility, usually with responsibility for **fitness for purpose**, training operators, **pre-commissioning** and **commissioning**. It usually has a fixed completion date, a fixed price and guaranteed performance levels.

Uncertain event *See* **risk event**.

Uncertainty A state of incomplete knowledge about a proposition. Usually associated with risks, both threats and opportunities.

Unlimited schedule* An infinite schedule, a schedule produced without resource constraint.

User acceptance test A formal test or series of tests to demonstrate the acceptability of a product to the user.

User requirements The requirements governing the project's **deliverables** or products as expressed by the user. What the user needs expressed in user terminology.

User requirements statement A document that defines the user's needs in user terminology from the user's perspective.

Users The group of people who are intended to benefit from the project or operate the **deliverables**.

Validate Testing that the deliverable meets the requirements.

Validation The process of providing evidence that a **deliverable** meets the needs of the user.

Valuation A calculation of the amount of payment due under the terms of a contract. Often undertaken at stages in large contracts and at completion.

Value A standard, principle or quality considered worthwhile or desirable. The size of a benefit associated with a requirement. In **value management** terms value is defined as the ratio of 'satisfaction of needs' over 'use of resources'.

Value engineering Concerned with optimising the conceptual, technical and operational aspects of a project's **deliverables**, value engineering utilises a series of proven techniques during the **implementation** phase of a project.

Value management A structured approach to defining what value means to the organisation and the project. It is a framework that allows needs, problems or opportunities to be defined and then enables review of whether the initial **project objectives** can be improved to determine the optimal approach and solution.

Variance A discrepancy between the actual and planned performance on a project, either in terms of schedule or cost. (Mathematical definition – the mean square difference between the value of all the observed variables and the mean (average) of all the variables – a measure of the spread and grouping of the distribution of a variable.)

Variance at completion The difference between **budget at completion** and **estimate at completion**.

Variation A change in **scope** or timing of work that a supplier is obliged to do under a contract.

Variation order The document authorising an approved technical change or variation.

Vendor A company or person contractually committed to provide goods (either direct or through a supplier).

Verification Proof of compliance with specified requirements. Verification may be determined by test, analysis, inspection or demonstration.

Verify Testing that the deliverable meets the specification and designs.

Version control The recording and management of the **configuration** of different versions of the project's products.

Virtual models A visual representation of a deliverable which can be used to test its operational performance.

Vision statement An outward-facing description of the new capabilities resulting from a project or **programme** delivery.

Warranty A promise given by a contractor to the client or owner regarding the nature, usefulness or condition of the supplies or services delivered under the contract.

Waterfall model A management model used particularly for IT development projects.

What-if assessment The process of evaluating alternative strategies.

What-if simulation* Changing the value of the parameters of the project network to study its behaviour under various conditions of its operation.

Work The total number of hours, people or **effort** required to complete an activity.

Work breakdown code A code that represents the 'family tree' of an element in a work breakdown structure.

Work breakdown structure* (WBS) A way in which a project may be divided by level into discrete groups for programming, cost planning and control purposes. The WBS is a tool for defining the hierarchical breakdown of work required to deliver the products of a project. Major categories are broken down into smaller components. These are sub-divided until the lowest required level of detail is established. The lowest units of the WBS are generally **work packages**. In some instances work packages are further divided into activities that become the activities in a project. The WBS defines the total work to be undertaken on the project and provides a structure for all project control systems.

Working group A group of two or more people to which work is delegated to individuals and the inter-relationships between activities is managed through a single person who may be a member of the project team.

Work load Work load is the amount of work units assigned to a resource over a period of time.

Work package* A group of related activities that are defined at the same level within a **work breakdown structure**.

Work package manager A person with responsibility for leading and managing a part of a project to achieve specific aims that have been agreed with the **project manager**.

Work units Work units provide the measurement units for resources. For example people as a resource can be measured by the number of hours they work.

Yield The return on an investment.

Zero defects A measure of the quality of a deliverable where the deliverable is defect-free.

Zero float Zero float is a condition where there is no excess time between activities. An activity with zero float is considered a critical activity.

Project management acronyms

The following list details acronyms commonly used in project management across all sectors.

Where an acronym has more than one commonly used meaning, each project management-related meaning is given as a separate entry.

AC	Actual cost
ACWP	Actual cost of work performed
ACWS	Actual cost of work scheduled
ADM	Arrow diagram method
ADR	Alternative dispute resolution
ALAP	As late as possible
ALARP	As low as reasonably practicable
AOA	Activity-on-arrow
AON	Activity-on-node
APM	Association for Project Management
APMP	APM qualification at IPMA level D
ARR	Annual rate of return
ASAP	As soon as possible
B2B	Business-to-business
B2C	Business-to-consumer
BAC	Budget at completion
BCM	Business change manager
BCWP	Budgeted cost of work performed
BCWS	Budgeted cost of work scheduled
BoK	Body of knowledge
BOM	Bill of materials
BOOT	Build-own-operate-transfer
BOQ	Bill of quantities
BSI	British Standards Institution
CA	Configuration audit
CA	Control account
CAD	Computer aided design
CAM	Computer aided manufacturing
CAM	Cost account manager
CAPEX	Capital expenditure
CAPM	Certificate in Applied Project Management (PMI)
CB	Configuration board
CBS	Cost breakdown structure

CCB	Change control board
CCB	Configuration control board
CDR	Critical design review
CI	Configuration item
CM	Configuration management
CPA	Critical path analysis
CPD	Continuing professional development
CPI	Cost performance index
CPM	Certificated Project Manager (APM) – maps to IPMA Level B
CPM	Critical path method
CMM	Capability maturity model
CR	Change request
CRD	Client requirements document
CSA	Configuration status accounting
C/SCSC	Cost/schedule control systems criteria
CSF	Critical success factor
C/SPCS	Cost/schedule planning and control specification
CTC	Contract target cost
CTR	Cost–time resource
CV	Cost variance
DCF	Discounted cash flow
DCP	Detailed cost plan
DRACAS	Defect reporting and corrective action
DSDM	Dynamic systems development method
DSM	Design structure matrix
EAC	Estimate at completion
ECC	Estimated cost to complete
ECR	Engineering change request
EF	Early finish
EFQM	European Foundation for Quality Management
EFT	Earliest finish time
EMS	Environmental management system
EMV	Expected monetary value
EPC	Engineer, procure and construct
EPCC	Engineer, procure, construct and commission
EPIC	Engineer, procure, install and construct
EPMO	Enterprise project management office
ERM	Enterprise resource management
ES	Early start
ESA	End stage assessment
EST	Earliest start time
ETC	Estimate to completion

EU	European Union
EV	Earned value
EV	Expected value
EVA	Earned value analysis
EVM	Earned value management
EVMS	Earned value management system
FAST	Functional analysis and system technique
FAT	Factory acceptance test
FBOOT	Finance, build, own, operate, transfer
FCC	Forecast cost at completion
FEED	Front end engineering design
FF	Finish to finish
FF	Free float
FFP	Fit for purpose
FMEA	Failure mode and effect analysis
FMECA	Failure modes, effects and criticality analysis
FS	Finish to start
FTE	Full time equivalent
GERT	Graphical evaluation and review technique
GoPM	Governance of project management
HAZCON	Hazardous condition
HAZOP	Hazard and operability
HRM	Human resource management
HSE	Health and Safety Executive
HSE	Health, safety and environment
IBR	Integrated baseline review
IC	APM Introductory Certificate Qualification
ID	Identification
IFB	Invitation for bidding
IPMA	International Project Management Association
IPR	Intellectual property rights
IPT	Integrated project team
IRR	Internal rate of return
IS	Information systems
ISEB	Information Systems Examination Board
ISO	International Standards Organization
IST	Integrated system testing
IT	Information technology
ITT	Invitation to tender
JIT	Just in time
JV	Joint venture
KISS	Keep it simple

KM	Knowledge management
KPI	Key performance indicator
KRA	Key result area
LD	Liquidated damages
LFD	Late finish date
LOB	Line of balance
LOE	Level of effort
LOI	Letter of intent
LSD	Late start date
MIS	Management information system
MOC	Management of change
MoR™	Management of risk (OGC)
MPA	Major Projects Association
MR	Management reserve
MS	Milestone
MSP	Managing Successful Programmes (OGC)
MTO	Material take-off
NPV	Net present value
OBO	Operated by others
OBS	Organisational breakdown structure
OD	Original duration
ODC	Other direct costs
OGC	Office of Government Commerce
OPM™	Organisational Project Maturity Model
OR	Operations/operational research
PBS	Product breakdown structure
PBR	Programme benefits review
PC	Planned cost
PDM	Precedence diagramming method
PDN	Project deviation notice
PDR	Preliminary design review
PDU	Professional development unit
PEP	Project execution plan
PERT	Program evaluation and review technique
PESTLE	Political, economic, sociological, technical, legal, environmental
PF	Productivity factor
PFI	Private finance initiative
PID	Project initiation document
PIG	Probability-impact grid
PIM	Probability-impact matrix
PIR	Post implementation review

PM	Project manager
PMB	Performance measurement baseline
PM BoK®	A Guide to the Project Management Body of Knowledge (PMI)
PMCDF	Project Manager Competency Development Framework (PMI)
PMI	Project Management Institute
PMIS	Project management information system
PMM	Project management maturity
PMMM	Project Management Maturity Model (OGC)
PMO	Project management office
PMP	Project management plan
PMP®	Project Management Professional (PMI qualification)
PMS	Project master schedule
PPP	Public private partnership
PPR	Post-project review
PQ	APM Practioner Qualification-maps to IPMA Level C
PR	Public relations
PRAM	Project Risk Analysis and Management Guide
PRD	Project requirements document
PRINCE2	Projects in controlled environments
PROMPT	An early management methodology on which PRINCE was originally based
PSO	Project or programme support office
PV	Planned value
QA	Quality assurance
QC	Quality control
QMS	Quality management system
RACI	Responsible for action, accountable (yes no decisions), consult before (2 way), inform after (1 way)
R&D	Research and development
RAD	Rapid applications development
RAG	Red, amber, green
RAM	Responsibility assignment matrix
RAMP	Risk Analysis and Management for Projects
RBS	Risk breakdown structure
RCA	Root cause analysis
RFC	Request for change
RFI	Request for information
RFP	Request for proposal
RFQ	Request for quotation
RMP	Risk management plan

ROI	Return on investment
SCERT	Synergistic contingency evaluation and response/review technique
SD	System dynamics
SE	Systems engineering
SF	Start to finish
SHAMPU	Shape, harness and manage project uncertainty
SMART	Specific, measurable, achievable, realistic, time-framed
SOR	Schedule of rates
SOR	Statement of requirements
SOW	Statement of work
SPI	Schedule performance index
SS	Start to start
SSADM	Structured systems analysis and design methodology
SV	Schedule variance
SWOT	Strengths, weaknesses, opportunities, threats
TF	Total float
TLC	Through life cost
TOR	Terms of reference
TQM	Total quality management
TSO	The Stationery Office
UAT	User acceptance test
VM	Value management
VOWD	Value of work done
WBS	Work breakdown structure
WP	Work package

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