

Gower



Handbook of Project Management

Fifth Edition

Edited by

Rodney Turner

Gower Handbook of Project Management

*Do not like some ungracious pastors do,
Show me the steep and rocky way to heaven,
While, like a puffed and reckless libertine,
Himself the primrose path of dalliance treads,
And heeds not his own counsel.*

Hamlet

*This book is dedicated to project management
and the steep and rocky mountain path
through which we realize our objectives.*

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5th Edition

Edited by
RODNEY TURNER

GOWER

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Preface

Welcome to the fifth edition of the *Gower Handbook of Project Management*. When I was first asked to prepare this edition, Gower asked me for a contents page. I took the contents page from the fourth edition and made very few changes, apart from deleting the final part relating to the management of the people on the project. Gower came back and said that rather than looking like edition 5, it was looking more like edition 4.1. They would like the fifth edition to be noticeably different than the fourth edition. Spurred on by that, I then took the exact opposite tack. Project Management is a growing field of study, with a large number of highly reputable authors. There is more than one person able to write well on every topic in the book. So I decided to make the fifth edition completely different from the fourth, with a new author for every chapter. In the event two chapters are written by the original authors from the fourth edition:

- Steve Simister has written the chapter on Managing Value. He was co-editor of the third edition, and I wanted to keep him as an author.
- Dennis Lock has written the chapter on Project Implementation. The new author I invited to write that chapter let me down (I won't name the guilty party), and Dennis very kindly let me reuse his chapter from the fourth edition, even though I had dropped him for the other chapters he wrote. I am very grateful to Dennis.

I must admit with the number of changes Steve and Dennis made to their chapters, I think if I had pursued the original plan, the new edition might have been edition 4.01. I must apologize to all the authors from the fourth edition who I have not reused. It is absolutely no reflection on the quality of their work. It is just project management is now a growing field with a wide range of authors able to write on every topic, and it is the purpose of a handbook like this to provide different perspectives on the topics contained in it.

I have made two significant structural changes to the fourth edition:

1. The first is probably the most controversial. I have dropped the part on Managing People. I will receive a lot of criticism for that. But Gower is about to publish a book, the *Gower Handbook of Managing People on Projects*. So in defense I can say that managing people on projects has now, quite rightly, been given a dedicated book. It doesn't need to be part of this book. But another reason for dropping it is that the field of project management is constantly growing, and if I don't reduce the topics covered, the book will become so large it won't be able to be bound in a single spine. The third edition was 850 pages with 44 chapters. Between the third and fourth edition I dropped the parts on Finance and Contracts. The fourth edition was still more pages, 870 pages with 40 chapters. Now I have dropped Managing People, but there are 35 chapters. I don't know how many pages yet. In the modern age, books should be slimmer, so I must try to reduce the size of the book.

2. In the third and fourth edition, my plan in sequencing chapters was to start with corporate strategy and work down through portfolios and programs to projects. I decided this time that this is the *Gower Handbook of Project Management*, so I should start with projects, and work outwards to corporate strategy. So Part 1 is just about projects and project management. The links to the strategy of the parent organization are moved to Part 4, which is entitled 'Portfolio', but is about portfolios in the wider sense.

As before, I don't necessarily share the views of all the authors. I think it is healthy that a book like this should have a wide range of perspectives. Again, there is nothing that I violently disagree with, and since I think Project Management is a social construct, I would not even say anything is 'wrong', just different perspectives of the same thing. A cylinder looks like a circle if you view it along one axis and a square if you view it from the side. So you can put a square peg in a round hole; it can look like a circle to some people and a square to others. Neither is wrong for expressing their views. Project Management is the same.

Each chapter has a list of references and further reading. Not all the references are cited in the text. Some are there as further reading. For me, in a book like this, references fulfil two purposes:

- They provide additional sources for people who want to explore the topic further.
- They acknowledge the source of somebody else's material or ideas.

Only books really satisfy the first purpose. Perhaps some magazines and readily available academic research journals also meet that need. PhD theses, papers in conference proceedings and arcane academic journals do not. So I have tried to avoid including those as references. They are only included if they satisfy the second purpose and there is not other text that does so.

On last point, I have used the original English spelling of program (using the same stem as diagram and epigram), rather than the Victorian affectation, programme. When you realize that all the grief about whether it is program or programme is caused by Victorian theatre owners wanting to make their theatre programs look posh by using the French spelling, you think, 'Give it a rest; keep it simple'. I have also used the correct English spelling, organization.

In the two previous editions I have edited, I said I hoped the book would run to further editions, and asked people to e-mail me their suggestions for improvement. The hope remains there will be a demand for further editions, and I repeat the request.

Finally, I would like to thank Judy Morton for her help in editing the book.

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Other Books by Rodney Turner Published by Gower

The Gower Handbook of Project Management, 3rd edition, 2000, edited with Steve Simister, ISBN: 978-0-566-08138-5 (hardback), ISBN: 978-0-566-08397-3 (CD-ROM)

The Gower Handbook of Project Management, 4th edition, 2008, editor, ISBN: 978-0-566-08806-3 (hardback), ISBN: 978-0-566-08994-7 (e-book – PDF), ISBN: 978-1-4094-5841-8 (e-book – ePUB, 2012), ISBN: 978-0-566-08838-4 (CD ROM)

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A Handbook for Project Management Practitioners

RODNEY TURNER

Projects and project management are now widely recognized by organizations as being essential to achieving their strategic objectives. Achieving the strategic objectives often involves change, and that change needs managing in a different way than managing the routine work of the organization. The change can take several forms:

- It may be an engineering construct, a new building, new infrastructure or a new product or production machinery;
- It may be an information system, involving new information and communication technology (ICT);
- Or it may be a social construct, new processes, a new organization's structure or new skills in the work force.

In each case, the organization that wants the new asset creates a temporary organization, a project, to which resources are assigned to do the work to deliver that beneficial change. The change itself is some new facility or asset. We have just seen that the facility or asset may be an engineering construct, an ICT system or a social construct. Once the project is finished, that asset will be operated to deliver benefit to the owning organization. During its life, the temporary organization needs managing to deliver the asset and achieve the benefit on completion. The asset and desired benefit (the objectives) must be defined, as must the process of achieving the objectives, and the work and delivery of the objectives must be monitored and controlled. The management of the project (the temporary organization) is the responsibility of project management practitioners.

This book is intended as a handbook for project management practitioners. The aim is to give an introduction to and overview of the essential knowledge required for managing projects. Competence can be defined as the knowledge, skills and traits required to deliver desired results (Crawford, 2003). Through this book I introduce the reader to the knowledge required to manage projects. Competence the individual will develop through their experience, and through their essential traits they bring to the job. The project management professional societies throughout the world take several different approaches to defining the competence required to manage projects.

- a) Some focus on the knowledge and skills required. This is the approach taken by the Project Management Institute (PMI, www.pmi.org), a global organization based in North America, through its body of knowledge and certification program (Project Management Institute, 2013). This is an input based approach to competence.
- b) Some focus on what project managers have to be able to do to manage projects, what functions they have to perform. This is the approach taken by the Association for Project Management (APM, www.apm.org.uk), the UK's national association, through its body of knowledge and certification program (Association for Project Management, 2012), and by the International Project Management Association (IPMA, www.ipma.ch), a global federation of 59 national associations of which APM is the largest (International Project Management Association, 2006; Association for Project Management, 2008). This is a performance based approach to competence.
- c) Some focus on what project managers must deliver. This is the approach adopted in the UK by the Engineering Construction Industry Training Board (ECITB, www.ecitb.org.uk), in its National Occupational Standards for Project Management (Engineering Construction Industry Training Board, 2003) and by the Australian Institute of Project Management (AIPM, www.aipm.com.au), in its National Competency Standards for Project Management (Australian Institute of Project Management, 2004).

Lynn Crawford (2003) says that competence is the ability to perform according to defined standards. Those standards can take different forms:

1. They may be global standards. *The PMI Guide to the Project Management Body of Knowledge (PMBOK Guide)* (Project Management Institute, 2013) is often presented as a global standard. The International Standards Organization has produced a standard for Project Management, ISO 21500 (International Standards Organization, 2012). Lynn Crawford herself is leading a global working party to produce global standards for project management, called GAPPS, the Global Alliance for Project Performance Standards (www.globalpmstandards.org).
2. They may be national standards. The *PMBOK Guide* (Project Management Institute, 2013) is also an American national (ANSI) standard. In the UK, the ECITB has produced the National Occupation Standards for Project Management (Engineering Construction Industry Training Board, 2003) and in Australia AIPM has produced the National Competency Framework for Project Management (Australian Institute of Project Management, 2004).
3. They may be standards produced by professional associations, such as the *PMBOK Guide* (Project Management Institute, 2004), the APM Body of Knowledge (Association for Project Management, 2012) and the IPMA Competency Baseline, ICB (International Project Management Association, 2006).
4. They may be job descriptions produced by individual organizations for specific jobs within the organization.

As I say, in this book I can only give a guide to the knowledge required by project management practitioners in their work, not to the performance required by project managers. Table 1.1 shows the content of this book, and how it relates to three of the standards, the APM Body of Knowledge, the *PMBOK Guide* and the IPMA ICB3.

In the next section I give a brief description of the contents of each chapter, and in the following section a brief description of knowledge areas not covered in this book.

The Gower Handbook of Project Management

The book consists of five parts:

- The first describes projects and considers various elements of project management and its successful implementation.
- The second part describes the functions that a project manager has to perform in execution of the project, and how they deliver performance.
- The third part describes the process that needs to be followed in managing the project
- The fourth part describes various issues relating to the management of multiple projects.
- The fifth part considers a few perspectives of projects and their management.

PART 1: PROJECTS

In the first part of the book, we consider the nature of projects and their management. After an introduction to projects and project management, we look at various issues relating to the success of project management, including project strategy, the value of project management, project management maturity and auditing.

Chapter 2: Projects and their management: Chapter 2 describes projects and their management. This is of course the core topic of this book, and so is from where we start. This chapter gives an overview of projects and project management, by describing a theory of project management. We start with five simple premises, and show that much of what we understand as project management follows naturally from those five premises. We find that if we assume those premises are correct then we need many of the tools and techniques described in this book to manage our projects.

Chapter 3: Implementing strategy through projects: Chapter 3, describes how to develop a strategy for implementing a project. Before even starting planning a project, you should have a basic idea of how to go about it – this is the strategy. The project strategy should be driven by corporate strategy, and sets the basic framework for undertaking the project. We consider the elements of a project strategy and how it should be formulated, and give an example.

Chapter 4: The value of project management: Is it worthwhile adopting project management as an organization? Chapter 4, describes the results of a project done for PMI® into the value of project management. Organizations adopting project management show value from its adoption, from among other things, improvement in the performance of projects. Value results from the fit of the project management methodology adopted to the organization, its context and needs, and not necessarily from the maturity of the practices adopted.

Chapter 5: Maturity models in project management: Unfortunately, it has been difficult to show a correlation between project management maturity and project performance. We saw in the previous chapter that it is important that the project management methodology adopted should fit the organization's needs: some organizations will

need simple procedures and some more bureaucratic. However, it is still worthwhile to understand what constitutes good practice, and to try to improve the procedures adopted to meet the organization's needs for the successful delivery of projects. Chapter 5 describes project management maturity, how to assess maturity and the contribution of maturity to success.

Chapter 6: Auditing projects and programs: Is the project management we have adopted likely to lead to project success? We can audit the adoption of project management to determine if we have adopted the best project management procedures and that they are being applied on a given project in a way likely to deliver success. Chapter 6 describes project and project management auditing, and their contribution to project governance.

PART 2: PERFORMANCE

The second part of the book looks at what the project manager must do and produce. The parent organization undertakes the project to achieve beneficial change. In order to achieve that it must deliver some outputs or requirements, and they must be delivered within constraints of time, cost and quality. The project involves risks which must be managed, and particular risks are threats to health and safety and potential impacts on the environment.

Chapter 7: Measuring performance: Managing the project management functions is about delivering performance. Chapter 7 describes how to measure and assess performance as an introduction to this part.

Chapter 8: Benefits realization management: The parent organization undertakes the project to achieve development objectives, to achieve some business need. It is expected that the project will deliver benefit, and without that benefit the project is not worth doing. Not only does the parent organization need to define what the expected benefit is, it needs to make sure that it is actually achieved once the project is completed.

Chapter 9: Requirements management: To achieve that benefit the project must deliver certain outcomes, or requirements. Those requirements must be defined, and that initiates the project planning process. The requirements must also be delivered and converted into the expected benefits.

Chapter 10: Managing scope and configuration: To achieve those requirements the project team needs to do work to deliver products. The products and their components need to be defined through a product breakdown structure, and the work to make and assemble those components identified through a work breakdown structure. Configuration management is a tool to control the identification and delivery of work and products.

Chapter 11: Managing value: The benefits only have any value to the parent organization if they can be produced at a cost that allows it to make a profit. Further the higher the benefit for a given cost, or the lower the cost for a given benefit the better the project's value. Value management is a tool for optimizing the project's outcome.

Chapter 12: Managing quality: To perform effectively, the project's products must be delivered to certain standards. First, the product must perform to provide the functionality expected, and to solve the problem, deliver the benefit and value expected of it. It must also meet other performance requirements, or service levels, such as availability, reliability and maintainability, and have acceptable finish or polish.

Chapter 13: Organizing for projects: In order to be able to do the work, it is necessary to determine what people are required, the roles and responsibilities they will fulfil,

what skills they need and the numbers required. These people need to be structured into the temporary organization that is the project, and the relationship of that temporary organization with the parent organization identified.

Chapter 14: Managing for stakeholders: The wider project team encompasses people beyond those doing work. There are people whose lives are affected by the project and its outcomes, and most of these have a view on it. Some people view it positively, some negatively. Some can influence the outcome, some cannot. Where they view the project negatively, and can influence the outcome, they will work to undermine the project. The project manager needs to communicate the vision, communicate the process, to win everybody over to the project. He or she also needs to negotiate everybody's involvement, making them aware of how the project can lead to positive outcomes for them, and what contribution is expected from them.

Chapter 15: Managing the schedule: To provide benefit, the project's products must be obtained within a certain time to satisfy the need, and to cover both interest and capital payments on the finance. Hence, the timing of the work must be managed. Sometimes very tight time constraints must be met, but normally they are more flexible. Also on many projects, the work of different resources must be carefully coordinated, and that will also be achieved through the management of the timing of the work.

Chapter 16: Managing cost and earned value: Likewise, to be of value, the functionality must not cost more than a certain amount. Clearly the more benefit it delivers, the more that can be spent on its delivery. The cost of the product, and the value it gives, must be estimated, and the cost controlled within those limits while the work is done.

Chapter 17: Managing resources: The actual resources required (money, materials and people), must be identified and estimated, and their assignment to the work managed.

Chapter 18: Managing risk: Projects being unique, novel and transient are inherently risky. More so than the routine work of organizations. This is what differentiates project management from the management of normal operations. Risk management is therefore an essential part of project management.

Chapter 19: International projects: The application of the management techniques to manage the project functions can be different on international projects. Chapter 19 considers the management of risk and quality (including safety). It also considers how to establish an offshoring arrangement.

Chapter 20: Sustainable development: The impact of the project on the environment must also be carefully managed. It is now common to talk about sustainability. I sometimes say I think this is old wine in new bottles. But the new thing that sustainability adds over and above environmental management is the idea of the triple bottom line, environmental, social and economic impact. Also the new bottles make the idea more attractive and gets more people to take an interest in it.

PART 3: PROCESS

Because projects are transient, their delivery follows a development process, from germination of the idea, through initiation, design and delivery, to commissioning, handover to the client and close-out of the work. As we progress through the process, the plans and design of the product or objectives are developed in increasing detail. We gain greater understanding of the objectives and how they will be delivered, and that

feeds into increasing detail in the plans. Because we develop the lower level definition at successive stages of the process, the levels are essentially linked to the stages.

Chapter 21: Managing the process: There are many versions of the project process, but they all essentially contain the steps of germination of the idea, proposal and initiation, design and appraisal, mobilization of the team, execution and control and integration of the team and their work, testing, commissioning and handover of the project's product and close-out of the work. We consider processes at many levels: the project's goals, outcome's, outputs and the management of the project functions.

Chapter 22: Project start-up: The difference between project start and start-up has been likened to the difference between starting the engine of a car to the complex sequence of activities required to start the diesel engine of a ship. A complex sequence of activities are required to start the project, to mobilize the team, to initiate the project definition process, to obtain agreement to the project objectives and plan to deliver them.

Chapter 23: Feasibility, design and planning: The problem the project is to solve (or opportunity it is to exploit) is identified. Several options are developed, functional designs produced and respective costs and benefits estimated to the current level of accuracy. The best solution is chosen for further definition. A high level, strategic plan for the design and execution of the project is developed. A systems design is produced, and the costs and benefits estimated in more detail. The project is appraised and if found acceptable, it is sanctioned. The project team, including contractors, need to be mobilized.

Chapter 24: Managing implementation: Work is undertaken to deliver the project's products. The first step is to produce detailed plans to control execution, as opposed to the systems level plans required for appraisal. As work progresses, it must be measured and controlled to ensure the project delivers the required performance. A key feature of project management, which sets it apart from normal operations, is the integrative function. Operations management emphasizes discrete functions; project management integrated teams. This is in evidence throughout the life-cycle, but particularly at this stage. The work of the project members must be integrated, the work of the design, execution and commissioning teams must be integrated, the work of project team and client must be integrated.

Chapter 25: Project close-out: The work of the project is brought to a timely and efficient conclusion. The product is tested and commissioned, and handed to the operations team, who must be trained in its use, and operational and logistical procedures must be put in place. The client ensures they receive the benefit required to repay the project finance, and the contractor obtains sign off from the client and receives final payment. The project team is disbanded, and debriefed. The project performance is audited, and lessons learnt for future projects.

PART 4: PORTFOLIO

Few projects take place as an isolated, stand-alone project. They are part of a larger portfolio in one form or another. Part 4 considers the several different forms of portfolio the project can exist in. We start with complex infrastructure projects, which have many of the features of programs. We then consider program management and portfolio management, and how programs and portfolios link projects to corporate strategy. We consider the nature of the project-oriented organization, and the governance of project

management. Finally, we consider the PM Office, where P can stand for project, program or portfolio, and its role in the coordination of different constellations of projects.

Chapter 26: Complex projects: Chapter 26 describes the management of complex projects. First it introduces the practitioner view of what constitutes complexity, identifying six elements of complexity. Then it describes the academic view, with two dimensions of complexity, the complicatedness of the technology and the complexity of the social system. That leads to four management styles, ranging from the routine management of the simple to the dynamic management of the complex.

Chapter 27: Managing programs of projects: Often an organization will undertake an extended program of change, beyond the scope of a single project. They need to undertake several related projects to achieve their overall change objectives. To achieve the best results the organization should manage those projects as an integrated program. The projects in a program contribute to a common, shared objective, or outcome.

Chapter 28: Managing portfolios of projects: Often an organization will be undertaking a portfolio of projects with unrelated objectives, but which need to draw on a common pool of resources (labour, money and information). To achieve the best results the organization should manage the portfolio in a coordinated way, prioritizing resources and coordinating interfaces between the projects. A portfolio of projects shares common inputs.

Chapter 29: Managing the project-oriented organization: The project-oriented organization is one undertaking several portfolios or programs of projects. Chapter 29 describes the management of the project-oriented organization, including the management of human resources in such an organization.

Chapter 30: The governance of projects and project management: The organizations at all levels of this cascade, project, program, portfolio and project-oriented organization, whether temporary (project and program), or permanent (portfolio and project-oriented organization), require governance. Chapter 30 outlines the governance of project management, including the institutions of the governance of projects and how to link corporate governance to project governance.

Chapter 31: The project management office: Many organizations have a project or program office to administer the systems either for individual large projects, or all the projects in programs or portfolios they are undertaking.

PART 5: PERSPECTIVES

I end with two chapters looking at the history of project management and what we can learn from it.

Chapter 32: The common story of great projects: Chapter 32 describes research into the management of great projects, projects that were very successful, surpassing all expectations and having a significant impact on industry and markets. Through the study of these projects, we can identify seven common contributors to their phenomenal success.

Chapter 33: Project history: Chapter 33 gives another view of project history. There are many memes of project management, beliefs about what constitutes good project management which remain untested and unproven; where these memes came from, we can begin to challenge them, and understand project management better. We consider the example of the Manhattan project to develop the first nuclear bomb, a successful

project of which the management violated many of the currently held beliefs of project management. A study of the history of project management can help us understand our discipline, how it developed and perhaps challenge some deeply held beliefs.

OTHER PROJECT MANAGEMENT KNOWLEDGE AREAS

In compiling the book, choices had to be made about what was to be included. I have decided to leave out the parts relating to people, commercial and contractual issues. People might say these three issues are important. Projects cannot happen without people, finance and contracts. That is true, but I think they constitute books in their own right. This book is the core management of projects. Gower is producing a *Gower Handbook of People In Project Management*, giving a much wider view than my earlier book (Turner, 2003a), and with time we may see a Gower handbook covering the commercial and contractual issues. For completeness of this overview of the project management body of knowledge, I include brief descriptions of these areas. They are summarized in Table 1.1.

Table 1.1 The structure of this book and its relationship to the project management bodies of knowledge of leading professional institutions

Gower Handbook of Project Management 5th edition, Chapter		APM BOK, 6th edition APM, 2012		PMI Guide to the PMBOK, 5th edition PMI, 2013		IPMA ICB3 IPMA, 2006	
1	Introduction						
Projects							
2	Projects and their management	1.1.1	Project management	1.2 1.3	What is a project What is project management	3.01	Project orientation
3	Implementing strategy through projects	1.1.7 1.2.3	Success and maturity Strategy	1.4.3 2.2.3	Projects and strategic planning Project success	1.01	Project management success
4	The value of project management						
5	Maturity models in project management	1.1.7	Success and maturity				
6	Auditing projects and programs	3.6.2	Reviews				
Performance							
7	Measuring performance	3.1.1	Business case				
8	Benefits realization management	3.1.1 3.2.1	Business case Benefits management	2.3	Organizational influences		
9	Requirements management	3.2.5 3.2.6	Requirements management Solutions development	4.1 5.2	Develop charter Collect requirements	1.03	Project requirements and objectives

10	Managing scope and configuration	3.2 3.2.2 3.2.3	Scope management Change control Configuration management	4 5	Project integration management Project scope management	1.10 1.15 2.08	Scope and deliverables Changes Results orientation
11	Managing value						
12	Managing quality	3.6.1 3.6.2	P3 assurance Reviews	8	Project quality management	1.05	Quality
13	Organizing for projects	3.1.4	Organization	9	Project human resource management	1.06	Project organization
14	Managing for stakeholders	3.1.6	Stakeholder management	2.2.1 13	Project stakeholders Project stakeholder management	1.02	Interested parties
15	Managing the schedule	3.3.2	Time scheduling	6	Project time management	1.11	Time and phases
16	Managing cost and earned value	3.4.1	Budgeting, cost control	7	Project cost management	1.13	Cost and finance
17	Managing resources	3.3.1	Resource scheduling	6.4 9	Estimate activity resources Project human resource management	1.12	Resources
18	Managing risk	3.5.1 3.5.2	Risk context Risk techniques	11	Project risk management	1.04	Risk and opportunity
19	International projects	2.7					
20	Sustainable development	1.2.1 4.6	Environment Sustainability			3.09	Health, safety, security and the environment
Process							
21	Managing the process	1.1.6	Life-cycle	2.1.4 2.4 3	Organizational process assets The project life-cycle Project management processes		
22	Project start-up	3.1.5	Planning	4.1 4.2	Develop project charter Develop project management plan	1.19	Start-up
23	Feasibility, design and planning	3.1.5 3.7.3 3.7.4	Planning Mobilization Provider selection	4.2	Develop project management plan		

24	Managing implementation	3.1.2 3.2.2	Control Change control	4.2 4.3	Direct and manage project work Monitor and control project work	1.16	Control and reports
25	Project close-out			4.6	Close project or phase	1.20	Close-out
Portfolio							
26	Complex projects						
27	Managing programs	1.1.2	Program management	1.4.1	Program management	3.02	Program orientation
28	Managing portfolios	1.1.3	Portfolio management	1.4.2	Portfolio management	3.03	Portfolio orientation
29	Managing the project-oriented organization						
30	The governance of projects and project management	1.1.8	Sponsorship	1.4.3 2,2,2	Projects and strategic planning Project governance		
31	The project management office			1.4.4	Project management office		
Perspectives							
32	The common story of great projects						
33	Project history						

PEOPLE

Project management may be viewed as a systems science or a social science. I believe it is more social science than systems science, but in most of what appears above you may have gained the impression that it is more systems science. The people issues are about the social science, managing the needs of all the people involved in the project. I have decided to leave this out and it will be the subject of a separate book, expanding on my earlier book (Turner, 2003a). People in project management may cover the following issues:

Managing human resources in the project-based organization: Projects are unique, novel and transient, and hence standard Human Resource Management concepts do not apply to project-based firms. Every project requires a new structure, and every time a new project is created the human resource configuration of the parent organization changes. Thus, some of the core concepts of HRM need rethinking. There are three core concepts of HRM theory in particular which need novel approaches in a project organization. These are the selection of people to work for the organization, the management of their careers and their and the organization's learning and development. There are also three new processes required: the assignment of people to projects, their development on projects and their dispersment after projects have been completed.

Developing project management competence of individuals: To undertake its projects, an organization needs competent individuals. It needs to develop people competent in the technology of the project and people competent in the management of projects.

Developing enterprise-wide project management capability: The organization also needs to be competent itself in the technology used and in the management of projects, and so needs to develop enterprise project management capability. The competence of the people is a component of this, but there are also other things the organization can do to develop its capability and to innovate in the processes it uses. These include the use of procedures, reviews and benchmarking, knowledge management and the development of a project management community.

Managing teams: Project teams are formed to undertake a unique and novel task, and are transient in their existence. The team needs to be formed and raised to peak performance. This is part of the mobilization process. Achieving peak team performance is critical to project success. The team needs to be composed of a balanced set of individuals with complementary strengths and weaknesses. The team also needs to be properly disbanded at the end of the project so that its members can look forward to their future work, and they need to be properly debriefed so that the organization can learn from their experiences.

Leadership: Volumes have been written on the elusive quality of leadership, and volumes devoted to the question of whether leaders are born or made. My view is that the majority of people are born with inherent leadership skills, and they can learn to develop these. Understanding the skills and styles of good leadership can improve the performance of a project manager in leading the team and motivating the individuals in the team to great things. One of the most important skills of a good leader is to be able to communicate the vision for the project, and the process of achieving that vision.

Managing communication: Communication between the project manager and the client, between the client and the project manager and between both and the other stakeholders is essential for maintaining cohesion of the project team. The client in particular wants to be comfortable about project progress and to trust the project manager. The right type of communication from the project manager is essential to maintain that comfort and trust. But in order for the client to be able to trust the project manager, the latter must know what the client wants and needs, and so communication in the opposite direction is also essential. Communication with all the stakeholders is essential for keeping them committed and resolving conflict.

Managing conflict, persuasion and negotiation: Conflict often arises on projects, either because people have differences of opinion about the expected project outcomes, or because some people misunderstand or fear the expected outcomes, or because there are personality clashes. Unresolved conflict can be damaging to the project's performance and so must be managed. If people fear or misunderstand the expected project outcomes, then if they are properly explained they may be persuaded to accept them.

Managing culture: The team is composed of many individuals, with different backgrounds. International teams are now common, and the project manager and team members need to be aware of cultural differences. However, there is a view that the cultural differences between different professions can be greater than that between nations. Hence even people working within a single country need to be aware of difference that can arise from a person's professional, religious, class, educational, gender, age and other backgrounds.

Managing health and safety: In all working environments, the safety and health of people doing the work must be of paramount concern to managers, mainly for moral reasons. However, a safe working environment usually results in more cost effective

outcomes. Since some managers do not seem to behave ethically towards their employees, this area is now also tightly controlled by law.

Ethics: Several times I have said people should behave morally, especially with regard to health, safety and the environment. So often the law has to intervene. Experience shows that even though many people think the moral road is the more expensive road, it often leads to greater rewards, and on earth, not just in heaven. The ethical approach usually leads to the greater good for everyone, and people respect that and respond in like fashion.

CONTRACTUAL

On anything but the smallest projects, the sponsor will not have the necessary resources in-house to undertake the project. Hence, it is almost always necessary to buy in external goods and services. On a project there is an essential difference between the procurement of a service, such as works or labour, which is used over an extended period of time, and the procurement of goods and materials, which are delivered at an instant in time. The term 'procurement' tends to be used for the latter and 'project contract management' for the former, even though both involve procurement and contracts. These issues were covered by my book (Turner, 2003b).

Project contract management: The client must develop a contract strategy, deciding the best form of contract from several available to appropriately motivate the contractor and govern the relationship between them. They must choose an appropriate contractor to do the work and govern the relationship with the contractor. Contractors must bid for work and administer the relationship with the client. Both the client and contractor need ways of managing variations, to minimise claims arising, and to try to prevent claims becoming disputes.

Procurement: The word 'procurement' strictly applies to the purchasing of all goods and services, but in projects it does tend to be limited to the procurement of goods and materials. Similar processes apply as applied to the selection of contractors as described above, but at a more detailed level.

Contract law: In most countries the law of contract involves concepts of offer, acceptance, consideration, functions, validity, mistakes, terms and conditions, termination and remedies.

COMMERCIAL

There are several commercial and financial issues relating to the way the project is financed.

Project appraisal: The value for the project must be appraised, by comparing projected cash inflows (revenues and savings) to expected cash outflows (costs) using investment appraisal techniques.

Finance: Finance must be raised from any of a number of sources. The simplest is to obtain money from the parent organization. Alternatively, money can be obtained from other equity shareholders, or as loans from banks. There are also a number of specialist sources of finance. The costs and benefits of different sources of finance must be compared, and a financial package produced for the project.

Taxation: Even rich people have to pay their taxes. It is important to understand the tax laws of the country. What counts as capital expenditure and what as revenue? What tax exemptions and grants are available? How can capital exemptions be worked to the best advantage? How can expenditure be phased to best tax advantage?

Insurance: The sponsor’s investment needs to be protected against unexpected loss. Some risks are insurable, such as fire, civil strife, transport losses. Severe weather can be insured, but not inclement weather. Projects may be insured with insurance companies. However, there are also ways of insuring the projects, such as setting aside a contingency in the budget, or buying currency futures. That is related to risk management.

GENERAL MANAGEMENT KNOWLEDGE AREAS

Most versions of the project management body of knowledge also deal with some of the general management skills required by project managers. Some of these are directly related to knowledge topics above, the knowledge topics above just being their interpretation in the unique, novel and transient context of projects or project-based organizations. The general management issues are also summarized in Table 1.2.

Table 1.2 Other areas of knowledge relevant to project management not covered in this book

Competencies not included	APM BOK		PMI Guide to the PMBOK		IPMA ICB	
People						
Human resource management	4.3	Human resource management	9.1	Human resource planning	3.08	Personnel management
Developing people	2.1.3 2.2.2 2.2.4	Delegation Competence Learning and development	1.7.1 9.3	Responsibilities and competencies of the project manager Develop project team		
Enterprise PM capability	1.1.5 2.2.1	Knowledge management Communities of practice				
Managing teams	2.1.7	Teamwork	2.3 9.4	Project team Manage project team	1.07	Teamwork
Leadership	2.1.3 2.1.5	Delegation Leadership			2.01 2.02	Leadership Engagement and motivation
Managing communication	2.1.1 3.1.3	Communication Information management	2.1.2 10	Organizational communications Project communications management	1.18	Communication

Managing conflict, negotiation, politics	2.1.2 2.1.6 2.1.4	Conflict management Negotiation Influencing	1.7.2	Interpersonal skills of a project manager	2.10 2.11 2.12	Consultation Negotiation Conflict and crisis
Managing culture			2.1.1	Organizational cultures and styles	2.06 2.14	Openness Values appreciation
Health and safety	4.2	Health and safety				3.09 Health, safety, security and the environment
Ethics	2.2.3	Ethics frameworks			2.15	Ethics
Contractual						
Contracts	3.7.1	Contracts	12	Project procurement management	1.14	Procurement and contract
Procurement	3.7.3	Procurement	12	Project procurement management	1.14	Procurement and contract
Legal	4.4	Law			3.11	Legal
Commercial						
Appraisal	3.1.1 3.4.3	Business case Investment appraisal				
Finance	3.4.2	Funding			3.10	Finance
Taxation						
Insurance						
General management areas						
Organizational behavior and Human resource management	2.1.3 4.3	Organizational structures Human resource management			2.03 2.04 2.05 2.09 2.13	Self-control Assertiveness Relaxation Efficiency Reliability
Operations	1.2.2 2.1.4	Operations Organizational process assets	1.5.1	Operations and project management	3.05	Permanent organization
Accounting and finance	4.1	Accounting				
Markets						
Information technology	3.1.3	Information management			1.08	Problem resolution
Innovation and change	3.2.4	Change management			2.07 3.07	Creativity Systems, products, technology
Governance						
Strategy	1.2.3	Strategy	1.5.2	Organizations and project management		

Organizational behaviour and Human Resource Management: Elements of organization behaviour include: work and organizational design; organizational learning; leadership; team development; individual empowerment and motivation. Elements of human resource management include: assignment, appraisal, reward, development, dispersal, terms and conditions of employment and industrial relations.

Marketing and Customers: Marketing is the process by which an organization identifies its customers the products they want to buy, and how to influence their buying habits. There are ways of identifying the marketing mix (the four P's: product, price, promotion and place of sale), and the product portfolio, and making improvements to both. Marketing is significant to projects in two ways. The project-based firm, selling bespoke products and services, needs to identify its customers and the products and services they want to buy, like anyone else. In routine organizations, the marketing process will lead to the identification of new products, technologies or organizational structures needed to service the market, and the implementation of those changes is undertaken through projects (or at least it ought to be).

Operations: Above we have identified the processes required to manage projects. Organizations also need to define the processes required to manage their routine operations.

Information Technology: I talked above about identifying the information management needs of projects. Organizations need to identify the information needs of all their business processes across all areas of management and all functions.

Accounting and finance: Organizations must manage the cash. Firms in the private sector need to generate cash to operate and to grow, and they need to make profits to provide returns to shareholders. Organizations in the public and voluntary sectors need to ensure that they do not over-spend their budgets, and ensure that they get value for money. That will not happen by accident; it must be planned and controlled.

Innovation, technology and change: Technology may be viewed as part of operations and innovation part of marketing. I have included this separately, because I see operations as being about defining the business processes. The knowledge of the technology that adds value for the organization is a key part of its competitive advantage, and so that knowledge, that technology, should be managed carefully, and separately from routine operations. Innovation and change are essential to maintain competitive advantage. Innovation usually refers to improvements in the products and technology of the organizations, and change to improvements in the process and effectiveness of the organization.

Governance: Absolutely nothing happens in an organization without governance. In a narrow sense governance (in the private sector) is the legally defined roles of directors and the company secretary. In a wider sense governance is the process by which the organization defines its objectives, and the means of obtaining those objectives and the means of monitoring performance. It is strategic planning and implementation through projects, and it is leadership (communicating the vision, communicating the process).

Strategy: At the end we are back where we started. Projects are undertaken to help organizations deliver their strategic plans. The strategic planning process is essential for the survival of organizations, and it is the strategic planning process that generates projects. There is not one without the other, and there is no organization without either.

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Projects

In Part 1, we consider the nature of projects and their management. After an introduction to projects and project management, we look at various issues relating to the success of project management, including project strategy, the value of project management, project management maturity and auditing.

Chapter 2: Projects and Their Management

In Chapter 2, I describe projects and their management. This is of course the core topic of this book, and so it is the starting point. In this chapter I give an overview of projects and their management, by describing a theory of project management. I start with five simple premises and show that much of what we understand as project management follows naturally from those five premises. I show that if we assume those premises are correct then we need many of the tools and techniques described in this book to manage our projects.

Chapter 3: Implementing Strategy Through Projects

In Chapter 3, Aaron Shenhar and Peerasit Patanakul describe how to develop a strategy for implementing a project. Before even starting to plan a project, you should have a basic idea of how to go about it – this is the strategy. The project strategy should be driven by corporate strategy, and sets the basic framework for undertaking the project. Aaron Shenhar and Peerasit Patanakul describe the elements of a project strategy and how it should be formulated, and give an example.

Chapter 4: The Value of Project Management: Rethinking Project Management Maturity and Fit

Is it worthwhile adopting project management as an organization? In Chapter 4, Mark Mullaly and Janice Thomas describe the results of work they did for PMI® into the value of project management. They clearly demonstrated that organizations adopting project

management show value from its adoption, from among other things, improvement in the performance of projects. Value usually results from the fit of the project management methodology adopted to the organization, its context and needs, and not necessarily from the maturity of the practices adopted. Mark Mullaly and Janice Thomas discuss their findings.

Chapter 5: Maturity Models in Project Management

Unfortunately, it has been difficult to show a correlation between project management maturity and project performance. We saw in the previous chapter that it is important that the project management methodology adopted should fit the organization's needs: some organizations will need simple procedures and some more bureaucratic. However, it is still worthwhile to understand what constitutes good practice, and to try to improve the procedures adopted to meet the organization's needs for the successful delivery of projects. In Chapter 5, Ginger Levin and J. LeRoy Ward describe project management maturity. They describe how to assess maturity and the contribution of maturity to success.

Chapter 6: Auditing Projects and Programs

Is the project management we have adopted likely to lead to project success? We can audit the adoption of project management to determine if we have adopted the best project management procedures and that they are being applied on a given project in a way likely to deliver success. In Chapter 6, Martina Huemann describes project management auditing. She considers project and project management auditing, and their contribution to project governance.

Projects and Their Management

RODNEY TURNER

In the two previous editions of this book, I have started with corporate strategy and worked down to the project through programs and portfolios. However, the book is the *Gower Handbook of Project Management* and so with this edition I decided to start with projects and project management and work out from there. We need to answer a number of questions:

1. What are projects and project management?
2. What is their nature?
3. What do we use them for?
4. What do they entail, and what do they require us to do?

The answers to those questions will point to the contents of a handbook of project management. In this chapter, I attempt to develop an understanding of projects and project management based on a few simple assumptions or premises. From that I try to answer the four questions, and so show what a handbook of project management needs to cover.

Early attempts to develop a theory of project management were based on a large number of assumptions, and so were only as good as the assumptions and the definitions of the terms used in them. One of the best early attempts was by Cleland and King (1983, first edition 1968). They assumed:

- the project organization is a temporary matrix coordinated by the project team;
- projects move through a life-cycle;
- the project management process is inherently one of planning and control;
- the project organization delivers against objectives of time, cost and functionality set outside the project;
- tools such as work break-down structure and critical path analysis are useful.

The resultant theory is only as sound as the definition of the word 'matrix', and the assumptions of project life-cycle, project management life-cycle, the importance of time, cost and functionality and the usefulness of break-down and critical path analysis as tools. The theory draws upon a considerable amount of empirical evidence in its assumptions and so is only as valid as that empirical evidence.

My aim is to use just five simple assumptions or premises, and from that develop an understanding of what we mean by projects and project management. The first four premises point to the first four parts of this book. The fifth points to another handbook that will be published at the same time as this one (Lock and Scott, 2013). The five premises are:

Project: A project is a temporary organization to which resources are assigned to do work to bring about beneficial change.

Performance: The change delivered will be of value if the benefit justifies the cost.

Process: Project governance provides the structure which helps define: the objectives of the project; the means of attaining those objectives; the means of monitoring performance.

Portfolio: A portfolio is a group of projects sharing common resources. A program is a portfolio of projects contributing to a common outcome, which cannot be achieved by any of the projects on its own. The project-based organization is one in which the majority of work is organized as projects or programs.

People: The project is governed on behalf of all the stakeholders, including the owner and contractor.

The Project

The first premise defines the project:

Premise 1: A project is a temporary organization to which resources are assigned to do work to bring about beneficial change.

Figure 2.1 illustrates this premise. The project takes resources and does work to produce a new asset, the project's deliverable, called the 'output'. The output is the change. It may be a new building, a new production process, a computer system, a new organization structure, trained managers, a family holiday and so on. A very narrow view of project success says that the work of the project is finished to time and cost. A slightly wider view says that the project's output is delivered on time, at the desired cost, and that it meets the specification. This we judge on the last day of the project. But we don't want the output for its own sake. We deliver it because it will give us new competencies; it will enable us to do new things. This is called the 'outcome'. The operation of those new competencies provides the benefit we want. A wider view of project success says that the output works to provide us with the new competencies, and that their operation provides us with the benefit. This we can judge in the months following the project. The new competencies may be all we want, but with time they will enable us to achieve higher level strategic goals. That will enable us to achieve significant performance improvement. We judge whether we achieve the goals and the performance improvement in the years following the project.

Two examples of this might be:

- a) Xue (2009) describes the construction of a bridge across the Yangtze River just north of Shanghai. The goal of the project was to create economic development on the north side of the river. The area around Shanghai is the most economically developed

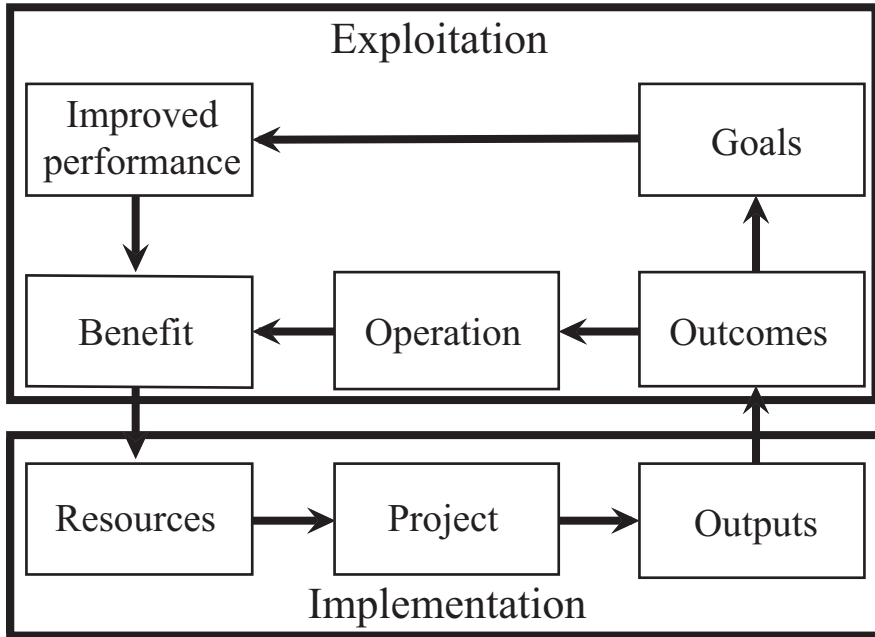


Figure 2.1 A results-based view of projects and project management

part of mainland China. Only Taiwan and Hong Kong are more developed. But the area on the north side of the river was not well developed because traffic flows across the river were poor, so people wouldn't build their factories on the north side of the river, because it was difficult to get their products to the south side to be shipped. So they had to improve transport across the river. That is the desired project outcome: better traffic flows across the river. The project output that enables them to achieve this is a bridge. The bridge was built to time, cost and specification. So traditional project managers would view that as a success. But nobody used it for two years, and so nobody built their factories on the north side of the river and there was no economic development. Somewhat late the Chinese government appointed a business change manager with responsibility for encouraging people to use the bridge, and a senior responsible owner, with responsibility for encouraging people to build their factories on the north side of the river. As a result of the work done by Xue (2009) and Lockie et al (2007) the Chinese government now ensures these people are appointed at the feasibility stage of the project, to work throughout the project to ensure that the output will work to deliver the outcomes, and that with time the goals will be achieved.

- b) The marketing department of a company identified that it could improve its marketing practices (outcome) and that would enable the company to increase its profits (goal). The suggested solution was a customer requirements management system, CRMS (output). The marketing department asked the information systems department to deliver a CRMS. At that point all communication between the two departments ceased and the IS department went away and delivered an industry standard CRMS to time, cost and specification. A year later the marketing practices still hadn't improved

and the company was not making the improved profits that justified the cost of the system. The marketing department said yet again the IS department had failed. But no, yet again the marketing department had failed. They hadn't worked with the IS department in the feasibility stage to determine how the system (output) would be used to deliver the desired improvements (outcomes) and make any necessary tailoring of the system, and the marketing department hadn't appointed a business change manager from the marketing department, to ensure that the system was used to deliver the desired outcome and thereby achieve the desired goals.

Three terms in Premise 1 need defining, and in doing so, it points to the nature of a project.

A TEMPORARY ORGANIZATION

Whenever people gather together to do something they form an organization. So a project is an organization; that is axiomatic. All we are saying is it is temporary. People have challenged the definition of a project as a temporary organization:

1. Some projects are not so temporary. In the extreme, some projects have lasted hundreds of years. The most extreme I have heard about is the Rhine to Danube Canal which was 1,200 years (sic) from first works to final completion.
2. Other people say that all organizations are temporary; none last for ever. The oldest organization I know about is the Roman Catholic Church which is 2,000 years old. That is temporary on some time scales. The average Fortune 500 company lasts 50 years which is less time than the largest of projects.

The response to both these objections is that with projects the intention is they should be temporary. The project is created to bring about change, and when that change is achieved, the project is disbanded, whereas with other organizations the intention is they should be permanent (though the likelihood is their existence will be transient). The difference in intention (a social construct) produces a different approach to the management of a temporary versus permanent organization.

Ralf Müller and I (2003) also differentiate between a temporary task given to the routine organization and a project. A temporary task can be unique, novel and transient, but it is undertaken by the routine organization, by people who don't change their job function to do the task. For instance when I take my car to be serviced, the service is unique, novel and transient, but it is performed by the garage as part of their routine work, so it is temporary task, not a project. For a project, we create a temporary organization, and give people new functions for its execution. Many definitions of a project describe it as a temporary task. For instance the Project Management Institute, PMI, (Project Management Institute, 2013) describes it as a temporary endeavor. But I think it is important to differentiate between a temporary task given to the routine organization, and a project which is a temporary organization created for the purpose of doing the work to bring about the change.

Defining a project as a temporary organization sets Project Management firmly as part of Organizational and Management Theory and suggests we can draw on ideas from there to enlighten our understanding of projects. It also leads to our first conclusion.

Conclusion 1: Project Organization Management, or Integration Management (Chapter 13), is an inherent component of Project Management.

There are other views of a project:

A NEXUS OF CONTRACTS

It has been suggested that a project is a nexus of contracts. But every organization can be viewed as a nexus of contracts (Jensen, 2000). So a project is just a temporary nexus of contracts. Some contracts will be informal; the word 'treaties' is sometimes preferred. But some will be formal legal contracts and so Project Contract Management and Procurement is an inherent component of Project Management.

Conclusion 2: Project Contract Management and Procurement (Turner, 2003) is an inherent component of Project Management.

AN INFORMATION PROCESSING SYSTEM

Graham Winch (2005) suggests that a project is a system for processing information. However, that view is encompassed by Premise 1. Information is a resource, which is assigned to (and managed by) the temporary organization. That means Information Management is an inherent component of Project Management.

Conclusion 3: Information Management, including Communication Management (Lock and Scott, 2013) is an inherent component of Project Management.

So far we have shown that three of the nine of PMI's body of knowledge areas – Integration Management, Contract Management and Communication Management – are an inherent part of project management.

THE BENEFICIAL CHANGE

The two examples above illustrated that it is necessary not only to have a project manager to deliver the output, but also a senior responsible owner (Cabinet Office, 2011), to ensure the output is used properly to achieve the outcome and with time achieve the goal.

Conclusion 4: Benefits Management (Chapter 8), Requirements Management (Chapter 9) and Quality Management (Chapter 12) are inherent parts of Project Management.

The project consumes resources, which costs money. We define the owner as the person who provides the money to buy the output and receives benefit from its operation. (Throughout this chapter, whenever I say 'person' I may mean a natural person, a human being, or a legal person, or an organization). The owner pays the money to a contractor who does the work; effectively the owner buys the project's output off the contractor. The owner may delegate operation of the asset to operators or users. The owner may gain the benefit from the operation of the output directly. Or the output may produce some

product or service, and the owner gains their benefit by selling that product or service to third parties. So we have defined four inherent roles:

Role 1: The owner, who buys the project's output and receives the benefit from its operation.

Role 2: The contractor, who receives money from the owner to do the work to deliver the asset or output.

Role 3: The users or operators, who operate the project's outputs on behalf of the owner to produce the outcome, product or service desired.

Role 4: The consumers who buy a product or service produced by the operation of the asset.

THE WORK

In order to deliver the desired outcome or asset, Premise 1 suggests it is necessary to do work. Premise 1 thus implies a break-down structure, Figures 2.1 and 2.2, and to define a project, each level of this break-down must be defined.

Conclusion 5: Break-down Structure is an inherent component of projects.

To define a project we need to define

- the expected outcome, benefit or purpose;
- the output, facility or asset that will enable us to achieve that;
- the work required to deliver the output.

Projects are fractal. The asset will consist of components, each requiring work to deliver them. Each component and each element of work to deliver a component will have the features of a project in that it will be a temporary organization requiring resources to deliver beneficial change, namely the ability to do other work and achieve the overall asset. Further the components will have sub-components, and so on.

Conclusion 6: Product and Work Break-down Structure are inherent components of projects.

The work of the project needs to be managed. Thus Scope Management is inherent. In order to manage the work we need to define the output and its components at all levels of break-down, and the work at all levels of break-down. Thus the tools used for managing scope will include product and work break-down. But we need further tools to help us define and manage those. Configuration Management is a tool with appropriate features, which has been shown from empirical evidence to perform that task (Turner, 2009).

Conclusion 7: Scope Management (Chapter 10), is an inherent component of Project Management, and Configuration Management is a tool with the appropriate features which has proved useful for managing scope.

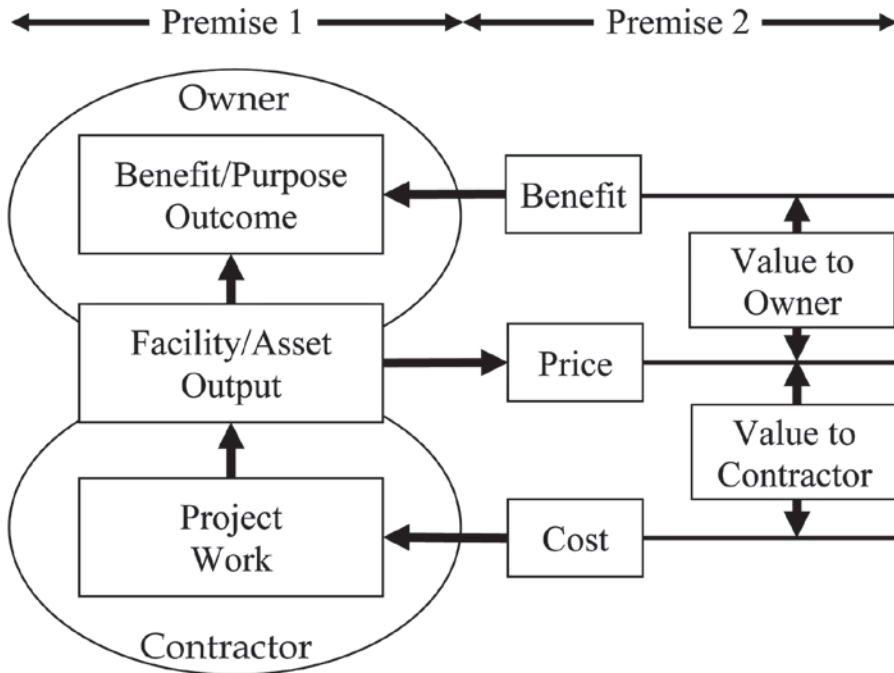


Figure 2.2 Three essential levels of a project

THE RESOURCES

Premise 1 says that resources are required to do the work. Indeed Premise 1 says the project is an organization so people are involved by definition.

Conclusion 8: Human Resource Management (Lock and Scott, 2013) is an inherent part of Project Management.

Resources can include materials, plant and equipment and financial resources (money). These resources need to be managed. In order to plan the resources required it is necessary to define them at each level of work and product break-down. Thus organization break-down is an inherent tool for managing resources. At any level of break-down, it will be useful to define which resources will perform which duties at a given level of break-down, either to do work or deliver components of the asset. A Responsibility Chart is a tool with appropriate features, which has been shown from empirical evidence to perform that task (Turner, 2009).

Conclusion 9: Resource Management (Chapter 17) is an inherent part of Project Organization Management.

Conclusion 10: Organization break-down is an inherent tool for managing resources, and Responsibility Charts are a tool with the appropriate features which has proved useful for managing resources and project organization.

A key resource is money. Those discussed above are direct costs. But there are also transaction costs associated with the creation of the temporary organization, and to manage the contracts and treaties. There are also economic costs such as inflation and taxation. Thus cost break-down is inherent. Further, 500 years of theory from Cost and Management Accounting says that in managing cost it is necessary to monitor the volume of work done and the cost per unit of work. I have shown that when applied to Project Management this results in Earned Value Analysis (Turner, 2009). Thus another management discipline (Accounting, Finance and Economics) suggests that EVA is the appropriate tool for managing cost.

Conclusion 11: Cost Management (Chapter 16) and Financial Management (Turner, 2004) are inherent components of project management, and Earned Value Analysis (Chapter 16) is an appropriate tool for managing costs on projects.

Conclusion 12: Cost break-down (Chapter 16) is an inherent tool for managing costs.

UNIQUE, NOVEL AND TRANSIENT

It has been said (Turner, 2009) that projects are unique, novel and transient:

- Every project is different from every other project.
- The work of the project is novel.
- The project has a transient existence.

The third statement is part of Premise 1. The first is a tautology. Every organization is unique, no two are the same, whether projects or routine organizations. But with a project we expect the work to be non-routine; that is the work of the project will be unlike anything we have done before. Some projects are more or less routine than others. A popular categorization of projects defines four types of project (Turner, 2009):

- Repeaters: virtually routine batch processing;
- Runners: quite similar to previous projects;
- Strangers: essentially different from previous projects but with some common elements;
- Aliens: unlike anything we have done before.

If the work of the project is non-routine, there is some uncertainty about whether the work will deliver the desired output, and whether the output will operate properly to deliver the desired outcome. This suggests that this uncertainty or risk needs to be managed.

Conclusion 13: Risk Management (Chapter 18) is an inherent component of Project Management.

From Premise 1, I have shown that eight of the nine of PMI's body of knowledge areas (Project Management Institute, 2013) are an inherent part of project management, in the order we first encountered them:

- Integration Management;
- Contract Management;
- Communication Management;
- Quality Management;
- Scope Management;
- Human Resource Management;
- Cost Management;
- Risk Management.

We have also seen that many of the popular tools, such as product, work, organization and cost break-down are also inherent.

The Performance of the Project

The second premise defines what we mean by the value of the project, and thus it introduces the concept of performance.

Premise 2: The change delivered will be of value if the benefit justifies the cost.

There are two major parties making a judgement of the value of the project; the owner and contractor, Figure 2.2. The owner pays the contractor a price to buy the asset (change or output), and the contractor spends some of that price, the cost, to do the work. The asset will be of value to the owner if the benefit they receive from the operation of the asset justifies the price they paid for it. The project will be of value to the contractor if the price is greater than the cost. The benefit and the price may include intangibles; they need not be purely financial. For the rest of this discussion I focus on the value to the owner.

Thus before the project starts the owner will want to be convinced the project is worthwhile and conduct investment appraisal to assure themselves of that. The theory of accounting, finance and economics suggests many investment appraisal techniques, such as discounted cash flow or options pricing. Different ones are appropriate in different circumstances.

Conclusion 14: Investment Appraisal (Turner, 1995) is an inherent component of the financial management of projects.

The owner will also want to optimize the value of the project – that is to obtain the best benefit possible for a given cost. Thus they may want to undertake Value Management to optimize the ratio of benefit to cost.

Conclusion 15: Value Management (Chapter 11) is an inherent component of Project Management.

Completing the project within a certain timescale will also optimize the value. There are several reasons for that, including:

- The theory of accounting, finance and economics tells us there is time value of money. The earlier the benefit is obtained the higher its value.
- Sometimes the benefit can only be obtained in a limited time window. The earlier the project is completed in that time window the greater will be the benefit.
- Sometimes the benefit can only be obtained on a certain day. This is especially true for sporting or cultural events, or scientific conferences. The project must be completed by that day or the benefit is lost completely.
- Some costs are time dependent. Many indirect costs are proportional to time; the longer the project takes, the greater they will be. Some direct costs are inversely proportional to time; the shorter the project is, the greater they are. Thus there is a time that optimizes the cost of the project and another that optimizes the ratio of benefit to cost.

The project is a temporary organization, and so to manage the time it is necessary to define and control the start and finish dates, and communicate those to the people involved in the project. But the project is fractal, and so it will also be necessary to plan and control the start and finish dates of work elements and to communicate them to the people involved in those work elements. Anecdotal evidence suggests that bar charts (Gantt charts) are a useful tool for planning, communicating and monitoring the schedule. Mathematical theory suggests that Critical Path Analysis can be used to plan the schedule, but it is just a suggestion.

Conclusion 16: Time Management (Chapter 15) is an inherent component of Project Management, and bar charts are a tool with the appropriate features which has proved useful for managing the timescale of a project.

Time management is the ninth of the PMI body of knowledge areas, and so we have now seen that all nine are inherent. However, we have also seen that other body of knowledge areas such as Benefits Management and Requirements Management are also inherent. Further, we have seen that every chapter in Part 2 describes an inherent feature of project management. We now turn our attention to the management process.

The Process of Project Delivery

To introduce the management process, I start with a definition of project governance, and for that I adapt the OECD definition of governance (Clarke, 2004):

Premise 3: Project governance provides the structure which helps define:

- the objectives of the project;
- the means of attaining those objectives;
- the means of monitoring performance.

Premise 1 implied it is necessary to define the objectives and the means of obtaining them. What Premise 3 adds is that governance provides the structure to do that and also to define the means of monitoring performance. Premises 1 and 3 together define Project Management:

Conclusion 17: Project Management is the means by which the work of the resources assigned to the temporary organization is planned, managed and controlled to deliver the beneficial change.

PROJECT LIFE-CYCLE

Premise 3 suggests there is a project life-cycle. On its own, it suggests that there are three inherent steps to the project life-cycle:

- Definition: when the objectives are defined;
- Design: when the means of obtaining those objective are defined;
- Execution: when the work is done and performance monitored.

Combining Premises 1, 2, and 3 suggests that there are five inherent steps in the project life-cycle:

- Concept: when possibility of beneficial change is first identified, the outcome (desired benefit) and possible outputs (project deliverables) to achieve that outcome are identified.
- Feasibility: when possible means of obtaining the outputs are identified, and their feasibility and comparative values assessed, and one chosen for further development.
- Design: when definition of the desired outputs and outcomes is refined, the means of achieving them defined and the value to the owner proven.
- Execution: when the work to deliver the output is undertaken and performance monitored.
- Close-out: when the output is commissioned and handed to the owner or users for them to operate to produce the desired outcome.

Some people suggest that not all projects have a life-cycle, and quote agile programming. I disagree. The life-cycle can take place in strict series, sometimes it will overlap as in fast-track, sometimes stages will run in parallel, sometimes stages will be repeated and sometimes (as in agile programming), they will be cyclic. However, what is usually the case is the five steps above are not one project, but typically two or three. The fourth edition of the PMI PMBOK recognize this (Project Management Institute, 2013). Concept and feasibility are usually a separate project. Then design, execution and close-out may be one project or two, with design conducted separately in the latter case. But the project life-cycle is inherent.

Conclusion 18: The project life-cycle (Part 3) is an inherent part of project management.

Premise 3 also identifies four additional project roles, Figure 2.3.

Role 5: The sponsor is the person who defines the objectives of the project, the desired outcome (benefit) and defined output (deliverable, facility or asset). He or she identifies that there is the ability to obtain benefit from the change which provides value, and sources the resources including money to invest in the change.

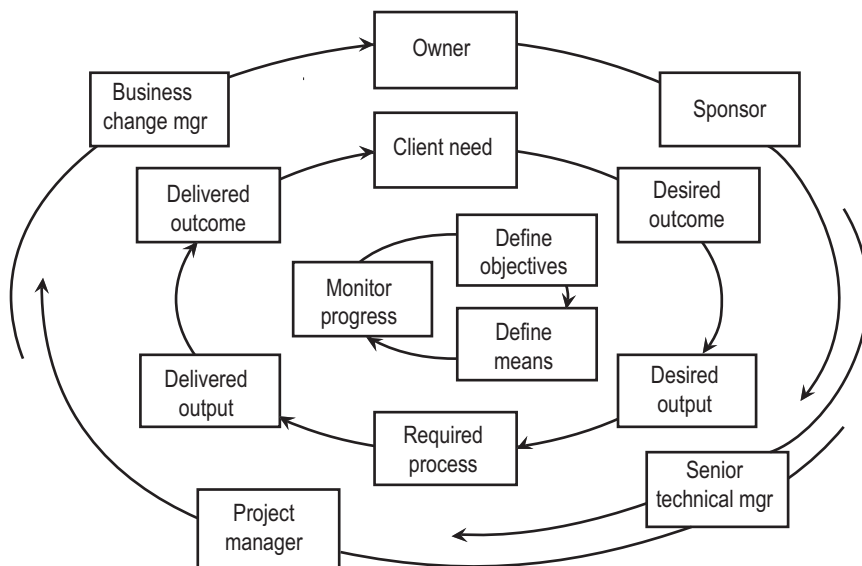


Figure 2.3 Four governance roles of projects

Role 6: The senior technical manager works with the sponsor, especially in the feasibility stage, to define an output able to deliver the outcome, and to assess its financial and technical feasibility.

Role 7: The project manager is the person who manages the design of the method of delivering the output and manages the process of its delivery.

Role 8: The business change manager is the person who monitors performance of the output after project completion to ensure the desired outcome is achieved.

The project manager may also be the steward, and the project sponsor may also be the broker, but not necessarily so.

MANAGEMENT CYCLE

Premises 1 and 3 also suggest that there is a management cycle, with four inherent steps:

- **Planning:** the work of the temporary organization is planned.
- **Organizing:** the resources required to undertake the work are identified.
- **Implementing:** the work is assigned to the resources.
- **Controlling:** performance is monitored, and corrective action taken to ensure the desired output (change) is obtained and that it is capable of delivering the desired outcome (benefit).

The PMI PMBOK (Project Management Institute, 2013) has a management process with five steps. To the four above they add starting processes.

Conclusion 19: The Management Cycle is an inherent part of Project Management. It can be said that there are 11 body of knowledge areas in PMI's PMBOK. We have now encountered the other two, the project life-cycle and management processes.

QUALITY MANAGEMENT

Conclusion 4 suggested that quality management is an inherent. Premises 1 and 3 suggest what the elements of quality management are: we need to manage both the quality of the objectives, the output and outcome, and the means of obtaining them, the management process. Premise 3 also tells us that we need to define the means of obtaining our quality objectives, quality assurance and the means of monitoring their achievement, quality control. Thus we deduce the need for four of the five elements of my five element model for managing quality (Turner, 2009), and see that quality management comprises four components:

Conclusion 20: Quality management includes:

1. quality assurance of the project's outputs;
2. quality control of the project's outputs;
3. quality assurance of the management process;
4. quality control of the management process.

The fifth element in my model (Turner, 2009) is attitudes to good quality in the organization.

Portfolios of Projects

Many projects take place in portfolios of projects. There are many ways of grouping projects, but 'portfolio' is a term encompassing them all, but also having a specific meaning. We identify three project groupings here:

Premise 4A: A portfolio is a group of projects or programs sharing common resources.

Premise 4B: A program is a portfolio of projects contributing to a common outcome, which cannot be achieved by any of the projects on its own.

Premise 4C: The project-based organization is one in which the majority of work is organized as projects or programs.

A company's total investment activity is called its investment activity. But that may be made up of large projects, programs and portfolios of smaller projects and programs. A portfolio can comprise projects, programs and portfolios of small projects; a program can comprise projects, portfolios of smaller projects and some elements of routine operation. Portfolios are considered in Chapter 27 and programs in Chapter 28.

People suggest a difference between a project-based and a project-oriented organization. Anne Keegan and I (2001) suggest project-based organizations are such perforce. The products or services they supply are bespoke, and so they necessarily undertake projects to deliver them. Martina Huemann (Chapter 29) suggests project-oriented organizations

are such by choice. They choose to use temporary organizations to do their work. Premise 4C covers both. The project oriented organization and its projects, programs and portfolios need governance, and Ralf Müller describes that in Chapter 30. A specific tool of governance is the project office and Brian Hobbs and Monique Aubry describe that in Chapter 31. We call it the project office, but it can be responsible for projects, programs or portfolios. The Office of Government Commerce (2009) refers to PM3O.

The People Involved

There are two parts to the OECD definition of governance (Clarke, 2004). I used only one part in Premise 3. The other leads to our final premise:

Premise 5: The project is governed on behalf of all the stakeholders, including the owner and contractor.

The governance literature suggests that there are two paradigms for the governance of the corporation:

- One suggests that it should be governed for the benefit of the shareholders only, and that the board of director's sole objective is to maximize shareholder value.
- The second suggests that the corporation should be governed on behalf of a wider set of stakeholders, including the staff, customers and local community as well as the shareholders, and that all their needs should be balanced against each other.
- There is evidence that those boards of directors which look after the wider set of stakeholders actually maximize shareholder value *en passant*, whereas those who focus just on the interests of shareholders do not achieve such good results.
- The same two views can be taken for projects.
- The project manager's sole responsibility might be to maximize the value of the project for the owner.
- Or his or her responsibility might be to a wider set of stakeholders to maximize the value for all of them.

Ralf Müller and I (2007) showed quite clearly that project managers who take care of a wider range of stakeholders achieve better results. Taking care of team satisfaction had the biggest impact on projects success, user satisfaction the second biggest impact and customer satisfaction the third biggest. Projects are coupled systems. Making a change in one area can have an impact in another. So you do not optimize the whole project by optimizing each bit of it. You have to optimize a project as a whole, and that almost certainly means balancing the interests of stakeholders across the project. For instance, Figure 2.2 shows that if we try to increase the profit to the owner, by reducing the price, you reduce the profit to the contractor, and if you take that too far it is of no value to the contractor to do the work, and the project does not happen. On the other hand, if you try to increase the profit to the contractor by increasing the price, you reduce the value to the owner, and if you take that too far it is of no value to the owner to do the work and so the project does not happen. What is best for the project is to achieve a balance between the owner's and the contractor's interests.

Conclusion 21: The project should be optimized for all parties, not just one, the owner, and so the project should be undertaken as a partnership between all the parties involved, but particularly the owner and contractor.

Ralf Müller and I (2004) have shown that forming a partnership between the client and the project manager, where they work cooperatively and rationally towards mutually beneficial outcomes is a *necessary* condition for project success. Unfortunately it does not always happen.

The engagement of stakeholders in the project is considered in Chapter 14.

Concluding Remarks

From just five premises, I have shown that all the elements of Parts 2 to 4 of this book are inherent parts of Project Management. They do not need to be assumed as Cleland and King (1983) did. I have shown that the use of some common tools and techniques are inherent, and some can be derived from other management disciplines. The concepts presented here do not preclude existing theories, such as the systems approach (Cleland and King, 1983), the process approach (Turner, 2009) and the project as an information processing system (Winch, 2005). But they can be overlaid on this theory to provide additional insights. They do not need to be the primary focus of the theory, nor should they be. The concepts presented here set Project Management firmly as part of Organizational and Management Theory, enabling the discipline to draw on insights from other management disciplines.

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Implementing Strategy through Projects

AARON SHENHAR AND PEERASIT PATANAKUL

Strategic project management is gradually becoming a popular and growing trend within the discipline of project management. The general idea is that project management teams must learn how to deal with the business aspects of their projects, as well as better support their company's business strategy and sustainability, rather than just focusing on meeting traditional time, budget and performance goals. Although not new and gaining popularity, it seems that strategic project management has not yet become an explicit and widely used approach in the practice of project implementation. One of the concepts that was mentioned as an important element is *project strategy*; however, no universal framework or even a clear definition of what project strategy is, has so far emerged. The purpose of this chapter is to provide a framework for developing, studying, planning and implementing the concept of project strategy. The chapter will first discuss the general evolution of the concept of strategy and the need for strategy at the project level. We will then suggest a response to the questions "*What is project strategy? What are its components?*" Empirical evidence from a real-life project will demonstrate how specific strategy components can be applied to project planning and implementation. Ultimately, the goal is to provide a framework and guidelines for organizations and managers on how to plan their projects with a strategic focus in mind and how to manage them in a more strategic way for better business results.

Strategic Project Management

For decades, researchers and practitioners have been searching for a better way to manage projects since both communities realized that many projects are still managed in an ineffective way (Williams, 2005). Many seem to agree that the traditional emphasis on meeting time, budget and project performance (or scope) goals is no longer sufficient to guarantee the achievement of organizational business objectives (Shenhar and Dvir, 2007). A new trend is thus emerging, collectively called 'strategic project management' (Cleland, 1998; Shenhar, 2004). Based on the realization that projects are, most of the time, initiated to achieve business results, strategic project management is a concept that helps organizations, project teams, project managers and executives focus project execution on achieving business results without discarding the traditional mindset. Meeting operational goals and efficiency has always been and will continue to be

important for project success. But in the modern organization, project teams should learn how to plan and execute their projects, not just for meeting time and budget goals, but also for creating customer satisfaction, and above all, achieving business results.

One of the central building blocks of strategic project management is likely to be the concept of 'project strategy'. Project strategy helps guide project participants during project planning and execution processes to be more business-focused for better achieving business results and for better supporting the organization's business strategy (Arto, Kujala, Dietrich and Martinsuo, 2008). In fact, it can be argued that project strategy is the 'missing link' in project planning. But what exactly is project strategy? How is it defined? And what are its components and constructs? Prior to discussing project strategy, the concept of strategy in general will be discussed in the next section.

THE CONCEPT OF STRATEGY

The concept of strategy in society was originated in the early days of writing about war, among them famous works of Sun Tzu, who first wrote about strategy around 400 BC, and von Clausewitz, analyzing the Napoleonic wars in the late eighteenth century. Early war philosophers had no difficulties in defining strategy. Strategy was a clear concept, and it was focused only on how to win a war or a battle. It was only in the modern era, that the context of strategy has been expanded to additional aspects of life. The term strategy is now used in different environments and in much broader contexts. In the organizational arena, a typical definition of organizational strategy is, 'top management's plans to attend outcomes consistent with the organization's missions and goals' (Wright, Pringle and Kroll, 1992). In a wider perspective, Starbuck (1965) claimed that when dealing with strategy, 'one could legitimately discuss everything that has been written about organizations'. Strategy, therefore, on one hand, has been claimed to be limited to top management's planning, while on the other hand it includes everything the organization does.

To cope with the multiple ways of looking at strategy, several scholars suggest some framework or perspectives of strategy. Mintzberg (1994), for example, has offered five different perspectives of strategy (The five Ps). According to Mintzberg, strategy is one or more of the following:

- A *plan*; a direction of how to get from here to there;
- A *pattern* of consistent behavior over time;
- A *position*, created by a different set of activities and typically results in a unique set of products in particular markets;
- A *perspective*; the fundamental way of doing things;
- A *ploy*; a deception, a specific manoeuvre intended to outwit an opponent or competitor.

Porter (1980) established a foundation for the concepts of competitive analysis, a set of generic strategies, and the notion of the value chain. In particular, his generic strategies include: *cost leadership*, *differentiation* and *focus*. He claimed that an organization must make a choice among these to gain competitive advantage. Porter's work created a continuous debate on the essence of strategy, whether companies should focus on one

strategy or they could combine different and sometimes even opposing strategies. In a later work, he (Porter, 1996) re-described strategy as:

the creation of a unique and valuable position, involving a different set of activities

Porter claimed that strategy is *doing different things, or doing the same things differently*, and emphasized that operational effectiveness is *not* strategy. It must be a given in the modern organization, and could no longer serve as competitive advantage. In addition to Porter's generic strategies, several other typologies have been proposed to describe different strategies (for example see Miles and Snow, 1978). The concept of strategy discussed above can now lead us to the conceptualization of project strategy.

CONCEPTUALIZING PROJECT STRATEGY

Since the 1950s, project management scholars have focused on the development of tools, techniques and procedures that would assist in managing projects effectively. However, as mentioned, not until recently did studies start to shift the focus from traditional project management to new research agendas on the strategic aspects of project management. Scholars realized that even when project management procedures have been carefully followed, still, the project business outcomes could be disappointing (Williams, 2005). How then, can one inject the concepts of strategy into the project management experience? What should project strategy be like?

The contemporary views about strategy have made the field quite broad, and probably too vague. In the modern organization, every action, every plan and almost every decision is casually called today *strategy*. Yet, projects are about focus and about specific activities to achieve specific goals. In order to conceptualize the idea of project strategy, one must narrow the scope and discussion about strategy. Instead of talking about plans to attend outcomes, or courses of actions, we propose returning to the original idea, namely, the military arena. In the military environment strategy simply and unmistakably means, *how we are planning to win*. The same principle should apply to projects. As most projects are executed in a competitive environment, typically, the project outcome – a product, a process or service – is likely to face competition in the market from other products or services. Thus, for each product or service one should ask, how is it going to stand out in the face of competition, and how are we going to beat our competitors? A project's product must have some appeal, or as the common term used in a business context, it must have *competitive advantage*. Thus, in today's environment, the project objective is not just to build the product or service, but also to create competitive advantage. And just as in war, project strategy is about winning – winning the market battle with the specific product or service produced by the project. Project strategy is the specific way that relates to the project's unique approach, direction and the path that is planned in order to make this winning happen. In many cases though, projects may not always be carried out in a competitive environment. Even so, projects still need to bring in value. Project strategy, then, simply becomes the specific way in which the project is going to create new value.

A good strategy should involve both effectiveness *and* efficiency. Obviously, winning a war involves choosing the right battles, but it also involves knowing how to fight them. Thus, in an analogous way, winning project battles means first of all picking the right products. But this step represents only one part of the way toward winning; full winning

should also include doing projects right. Project strategy should, therefore, be both about effectiveness – that is, making the right choices and defining your product the best way; and about efficiency – executing projects in the best way possible.

What, then, distinguishes a project strategy from a project plan? Each project must have a plan for execution, for getting things done. Project strategy should be at a higher level than a plan and should, in fact, drive the plan. Project strategy should involve the perspective, the guideline, the attitude, the direction and the policy, which leads to the actual plan, and which will promote a pattern of behaviour that is needed for winning and succeeding. Once the strategy has been established, plans include the tactical decisions about activities that should be carried out, and involve resources, timelines and deliverables.

What Is Project Strategy?

The previous discussion is guiding us to contend that project strategy must be a rich construct that may help organizations and managers initiate, plan and execute a project with the intention of achieving business results. Using most of Mintzberg's five Ps model, a project's strategy will include a 'perspective' (the background, the reason and the general idea), a 'position' (a goal we want to achieve, and how will we know that we have achieved it) and a 'plan', or guidelines (that is, how will we will do it in order to achieve what we hope to). In simple words, a project strategy will include the 'Why', the 'What' and the 'How' to create the best competitive advantage and value from the project. More formally, we define project strategy as:

Project Strategy is the project perspective, position and the guidelines on what to do and how to do it; to achieve the highest competitive advantage and the best value from the project.

This definition is based on three major parts: perspective, position and guidelines. The three parts are expanded into eight implementable components: Business Background, Business Objective, Strategic Concept, Product Definition, Competitive Advantage/Value, Success and Failure Criteria, Project Definition and Strategic Focus (Patanakul and Shenhar, 2012). Figure 3.1 illustrates project strategy and its components.

THE PERSPECTIVE

The first 'P' is the perspective part of project strategy. It presents the background, the environment; the reason 'why' we initiate the project, the overall objective and what is the concept that will guide the project's experience. It includes the following three elements:

Business Background: defines the business environment, the reason and opportunity behind the project. Business background typically starts with describing the environment, identifying the customer and/or user. It then describes and articulates their need – what do they want, what is their problem, what could help them and how will this need be addressed, namely, is there a feasible way to solve the customer's problem, and what is it? Next, the background will state how this need could be addressed, and finally, what is the business opportunity associated with this need and solution.

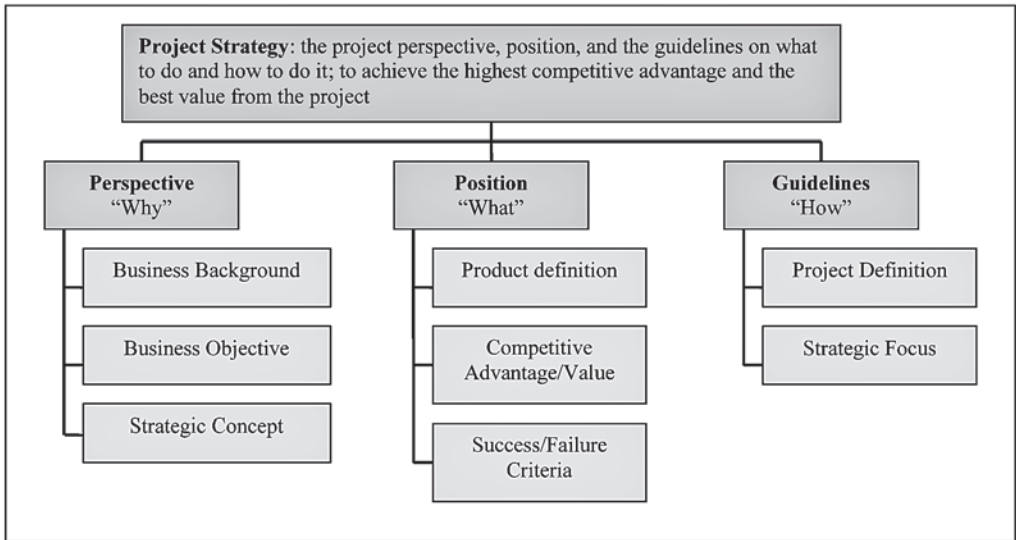


Figure 3.1 Project strategy and its components

Business Objective: states the ultimate business goal of the project. Typically, it expresses the long-term business status that will be achieved when the project is completed.

Strategic Concept: describes the general strategic idea behind the project's expected business and how this idea will be aligned with the company's business strategy. Specifically, it is the guiding strategic principle that would dominate the project's plan and execution, and will guide the project's product creation and deployment.

THE POSITION

This is the second 'P', the position that will be achieved after the project has been completed. The position part involves the 'what' we expect to get, once the project has been completed. It is the 'state of the world' and the position that the company will achieve in its business environment, after the project ends. The position includes the following parts:

Product Definition: describes the specific product that will be available once the project is completed. It defines the kind of product, its scope and how it will be used. A product definition may include the product's concept of operation, as well as its functional requirements and technical specifications.

Competitive Advantage/Value: is the most important part of the project's strategy. It articulates the specific argument as to why the customer would buy the product, and why is it better than alternatives, such as, competitive products, previous products or other ways customers have employed before to deal with their problem or need. Competitive advantage may be in more than one area, and be based on a combination of product attributes, functionality, performance, quality and reliability, purchasing and life-cycle cost and so on. In some cases, a map could articulate the competitive advantage where the attributes of the product are displayed compared to competitive and previous products. Finally, this component will also discuss the value created by the project. First, in non-competitive

environments, competitive advantage will be replaced by the value delivered to customers and users. Second, it will also articulate the value created by the project to the performing organization. How will this project contribute to our business and long-term strategic goals?

Success and Failure Criteria: determines the expectations from the project. It defines the metrics that will assess success or failure. It makes things clear in advance: how will the project outcome be assessed and what are the difficulties and risks to be aware of. The criteria will first outline in detail the success dimensions against which project's outcome will be judged. Typical success dimensions that have been offered include, efficiency (time cost and performance), impact on the customer, impact on the business and direct success (see Figure 2.1) and preparing for the future (Shenhar, Dvir, Levy and Maltz, 2001). In specific cases projects may need to define their own success dimensions for their unique situation (such as getting FDA approval for clinical trials of a new drug, or getting a city's government go-ahead or approval for a new site development). In addition, the expected business success could be described in terms of a business plan: the projected sales and growth pattern of sales over a period of several years. In other cases it may include more general statements about projected market performance. In addition, since projects present risk and difficulty, this part should also outline the constraints faced in the project and the major risks expected, that is what can go wrong, and what will be considered a project's failure.

THE GUIDELINES – (PLAN)

The last major part of project strategy involves the 'how' – 'how are we going to make this happen'. It is also the last 'P', which designates the 'plan' of action to achieve the project results, as well as the behaviour that is needed to get there. The guidelines include two parts, the project definition, and the strategic focus.

Project Definition: defines the project that will be put in place to create the product. Most of the project definition is devoted to a classical definition of a project:

- The project's scope, which defines the final deliverables of the project;
- The work that will be done;
- What will not be done on the project.

Typically, it includes a statement of work (SOW), which will later form the basis for a project work breakdown structure (WBS), the general time frame that it will take, the approximate cost and the manager and team that will undertake the work. In addition, project definition could indicate the uniqueness of the project, that is, the project's type, based on a possible typology of project types in the organization, for example, Shenhar and Dvir's 'Diamond' (2007). Using a Diamond framework the project's type is defined by its novelty, technology, complexity and pace levels.

Strategic Focus: is the last component of the project strategy, and the second most important. It creates the mindset and guidelines for behaviour to achieve the product's competitive advantage and value. The right strategic focus translates the desired competitive advantage into guidelines for project participants. These guidelines help focus activities and foster behaviour that will make the competitive advantage a reality. The right strategic focus should create in the project an environment of relentless pursuit of competitive advantage (Poli, 2006). Strategic focus may include among other things the following items:

- *Guidelines for Behaviour*: rules and guidelines that would direct behaviour and decision-making. The right pattern of behaviour will cumulatively contribute to the expected competitive advantage.
- *Policies*: the right policy will drive team member decisions and activities that are consistent with the competitive advantage, and will free the managers from dealing with every detail. The policy will articulate how to manage and leverage company strengths, exploit professional expertise, use internal synergies and build external alliances.
- *Processes*: the specific processes that will consistently support the creation of competitive advantage.
- *Roles and Responsibilities*: the specific roles that different team members will take on to foster the creation of competitive advantage. They might include roles of: responsibility for cost, ease of use or product performance.

Even though some of the strategy elements mentioned above, such as product definition, project definition and success/failure criteria, are not new to the discipline of project management, they were often not clearly defined to reflect the business perspective and competitive advantage/value. To formulate a project strategy, all eight elements have to be defined, integrated seamlessly and support each other. To demonstrate the role of the project's strategy in actual projects, we next present the findings from a research case project, which has met and even exceeded its business objectives.

An Example of Project Strategy

This section demonstrates how project strategy is articulated and used in a real-life situation on a modern project undertaken by a company in the communications industry.

THE NETWORK COLLABORATION SYSTEM

The organization is a major telecom company that provides network services to thousands of commercial customers, with 80% of the company's business coming from 20% of its high profile customers. The company's revenue depends directly on the amount of available network uptime and bandwidth that it is able to provide in the dynamic and highly competitive world of telecommunication. The need for this project was accentuated by a major service outage for one of its biggest customers – a major financial institution. The Network Collaboration project was initiated to allow retirement of a previous manual intervention process, which was highly unreliable and notably slow, and replace it with an automated programmable software framework that could be used for faster network trouble identification, trouble assignment and trouble recovery. The customers of this project involved both internal company employees responsible for network health, as well as employees of external corporate customers who would be notified of potential network congestion or failure, so they could plan their continued business operations around such untoward incidents in advance. Finally, the company's managers and executives would also be able to effectively manage their resources and focus their groups' attention on critical problems that could affect business profitability. Project execution started by analyzing system needs and requirements, and was followed by enterprise

architecture and system design, hardware and code development and testing, deployment and production support and building a customer support organization. The project was executed during a period of 18 months by a team of 16 people, with the introduction of an interim limited-features prototype, which enabled early testing after 6 months.

The final system proved to be highly successful. It saved the company over 85% of the problem notification costs, and reduced by 50% the mean time to repair (MTTR) needed, in addition to considerable saving from reducing its network maintenance personnel.

PROJECT STRATEGY

The project strategy of the Network Collaboration Projects can be articulated through three major parts: perspective, position and guidelines, summarized in Table 3.1.

Table 3.1 The articulation of project strategy of the Network Collaboration Project

Strategy components		The Network Collaboration Project
Perspective	Business background	Increased risk of lost revenue, due to network downtime. Need to provide early alert, quick resolution and network protection. Situation provides an opportunity for creating leadership in network reliability.
	Business objective	Increase revenue due to increased uptime and reduced maintenance cost. Establish the company as leader in network reliability.
	Strategic concept	A new collaborative and automated approach to network reliability, which integrates company services with proactive feed-ins and feed-outs to customers and alerts.
Position	Product definition	Cyber availability and alert software portal that collects, stores, analyzes and shares data on network events.
	Competitive advantage/value	Easy- and quick-to-use system enabling customers to express their changing networks needs. Significantly lower MTTR and quick customer integration turn around resolution time.
	Success and failure criteria	Completion in 18 months, with first prototype in 6 months. Be able to handle at least X events per hours and X/2 notifications per hour. Revenue increase is \$Y per year. At least 80% of satisfied customers. Three fold scalable system, and ability to consolidate similar solutions in the future. Risk of launch delays, and inability to identify new threats.
Guidelines	Project definition	Design, develop, purchase and integrate front- and back-end hardware and software systems. Perform extensive test runs and modifications. Train and integrate major customer personnel. Project type: Breakthrough, System, High-tech, Fast/competitive.
	Strategic focus	Focus on customer interface and easy-to-use functionality and high performance. Build system modular and expandable. Leveraging internal strengths of experience with company's own network. Use collaboration and track requirement techniques and software.

Perspective

Business Background: defined the reason and the motivation for the project. It defined the environment, the need and more importantly, the business opportunity. The business perspective should help teams understand the big picture behind their project and enhances the sense of association with the organization while working on the project. Specifically, for the Network Collaboration project, there was a risk of losing business with a major client and, in turn, losing revenue due to network downtime. The company also saw this as an opportunity to become a leader in network reliability by implementing an early warning, quick resolution and network protection system.

Business Objective: focused the team on what was really the ultimate goal of the project beyond 'just getting the job done'. The goal in this project was to provide a better service by increasing uptime and reducing maintenance cost that would lead to an increase in revenue and to industry leadership in network reliability. Finally, the Strategic Concept clarified what approach should be taken to achieve the business objectives, and how the product was going to 'win' in the marketplace. It reflected the big picture strategy of the project and guided later the specific elements of competitive advantage and value that would be achieved once the project was completed.

The Strategic Concept: of the Network Collaboration project was based on a new collaborative and automated approach to network reliability, which would integrate company services with proactive feed-ins and feed-outs to customers and alerts. As we can see, the goal of the perspective part of project strategy is to understand and articulate the background, the environment and the reason 'why' then initiates the project, the overall business objective and what is the strategic concept that will lead to achieving the objective.

Position

The Product Definition: defines the end product of the project. That means defining the end result that customers will get at the end of the project and which did not exist at project initiation. It typically defines the kind of product and its main functions (what does it do?). For the Network Collaboration project, the product was defined as a cyber availability and alert software portal that collects, stores, analyzes and shares data on network events. Product definition articulates the result, while ...

Competitive Advantage/Value: articulates the unique product elements and reasons that will attract customers to select the company's product and not those of its competitors. The competitive advantage is directly derived from the strategic concept, but represents a more detailed and specific list of attributes that will attract customers to our product. Please note that when no competition exists, it is the value that replaces the term competitive advantage, but it serves the same function for the product's customers and users. The competitive advantage of the Network Collaboration product was the ease of use and the reduction of network downtime. These items were translated into a map of quantitative measures that described how that product is better than its competitors'.

Success and Failure Criteria: establish the metrics with which project success or failure will be judged. It articulates the short- and long-term expectations and the measures that will indicate that success was achieved. Such criteria should be quantifiable as

much as possible to allow objective evaluation of success. The criteria for the Network Collaboration project included meeting development time and cost, quality performance of product, expected increase in business and customer satisfaction (expressed by a percentage goal). Overall the position components of project strategy involve the 'what' we expect to get, once the project has been completed.

Guidelines

The Project Definition: defines the work and the effort undertaken by the project to meet the objectives and the specific focus that will create the competitive advantage. A well-defined project definition forms the basis for effective project management. The first part of the project definition is the traditional project definition. It includes a scope statement, the timeframe and ballpark budget needed. It also defines the organization, the team and the project manager that will perform the project. In addition, since one-size-does-not-fit-all, it also defines the uniqueness of the project type, which will distinguish it from other projects and help select the project management style. The Network Collaboration project definition involved designing, developing, purchasing and integrating front and back-end hardware and software systems; performing extensive test runs and modifications, and training and integrating major customer personnel. Using the Diamond model, the project's novelty, technology, complexity and pace was defined as breakthrough, system, high-tech and fast/competitive, respectfully.

Strategic Focus: defines the behaviour and policy that will guide the project execution in order to achieve the desired competitive advantage and/or value. The strategic focus of the Network Collaboration project was on customer interface, easy-to-use functionality, high performance and system modularity and scalability. The team leveraged internal strengths of experienced people within the company and focused on team collaboration and on using advanced techniques and software for tracking requirements. In summary, the guidelines of project strategy address the 'how' questions. 'How are we going to make this happen?' They also designate the 'plan' of action to achieve the project results, as well as the behavior and focus that is needed to get there.

Concluding Remarks

OUTLINING PROJECT'S STRATEGY QUESTIONS AND ANSWERS

To help develop a project strategy, Table 3.2 provides a summary of the project strategy framework in terms of what are the questions that each component is answering and the detailed elements that provide these answers.

Table 3.2 The questions and answers of project strategy

	Project strategy components	Questions	Details
Perspective – ‘why’	Business background	Why are we doing the project? What is the business perspective and motivation?	Who is the customer/user? What is the need? How we address this need? What is the business opportunity?
	Business objective	What do we want to achieve?	What is the ultimate goal to be achieved after project completion?
	Strategic concept	What is the general strategic competitive idea?	What is the guiding strategic principle that would dominate the project’s plan and execution, and will support the company’s strategy?
Position – ‘what’	Product definition	What is the product that will be created or produced by the project?	What are we producing? What kind of product is it? What is the concept of operation, and the product’s functions?
	Competitive advantage/value	How good is it? Why is it better? Why would the customer buy? What is the value for us?	What is the advantage to customer/user over: - Competitors? - Previous products? - Alternative solutions? Product cost/effectiveness How would we benefit?
	Success and failure criteria	What are the expectations? How to assess success? What can go wrong?	What are the success dimensions and measures? What are the major risks and their consequences?
Guidelines – ‘how’	Project definition	How do we do it? What is the project?	Project scope Project deliverables Project type – classification Project leader, project team Resources
	Strategic focus	How to behave? What to do to achieve competitive advantage/value? How to create a relentless pursuit of competitive advantage/value?	Guidelines for behavior Policy for managing and leveraging: - Company competencies - Professional expertise - Internal synergy - External alliances

IMPLICATIONS FOR MANAGERS AND FURTHER STEPS

The concept of project strategy has still not become an integral part of most project plans and execution practices. Although many teams understand the importance of their projects to their company's business success, they often lack a formal framework that could be applied and followed throughout the project. In this chapter, we have proposed, defined and tested a formal framework of project strategy and outlined its components. However, a few further implications should be noted.

To promote project management as a strategic activity with the explicit goal of creating a competitive weapon for organizations, the project strategy concept must be well defined, articulated and managed and continuously refined in a formal way. The formal framework of project strategy we proposed could help business leaders, project managers and project teams define and manage their projects' strategies. Using a formal document of project strategy in addition to the traditional plans will train project teams to pay attention to the business perspective, the strategic concept and above all, what the competitive advantage is that their project needs to achieve and how they can make it work.

Yet, the transition from the traditional approach to the strategic approach requires a shift in mindset of project teams as well as of higher-level managers. The concept of project strategy presented here provides a framework for discussion between teams and executives and for better connecting project and organization's strategic objectives. Without strong and explicit support from top executives, it is possible that project teams may not change their focus.

Finally, it may be that not all projects need a fully detailed and articulated project strategy. The framework we proposed might clearly fit most major strategic initiatives, but smaller and simpler projects that only involve modifications or improvements in previous products, or the fixing of a particular problem, may need only some of the elements we described. On the other hand, some projects may also require specific sub-strategies, which were not addressed in this chapter. Such strategies may involve technology, funding or logistics strategy.

Acknowledgements

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The Value of Project Management: Rethinking Project Management Maturity and Fit

MARK MULLALY AND JANICE THOMAS

Value, and particularly how it is created and captured in organizations, is an area of interest in many management disciplines (Lepak et al, 2007). Despite, or perhaps because of, the complex nature of value, a research project to understand what value project management delivers to organizations was initiated by the Project Management Institute in 2004. In May 2005 a team of international scholars and practitioners embarked on a major quest to understand what organizations invest in when they attempt to improve their practice of project management, how context influences these decisions and what benefits they receive from this investment, and then to ‘measure’ and ‘quantify’ this value. Over the next three years an in-depth, mixed methods, cross disciplinary study of 65 organizations worldwide elaborated new perspectives on the value project management can and does bring to organizations. In the process, we contributed to both our understanding project management’s value proposition and processes of value creation and capture in organizations (Thomas and Mullaly, 2008).

In the first section, we explore the definitions and theoretical underpinnings of studying value in an organizational context. We describe the conceptual model developed and then highlight the results of our study, pointing the interested reader to more detailed discussions. Next, we identify ongoing research studies which aim to test these theories and further future development of this research. We conclude by outlining emerging theories about organizational value in the context of project management. The findings of the research advanced our understanding of those aspects of context and implementation that contribute to, or detract from, the attainment of the types of value realized by organizations participating in the study. We also explore how the results of our research can be practically applied by organizations. We reframe understandings of the project management maturity model concept. In the project management field, maturity models have become prevalent as a tool for understanding capabilities and identifying improvement opportunities. Maturity models are also used as a tool for research, and a number of studies and papers have attempted to demonstrate both the relevance of maturity models as tools for assessment, and the linkage between improvements in maturity and increases in organizational performance. The research

also drew on contingency theory to explore the degree to which project management implementations are appropriate for, or 'fit', their context and the desired improvements in organizational results.

The second section of this chapter builds upon research findings to explore the relevance of maturity models as a means of evaluating organizational effectiveness and predicting performance when compared with those insights gained through the exploration of 'fit'. The alignment between maturity models and contingency theories of 'fit' are explored. The insights gained from each approach during our research are introduced. Finally, observations are offered regarding how maturity models could evolve to enhance their relevance and contribution to improving organizational effectiveness.

Investigating the Value of Project Management

The pursuit of value has been an area of interest in many management disciplines, including: general management; information systems; total quality management and human resources. (For more information see Lepak et al, 2007, and Thomas and Mullaly, 2008). During the expansion of project management in the 1990s the question grew as to what exactly could/should organizations be gaining from investment in more professional project management? The few empirical attempts to calculate the ROI of project management focus on one narrow view of project management improvement that is generally referred to as project management maturity. The work of the team led by Bill Ibbs (Ibbs and Kwak, 1997; Ibbs and Kwak, 2000; Kwak and Ibbs, 2000; Ibbs and Reginato, 2002; Ibbs et al, 2004) focused on valuing the results of investment in project management competency improvement. Others have contributed to this stream of research (Pennypacker and Grant, 2003) through survey-based research attempting to associate firm self-report data on project performance.

The Project Management Institute (PMI) furthered this line of inquiry by sponsoring a study between 2000 and 2002 seeking to identify what senior executives value in project management implementations (Thomas et al, 2002). Their results provided clear evidence that ROI was not the only meaningful or valuable result expected from investing in project management, further supporting the researchers who sought a multifaceted and balanced score card for evaluating project and project management success. Bryde (2003) derived a Project Management Performance Assessment model to be used to evaluate the performance and contribution of project management. He published the results of his survey as an effort to explore the value of project management in a way that built on the structure of the EFQM model. The study intent and constructs are interesting, but the small sample size and weakness of construct validity limits its usefulness. It be could also be argued that the explosion of project success metrics in the last 20 years (see Jugdev and Müller (2005) for a review) could be attributed to the popularity of the search for appropriate balanced scorecard metrics. Studies reported at the 2008 and 2010 PMI Research Conferences attest to the growing popularity of balanced scorecard concepts in project management research. However, few of these studies actually try to evaluate the success of the implementation of organizational project management but rather focus on developing scorecards for measuring individual project success.

Finally, we must note another stream of research that is often confounded with the value of project management research. Many researchers are tempted to focus on a single

element of project management or on the contribution of PM to project success in order to simplify the complexity of the value questions. These studies explore the contribution of training, risk management, project management maturity or the value of any one project and attempt to extrapolate to the value of project management from there. In this vein several recent studies addressed project success factors. These studies discuss for example the success factors of projects and project management for the organization (Cooke-Davies, 2002) or the influence of project management offices (PMOs) on reported project performance (Dai and Wells, 2004). Despite their importance, these studies do not result in a measure of the overall value of project management implementation, as they do not hold constant the impact of all other project management or organizational initiatives taking place at the same time.

SEEKING VALUE FROM PROJECT MANAGEMENT

Figure 4.1 illustrates our conceptual model of the value from project management and has three key constructs:

- First, what have organizations invested in order to improve their practice? Project management is clearly not the same thing across organizations; in order to understand what is providing value to any one organization, we need to identify what each organization is doing and calling project management.
- Second, what is the Organizational Context within which this project management improvement initiative is undertaken? We need to understand enough about the organization, its business orientation and environment to be able to assess the impact project management is having, isolating as much as possible contextual variables.

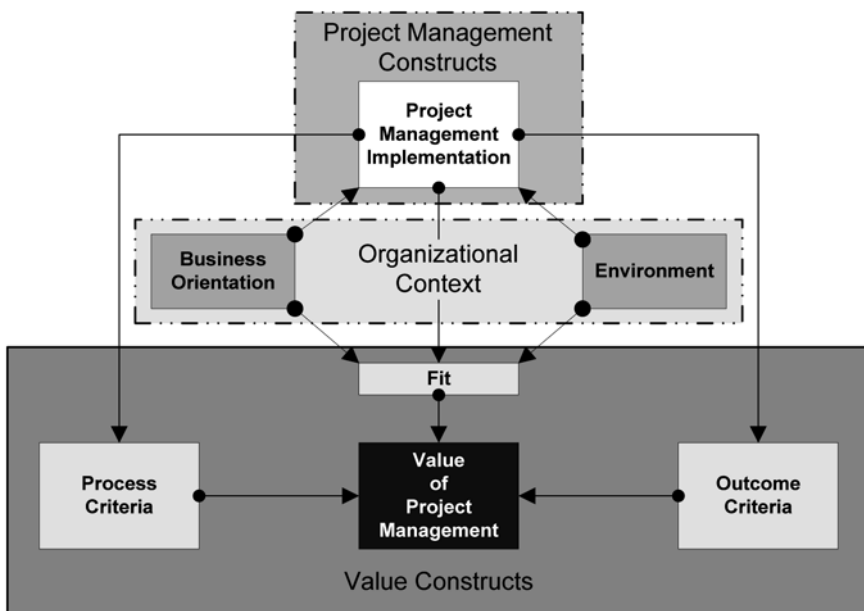


Figure 4.1 A conceptual model of the value from project management

- Finally, what types of improvements and benefits have this organization realized and at what cost? We need to identify and document evidence of all forms of value, recognizing that value comes in many forms, only some of which are directly quantifiable.

We suggested the fit or relationship between the project management constructs implemented and the organizational context would drive the types and magnitude of the benefits realized. Value is both tangible and intangible and both are equally important. Accessing indicators of the presence and measuring both tangible and intangible factors in value experienced by organizations demanded a complex method of data capture and analysis. We chose to adopt a long standing evaluation framework from human resources development evaluation literature (Phillips, 1998), to help us recognize the various approaches to what value can be to an organization. Adapting Philip's model to the context of project management implementation, Table 4.1 illustrates levels of where value realization can occur.

Table 4.1 Levels of value in organizations

Level	Value	Comment
Level 1	Satisfaction	Simplest interpretation. Individual stakeholders' perceptions
Level 2	Aligned use of practices	Consider the fit between what the organization identifies as appropriate practice (espoused theories) and actual practices (theories in use)
Level 3	Process outcomes	Identify process improvements caused by the use of project management.
Level 4	Business outcomes	Identify business improvements caused by process improvements.
Level 5	Return on investment	Cost saving and revenue compared to cost of the implementation

FINDING VALUE IN PROJECT MANAGEMENT

In our research (Thomas and Mullaly, 2008), we studied 65 organizations and found investments in implementing project management clearly result in recognizable and highly valued benefits to all organizations studied. The variety of valuable benefits realized and the number of different parties both within and outside the organization recognizing value from these investments is substantial. However, project management delivers value subtly in a number of ways that are often unique to the organization making the investment. The organizational context has a huge role in determining which investments deliver value and how much and what kinds of value will be realized. Value from project management can be present in all types of organizations. However, there is no blanket experience and even no guarantee that once a valuable implementation is made it will continue to be valuable as the world moves on. Those organizations reporting the greatest substantiated value from their investments appear to be those that implement

a project management implementation that has been customized to be effective for that particular organization.

Value Delivered May be Transient

Investments in project management do not necessarily result in a steady and ongoing stream of valuable benefits over time. As the organization and its context change and evolve, the outcomes it finds valuable and the processes necessary to achieve those outcomes evolve and change. Those organizations who continually invest in keeping their project management practices current with the context within which they operate continue to receive ongoing benefits and appear to recognize higher levels of value. This seems to be the result of two processes happening together. First, as the context changes, the fit between the project management implementation and the organizational needs may falter. Second, over time, what the organization found valuable from the initial implementation may become standard practice and taken for granted and the level of perceived value attributed to those activities and outcomes may go down (Hurt and Thomas, 2009).

Many organizations realize high initial value from their project management implementation. Implementations are often put in place to address a particular need which creates significant value. However, many organizations begin to experience stagnation or even decline after initial high levels of value. Often this is due to considering the initial problem 'solved' and taking little further notice of how projects are being completed. About a third of the cases in our research showed a future value trend of zero, no change in the value they are likely to realize from their project management in the future. These types of organization are at a critical point; attention paid now can allow positive value realization rather than value decline. Typically they have not yet reached a maturity in their implementation that allows for consistency and repeatability. These organizations require a review of their implementation's fit with current strategy and economic environmental context in order to determine what value can still be realized and more importantly which types of value are desired to be realized.

A few organizations actually experience a loss in value; however, in some organizations this is more than just a decline but value being destroyed. Such organizations experience: changes in tactical direction of their project management implementation; constant changes to process as a result of corporate realignment arising from mergers and acquisitions or/and a focus on their implementation as a control mechanism for primarily tangible benefit realization.

Value is Tangible and Intangible

Tangible value was found in more than half of our case organizations. All of the case organizations that reported tangible benefits were engaged in developing and delivering projects for clients. That is, the business of these organizations was projects. This group of organizations included information and engineering technology consulting companies; engineering, procurement and construction companies; construction companies and government agencies in three countries that provide construction services in competition with outside organizations. These organizations report tangible benefits that include:

increased credibility in their marketplace; easier response to regulatory pressure and an increase in their ability to carry out more projects and projects of greater complexity.

Intangible value is demonstrated by almost all of our case organizations. In fact, most organizations consider the intangible dimensions of value they experience to be important and significant, more so than the tangible dimensions. These intangible benefits were clearly recognized by all levels of organizational participants both inside and outside the organization. The more valuable intangible benefits reported include:

- improved strategic alignment;
- improved decision making;
- improved communication and collaboration;
- alignment of approach, terminology and values within an organization
- overall effectiveness of organization and management approach;
- an increased transparency and clarity of structures, roles and accountability.

Interestingly none of our case organizations chose to calculate a ROI for their project management implementation. Many chose not to collect data for such a calculation because of concerns about the validity of the measure, the formality and implications of attempting to measure, and the overhead of collecting this type of data (ROI itself has no ROI). Of the organizations which were in a position to make an ROI calculation because the data was collected within their organization they chose not to. It should be noted that while the value of benefits received by organizations could in most cases have been estimated, organizational members felt that these estimates would be difficult and time consuming to complete. However, the costs of the project management implementation were not collected in any standardized fashion and estimates of these costs would be nearly impossible to create.

In most organizations project management evolves from practical need; tangible gains such as ability to handle increasing numbers of projects and projects of more complexity are testament to this. Project management very rarely arises from a business case and as such there is often no baseline, start or end point over which to measure ROI. We heard and witnessed (by action in practice) that ROI would provide no useful information about the value project management brings to an organization, and what we resoundingly heard was that organizations were more interested in measuring elements of value arising as a result of their project management implementation that were directly related to their strategy as an organization. Consequently, value was felt in their bottom line because their business was able to deliver on strategic objectives.

Value Clusters

Components of value that emerged from the data we collected about organizations, their projects and their perspectives on project management reflected dimension of satisfaction, alignment, consistent process, process outcomes, business outcomes and realized benefits. Considering the major variants within these dimensions we were able to observe that organizations in practice realized six meaningful clusters of value, which explained 68% of the benefit achieved, Table 4.2. These clusters identify the kinds of valued benefits that tend to vary together across our case organizations.

Table 4.2 Clusters of project management value

Main cluster characteristics	Observations
Aligned practices Better processes Business outcomes	Organizations associated with this value cluster reported significant improvements in overall processes and process capabilities and valued the role of process in increasing transparency and improving project collaboration. Organizations measuring strongly on this component also reported significant improvements in overall organization performance including revenue increases and cost reductions.
Good practices Effective human resources No desire for change	Organizations measuring heavily on this cluster, reported solid project management practices, strong benefits associated with improved human resource effectiveness including improvements in quality of work life and work life balance. They evidenced no desire to change their project management practices indicating strong satisfaction with existing practices.
Better project results Aligned organizations Corporate culture	Organizations measuring strongly on this cluster typically report improvements in the organizational structures supporting project management resulting in greater alignment between projects and organizational goals, better project results and a strong positive impact on corporate culture resulting from the implementation of project management.
Good projects Not process Not customer satisfaction	This cluster represents a situation where project results (on time, on spec, on budget) are being reported at the same time as there is no project management process in place and where customer satisfaction is not as high as in other case organizations.
Good project management Not process Customer satisfaction	This cluster is associated with good project management practices resulting in good project results with few consistent project management practices in place. Customers are satisfied with the projects being delivered but there is little consistency of project practices.
New services Staff retention Growth	This value cluster occurs where the project management implementation facilitates the deliver of new services, improves retention of project management staff and growth in both the reputation and size of the organization.

VALUE CREATION VERSUS VALUE CAPTURE

To move to the language of Lepak et al (2007), we observed the creation of value at all levels of analysis and for all key stakeholders across the organizations we looked at. We feel confident that we documented the creation of value in almost all the organizations studied. The challenge is that different valuable outcomes with different influences were witnessed for each organization and different levels of stakeholders were able to capture

the value generated in each scenario. We observed the following influences on value creation and of value capture.

Influences on Value Creation

Identifying value creation requires an examination of what is valued and how it is generated, the antecedents and prerequisites of value as well as the process through which value is realized. Each of the following studies illustrates how the value project addresses several of these questions in unique and overlapping ways.

Eskerod and Riis (2009) examined the preconditions of project management implementations that create value in five cases – all large organizations. All of these organizations used well defined (as guided by PMBOK) common models of project management that were customized. The focus of these models was primarily on the project execution phase, and normally not including post-project phases. In these organizations, value was witnessed as efficiency, legitimacy, power and control and satisfaction. Eskerod and Riis recognized three common preconditions for realizing value:

- Making suitable investment in technical aspects (actual implementation and IT) and humans (training and consultation);
- Active involvement of project managers in development of the model;
- A well developed governance structure for the model but few mandatory requirements.

These qualitative findings were substantiated by a strong correlation we found in the larger sample using quantitative analysis.

In a study of three large organizations, Andersen and Vaagaasar (2009) explored why project management improvements are made and how improvements in project management affect value. They found similar standardization of a project management model and project management training and education. All of these investments were internally motivated. That is, the improvement efforts were driven by an internal organizational desire to improve practice rather than external pressures to do so. The primary motives driving these improvements were:

- Economic (seeking improved profitability and efficiency, ROI);
- Institutionalism (attempting to be seen to be putting in the proper efforts around reputation and satisfaction value);
- Innovation (greater availability and attractiveness of new ideas).

In these cases, value was witnessed as enhanced communication; shared understanding; competency improvement; positive PM culture, legitimacy; satisfaction; efficiency; and organizational learning. ROI and economic benefits were hard to calculate as they were difficult to measure. Economic benefits can't be measured so it is perceived value; institutionalism depends on willingness and openness of membership; innovation requires tolerance, not for organizations in the public eye, needed to alter practices. They also found that having a degree of legitimacy in choice of improvement is important and suggest that this shows how societal trends and culture influence the improvement efforts made and the value created.

Both of these studies stressed the important function a common model or understanding of project management had in paving the way for intangible value generation in these large organizations. Exploring the results from the rest of large organizations suggests that establishing this common language and perspective is indeed a prerequisite for generating value from investment in project management.

Exploring four cases in Serbia, Cicmil et al (2009) added to Anderson and Vaagaasar's observations of how culture influences the legitimacy of a particular project management implementation. Their aim was to determine which project management implementations are used in transitional economies and what drives their implementation. From a process, context and cultural (both internal and external) perspective both strategic adoption and resistance to project management was observed. They recognized a complex interplay among political, social and economic factors significantly influences project management implementation. They saw that adoption needs an external driver: this could be working with an external donor; seeking business philosophy alignment with sector; conducting work in the international arena; or keeping up with best practice from the 'west'. Thus adoption of the project management practices – adoption led value – generated its own value associated with enabling joint working with external (donor) organizations; development of professional expertise; effective problem solving and quality of work; and supports needed for continuity and change. At the same time, cultural values embedded in society also led to serious resistance. In some cases, project management implementations were only at a surface level for reputation purposes (for example, being seen to keep up with the west; or to maintain compliance with the requirements of NGOs and financial donors). No value was gained where project management did not fit with the strategy or structure of the organization. These findings reverberate through many of the cases collected within emerging countries (often commonly referred to by the acronym 'BRIC', representing Brazil, Russia, India and China) where we witnessed examples of companies adopting project management, sometimes on a very superficial level, to increase their legitimacy or business opportunities thus generating both hard dollar value and resistance.

Lechler and Cohen (2009) observed that the organizations that more comprehensively considered the configuration and organization, responsibility, decision authority and processes associated with project governance were more likely to generate value from their project management implementation. In particular they examined the role of project level steering committees in selecting, initiating, defining and controlling projects. They concluded that contrary to perceptions, these committees do not appear to complicate or delay project related decisions nor interfere with day to day decision making. They may decrease efficiency of process but achieve higher customer satisfaction. At the organization level they implement, refine and maintain project management standards potentially maximizing value from project management systems. Steering committees while relatively rare can be instrumental in realization of value from project management. This raises the question of the relationship with the PMO and steering committees and value.

Cooke-Davies et al (2009) explored how value is created from investment in project management by developing a model of how strategy fits with what project management is done and how it is implemented. Project management implementations were considered in relation to the strategic drivers of the need to differentiate and for economic improvement. Using four international cases, they demonstrated that maximum value from project management investments was seen in organizations that demonstrated fit

between strategic drivers and the type of project management model. They identified some of the prerequisites for value to be realized and some of the processes through which value is generated.

Examining all 65 cases, we explored the constructs of fit and value direction (and their intersection) to illuminate the effectiveness and continued viability of PM implementations in an organization (Mullaly and Thomas, 2009). Fit is a dynamic process that is difficult to measure directly with accuracy. Fit can be subjectively assessed from satisfaction; objective assessment requires context to be included. It assesses the current day. Fit is required to realize value. Value can only be assessed for the past. Value direction was determined based on past performance. Organizations with less fit don't have a positive value trend – they have failed to recognize external influences. Neutral value direction suggests that organizations are being catalyzed to change and project management implementation will also need to change to continue to provide value. Organizations can take appropriate action only when understanding the state of fit now and direction of value (for the future).

Evidence of Value Capture

Exploring value capture requires an understanding of how much and who captures the value generated. Mengel et al (2009) studied how intrinsic values embedded within the project management implementation support external value capture. They examined five cases paying attention to how the project management implementations influenced participants' perceptions of meaningful work. Here their interest was not in what value the organization could capture but on the intrinsic reward from creating meaningful work – attitudes, project management context, creativity could be captured by various organizational participants. They suggest that where value and meaningful work are found in combination at the individual level, valued organizational benefits such as being professional, putting people first, improved cooperation, enhanced communication, satisfaction and commitment and increased control over non-human resources are realized.

Crawford and Helm (2009) presented four cases examining the value of project management in the public sector. They suggest the highest required value in these implementations is stakeholder satisfaction and that the increased accountability and transparency that comes with effective project management implementation delivers this. In addition, they found evidence of both improved performance and adaptability to change. Expected and realized value was similar. Value was recognized in increased accountability and transparency; control and compliance; risk management; consistency in delivery; ensuring value for money and stakeholder engagement. They suggest that while it is the government or government agency that must invest in improved project management, it is the public who captures most of the benefits. Project management supports public sector governance and trends towards public value management and network governance. It could be argued that these project management improvements, by increasing the transparency and accountability on government projects make it more difficult for managers and project managers working within government. So again the question of who captures the value is critical.

Exploring a single megaproject, Li et al (2009) presented the value project management delivers to all stakeholders. Taking a megaproject stakeholder's perspective (enterprise, community, customer, suppliers) allowed the research to examine who captures what form of value. Extensive review of the value for all stakeholders, examining all types of value, showed how the value of improved quality and its effects on cost and time lead to improvements in personnel ability; satisfaction of stakeholders and development of public goods through the development of insight-based learning which is re-applied to the project management implementation and leads to quick improvements in capability.

Finally, Hurt and Thomas (2009) explore the role of PMOs in determining whether the value that is captured by these various stakeholders can be sustained over time. They started by exploring three case studies in one industry and then expanded their analysis to other organizations whose most recent project management implementation included the establishment of a PMO. They saw that these organizations very quickly realized significant value from relatively simple solutions. By solving specific problems (such as getting project costs under control, improving adherence to process and improving quality) the PMOs could document and capture significant value. However, over time, many of these PMOs struggled to maintain a perception of value captured within the organization. Hurt and Thomas speculate that changes to value structures and interpretations within organizations caused by growth, restructuring or other exogenous events means that what was valued in the past may no longer be valued in the future and that PMOs must continually reassess what they are doing and what value they are providing in the context of the shifting organizational and environmentally determined needs. Value comes from maintaining focus on what project management implementation needs to deliver and ongoing action to refine the fit between what they are delivering and the organizational needs and values.

IMPLICATIONS FOR REALIZING VALUE

This value study is exploratory in nature. Its prime purpose was to generate understanding of how, when and why organizations realize value from their investment in project management. The study succeeded in generating a list of theories about the interrelationship between investments in project management, context and the impacts of both of these on the value organizations expect to receive. The theories are complex and sometimes paradoxical but always based on the evidence collected from the 65 case studies. As expected in our initial model, each organization operating in its context implemented a unique project management implementation and received a unique set of value outcomes. However we still wanted to look for trends across organizations to identify to what extent we could identify relationships between the context and project management implementation choices that influenced the valuable benefits realized by organizations. As with any study, it is in the testing and fleshing out of these theories that the true contribution of this project will evolve over time.

Ultimately there is also a management challenge that needs to be addressed. Managers need some way to be able to assess outcomes such that we can determine what implementations will support the realization of the desired value from project management, and to understand the success (or lack thereof) of their decision making and subsequent actions. In the case of project management, the appropriate actions in implementing project management first arise from a perceived need, and an understanding

of the factors that best contribute to addressing and resolving that need. The following section outlines how the results of this research can be applied in supporting managers and organizations in implementing project management practices that best fit their circumstances, and are most suited to delivering their desired value. We explore these solutions through a commonly used framework for assessing and implementing project management practices: the maturity model.

Ensuring Project Management Fit

Assessment is a central means of supporting organizational improvement, enabling organizations to rationally identify opportunities to continue to improve, prioritize those improvements and make decisions. The assessment process must address both what is explored and examined, and how these results are shared and reflected back to the organization under investigation to support improvement. What to assess and how to conduct the assessment becomes increasingly complicated as the nature of the work becomes more intangible and increasingly knowledge-based.

The majority of assessment frameworks in place draw on the Plan-Do-Check-Act cycle of Deming (1993). In addition, they can typically be divided into two different approaches: audits and self-assessments. Inherently, all assessments are seen as tools for organizational learning. Their promise is the ability to be able to evaluate and understand current capabilities, strategically identify desired capabilities and determine the improvement activities that will enable realization of those capabilities.

EVALUATING ORGANIZATIONAL EFFECTIVENESS

The first challenge in developing an assessment approach is to determine what is to be examined; the second is to establish a means of effectively introducing those results in a way that both positive and effective outcomes are possible, and do occur. The development of meaningful assessment approaches that can evaluate effectiveness include an understanding of organizational size, environment and technology, as well as introducing the importance of controlling for context in understanding measures of organizational capabilities and their impact on performance. Another important dimension of assessment is understanding organizational dimensions of performance that the assessment approach seeks to influence. These include an understanding of an organization's ability to attain its goals, secure scarce resources or control the behaviors and processes of organizational participants.

Maturity Models as a Means of Assessing Process

The understanding of organizational functioning is central to the purpose of maturity models, and it can be argued that these can be evaluated through an exploration of process, structure, consistency and discretion. The development of maturity models stemmed from a desire to understand the discrete distinctions that existed between defined stages of organizational development, and their principles can be found in explorations

of corporate life-cycles, organizational goals and structures and the political influences within the organization that are the ultimate determinants of adopted strategy.

One of the earliest and most widely recognized maturity models was the Capability Maturity Model for Software (CMM-SW), developed by the Software Engineering Institute at Carnegie Mellon University, Pittsburgh, PA. It popularized the idea that maturity could be reflected by a number of levels assessed across a number of capability areas (Humphreys, 1992; Paulk et al, 1993). Since that time, a number of other maturity models have been developed that enable assessment of organizations against a range of practices and topics, including strategic management; innovation; contract management and leadership (Kraut, 1996).

In the field of project management, there has been a significant amount of effort and research conducted in the areas of maturity and the development of various maturity models (Ibbs and Kwak, 2000; Project Management Institute, 2003; Kerzner, 2005; Mullaly, 2006). Many of these have adopted a similar framework to that of the Capability Maturity Model, with five assessed levels of maturity and a number of capability areas across which the practices of each level are described.

While each of these models supports the identification of process capabilities, what they do not support is the linkage of these process capabilities with their influence on organizational performance. The most widely known maturity study to date is that conducted by Kwak and Ibbs (2000), which asserted a correlation between maturity and performance but demonstrated no statistically significant correlations. A review and evaluation of the effectiveness of project management maturity models as a means of supporting improvements of project success suggests this correlation is still elusive, and while maturity models have raised the visibility of project management, there is no evidence supporting the use of maturity models as an improvement tool or for asserting that maturity models in their current form could lead to strategic advantage (Jugdev and Thomas, 2002). Certainly, the larger goal of establishing differentiation and using assessment to attain competitive advantage has not been realized.

The Perspective of Contingency Theory and 'Fit'

An alternative perspective regarding the assessment of organizational capabilities can be found in contingency theory and the understanding of 'fit'. The need to explore fit emerged as a result of the belief that traditional views of strategy research did not properly reflect the actual challenges being observed by organizations. Contingency theory suggests that different strategies are appropriate for different organizational structures, environmental factors and market situations (Donaldson, 2001).

Contingency theory and 'fit' differs from traditional viewpoints reflected within maturity models. While maturity models suggest that improvements in process correlate directly with improvements in performance, the essential principle of contingency theory is that it requires a relationship between two distinct variables in order to predict a third variable. All models of contingency theory share a common understanding that if the organization is to perform well the context and structure must somehow fit together. In other words, in addition to an understanding of the process and capabilities that are adopted by an organization, performance is also influenced by the context and environment in which it finds itself.

This expansion of understanding has some broader implications for understanding the influences of organizational practices on performance. If performance is a product of context and structure (or process), then changes in one will necessitate changes in the other. Fit is dynamic, as well as being a product of an appropriate level of flexibility and a match between long-term strategy and administrative structure. Research has not only provided support for the dynamic and adaptive nature of fit, but suggested that it is not an 'event' or a 'place', but an on-going reflective process of change. Further, fit itself is not a fixed idea, but has multiple perspectives by which it can be evaluated. There are three possible approaches to assessing fit: selection, interaction and systems:

- *Selection*: suggests that there are specific structural or process capabilities that are directly correlated with the context of the organization, and for the most part ignored the resulting impact or influence on performance. A key criticism of this approach is that there is no evidence of a link to performance, and that a selection approach is more a theory of congruence than it is of contingency.
- *Interaction*: explains variations in organizational approach as a product of the interactions between organizational structure and context. A number of challenges have been cited, however, that suggest methodological issues result in insufficient levels of significance to demonstrate the validity of the interaction approach in many studies.
- *Systems*: is an approach that emerged in reaction to reductionist efforts to correlate single dimensions of structure and context with specific performance outcomes, and instead adopts a more holistic understanding of these interactions at an overall level. The systems approach suggests that fit is a product of various different but equally viable potential designs that must be matched to the different contingencies that face an organization.

Both congruence and contingency fit have been observed, but only contingency fit has a demonstrable link to performance. This suggests we should seek to support the evaluation of multiple perspectives of fit, where each type serves a specific purpose and is not mutually exclusive of the other. This would enable us to test the relationship and interdependencies among congruence (selection) and contingency (interaction and systems) theories of fit.

Criticisms of Maturity Models Suggested by Fit

As already noted, contingency theory and the concept of fit suggests an additional dimension of assessment than what is traditionally presumed in the adoption and use of maturity models. While maturity models purport to link improvements in process directly with better delivery of project results (see, for example, Ibbs and Kwak, 2000; Kwak and Ibbs, 2000), contingency theory suggests that it is necessary to understand both context and structure/process to establish a link with performance.

Introducing principles of fit and contingency theory into the exploration of maturity could potentially address a number of inherent challenges that have long bedeviled maturity research and the development of effective and relevant maturity models. In particular, there is an expressed concern that assessment models like those

used in evaluating maturity result in a long list of strengths and weaknesses that do not support identifying or prioritizing specific strategies that will lead to the attainment of competitive advantage. Inherent in this criticism is the challenge of identifying what implementations are appropriate for a particular context, typically requiring researchers to predict (or prescribe) the factors that will enable the attainment of fit. Moreover, being able to appropriately model or allow for the full range of potential structural and process elements that could describe an organization would require the definition of a universally applicable set of strategic choices on which to draw. This has led to many maturity models being prescriptive and narrowly focussed in nature, which directly contradicts the observation from studies employing contingency theory that organizations can be successful based upon different capabilities, provided that the strategy, structure and process of that organization is internally and externally consistent.

The other inherent challenge typically associated with maturity models is that they describe one specific way of managing, and presume a universal set of practices that must be adopted by all organizations. They ignore the external factors and contingent variables that different organizations encounter in different situations, economies and environments. Maturity models by their nature are abstractions, and as such are simplified representations of a complex reality and will inevitably need to change as reality changes. As abstractions, maturity models typically describe a specific place or static representation, ignoring the dynamic nature of fit and the fact that competitive advantage comes more from movement and an ability to change than it does from location or position. Possibly most significant is that maturity models represent an increasing continuum of formality, consistency and systemization, while the research into fit suggests that systemization is actually most prevalent only at middle levels of complexity, while both very simple levels of complexity and very high levels of complexity are much more likely to see more adaptive, dynamic and flexible approaches being adopted.

INSIGHTS FROM THE VALUE STUDY

Our research into the value of project management (Thomas and Mullaly, 2008) represents a comprehensive view of project management practices, and the impacts and influences of those practices on various aspects of organizational performance. Perhaps uniquely, it also incorporates assessments of both maturity and fit, and in doing so offers a perspective by which to evaluate the relevance of each approach and the understanding of organizational capabilities and impacts that each approach enables.

The project involved a comprehensive examination of 65 organizations from five continents. A significant amount of quantitative and qualitative data, in the form of researcher evaluations, interview transcripts, survey responses and document and project file reviews was collected by 18 research teams. This data set includes descriptions of what was implemented as project management within the organization; comprehensive contextual and demographic information about each organization and the nature, types and degrees of value that were attributable to the implementations within each organization. This mixed methods study applied a wide range of exploratory quantitative and qualitative analytic techniques (including textual analysis, grounded theory coding, principal components and correlation and regression analysis to name a few). All of the methods used and analysis conducted are described in detail in Thomas and Mullaly (2008) and will not be described in detail here.

Exploring Project Management Maturity

At the outset of the research, we made a conscious decision not to assess and evaluate maturity as part of the approach. This was in response to a number of the challenges including the static nature of the models, an unwillingness to predict or prescribe the practices that would be observed and the near universal set of potential practices that would need to be defined in advance to be comprehensive and exhaustive. Instead, we adopted a grounded theory approach where the research teams sought to understand how project management was defined and implemented by the case study organizations. Given the scope and detail of information collected regarding implementations within each organization, it was possible to infer the relative project management maturity associated with each implementation. Given that an explicit choice of a single maturity model did not occur at the outset, it was not reasonable or possible to retroactively apply a specific maturity assessment framework. Instead, recognizing that the vast majority of current maturity models associated with project management draw from the same constructs as that of the Capability Maturity Model (Humphreys, 1992; Paulk, et al, 1993), a generic five-level structure was developed, as outlined in Table 4.3.

Table 4.3 Assessed levels of project management maturity (after Thomas and Mullaly, 2008)

Level	Description	Details
1	Ad hoc	This level is associated with an informal and inconsistent approach to project management. In essence, Level 1 implies that there is no organizational implementation of project management; instead the processes that are utilized and the effectiveness of the results are the product of the experience and expertise of the individual project manager and teams.
2	Some practices	Level 2 suggests that there are some practices and capabilities defined and utilized at an organizational level, but that they are not complete or they are not consistently adhered to throughout the organization. While there is some level of organizational formality, it is not comprehensive nor is it fully applied.
3	Consistent practices	Level 3 represents a consistent and adhered-to project management implementation. It suggests that there is a complete project management process in place, and that it is consistently utilized on all projects within the organization. For many organizations, this level of maturity is the target level they seek to attain.
4	Integrated practices	A level 4 implementation would be one where there is not only a consistently defined and adhered-to project management process, but that it is fully integrated into the management capabilities of the organization. This does not presume only a project-driven organizational model, but does imply that the operational or functional management processes are aware of and integrated with those of project management and vice versa. Project management at this level becomes an integral management capability that is fully integrated within the organizational life-cycle.

5	Continually Improving Practices	The final level of maturity would be one where there is a holistic, fully integrated approach to managing projects that exists within an ongoing cycle of continuous improvement. The idea of continuous improvement is one where there is a formal and consistently adhered-to process of continually learning from, evaluating, assessing and improving the project management implementation.
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While a full discussion of observed maturity can be found in Thomas and Mullaly (2008), a brief overview of the findings relative to maturity are summarized here:

- There does not appear to be any correlation between the observed maturity of an organization and the degree of tangible value obtained from implementing project management.
- There was an apparent correlation between observed maturity and the degree of intangible value observed within an organization, with greater degrees of maturity typically evidencing greater levels of intangible value.
- The organizations realizing high levels of both maturity and intangible value demonstrated different contexts and adopted different implementations, suggesting that different organizations can be successful based upon different capabilities. Conversely, there was no correlation between either context or implementation that suggested that organizations would attain a specific level of maturity or realize specific value from its implementation.
- Only maturity levels of 1 through 3 were observed by the case study organizations, with no organizations evaluated at level 4 or level 5. While not conclusive, this may suggest that only those organizations with mid-levels of complexity would demonstrate a high level of systematization and therefore consistency; higher levels of complexity by extension require greater flexibility and discretion in the management of work.

Exploring Fit

The concept of fit was central to the investigative strategy of our research project from the outset. In the initial development of the conceptual model, fit was interpreted as the degree to which the implementation of project management was appropriate given the environmental factors (context) and business orientation (contingent variables) that the organization found itself in, as suggested by the selection approach to the evaluation of fit: the presumed relationship was between context and structure/process, without any specific correlation and consideration of performance. In the context of the original conceptual model, the realization of fit was considered to be the performance that was intended to be observed.

In the early examination of the data, fit was expected to be evidenced by high levels of satisfaction by the stakeholders and high levels of alignment between espoused and actual practices. The expectation was that if stakeholders expressed satisfaction with the process, and there was a level of consistency and alignment with how practices were actually applied, then the implementation could be said to 'fit' the organization. In later analysis, it came to be appreciated that satisfaction and alignment were at best proxies for

fit – it was empirically observed that organizations were able to demonstrate satisfaction (at least by some stakeholders) and even consistent and aligned adherence to practices, and still not have an appropriate implementation for that organization. To be truly able to answer fit, it was asserted that the research needed to be able to answer the question, ‘What implementations and context are associated with what value?’ (Thomas and Mullaly, 2008).

This question directly led to the identification of those factors of context and implementation that contribute to the realization of the different types of value realized in the study. The dimensions of context, implementation and value that were observed were based upon a grounded assessment of the case study data (Thomas and Mullaly, 2008). From this we identified those context and implementation factors that either positively or negatively contributed to each component of value that emerged within the study. The results of this analysis represent the primary contribution of the research effort: namely, the identification for any given component of value of those contextual and implementation factors that are most likely to contribute to or detract from the realization of that value.

The insights from this analysis are significant when viewed in the context of both maturity models and contingency theories of fit. Firstly, the findings undermine the premises on which most maturity models are developed. While maturity models most typically define one path of implementation and progression, and predict or prescribe the capabilities associated within each level in the maturity model, the results of our research suggest that there is no one implementation of project management that delivers value. Also, while the analysis of different maturity model levels against observed value demonstrated that there were some correlations between levels of maturity and the realization of higher levels of intangible value, these maturity levels were realized with different practices associated with the attainment of differing types of value. No specific set of contexts or practices in our research were universally associated with the delivery of value or the attainment of maturity overall. While maturity and value are correlated, this is only the case at a macro level, and these correlations appear to mostly demonstrate congruence, that is a selection approach to fit.

Secondly, the identified regressions support enhanced contingency approaches to fit, and particularly those associated with a systems approach to understanding fit. The regressions of implementation and context on value provide a holistic view of those aspects of an organization’s project management approach that influence the attainment of individual levels of value, and provide a suggestion of the degree to which each component makes a positive or negative contribution. Rather than a binary correlation of each context or implementation factor on value that would be suggested by an interactive approach, the results suggest the relative contribution that different aspects of what is implemented and the environment of an organization have on the ability of the organization to realize value from its project management implementation that are reflective of a systems approach, and reflect the micro-level associations that they identify as being a product of a systems approach. The focus is not so much on understanding the congruence between context and structure as in the selection approach, but rather on explaining variations in organizational performance from the interaction of organizational structure and context. The regressions specifically identify those characteristics of context and implementation that produce specific dimensions

of value, and help to understand precisely how each of the organization's strengths and weaknesses has the potential for adding or subtracting value.

IMPLICATIONS FOR MATURITY MODELS

The results of our research have significant implications for the continued development and future viability of maturity models. Multiple approaches to evaluating the relationship of implementation (or structure) and context to the attainment of performance (or value) have demonstrated that both congruent and contingency forms of fit were operating. Contingency theory allows multiple potential contingencies in the environment facing the organization, therefore requiring different configurations of structure and context. This suggests that developing a satisfactory explanation of the impacts on performance of project management implementations needs a more sophisticated approach to contingency theory. That is not to say that maturity models are necessarily irrelevant, but the results of the study certainly suggest the recommendations of maturity models are limited to macro-level assertions of congruence and should not be relied upon for micro-level determinations of what structure and implementation may be appropriate for an organization, given the contingent variables it faces within its context and the values that it seeks to realize from implementing or improving its approach to project management. For maturity models to continue to be relevant and for them to provide the level of insight from an assessment perspective and the appropriate recommendations in terms of improvement, a significant re-imagining of what maturity models are, and the structure and approach by which they are utilized, would be suggested:

- At a very minimum, maturity models need to take into consideration an appreciation of context, and an understanding of the contingent variables that organizations face that influence both how they implement project management and the practices they utilize, as outlined by the essential structure of contingency theory.
- Adopting a systems approach as offered by a sophisticated application of contingency theory will address the two essential challenges that are faced by any organizational designer, namely the selection of patterns of structure and process that match the contingencies facing an organization, and the development of actual structures and processes that are internally consistent.
- Re-considering the degree to which consistency and conformity to practices are actually evaluated will provide an opportunity to evaluate fit horizontally to assess the degree to which there is fit between units, and vertically to evaluate whether fit is aligned within a unit. One of the potential failings of maturity models is that they define consistency too broadly and deeply, expecting a consistent approach across all aspects of an organization and in all types of projects, where more adaptive approaches may be both warranted and capable of delivering greater value.
- Maturity models need to explicitly recognize both the macro-level and micro-level specifications of organizational capability. While maturity models inherently appear to assess macro-level congruence, they ignore what may be appropriate or required at a micro-level. At the same time, it appears to be equally important not to abandon the understanding of congruence that a macro-level evaluation of fit provides while addressing the more micro-level challenges.

- Most importantly, maturity models need to recognize that fit is dynamic and constantly in motion, and does not represent a static or Boolean capability. This may well be the greatest challenge to the evolution of maturity models from their current form, as they must recognize that changes in context must be reflected by changes in implementation to continue to ensure the realization of value, and that a static or prescriptive model of maturity cannot hope to provide the level of guidance that organizations require in making effective choices about their project management implementation.

Concluding Remarks

This chapter aims to demonstrate the value of project management, and to relate it to the concepts of maturity and fit, based on our research into understanding the value of project management (Thomas and Mullaly, 2008). Value is both tangible and intangible in nature; tangible value can be realized by even the most immature project organizations, while intangible value is much more strongly correlated with increasing levels of maturity. In addition, the study provided initial correlations of the context and implementation factors of project management that influence the various types of value that were actually observed.

While we did not set out to assess the maturity of project management implementations, this did prove to be a useful construct in understanding the overall correlation of capability with value, particularly as they relate to the consistency and formality of implemented practices. What is clearly demonstrated is that maturity alone does not incorporate an appreciation of the context within which practices are implemented, and therefore any recommendations derived from a maturity model in its current state must be suspect. While the application of maturity was useful in understanding the congruence of implementations with macro-level realization of value, it was only through the application of contingency approaches to understanding fit that appropriate judgments of implementation and context could be made to realize a specific value. Moreover, the study supports other research into contingency theories of fit that suggest a systems approach to understand contingency is most appropriate in understanding micro-level implementation and context options. The regressions specifically suggest those capabilities that will positively or negatively contribute to different types of value, and advances exploratory theories that suggest a model of what future maturity models could look like.

Finally, it is important to note that fit and maturity as is currently understood were both able to provide useful insights, especially when both approaches were adopted. This suggests that it is not a question of choosing one approach over the other, as much as it is understanding the contributions that each makes to an overall understanding of organizational capabilities. By adopting the full spectrum of approaches associated with contingency theory, it is possible to gain a more comprehensive and meaningful means of enhancing organizational effectiveness. Incorporating the lessons of contingency theory into future approaches of organizational assessment may finally yield models that truly support the improvements in performance that the use of assessment and evaluation instruments has long promised.

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Maturity Models in Project Management

GINGER LEVIN AND J. LeROY WARD

As executives in organizations from every industry sector continue to recognize the importance of programs and projects to overall success, the emphasis on continuous improvement in portfolio, program and project management processes increases. A portfolio process that has been in place and followed or a program or project management process that an Enterprise Program Management Office (EPMO) may have developed and implemented, even only a year ago, may require revisions and updates. Strategic changes may be responsible. Such activities as mergers, acquisitions or downsizing may cause a process to go out of date or be overcome by events. As such, they may no longer meet the needs of the practitioners. Assessing the overall maturity in terms of portfolio, program and project management is therefore one way to determine whether improvements are required, and if so, which improvements are the ones of the highest priority to implement.

This chapter describes the importance of maturity models, presents a description of some of the leading models available, explains the process of conducting a maturity assessment and describes why process improvement is essential for project-based organizations.

Maturity Modeling

Maturity is defined as ‘full development’ (Merriam-Webster, 456). The Project Management Institute, PMI (Project Management Institute, 2008), notes it is ‘the state of optimal performance within project, program, and portfolio management’ (184). Kerzner (2009) explains that some consider maturity and project management excellence to be the same, but suggests there is a difference: ‘maturity ... is the implementation of a standard methodology and accompanying processes such that there exists a high likelihood of repeated successes’ (58). Excellence on the other hand is noted not only by successful projects that continuously are executed and managed but where ‘success is measured by what is in the best interest of both the company and the project (that is the customer)’ (58). PMI (2003) defines a maturity model as ‘a conceptual framework, with consistent parts that defines maturity in the area of interest. ... it also may describe a process whereby an organization can develop or achieve something desirable. ... this process can result in a more highly evolved organizational state; in other words, a more

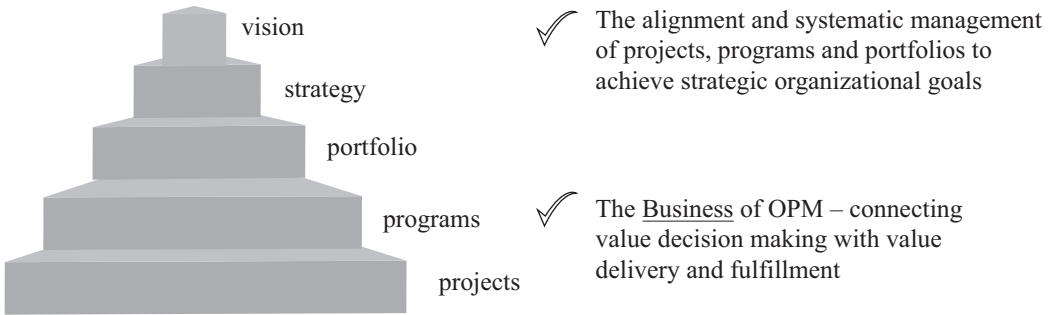


Figure 5.1 Organizational project management maturity

mature organization’ (5) Capability Maturity Models (CMM) ‘attempt to define industry practices that correlate with increasing levels of process maturity’. The resulting CMMs seek to provide (Nutt et al, 2003, 11)

- a) an industry standard or ‘framework’ by which relative maturity can be assessed;
- b) a clear path to evolve processes to achieve increasing mature states;
- c) specific guidance on best practices and their applicability and implementation.

According to the Project Management Institute (2008), Organizational Project Management, OPM (which also includes programs and portfolios, Chapters 27 and 28) is ‘the systematic management of projects, programs, and portfolios in alignment with the organization’s strategic business goals’ (9). The emphasis is to ensure that the programs and projects under way are reflective of the organization’s overall strategic goals and objectives and also that the portfolio management process continues to serve these goals and objectives and remains relevant as shown in Figure 5.1.

EVOLUTION OF MATURITY MODELS

Maturity models are not a new concept. Crosby (1979) developed a Quality Management Maturity Grid in which he described five stages of maturity:

1. Uncertainty: in which the quality problems are due to the quality department in the organization;
2. Awakening: in which people are beginning to recognize those in quality management might be able to fix problems in a correct way;
3. Enlightenment: in which managers and those in the quality department work together to fix problems;
4. Wisdom: in which quality management is integrated into the work of the organization;
5. Certainty: in which the organization lacks any quality problems as it has an understanding as to what is necessary.

He recommended the use of this grid to assess the organization's current state and its desired or 'to-be' state, emphasizing the purpose is to ensure the organization is and continues to make progress. To measure progress in each of the five stages, he included categories:

- Management understanding and attitude;
- Quality organization status;
- Problem handling;
- The cost of quality as a percentage of sales;
- Quality improvement actions;
- A summary of the organization's quality posture.

Crosby's work, with these measurement criteria, therefore served as a way to assess an organization's maturity.

In 1984, the U.S. Department of Defense (DoD) established a federally-funded research and development center (FFRDC), the Software Engineering Institute (SEI) at Carnegie Mellon University. Subsequently, DoD continued to fund the SEI and in 2010, extended its contract through June 2015, an agreement valued at US\$584 million. Its Director and Chief Executive Officer stated that 'Our purpose is to advance the state of the art in software engineering and transition these advancements to the community so that organizations may develop and acquire software that is more reliable, more secure and more dependable' (Carnegie Mellon University, 2010).

Building on the work of Juran, Deming and Crosby, Humphrey (1989) published the beginnings of the first CMM. Humphrey's approach was somewhat different based on his insights in the software industry that an organization's processes mature in stages on the basis of solving problems in a certain order. He set forth five stages to show the evolution of software development practices rather than measuring each process independently. It led to the first CMM from the SEI, released in 1991. This Software CMM, according to the SEI, is often called 'The CMM' as it was the first capability maturity model and was adopted by organizations worldwide. It was intended for use by government contractors in evaluating their maturity to complete software projects. It is no longer supported since the publication of the Capability Maturity Model for Integration (CMMI) discussed later in this chapter. It consists of five levels of maturity with Key Process Areas, which describe goals, commitment to perform, ability to perform, activities to perform, measurement and validation.

This model subsequently led to interest by many in the project management profession in maturity models for all types of projects and to the publication of project management maturity models. It also led to the development of maturity models in other areas such as business development, research and development, telecommunications, knowledge management, product development and leadership to list a few.

EXAMPLES OF SOME MATURITY MODELS

A number of maturity models are available for portfolio, program and project management. This section presents a brief overview of some of the leading models and their characteristics.

ESI International's Maturity Models

On the basis of a paper and presentation by Fincher and Levin (1997), ESI International began the development of the Project Framework Maturity Model. These five levels and their definitions also were similar to those of the CMM-SW:

1. *Initial*: Ad hoc, no formal project management process;
2. *Repeatable*: Implementing a project management methodology;
3. *Defined*: Project management practices used and adapted;
4. *Managed*: Project management practices measured and controlled;
5. *Optimizing*: Focusing on process improvement.

Fincher and Levin proposed goals for Levels 2 to 5 based on each of PMI's knowledge areas in the *PMBOK Guide* (Project Management Institute, 2008, first edition 1996), with Level 5 having seven goals.

*ProjectFRAMEWORK*TM (Levin et al, 1999) expanded on this work to develop a model which provides guidance to organizations to improve the way they manage projects. It focuses on continuous improvement in managing and developing project management at the organizational level. *ProjectFRAMEWORK*TM consists of five levels, similar to those originally proposed by Fincher and Levin, but with Level 3 titled Integrated, and Level 4 titled Comprehensive. Following the work of the SEI in the CMM-SW (Software) and in discussions with the SEI, *ProjectFRAMEWORK*TM describes for Levels 2–5 objectives, commitment to perform, ability to perform, activities performed, evaluation and verification, with examples in each area based on the PMBOK knowledge areas.

The model was once available on ESI's web site for downloading at no cost by interested organizations. It was accompanied by a detailed assessment methodology, which included a questionnaire to be sent to project professionals at a variety of levels, questions to ask during interviews held, and items for consideration in review of organizational documents, such as policies, procedures and processes in project management, along with different items for review of documents prepared on actual projects. ESI established a training program in use of the model and certified professionals at the completion of this program. *ProjectFRAMEWORK*TM was updated after the second, third and fourth editions of the *PMBOK Guide* were issued. Levin et al (2010) prepared comparable models and assessment methodologies for program and portfolio management based on the second editions of the PMI standards in these areas.

Kerzner – IIL Project Management Maturity Model (also known as KPM³)

In 2001, the Kerzner/IIL Project Management Maturity Model (PMMM) was issued. Also a staged approach with five levels (Figure 5.2), it emphasizes different areas.

At Level 1, rather than being characterized as ad hoc or initial, instead is noted as basic knowledge. At this level, a series of multiple choice questions assess a project professional's understanding of the common terms used in project management. Level 2, or Common Processes, recognizes successes on one project are ones which can be repeated by others in the organization, and project management methodologies can be applied to other

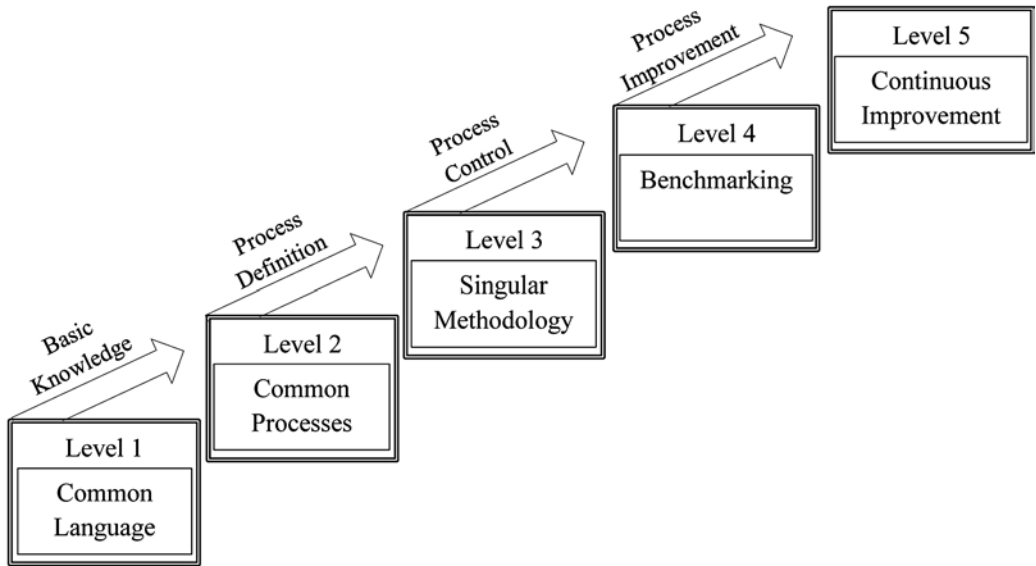


Figure 5.2 Kerzner's five levels of maturity

Source: Adapted with the kind permission of Harold Kerzner

functions in the organization, such as accounting or business development. At Level 3, or Singular Methodology, process control is facilitated as there is a single methodology for project management used in the organization. Level 4 is the Benchmarking level in which organizations use benchmarking with other companies to maintain a competitive advantage, noting organizations must select carefully companies with whom to engage in the benchmarking process, while Level 5 emphasizes Continuous Improvement.

Another feature in this model is its emphasis on risk management, with Level 3, noted as the level of highest risk for an organization based on the difficulty and time consuming nature of establishing and implementing a common methodology. A later edition of this model in 2005, included more attention to the Project Management Office (PMO), and the model also was updated in 2011 (Kerzner, 2009). This model was the first to focus on the importance of benchmarking, and as part of the IIL assessment approach, organizations could elect to anonymously benchmark with other organizations using this model for an assessment.

The Software Engineering Institute's Capability Maturity Model for Integration (CMMI)

In 2000, the SEI released the CMMI, later updated in 2002, 2006 and 2009 (referred to as CMMI-Development [DEV]), with a focus on integrating software and systems engineering. It was followed in 2007, by a CMMI-Acquisition [ACQ] model, emphasizing the acquisition process, and in 2009, by the CMMI-Services [SVC] focusing on service organizations since the development of quality service processes to lead to improvements

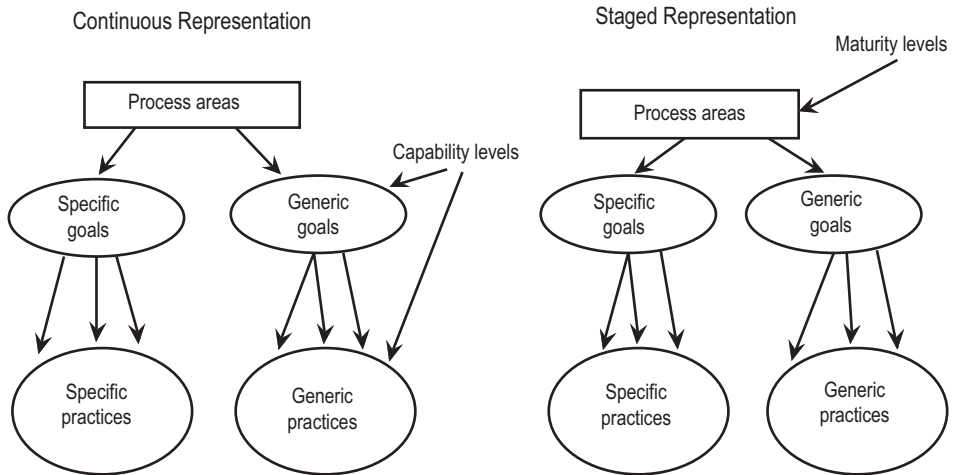


Figure 5.3 CMMI continuous and staged representation

in performance, customer satisfaction and overall profitability (Phillips and Shrum, 2010). The CMMI also emphasized either use of a continuous or staged approach (Figure 5.3).

The staged approach uses maturity levels to show the state of the organization's processes as a whole, while the continuous approach uses capability levels to characterize the state of the organization's readiness in an individual process area.

This model is applicable to project management as its Levels 2 and 3 focus on it extensively. Level 2, for example, emphasizes requirements management, project planning, project management and control, supplier agreement management and configuration management, with Level 3 including a focus on requirements development, integrated project management and risk management, among other areas.

Project Management Institute Organizational Project Management Maturity Model (OPM3)

In 1998 PMI initiated a global project to develop OPM3 as a standard for organizational project management. This standard was published in 2003, and consists of three areas:

1. *Knowledge*: the contents of the Standard;
2. *Assessment*: a method for comparison against the Standard;
3. *Improvement*: an approach to establish a process for possible improvements based on the Standard.

PMI developed OPM3 to help strengthen the relationship between strategic planning and the execution of programs and projects so the results are ones that are 'predictable, reliable, and consistent, and correlate with organizational success' (2003, xi). As part of this standard, an approach for a self assessment was included along with directories that contained over 600 best practices, capabilities and outcomes. OPM3 is set up in a manner in

which assessments can be conducted on project management, program management and/or portfolio management according to the following four stages of process improvement:

1. Standardize;
2. Measure;
3. Control;
4. Continuous improvement.

OPM3 does not contain levels of maturity but instead emphasizes best practices that need to be in place for multiple perspectives of maturity.

The Second Edition of the Standard (2008) contains 488 best practices or optimal ways to achieve stated goals or objectives in order to deliver portfolios, programs or projects predictably, consistently and successfully to bring to fruition the organization's strategic intent. These best practices are based on at least two capabilities, or specific competencies that must exist in the organization. These capabilities each have multiple outcomes and key performance indicators (KPIs) associated with them. The KPIs are used to see if each outcome associated with the capability is in place and can be either quantitative or qualitative. There are also dependencies within the best practices in OPM3, enabling a sequence to follow to achieve best practices that are not in place as noted during an assessment. The best practices are mapped to the knowledge areas in portfolio, program and project management. Business results, including predictability of success, resource use and the balanced scorecard, are other areas that can be assessed using OPM3 (Figure 5.4).

In the second edition (2008), 74 organizational enablers are part of the 488 best practices. These organizational enablers cover areas such as those shown in Figure 5.5.

While the OPM3 Standard contains an abbreviated assessment method, an OPM3 On Line assessment tool is available as well as detailed assessments conducted by individuals certified as OPM3 Professionals who have the ability to conduct assessments using the



Figure 5.4 What is measured in OPM3

<i>OPM</i> Policy and Vision	Competency Management	Sponsorship
<i>OPM</i> Practices	Success Criteria	Resources
<i>OPM</i> Techniques	Benchmarking	Knowledge Management
Training	<i>OPM</i> Communities	<i>OPM</i> Methodology
Management Systems	Metrics	Strategic Alignment

Figure 5.5 OPM3 organizational enablers

proprietary Product Suite methodology, a detailed on line tool to not only determine the best practices in place in an organization, but also to chart an improvement plan or roadmap to help organizations achieve other best practices.

Office of Government Commerce Models

The Office of Government Commerce (OGC), now known as the Cabinet Office, has also been active in the development of maturity models in portfolio, program and project management. Beginning as part of a project management maturity model in its PRINCE2 (Projects In Controlled Environments) methodology, in 2006, OGC released its Portfolio, Program, and Project Management Maturity Model (P3M3 Model). It was then updated in 2008 and 2010, recognizing that more organizations were moving into program and portfolio management. Even with the updates, OGC (2010) has set up each new version so it is comparable with the first model, making it easier for organizations to use the assessment approach. Its emphasis is to identify an organization's current capabilities, enable the organization to compare its current state to its desired state and determine needed improvements. OGC also has a self-assessment tool available. OGC purposely set up P3M3 without interdependencies between the models in order that independent assessments can be conducted. It also follows a five-level staged approach, building on the CMM-SW structure:

- Level 1: awareness of the process;
- Level 2: repeatable process;
- Level 3: defined process;
- Level 4: managed process;
- Level 5: optimized process.

The seven perspectives (Management Control, Benefits Management, Financial Management, Stakeholder Engagement, Risk Management, Organizational Governance, Resource Management) are in each of the three models and can be assessed at each level. Attributes are part of each perspective, with specific and generic attributes described as appropriate. The emphasis is to provide a flexible approach to meet an organization's

specific and unique requirements. Although a self-assessment approach is included, similar to PMI in OPM3 with its Certified OPM3 Professionals, the APM Group accredits consulting organizations to develop maturity questionnaires.

The Maturity Assessment Process

Regardless of the model selected, the actual assessment process used by the various maturity models available is fairly comparable. Typically, there are eight steps to perform.

STEP 1: OBTAIN ORGANIZATIONAL COMMITMENT AND HOLD A KICKOFF MEETING

The first step is to obtain formal commitment from executives supporting the assessment – the assessment may be performed for an entire organization, a business unit, a department or division, a program or a complex project. It is important to point out from the start that the assessment is not an audit but is a service the organization is requesting rather than something that is imposed. People at all levels need to realize its focus is on improvements and not on compliance, and for the assessment to have meaningful results for the organization, everyone involved needs to be open and honest with the assessors and point out areas of best practices or strengths as well as those in need of improvement. For example, assume the assessment is centered on a program; one project in the program may be following a best practice, such as a formal risk breakdown structure tied to its work breakdown structure, that could be useful on other projects in the program or on other projects in the organizational unit.

Once the commitment is received, the assessors (whether internal or external) should hold a kickoff meeting with everyone who will be involved. If the assessment involves a global organization in particular, the kickoff meeting should be recorded so it can be viewed later by those who cannot attend in real time. The kickoff meeting discusses:

- The purpose of the assessment;
- Areas to be assessed (portfolio, program or project, or all three);
- Assessment model to be used and why it was selected;
- Roles and responsibilities – both of the assessors as well as those in the organization who are participating in it;
- Key points of contact;
- A schedule for the assessment;
- Methods to use to communicate results.

STEP 2: REVIEW ORGANIZATIONAL DOCUMENTS

Organizations have a variety of information available contained in numerous sources concerning their policies, procedures, processes and guidelines concerning portfolio management, program management and project management. The assessment team reviews these documents to gain insight into existing practices.

STEP 3: REVIEW PROGRAM AND PROJECT DOCUMENTS

A sample of documents from programs and/or projects as appropriate next is reviewed by the assessors to determine whether the organizational practices actually are used. This step serves to show actual practice, and the assessment team then can determine why standard practices are not being followed if this indeed is the case.

STEP 4: DISTRIBUTE QUESTIONNAIRES

Many of the maturity models in the assessment approach include a questionnaire that can be sent to a variety of people in the organization including executives, functional managers, portfolio managers, members of a program management office, program managers, project managers and team members as well as perhaps to customers, end users, vendors and other suppliers. Using a questionnaire enables more people to be part of the assessment and helps to foster later support for resulting improvements. Different questionnaires may be sent to different participants on the basis of their role in the assessment process.

STEP 5: CONDUCT INTERVIEWS

Interviews are a major part of most maturity assessments. In the interview process, the assessor should explain to the interviewee why he or she was selected for the interview, outline the purpose of the assessment and help to facilitate an atmosphere in which the interviewee feels comfortable with the assessor to promote an open discussion. The assessor will ask different questions based on the interviewee's specific function. The interview is the time when the assessor can determine why practices are being followed, and if not, why not. More importantly, the assessor can ask interviewees for their suggestions for improvements. The assessor should note that all interviews are confidential, and should point out that specific statements, either negative or positive, will not be attributable to a specific individual. The assessor should note next steps in the process, and thank the interviewee for his or her time, also emphasizing if the interviewee has further suggestions how best to contact the assessor.

STEP 6: ANALYZE THE RESULTS

After the documentation is reviewed, questionnaires (if used) distributed and collected and interviews conducted, the assessment team analyzes the results. Based on the maturity model used, levels of achievement may be determined or the number of best practices in place is described. Specific examples from the assessment complement the analysis.

STEP 7: REPORT THE RESULTS

Then, a report on the results of the assessment is prepared. On the basis of the model, an assessment report and an improvement report may be prepared as one document or separate documents, with the assessment describing the actual results, and the improvement section or report providing details as to what must be done to reach the next level of maturity in the assessment model or to achieve more best practices, with a

proposed schedule to follow. It then rests with the point of contact as to how results will be shared within the organization. In many cases, formal presentations may be held; at other times, an informal presentation is held with the assessment team leader, and then the organization point of contact disseminates the results and the recommendations to be pursued. This person also determines whether or not results will be benchmarked with other organizations.

STEP 8: DETERMINE WHEN TO REASSESS

Many organizations conduct assessments on a regular basis, especially if they are interested in achieving a specific level of maturity. Assessments, however, take time to conduct, and people participating in them like to see progress between assessments to continue to willingly be part of them. An effective metrics program can complement the assessment process to indicate when certain key metrics are achieved, such as the number of projects completed on time, improvements in the overall Cost Performance Index (CPI) or the benefits realized versus those planned, can be set up and used to help determine whether it is again time to perform another formal assessment. Benchmarking with other organizations also is useful in making a decision as to when to reassess. Using the same assessors for the reassessment will reduce the time needed to complete the project. However, the emphasis remains the same: use the assessment to determine areas of strength and those in need of improvement. Even if an organization has attained the highest possible level in a staged model or all of the best practices in OPM3, it is difficult to continue to sustain such a high level of maturity. People in an organization may leave or change positions, new people may join the organization, or strategic changes may lead to a requirement to change policies, procedures and practices. A reassessment can help to see that the organization continues to follow the desired best practices and can leverage results from one assessment to the next. Continuous improvement, and not business as usual, is emphasized.

Contribution of Maturity to Overall Success

Research is limited in terms of the overall contribution of a maturity assessment to organizational success and by extension to program and project success. A study by Ibbs and Kwak (2000) showed there was no statistically significant correlation between maturity models and project success. A similar conclusion was reached in work done by Jugdev and Thomas (2002). Mullaly (2006) noted there was a lack of evidence of these models contributing to overall organizational success based on a study conducted of worldwide organizations between 1998 and 2003. This is further explored by Janice Thomas and Mark Mullaly in Chapter 4. Yazici (2009) studied organizational culture and project management maturity to evaluate the impact on project and business performance, which found project performance is not associated with high levels of maturity in project management. He found there was a combined influence associated with market culture and project maturity on business performance and project management maturity efforts to 'standardize and institutionalize processes, lead to better business performance' (23).

These studies show that maturity on its own does not contribute to enhanced performance. Their contribution is to serve as a way to assess an organization's capabilities

in portfolio, program and project management whether through a level approach, a continuous approach or a best practice approach depending on the model used. The level achieved or the number of best practices in place can indicate priorities and the way in which the portfolio process and specific programs and projects are executed. It is too easy to focus on becoming a Level 5, for example in program management, or to achieve 400 of the 488 Best Practices in OPM3 rather than to emphasize quality processes that are required and ones that can support innovation and creativity. The emphasis is to use the assessment to determine which processes should be improved to contribute to improved performance. They should also be used to identify which processes are not required and may instead be adding another layer of bureaucracy and not adding value as they are too time consuming and use resources ineffectively.

The assessment should prioritize the key improvements to implement, recognizing each one is actually a small project and should be treated as such with specific scope, quality, time, cost and other measures and someone in charge as a project manager to ensure it is implemented. Process improvement initiatives require dedication and are not something that can be completed well in one's spare time; consequently, executive support is critical. Another and equally important dimension is commitment to the improvement initiatives. People must buy into the processes to make them effective ones that enable them to improve how their work is done. Critical thinking, therefore, on the part of the team designing the improvements to ensure the focus is correctly placed, is essential to avoid the tendency of using the model solely to determine a score and make improvements later to increase the score.

Concluding Remarks

As Kerzner (2009) explains, '... excellence goes beyond maturity. You must have maturity to achieve excellence'. (59). As shown by Figure 5.6, it may take two or more years to reach some initial levels of maturity and then excellence may take at least an additional five years. He further explains in more mature organizations, 'more successes than failures occur. During excellence, we obtain a continuous stream of successful projects.

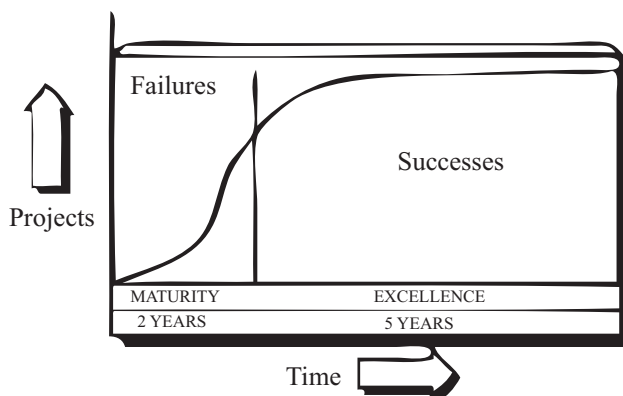


Figure 5.6 Kerzner's excellence model

Source: Adapted with the kind permission of Harold Kerzner

Yet, even after having achieved excellence, there will still be some failures' (59). Later in a private communication to Ginger Levin, he updated this statement: 'Excellence is when benchmarking takes place, lessons learned and best practices are captured, and continuous improvement takes place. However, maturity and excellence in project management cannot guarantee that your projects will be successful. Your chances of success will certainly improve, but success can never be guaranteed. Simply stated:

- Any executive that always makes the right decision is probably not making enough decisions.
- Any company where all of their projects are completed successfully is probably not working on enough projects and not taking enough risks for growth.'

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Auditing Projects and Programs

MARTINA HUEMANN

Project-oriented organizations will audit their projects and programs for many reasons, including for compliance, for quality assurance, for governance or for learning. It is often related to ISO certification or financial auditing. When project managers are asked about their experience with auditing, most report it has been a rather stressful, sometimes even hostile, event. Often it is perceived as a formal box-ticking exercise, to ensure all documents and project plans exist. Project managers do not perceive any added value in this process. Audits of projects and programs can often be initiated because they are not performing as desired. In some organizations projects and programs may be considered as unguided missiles, leading to the feeling they are out of the control of senior management. Little learning on projects may take place and mistakes get repeated again and again. To perceive project management auditing as learning opportunity calls for a reinvention of this quality assurance instrument. This is reflected in the auditing process and in the methods applied as well as in the attitude of the auditor and the cultural aspects of the audit. We may consider an audit as intervention into a project or program.

This chapter introduces new systemic working forms which might be used in addition to traditional working forms like interviews and document analysis.

Project Auditing

PURPOSE OF PROJECT AUDITING

ISO 19011 defines auditing as a systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which the audit criteria are fulfilled. The audit criteria are a set of policies, procedures or requirements set externally to the item being audited. Reasons for audits include certification, internal audits or contract compliance. Auditing is also a method of quality assurance and quality improvement in the context of projects and programs. A project audit is a systematic and independent investigation to check if the project is performing correctly with respect to product, project and/or project management standards. Different terms are used such as project health checks, quick scans or most commonly reviews. Generally, these are considered to be less formal than audits. In many organizations the

term audit tends to be used in the context of certification or financial auditing. In the context of projects or programs the term review is often used instead.

We differentiate controlling from reviews and audits. Project controlling to find out the progress and the status of the project is done by the project manager and the project team. A specific form of review is the peer review. Peer reviews for projects and programs are done by peer professionals such as program managers or senior project managers to give feedback and advice to the project or the program. However, an audit is always conducted by a party external to the project. Thus the auditor provides a perspective external to the project.

TYPES OF PROJECT AUDITING

Either processes or results of processes can be audited. Depending on the objectives and the scope of the audit, different types of audit or review exist:

- Audits that consider specific project deliverables like for example design reviews or contract reviews;
- Audits that consider (technical) project processes, often in combination with project deliverables, commonly referred to as project audit or project review;
- Audits that concentrate on a very specific topic relevant for the project, like risk audit, financial audit or sustainability audit;
- Audits that solely consider the project management process and its results, referred to as a management audit of a project or program or simply a project management audit.

Project audits to check the (technical) project processes and project deliverables are commonly applied in construction, engineering and product development projects and programs. They are applied at the end of project phases. The gate model for an integrated solution delivery of an international engineering company shows for instance the phases: concept, design, development, implementation and benefits delivery. Reviews are carried out to evaluate the deliverables produced during the phases. These reviews are audits of the solution under development, which include the following:

- *Concept phase review*: To assess the completeness of the design concepts, including consideration of alternative designs.
- *Design phase review*: To assess the completeness of design phase work, which includes process design and system requirements, logical design, operations plan and test plan.
- *Detailed design review*: To do a complete technical assessment of the detail design before beginning extensive coding or purchasing of software.
- *Pilot readiness review*: To assess whether the solution is ready to pilot.
- *Implementation readiness review*: To assess the readiness of implementing the solution to its planned full extent.
- *Implementation reviews*: To assess the implementation on each site that implements the new solution. It includes validation of implementation measurements, system performance, site adjustments, planning adjustments, implementation logistics, budget and schedule.

These reviews are linked to stage-gates, which are go/no-go decision points. Only successful reviews allow a project to schedule a gate meeting. These quality assurance activities are an inherent part of the technical content processes and are visualized in the work breakdown structure, the bar chart and the cost plan of such a project. Generally, the processes need to be checked rather early in the project to ensure the quality of the project deliverables, as only sound processes lead to good products and solutions.

A SPECIFIC CASE: PROJECT EXCELLENCE MODEL

A specific case is the Project Excellence Model <http://ipma.ch/awards/project-excellence/the-pe-model/> (accessed 09/13). The model was first developed by the German Project Management Association and has been applied as the basis for the assessments regarding the IPMA Project Excellence Award (see Figure 6.1) for many years (International Project Management Association, 1997). We mention the Project Excellence Model explicitly here in the context of project auditing, although it is considered as a non normative model. Project auditing is normative, as it always needs an explicit base to audit against. But one can argue that the Project Excellence Model with its open ended questionnaire provides a robust enough framework to be the basis for a project audit. If excellent assessors apply the model the strength of the project and further development potentials can be assessed in a transparent, traceable and repeatable way. A major strength of the Project Excellence Model is that it covers project management as well as project results and considers the relationship between process and results. Further it considers social and environmental issues explicitly in some of its criteria.

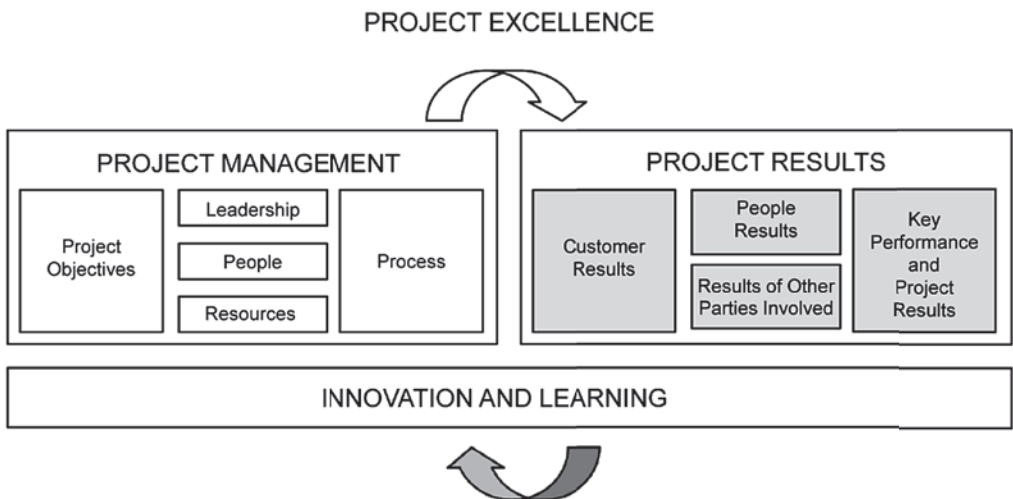


Figure 6.1 IPMA Project Excellence Award

Source: Reproduced with the kind permission of IPMA

Some companies (for instance Siemens) have further developed the model and linked it to the company internal project management process and guidelines to tighten the model up to an underpinning standard against which project management can be more easily assessed. Some parts of Siemens organize an internal Siemens Project Excellence Award to showcase excellent projects and promote project management.

Project Management Auditing

Management auditing of a project or program is an independent investigation to check if the management processes (project management or program management) are performed according to the specified standards of the parent company. The project management audit aims to establish rigor and to assure that project management processes and standards are applied appropriately.

Traditionally, the purpose of project management audits is quality assurance. To turn project management auditing into a learning instrument we add a competence perspective. In a project management audit the management competencies of the project are assessed. These are the organizational, team and individual competences to perform the project management process. Thus, the project or program management process and its results are reviewed. Results of the project start process are, for instance, that adequate project plans exist, a project team has been established, the project roles are clear and communicated. Further in this chapter we will concentrate on management auditing of projects.

THE LENSES WE PUT ON

The baseline for the project management audit, the management audit criteria, depends on the project management approach used as a basis for the auditing. We can only see what we are looking for. Project management standards (Office of Government Commerce, 2009; Project Management Institute, 2013; International Project Management Association, 2006, International Standards Organization, 2012) or company specific project management process description and guidelines can serve as a baseline, as a pair of lenses the auditor puts on to assess the quality of project management of a particular project. The possible learning is limited by the lenses applied, as we can only see what we are looking for through the filters we use. If our pair of glasses is traditional project management then the audit criteria are limited to the traditional project management objects of consideration like scope, schedule and costs. Additional project management objects of consideration such as the project organization, the project culture and the project context only become audit criteria, if a project management approach is used that considers them, such as PRINCE2 (Office of Government Commerce, 2009). If projects are seen as temporary organizations and project management is considered as a business process (Chapter 21), the design of the project management process becomes audit criteria. Only then will the auditor look to see if the project start process, for instance, was designed adequately:

- If there has been a project start work shop and/or a project kick off presentation;
- If the appropriate persons have been included in the project start.

The auditing forms shown later are based on a systemic-constructivist project management approach that for instance values project organization, context, culture, being process-oriented and considers project management as a business process (Gareis, 2005; Chapter 21).

The project management approach that serves as a base in a project management audit has to be agreed beforehand. In most cases the audit will be based on the project management guidelines used in the company that is conducting the project. In other cases consultants from a consulting company may be invited to do the audit, explicitly for the purpose to use a different project management approach as auditing criteria. This can increase the added value of the audit for the project as well as for the project-oriented company.

AUDITS ON A REGULAR BASIS

Project management auditing can be done randomly, regularly or because of a specific reason. Routine project management audits on a regular basis are rare. They are still very often carried out only if the client asks for it or if somebody in the line organization has a bad feeling about the project and suspects a project crisis. Then the method is used for problem identification and controlling purposes.

In some project-oriented companies auditing is done on a regular basis. As the project is a temporary organization (Turner and Müller, 2003), it needs to build up the project management competencies of its organization and its team. To add most value to the project the ideal point in time to do a project management audit is early in the project – for instance, after the project or program start has been accomplished. This provides feedback and gives the project the chance to further develop its management competence. Further audits later in the project are possible to give further feedback but also to verify if the recommendations agreed on in earlier audits were taken care of by the project.

STRUCTURED AND TRANSPARENT PROCESS

An audit needs a structured and transparent approach. Before the audit, an assignment is necessary to initialize the audit, appoint the audit owner (which in most cases will be the project owner), appoint the auditors and provide initial information about the project audit. The result is a project audit assignment that clearly indicates the objectives, reason, scope, timing and the methods to be used in the audit. A structured and transparent process supports the acceptance of the results. An example for a project management audit assignment is shown in Table 6.1.

Table 6.1 Auditing assignment for project: Implementation ERP System

Auditing assignment	
Project: customer project: Implementation of an ERP system	Start date of auditing: 23 February
Reason for auditing: routine, after project start	End date of auditing: 05 March
Auditing objectives: Analysis of the project management quality after the project has been started Analysis of the organizational, team and individual project management competences in the project Results are the basis for an agreement between project owner and project team for further development of project management competences in the project	Non-objectives: Auditing the contents processes Interviews with all relevant environments
Auditing methods: Documentation analysis Interviews with representatives of the project and selected relevant environments Self-assessment of PM competences Observation of a project team meeting	Auditing budget: Auditor: 7 days Representatives of the project: 6 days
Initiator auditing: PM-Office	Project Manager: R Hayes
Auditing-owner: R. Turner (project owner)	Auditor: M. Huemann

Depending on the complexity of the project or program and the objectives of the audit, one or more auditors are assigned. A project management audit process established in accordance with the ISO 19011 should include the steps:

1. Conducting a situational analysis;
2. Planning the auditing;
3. Preparing the auditing;
4. Performing the analysis;
5. Generating the audit report;
6. Performing the audit presentation;
7. Terminating the auditing.

The objectives of the analysis are to clarify the reason for and expectations from the audit. The auditors formulate first hypotheses about the situation the project is in and the quality of its project management process. In the planning step of the auditing the auditors plan the macro design of the process and the meetings they will have with the audit owner and the project organization, the analysis methods they will apply (like documentation analysis, interviews, observations and so on) and the presentation methods that will be used. The result of this step is the audit plan as shown in Table 6.2.

The audit plan has to be agreed by the audit owner as well as by the project manager representing the project to be audited.

Table 6.2 Auditing plan for project: Implementation ERP System

Working format	Participants	Date	Venue
Meeting: start of the auditing	Audit owner Auditor	23.02 Duration: 1 hour	Room: 2.22
Meeting: clarification of the auditing	Project manager Auditor	25.02 Duration: 1,5–2 hours	Room: 2.22
Self-assessment: PM competences of the project manager	Project manager	27.02 Duration: 1 hour	
Self-assessment: team PM competence	Project team	27.02 Duration: 3 hours	Room: 2.22
Group interview with the project manager and project team	Project manager Team members Auditor	01.03 Duration: 2 hours	Room: 1.12
Interview with the project owner	Project owner Auditor	01.03 Duration: 1 hour	Room: 1.12
Group interview with client representatives	Client 'project manager' Further client representatives Auditor	01.03. Duration: 1,5 hours	At client's site
Observation: project team meeting	Project team Project manager Auditor	02.03 Duration: about 1,5 hours	Room: 1.22
Presentation: audit results	Audit owner Project manager Project team Client representatives Auditor	03.03 Duration: 2 hours	Room: 1.10
Meeting: termination of audit	Auditor Audit owner	05.03 Duration: 1 hour	Room: 2.22

AUDIT METHODS

In a project management audit, a multi method approach is used. Methods to gather information include:

- document analysis;
- interview;
- observation;
- site visit;
- presentation;
- workshop;
- self-assessment;
- systemic constellation.

These methods can be used to analyze the project management competence of the project. Choosing which of these methods are applied depends on the specific case and

on the audit assignment. An audit should at a minimum include documentation analysis and interviews. The more holistic the picture should be the more different angles on the project or program are necessary, including interviews with different representatives of the project and relevant stakeholders such as investor, suppliers and other parties that are affected by the project. Further to traditional methods we made good experience by also applying self-assessment methods and systemic working forms. By applying such additional methods the audit becomes even more a learning experience for the project.

Methods to present the audit results include:

- report;
- presentation;
- workshop.

The quality of the results of the audit depends very much on the scope of the methods and the professional application of these.

Document Analysis

In a document analysis the project management competence of a project team can be observed. Documents to be considered are project management documents such as the project work breakdown structure, project bar chart, project environmental analysis, project organization chart, project progress reports and minutes of project meetings. Table 6.3 shows some questions from a questionnaire used in an audit.

Table 6.3 Auditing questionnaire

Project planning methods in the project start	Document	Quality
Project objectives plan	2	2
Plan of objects of consideration	1	–
Project work breakdown structure	2	2
Work package specifications (for selected WP)	2	3
Gantt chart	2	3
Project finance plan (demand?)	n.d.	–
Project cost plan	2	4
Project risk analysis	2	3
Project scenario analysis (Demand?)	1	–
Document key: n.d.=no demand, 0=no document, 1=information available, 2=document available	Quality key: 1=not adequate, 2=low quality, 3=average quality, 4=good quality, 5=very good quality	

This questionnaire supports the analysis. To add value to the project team the auditor does not stop with ticking boxes whether a certain project management document is there or not, but the auditor also analyses the quality of the project management plan and provides feedback. Criteria for assessing the quality of the project management plans include completeness, structure and visualization; and the consistency between the single project management documents. The quality criteria depend on the project management approach used as a basis for the audit. In the case of a process-oriented project management approach, for instance, the auditor will always look for a process-oriented work breakdown structure.

Interview

Interviews can be conducted to obtain more detailed information based on questions that arose from the documentation analysis. The interviews are conducted with the project manager, the project owner and representatives of the project team. In the case of a program, interviews with the program owner, the project managers and project owners of the different projects are required. To get a holistic perception on the project it is often essential to conduct further interviews with representatives of relevant stakeholders like the client and suppliers. Single and group interviews can be differentiated, while the single interviews may allow more concentration on one interview partner and digging into a very specific topic, the group interview has the advantage that the auditors can collect the possibly different perception of several interview partners at the same time and see their interaction with each other.

Observation

In an observation the auditors collect further information about the project management competence based on observation criteria. Project owner meetings, project team meetings and project sub team meetings can be observed. For instance, by observing a project team meeting, the auditors gain insight into the project management competence of the team.

Self-assessment

Applying self-assessments can greatly add to the learning perspective of an audit, as the auditees from the project team create a picture of the situation for themselves which may provide the auditors with additional insights, and at the same time make them understand the situation. Such self-assessments may cover assessments of individual project management competence of players such as the project manager, the project owner or a project team member. Such self-assessments provide the individuals with the possibility to reflect their current status of project management competences. In addition to individual self-assessments, self-assessments for the project team may be applied to allow the project team to reflect on whether they as a team have a common understanding of the project objectives, can develop commitment, use synergies, solve conflicts or see learning as a value in the project culture.

To make the project team more aware of the status of the project, a project score card may be applied to help the project team organize for project control. The assignment to the project team to apply a project score card and assess the project status allows the auditors to get a quick insight into the project and the project team to raise awareness as to where they stand.

The auditors may combine the team or project self-assessment with an observation. Both situations provide possibilities for observing the process and gathering further information

Systemic Board

A systemic board is a specific working form in which an individual or a small team uses different objects (for example wooden blocks) to visualize a project situation. For example an assignment given to a project manager or some representatives of a project can be to visualize the current situation of a project.

Figure 6.2 provides an example of such a systemic board. This working form allows the visualization of relationships, abstraction and systemic thinking. The method is increasingly applied in project and program evaluations and allows the generation of a rich picture of the project situation. It is an immediate intervention in the project as the project manager, who applies the method to show and verbalize the project situation,

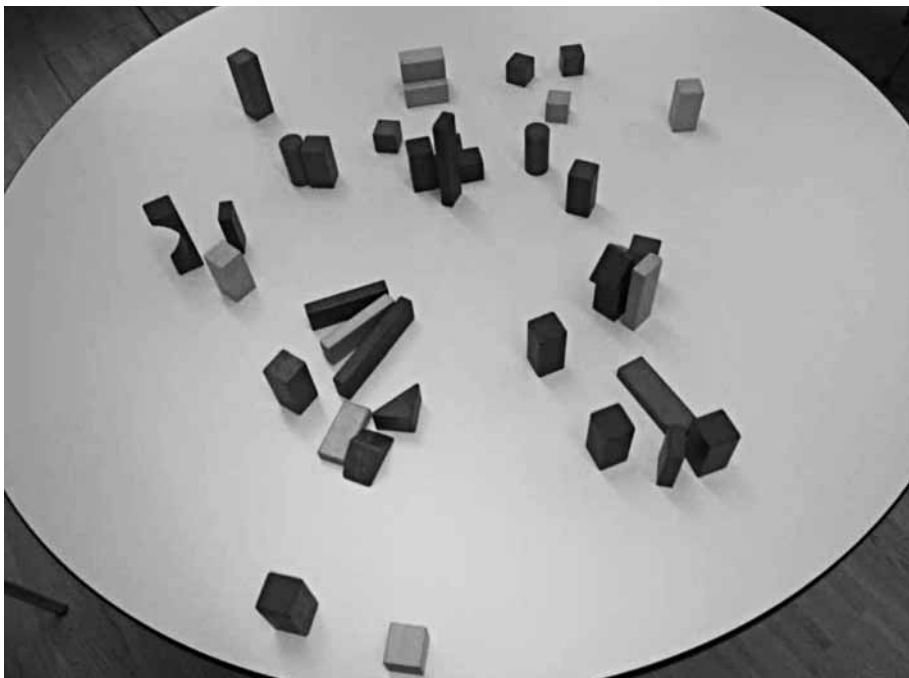


Figure 6.2 A systemic board as an audit method

Source: Author photo

understands the situation and may find or be guided to find solutions for improving the project situation. If the setting includes the working on a solution for example in a crisis situation or conflict situation the differentiation to project coaching might get blurred.

Presentation and Workshop

As part of collecting information on the project as well as for presenting the project management audit findings, presentations and even workshops can be used. Presentation situations might help to ease a stressful situation for the project manager, as he or she normally has the desire to showcase the project to the auditors. Such project presentations are an adequate method for example early in the audit, in an audit kick off, when the auditors and the representatives of the project or program meet and the auditors provide an overview on the auditing plan. The project manager might be given the task to introduce the project briefly in a 15- to 20-minute presentation. In order to make an audit a learning experience a presentation of the results is necessary. The results should at least be presented to the project manager, the project team and the project owner (who is the audit owner). This leads to a better understanding and greater acceptance of the results and enables the project to become a learning organization.

Report

The objective of the report is to summarize the audit findings and to provide recommendations to further develop the project. Table 6.4 shows the structure of a project audit report.

Table 6.4 Structure of an auditing report

Structure: Project management auditing-report
Executive summary
Situation analysis, context and description of the auditing process of Project XY
Brief description of the Project XY
Analysis of the project management of Project XY
Analysis of the project start
Analysis of the project coordination
Analysis of the project controlling
Analysis of the project close-down
Recommendations for the further development of project management of Project XY
Recommendations for the further development of project management in the company
Enclosures

We differentiate between recommendations for the project and those for the parent company, if some of the issues are of general concern for all projects or if issues cannot be solved at project level, but only at company level. To increase acceptance, the project

manager should have the opportunity to provide feedback to a draft report. The audit report is the basis for the follow-up agreement which is done between project manager and project owner/audit owner. The latter is responsible for checking whether the recommendations have been followed.

CLEAR ROLES IN THE AUDITING SYSTEM

The auditing system is a temporary communication system in which the audit owner, the auditor(s), representatives of the project and representatives of relevant environments cooperate. We differentiate between the initiator of the audit and the audit owner. Initiators of the audit can be for example the PM office, a representative of a profit center or the client.

Audit Owner

We recommend the audit owner should be the project owner, whose interest is to assure the quality of the management of the project, provide a learning opportunity for the project team and to ensure the audit can be performed. The audit owner is responsible for the assignment of the audit, agreements about scope, timing of the audit with representatives of the project and the auditor. Further the audit owner has to ensure the (project) resources for the audit.

Auditors

Often the audit is performed by two to three auditors, one of whom takes over the role of lead auditor. The auditors analyze the project management and give recommendations regarding the further development of the management of the project. The auditor is not responsible for following up, to see whether the recommendations are implemented into the project. The auditor needs not only profound project management competences but also auditing competences like designing the auditing process or performing an interview professionally. Thus attitude, social competence and emotional intelligence are important.

Auditees

The role of the main representative of the project is taken over by the project manager of the project that is audited. The objective of this role is to contribute information for the audit and to invest resources. Tasks of the project manager in an audit are for example to contribute to clarify the situation in the project, give feedback to the audit plan, to agree on scope and methods of the audit, provide documents for the documentation analysis or be an interview partner. Further representatives of the project and project stakeholders serve as information providers in the audit process.

RULES, VALUES AND COMMUNICATION

The rules for the audit have to be agreed in the auditing system. The communication policy should be agreed between the auditor and the project manager as the main representative of the project at the beginning of the audit. To provide a learning opportunity to the project, the audit needs to be performed in a cooperative style. That also means that the representatives of the project that is audited should be kept informed by the auditor. Circumstances that should lead to a cancellation of the audit and the consequences of a cancellation should also be agreed on at the start. The quality of the audit depends on the willingness of the project to cooperate and the time and resources available. One major challenge is that the results of the audit are not perceived as personal feedback to the single project manager who then will be blamed for mismanagement. This means also that there is the need for a certain culture of openness in the project-oriented company.

FOLLOW-UP OF THE AUDIT

Often the results of the audit are not implemented by the project. A formal follow-up is necessary. An audit follow-up agreement signed by the project manager and the project owner ensures the implementation. After the auditors have provided their feedback and recommendations in the audit presentation and documented them formally in the audit report, they step out. The audit is formally determined in a last meeting with the audit owner. Determining which of the actions recommended in the audit report needs to be implemented in the project is agreed between the project owner and the project manager or project team. Thus the follow-up of the audit is also the task of the project owner and not of the auditor.

AUDITING FOR THE GOVERNANCE OF PROJECTS

So far we have discussed the methods and process of management auditing of projects and programs. In this section we reflect on the need and benefits. Finally we clarify the role of the PM Office (PMO).

NEED AND BENEFITS

The need for management auditing of projects derives from the empowerment of the project and programs, which in an ideal project-oriented organization act autonomously with a minimum of intervention by the line organization. To assure quality and the application of agreed standards, management auditing is necessary. Therefore we perceive project and project management auditing as instruments for governance in the project-oriented company. The benefits of audits of projects are twofold. On the one hand they provide a learning opportunity to the single project to improve its project management competence. On the other hand, by evaluating the results of several management audits, patterns can be found. For instance, if a lot of the projects have a low-quality cost plan or do not apply proper project control, these issues are general subjects for improvement in the parent organization. The results of the audits can further lead to an improvement of the business processes project management or program management.

RESPONSIBILITY

Empowerment of projects and programs is one of the key values of the project-oriented company. To govern the projects and to ensure quality of the project management and program management processes, the PMO provides project management guidelines and procedures, standard project plans for repetitive projects, project management infrastructure, management consulting services and management auditing for projects and programs. Thus the PM office is responsible for the development of guidelines and procedures of the management auditing of projects. A standardized auditing process ensures the comparability of the auditing results between projects.

Auditors may be recruited externally to the company (such as consulting companies), or internally. Auditing can be considered as job enlargement for senior project managers. The auditors are often organized in a (virtual) pool linked to the PMO. Also, the PM office is responsible for the training of the auditors. Professional auditors need to be experienced project managers, but also need to know the auditing process and methods.

Concluding Remarks

The chapter shows what a systematic auditing process might look like. It has described auditing methods such as documentation analysis, interviews and observations. In addition less traditional methods such as self-assessment and systemic constellations have been introduced. The roles in the auditing system are described and the need for a clear communication policy is stressed. Finally the responsibility of the PMO for the provision of auditing guidelines and forms is discussed and the benefits reflected.

The benefits of management auditing of projects and programs are to provide governance as well as learning to a project or program. However, the evaluation of the results of several project management audits may serve as a basis for the further development of project management in the project-oriented organization.

The chapter advocates that management auditing of projects and programs should be performed to value. The recommendations as shown in this chapter can be summarized as follows:

- *A modern project or program management approach:* This has to be the basis for managing auditing of project and program.
- *Auditing should be done on a regular basis:* For instance every project or program with a certain complexity should be audited after its start, and maybe at significant stage-gates.
- *A certain formalism is required:* Auditing process description and forms like auditing assignment, auditing follow-up agreement, support the standardization and transparency of the audit.
- *Clear expectations and communication agreements:* Objectives, scope, consequences of the auditing have to be clear. It is not the project manager who is audited but the project. This has to be communicated! A communication policy has to be agreed on.
- *Assessing the quality of the project methods and techniques:* It is not good enough to tick boxes whether a certain project management document exists or not, but to add value

it is necessary to go one step further and assess the quality of project management and provide feedback.

- *Multiple audit methods:* Interviews with the client and suppliers are very challenging but add different and very important perspectives to the audit results. An audit based on only one interview with the project manager is very limited. Self-assessments and systemic constellations are good instruments for learning. A presentation of the audit results adds on to the understanding and supports the acceptance of the results.
- *Clear role and responsibility of the auditor:* The auditor provides his or her feedback to the project and recommends actions. Which of these actions need to be implemented in the project is agreed between project owner and the project manager or project team. The follow-up of the audit is the task of the project owner and not the auditor.
- *Responsibility for the auditing:* The PMO can provide auditing as a service to the projects and programs.
- *Professional auditors:* The auditors need to be experienced project managers, but also need to know the auditing process and methods. Senior project managers, who would like to act as auditors need special training in auditing methods.

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2 Performance

In the third edition I called this part Functions, following the lead I had set in my book, *The Handbook of Project-based Management* (3rd edition, McGraw-Hill, 2009). In the fourth edition and this edition, I have called it Performance mainly for the alliterative effect. However, it is now common to talk about the so called golden triangle as time, cost and performance, or else to describe it as time, cost and functionality, and the three together as performance. Thus it is now common to talk about the achievement of a project's objectives, and its time, cost and quality targets generically as the management of project performance; thus the name of this part. PMI in its *PMBOK Guide* of course refers to these elements as the body of knowledge areas, the areas required to deliver project performance.

The first chapter gives an introduction to performance measurement. The next five describe a chain through which we define and manage what the project will deliver. We start with the benefits we ultimately want to achieve and then define the requirements of the project to help us achieve those benefits. Then we need to manage the scope of work of the project, and the value of the projects, which is the ratio of the benefit to the cost of the work. Finally we need to manage the finish or quality of the new asset delivered. The next two chapters are about the organization to deliver the project, the project organization itself, and the engagement of other stakeholders. Then we consider the other two major components of performance, time and cost, and the manpower or resources needed are a component of cost. The project is subject to uncertainty, and so we need to manage that risk. Finally in this part we consider the environmental impact of the project, which is now dealt with under the concept of sustainability.

Chapter 7: Measuring Performance

In Chapter 7, Lynn Crawford gives an introduction to this part, giving an overview of the issues of performance measurement, describing how to measure the performance of not only projects, but also programs, portfolios, the project-oriented organization and people in projects.

Chapter 8: Benefits Realization Management

In Chapter 8, Gerald Bradley describes the management of benefits. He considers the potential contribution of benefits realization management, its components and how to implement it.

Chapter 9: Requirements Management

Darren Dalcher describes requirements management in Chapter 9. First he reminds us why it is important, and then describes the requirements management process. He explains requirements management throughout the project life-cycle and introduces a requirements management toolset. He also explores the factors delivering successful requirements management.

Chapter 10: Managing Scope and Configuration

In Chapter 10, Hemanta Doloi describes the management of scope and configuration. He introduces the scope management process and describes a technique he has developed called the life-cycle project management model.

Chapter 11: Managing Value

Projects are undertaken to deliver value for the sponsor. Understanding, defining and managing this value is critical to success. In Chapter 11, Stephen Simister describes the process of value management, a structured technique for understanding, defining and managing value. The broader concept of value is explored in considering how projects contribute to shareholder value.

Chapter 12: Managing Quality

Not only is it necessary to define the functionality of the facility, but also the quality of finish. This covers many attributes or service levels required. In Chapter 12, Nevan Wright describes the management of quality. He adapts six sigma to fit sigma to describe a quality management process for projects, and to develop supporting tools and techniques.

Chapter 13: Organizing for Projects

In Chapter 13, Monique Aubry describes the organization of projects. She describes the project function, and implications for the organization of projects.

Chapter 14: Managing for Stakeholders

Stakeholders are the people who have an interest in the outcome of the project. Some can be for, some against. In Chapter 14, Pernille Eskerod and Martina Huemann describe how to engage with stakeholders and to emphasize that we are trying to win their support; they talk about managing for stakeholders rather than of stakeholders. They describe a stakeholder management process, and consider the roles people have to engage with for stakeholders.

Chapter 15: Managing the Schedule

In Chapter 15, Homayoun Khamooshi describes the management of the project schedule. He describes the components of the project schedule, and how it should be developed, before describing some of the more modern views on the nature of project scheduling.

Chapter 16: Managing Cost and Earned Value

In Chapter 16, Mario Vanhoucke describes the use of earned value management, EVM, to manage the costs and schedule of a project. He describes its various components, and gives detailed examples.

Chapter 17: Managing Resources

In Chapter 17, Vittal Anantatmula describes how to manage a key component of cost, the resources used on the project. He describes a resource management process, and gives a brief overview of the critical chain method to optimize resource usage.

Chapter 18: Managing Risk

In Chapter 18, David Hillson describes how to manage the risk inherent in the work of projects, and the uncertainty in all estimates. He describes the concepts of risk management, a risk management process and the responsibilities of people involved.

Chapter 19: International Projects

In Chapter 19, I describe international projects. In our globalized world, international projects are becoming more and more common. It was originally my intention to write about international and virtual teams, but I have dropped people from this edition of the book, so decided not to introduce it here. So I cover two issues related to the chapters of Part 2, risk and quality. I also consider the issue of offshoring, that is sub-contracting work overseas. I consider why we do it and how to establish an offshore arrangement.

Chapter 20: Sustainability

In Chapter 19, Gilbert Silvius and Ron Schipper describe sustainability on projects. They describe concepts and principles of sustainability and how they apply to projects.

LYNN CRAWFORD

Performance measurement is the selection and use of quantitative or qualitative data to provide information about the quality and performance of activities, systems, individuals, groups and organizations and to determine progress towards and achievement of objectives. It is a widely accepted concept in business where it is primarily associated with financial criteria such as return on investment (ROI). Since the 1980s, financial measures of performance have been criticized as historical in nature, offering little guidance for future performance or improvement. They are seen to encourage a short term view that lacks strategic focus, does not take into account the specific needs or expectations of clients or customers and is insensitive to the external context. Such concerns were addressed in the balanced scorecard approach (Kaplan and Norton, 1992), which proposed the use of customer perception, internal business process and learning and growth measures in addition to financial criteria. Another extension of the criteria traditionally used to measure organizational success is proposed in the triple bottom line (Elkington, 1994), which includes social and environmental criteria as well as economic performance measures.

For projects, financial measures and other hard or objective criteria, such as time and cost, remain central to the measurement of performance but the need for a wider and more contextually sensitive set of assessment criteria has been increasingly recognized. Before deciding on the specific criteria or measures for assessment of performance in the project context we need to consider the purpose of the assessment, the units to be measured and how measurements will be made. There are many dimensions to consider. Are we measuring performance of a single project, a program or a project portfolio? Are we measuring success on completion or success or performance at phases in a project or program life-cycle? What is the difference between concepts of success and performance? Are we measuring the performance of individuals or teams within projects or are we measuring the project management capability of an organization or business unit?

This chapter will begin with discussion of a range of issues that need to be considered when undertaking any form of performance assessment or evaluation, including what to measure and why. It will then look in more detail at measuring performance of single projects, multiple projects including programs and portfolios, organizational project capability, people in projects and finally sustainability and corporate social responsibility.

Assessing Performance

PURPOSE OF ASSESSMENT

Assessment is any process that allows us to receive feedback on or make judgments about or in some way analyze a set of activities. It can take many forms. In designing a performance assessment process it is useful to think in terms of what, when, where, why and how, as well as who will conduct the assessment and for whom is it being done. Measuring performance requires effort both on the part of assessors and those who are being assessed or are responsible for what is being assessed. To ensure that the assessment process is useful, meaningful and resource efficient we need to understand the purpose of the assessment. Why is it being undertaken? Possible purposes are:

- Ensuring alignment with strategy;
- Determining achievement of objectives or outcomes;
- Determining effectiveness or efficiency;
- Reviewing progress;
- Ensuring adequate competence or capability to support performance;
- Providing feedback for improvement.

UNIT AND CONTEXT OF ASSESSMENT

In order to satisfy the specific purpose, what needs to be assessed? Answering this question requires an understanding of both the unit of assessment and its context. As shown in Figure 7.1, the focus of assessment may be on outcomes, processes and practices or the competence and skills of people.

	Single Project	Multiple projects	Organisation
Competence & Skills	Project Manager Project Director Project Sponsor Project Team Members Project Team	Program Manager Program Sponsor	Portfolio Manager PMO Manager Executive Sponsor
Outcomes, Processes & Practices	Project Project Performance Project Success Project Healthcheck Project Management Project governance	Program Program Performance Program Success Program Healthcheck Program Management Program Governance	Portfolio Portfolio Performance Portfolio Success Portfolio Management PMO Management PPP Governance Organisational PM Capability

Figure 7.1 Context for performance assessment: a guiding framework

The context may be a single project, multiple projects or programs or organizational capability including portfolios.

PERFORMANCE AND SUCCESS

When measuring performance we need to be very clear about the terms we use and what we are assessing in order to avoid confusion and ensure effectiveness of the assessment process. Although the term 'measuring performance' is widely used it is actually open to a wide range of meanings and interpretations. Terms such as performance and success are often used interchangeably but different people at different times may interpret them in different ways. It is now generally accepted that success is in the eye of the beholder and may be a matter of timing. The Sydney Opera House is often used as an example of this. At the time of its design and construction it was considered a failure because it significantly failed to meet time, cost and quality criteria, but decades later it is recognized as the most representative man-made monument in Australia and a masterpiece of modern architecture. This illustrates a difference between project management success and product success. In the case of the Sydney Opera House, while the management of the project may be considered unsuccessful, the final product is an acknowledged success.

This distinction between project management success, concerned with internal measures of project performance such as time, cost and quality and product or project success, measured against the overall objectives of the project (Cooke-Davies, 2002; Jugdev and Müller, 2005), is useful, although success remains an ambiguous concept that may be judged differently from different stakeholder perspectives over time. Nevertheless, for practical purposes the definition provided by Baker, Murphy and Fisher (1988) in their landmark study reflects a generally accepted understanding of the concept. They concluded that success is a matter of perception but that a project will be most likely to be perceived as an 'overall success' if:

the project meets the technical performance specifications and/or mission to be performed, and if there is a high level of satisfaction concerning the project outcome among key people on the project team, and key users or clientele of the project effort.

Further, although it is generally agreed that time and budget performance alone are inadequate as measures of project success, they are still important components of the overall construct. Project management success can therefore be seen as a component of project success. In examining the literature on project success, Patanakul, Iewwongcharoen and Milosevic (2010) proposed that dimensions for judging success could be categorized into internal or project related criteria (time, cost and performance), customer related criteria (satisfaction, actual utilization and benefits) and organization related criteria (financial, market and benefits).

When thinking about assessment metrics it is useful to distinguish between *success* measures which relate to the achievement of objectives or outcomes and *performance* measures which relate to the processes and practices used to deliver the outcomes. In terms of timing, performance measures relating to processes and practices are most likely to be used during the course of a project or program while success measures relating to the achievement of outcomes are most likely to apply at closure. Customer related criteria

such as actual utilization and benefits are most often measured some time, generally three to 12 months, after project or program completion and handover.

CRITERIA AND FACTORS

Two other terms that often cause confusion and lack of clarity in performance measurement are 'criteria' and 'factors'. Essentially, criteria are measures or metrics that can be used as a basis for judgment and factors are elements or causes that contribute to a result. This may seem confusing because factors that affect a result may also be used as criteria. For instance, delivery on budget may be used as a criterion for judging success, but delivery on budget may also be a factor contributing to achievement of other criteria for judgment of success such as return on investment or client satisfaction.

BENCHMARKS AND STANDARDS

In order to interpret and make use of performance measures it is necessary to have standards or guidelines of acceptable performance against which actual performance can be compared. These will vary according to the purpose of assessment and the performance measures being used. Basic performance measurement for monitoring purposes compares actual performance with planned performance. However, it is still necessary to have guidelines that indicate what level of variation is considered acceptable. For instance, if we are assessing time and cost performance of a project at completion, acceptable performance may be $\pm 5\%$ of agreed baseline. Acceptable quality may be set at zero defects or 90% customer satisfaction rating.

Other forms of performance measurement may be used to identify gaps or drive improved performance. In this case standards can provide indicators of minimum achievable outcomes, process checklists or targets for improved performance or 'best practice'. An example of this would be assessment of organizational project management capability, where we may decide to use one of the many capability maturity or excellence models available from professional associations and consulting organizations (PMI's OPM3, the UK Cabinet Office's P3M3, IPMA's Delta, Human Systems' 4Quadrant Model, see Chapter 5) both as a basis for measurement and a guide for improvement.

Benchmarks are a particular form of comparative indicator. They are measures that represent the best performance of a particular outcome, process or practice either within or across projects or industries. Internal benchmarking can be done within an organization by identifying the best performance against one or more metrics across a number of projects, divisions or other units of assessment. The benchmark demonstrates that a specific level of performance is achievable and provides a realistic target for improvement across all projects or divisions. External benchmarking involves looking outside the organization for 'best practice' comparators. This is most effectively done if there is access to a database of performance data that can be used as a basis for comparison. Such databases are generally developed over a period of time through collaborative arrangements between groups of companies. Examples are the Benchmarking & Metrics program of the Construction Industry Institute (CII) which enables member companies to compare performance of their capital and maintenance projects against a large sample of projects from industry leaders; the extensive database of process industry projects maintained by Independent Project Analysis (IPA) as a basis for assessing and comparing

project elements and results and the cross industry project management benchmarking network facilitated by Human Systems International Ltd (HSIL) that focuses on assessment and improvement of organizational project management capability.

MEASURES

Performance measures are generally considered to be quantifiable expressions of the amount, cost or result of activities that provide information on quality of capabilities, capacity, processes, practices and outcomes during a given time period. They should, as far as possible, be objective in the sense that they are not influenced by emotions or open to multiple interpretations. Ideally, measures will be direct rather than indirect.

A measure is direct when it measures, directly, what you want it to measure. For instance, if you want to know the number of bricks laid in a specified time period, you can count the number of bricks laid. A measure is indirect when you measure something by measuring something else. For instance, you may wish to measure commitment of team members. You could ask them directly to tell you how committed they are but the answer would be subjective. Alternatively you could measure the number of days sick leave taken in a specified time period and use this as an indirect measure of team member commitment. This example illustrates one of the difficulties in using indirect measures. The relationship between the measure and the phenomenon in which you are interested is not clear and straightforward. While it is reasonable to assume that there is a link between team member commitment and attendance on the job, there are many other factors that may contribute both to number of days sick leave and to commitment. This is referred to as 'noise' in the system. Clearly, direct measures are preferable but not always possible. Similarly, objective measures are preferable but not always possible. Customer satisfaction is a commonly used measure that is difficult if not impossible to measure both directly and objectively. A measure of customer satisfaction may be repeat business. This measure is objective but indirect. Asking the customer to rate their level of satisfaction on a scale of 1 to 5 is a direct measure but is subjective. Although the answer will be a number and will appear quantitative, it is in fact subjective. It is important to remember that numbers are not always objective. For instance, measures that use any opinion based rating or ranking scale are inherently subjective.

In projects, time, cost and other financial measures are popular because they are easily determined, objective and direct. Other aspects of performance are less amenable to direct and objective measurement. Tangible outcomes are easier to measure directly than intangible outcomes and so benefits, which are usually intangible, can be particularly challenging. The more indirect the measure, the more difficult it becomes to ensure that the measures are objective and meaningful indicators of the outcome or quality that is being measured.

Characteristics of good measures

Apart from striving wherever possible for measures that are direct and objective, and understanding the limitation of measures that are indirect or subjective, there are other characteristics to look for when selecting performance measures. The following

characteristics are adapted from the requirements for performance information set by the Government Accounting Standards Board (USA) (2008).

Relevant measures: satisfy the purpose and requirements of the audience for which they are intended. They will also be *useful* in providing feedback that is required for governance, control or improvement.

Understandable measures: will be clear to those required to provide, analyze, receive and interpret the information they provide.

Timely measures: will be current and provided with sufficient frequency to support decision making and action.

Comparable measures: provide feedback on changes in the level of performance over time and whether or not performance expectations are being met. They also enable comparisons with performance against the same measures in similar projects, divisions or organizations for benchmarking purposes.

Consistent measures: support comparability by ensuring that the same items of performance information are reported over time to enable tracking of variation or improvement in performance. Measures should however be reviewed from time to time to ensure continuing relevance.

Reliable and valid measures: are verifiable, free from bias and measure what they are meant to measure. Of course, this can be more challenging where it is necessary to use indirect and/or subjective measures, but triangulation, which involves using a number of measures to track the same item of performance, may improve validity. Internal control systems for collection of performance data can assist with reliability.

For all measures it is also important to ensure feasibility, cost and resource effectiveness in collecting the necessary data. In other words, the data are available and will not require unreasonable levels of additional effort to collect and analyze. This raises the issue of how many performance measures to use. Collecting, storing, reporting, monitoring and analyzing data can be expensive in terms of time and effort. Tracking too many performance measures at any one time may dilute the overall impact but too few measures may not provide a useful picture of performance. One suggested rule of thumb is the use of 10–15 measures at any given level of the organization (Office of Financial Management, 2009). Each level of the organization (executive, division, portfolio, program, project) may have 10–15 measures that include some measures used by lower levels.

Success criteria and factors as measures

A useful source of potential measures for project performance are success criteria and critical success factors. A considerable amount of research has been done over the last 40 or so years providing useful checklists. If we are measuring performance to determine whether objectives have been achieved, then success criteria may be a useful source of generic measures. Factors that have been found to contribute to satisfaction of success criteria are useful as progress measures and indicators of likely achievement of desired objectives and outcomes. Fortune and White (2006) reviewed 63 research publications that had focused on critical success factors for projects. The results of their analysis have been divided into necessary conditions, practices and project characteristics and are presented in Table 7.1

Table 7.1 Critical success factors for projects identified by Fortune and White (2006)

Necessary conditions	Practices	Project characteristics
Support from senior management	Strong/detailed plan kept up to date	Proven/familiar technology
Clear realistic objectives	Good communication/feedback	Environmental influences
Strong/suitably qualified/sufficient staff/team	User/client involvement	Political stability
Competent project manager	Effective change management /control	Project size/complexity/# of people involved/duration
Strong business case/sound basis for project	Good leadership	Different viewpoints (appreciating)
Sufficient/well allocated resources	Risks addressed/assessed/managed	
Realistic schedule	Effective monitoring/control	
Project sponsor/champion	Planned close down/review/acceptance of possible	
Adequate budget	Correct choices/past experience of PM	
Good performance by suppliers/contractors/	Past experience (learning from)	
Organization adaptation/culture/structure		
Training provision		

They noted that the three most cited factors are: the importance of a senior management support; clear and realistic objectives and production of an efficient plan. Through my own work, I have identified four sets of practices (engagement of stakeholders, communication of change, ensuring business integration, making informed decisions) and two contextual variables (stability of context and stakeholder cohesion) as key predictors of project success. Other factors considered as influencing success include organizational culture; behavioral competencies of the project manager; fit between the project manager and the project; leadership; vision; knowledge sharing; social embeddedness and cultural characteristics; change readiness and change implementation capability.

CATEGORIZATION

Comparability of measures and benchmarking of performance, whether internally or externally, requires categorization to enable like to be compared with like. Categorization facilitates analysis and enables data to be used in a variety of ways for reporting purposes. Categorization is done by assigning labels or attributes to distinguish between items of different types. For performance measurement on projects, the first level of categorization is identification of projects as a unit of measurement by differentiating projects from

operations. Measurement may then be done at the level of the individual project, at the program level or the level of portfolios of projects and programs. A corporate project portfolio may be broken down by business unit or division, by geographic location or industry sector.

Categorization systems are rarely simple. They are usually hierarchical in that projects are categorized or labeled one way (for example small, medium, large) and then each category is categorized further, in different ways (Crawford et al, 2006). For instance, small, medium and large project types may be broken down into different groupings based on other attributes. In parallel systems of categorization, several sets of attributes are assigned to every project. Both parallel and hierarchical systems may be combined so that, for instance, all projects may be categorized by division, by size and by phase (initiation, planning, execution, close-out).

In some cases it is useful to use composite attributes for categorization. The most common example is complexity. Although projects may be categorized as being of high, medium or low complexity this is open to a wide range of interpretations. Most organizations that categorize the level of complexity use several attributes, between two and 12 (with an average of five). These attributes include project scope, technical complexity, number of functions and skills and level of ambiguity and uncertainty (Crawford et al, 2006). A useful approach to categorization of complexity is provided by the Global Alliance for Project Performance Standards (www.globalpmstandards.org) in their CIFTER, a table used for categorizing the management complexity of projects. The CIFTER uses seven dimensions of management complexity, rated from low to high or very high to arrive at a score that can be used for comparing projects with similar levels of complexity. A similar instrument (ACDC Table) differentiates management complexity of programs, taking into account governance, stakeholder relationships, program definition, benefits delivery and resourcing.

The most commonly used attributes for project categorization are: application area, nature of work, client/customer, complexity, cost, size, strategic importance, risk level, organizational benefit, deliverables (Crawford et al, 2006). Attributes are selected according to the purposes for which they are to be used but each attribute may be used for different purposes. For instance, the composite attribute, complexity, may be used to guide choice of governance structure, risk mitigation strategy, contract type, selection of methods and tools or choice and assignment of personnel. For performance measurement, two major purposes for categorization are tracking of efficacy of investment in projects and developing project delivery capability within the organization. Measures of time and cost performance could be used for both these purposes.

Categorization is a pre-requisite for reference class forecasting which is based on theories of decision-making under uncertainty (Kahneman and Tversky, 1979). Reference class forecasting relies upon information about actual performance in a reference class of comparable projects and has been proposed as a way of mitigating the effect of optimism bias and strategic misrepresentation on estimates (Flyvbjerg, 2006) in infrastructure projects.

Measuring Performance in Specific Contexts

The basic principles and building blocks of performance measurement can be applied in various project contexts (Figure 7.2).

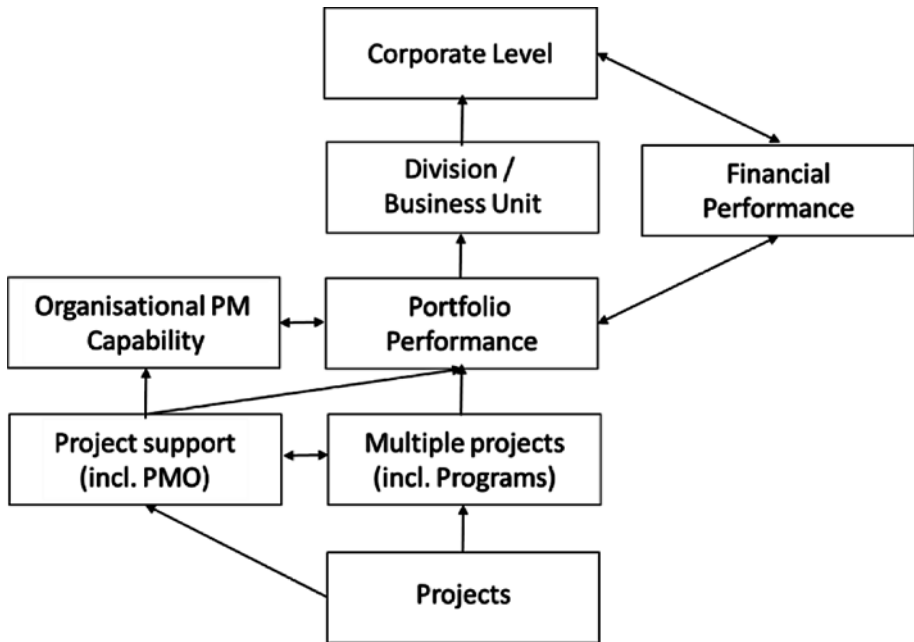


Figure 7.2 Reporting and data flows for project-related performance measurement

Some ideas for measuring performance of single projects, multiple projects including programs, portfolios, organizational project management capability and people in projects are provided here.

PROJECTS

Projects are the primary unit for measurement of project-related outcomes, processes and practices. Assessments at the program, portfolio and organizational capability levels will all draw upon one or more aspects of individual project performance so it is appropriate to deal with this first. Measures used at the project level are primarily concerned with monitoring and reporting performance against scope, time, cost and quality baselines. The focus of measurement is internal to the project rather than for comparative purposes. For the individual project, standards are only likely to be used to set tolerances for acceptable variation from baseline. Ideally this information will be used to monitor and control project performance but in some cases the focus for collection of performance data at the project level may be less for the benefit of the project and more to meet the demands of reporting cycles and other requirements.

Project managers notoriously have difficulty with cost reporting because many organizations do not have integrated systems that provide timely cost data that are relevant at project level. Where enterprise resource planning (ERP) systems are in place they may help or hinder performance measurement at the project level. If the systems are well tailored to gathering and reporting of project level data then this can increase accuracy and reduce the effort required by project managers for data collection, analysis

and reporting. If not well tailored and integrated, ERP systems can increase the data collection burden at the project level while reducing timeliness.

Usually the performance data collected at project level will be dictated by requirements for upward management reporting. However, the project manager may choose to use particular measures in order to drive aspects of performance or behavior. For instance, if a project manager is concerned about resource utilization on projects perhaps with a view to ensuring good work/life balance, they may choose to monitor overtime on the project. As long as it is not overdone, some measures can be changed from time to time to focus attention on particular aspects of performance.

An important tool for measuring performance at the project level is Earned Value Management, EVM (Chapter 16), which integrates scope, time and cost measures in a way that enables forecasting of estimated cost and time performance to completion. EVM is most useful for measuring performance of projects with clear scope definition and tangible outcomes where the amount of the scope delivered at any point of time can be objectively measured. It is less suited to projects with intangible outcomes or unclear scope definition.

Project Health Checks (Chapter 6) may provide the opportunity to benchmark the use of processes and practices on the project with other projects within the organization or industry sector. These forms of assessment are clearly intended to both monitor and drive performance at the project level. Benchmarked project health checks are generally designed to encourage improvement in the way projects are managed.

For effective performance measurement it is important that the metrics used at the project level are meaningful to the project manager and the project team. If they understand how the data is to be used by others they are more likely to ensure accuracy in reporting. There are dangers however. In the absence of a no-blame culture, performance metrics may be manipulated to provide protection or pursue personal political agendas.

MULTIPLE PROJECTS AND PROGRAMS

In measuring performance of multiple projects, while the majority of the base data is collected at the level of the individual project, the focus moves from performance against baseline for each project to performance trends across groups or categories of project. This is where categorization, standards and benchmarking become important for purposes of comparison. When organizations look at performance data across all of their projects they will be looking for metrics that provide feedback on issues such as overall financial performance, resource utilization and productivity, benefits realization, customer satisfaction, aggregate risk, accuracy of forecasts, safety and sustainability. They may compare performance of different types of projects, or projects within different divisions, business units or regions. They will set tolerances for acceptability of variance on key measures to be applied across all or groups of projects being undertaken in the organization. This type of information will be reviewed by senior managers and distilled for presentation to the executive and board as a basis for decision making and setting improvement targets.

Measuring performance in programs is similar to general management concern for the performance of multiple projects as described above. The difference is that the program manager will be particularly concerned with progress towards achievement of the specific objectives for the program including delivery of program benefits. At the program level,

there is an opportunity for comparison and aggregation of results across the program and assessment of features that are more significant for programs than for projects such as resource utilization, program risk, change management, stakeholder satisfaction and benefits realization. Although there is increasing evidence that effective benefits delivery begins with progressive monitoring at the project level, this is generally considered to be more effectively done at program or divisional/business unit level. Performance metrics in programs will include project specific metrics rolled up as well as metrics that relate to the program as a whole. The focus is on monitoring and controlling performance of the program against baseline as well as utilizing performance measures to drive performance improvement.

PORTFOLIO LEVEL

Measuring performance at the portfolio level is in many ways an extension of performance measurement in the context of multiple projects and programs. Projects remain the primary unit of measurement and there will be a concern for overall financial performance, resource utilization and risk. The specific difference at the portfolio level is the need for performance measures that provide feedback on the alignment of project based activity with corporate strategy. Areas of interest will include alignment of commitment with capabilities, balancing of the portfolio to support strategy delivery and manage risk exposure and performance data that will support prioritization when allocating resources. Performance measurement at this level is critical to good project and corporate governance.

ORGANIZATIONAL PM CAPABILITY

Performance measurement at the individual, multi-project and portfolio levels is primarily concerned with results. However, performance measurement is also important in assessing and driving the improvement necessary to ensure the capability is in place to consistently deliver results at acceptable standards of performance. To develop and improve project management capability you need to know the status of your current capability, and have a plan for where you want to be. In fact, evidence suggests that just maintaining current capability means that you have to be involved in some form of continuous improvement or it will go backward (Thomas and Mullaly, 2008). All of this requires an understanding of the components of organizational project management capability, ways of assessing or measuring those components and standards and benchmarks against which to judge how well you are performing as a basis for planning improvement.

If we think about project management capability as encompassing everything within an organization that relates to delivery through projects, we realize that it involves the whole of the organization and not just the project management community and the projects themselves. It involves the capability of the board of directors and senior management who set the corporate strategy, decide on the portfolio of projects and programs they will undertake and how they will resource them. The executive team also provide the vital link between corporate, program and project governance, between the permanent and temporary or project based parts of the organization, through their role as sponsors (Crawford et al, 2008). The permanent organization or business as usual (BAU) needs to have the capability to accept the fruits of projects and programs

and exploit them to achieve the planned benefits. Organizational project management capability encompasses portfolio, project and program management processes, systems and practices, as well as the competencies and skills of the people who use them. When thinking about assessment of an organization's overall project management capability there is a tendency to think in terms of models for assessment. A number of models are available for this purpose and they tend to be in the form of 'Excellence' or 'Maturity' models (Chapter 5).

General management is familiar with business excellence models such as the European Foundation for Quality Management (EFQM) Excellence Model and Baldrige Award which they use to identify, describe and then improve business processes. Similar models, focusing on project and program management, can be used to assess the current status of organizational project management capability, to guide development and for periodic re-assessment to determine and demonstrate progress. The IPMA International Project Excellence Awards and IPMA Delta (www.ipma.ch/2012/ipma-delta/), and the Human Systems 4 Quadrant Model (www.humansystems.net/services.html), which has been continuously developed over the last 15 years by the companies that are members of the Human Systems knowledge networks are excellence models developed on principles similar to those driving the EFQM and Baldrige awards. The focus here is on identifying and assessing those working practices that lead to improved performance (Cooke-Davies, 2004).

The large number of available maturity models have been strongly influenced by the Capability Maturity Model (CMM) developed by the Software Engineering Institute (SEI) of Carnegie Mellon University for the software development process (Chapter 5). Many of these have combined the concept of maturity as established by the SEI CMM with the view of project management presented in the Project Management Institute's *PMBOK Guide* (Project Management Institute, 2013), which tends to present a specifically project centric or tactical view.

In 2003 the Project Management Institute released its Organizational Project Management Maturity Model Knowledge Foundation (OPM3) which identifies more than 600 best practices, more than 3,000 capabilities and more than 4,000 relationships between capabilities. They have since developed an OPM3 Product Suite (Project Management Institute, 2008a), and a process for certification of assessors. The UK Cabinet Office has also developed a Portfolio, Programme and Project Management Maturity Model, P3M3 (Office of Government Commerce, 2010), in recognition that maturity questionnaires provide an effective tool for identifying areas where an organization's processes may need improvement.

Different organizations in different industries will place emphasis on different aspects or components of project management capability. Each organization should therefore choose the model and process best suited to their need as a basis for establishing their current baseline, formulating and driving an improvement plan and conducting periodic reassessment.

Project, Program and Portfolio Management Offices (PMOs) of various types and sizes have become an important aspect and repository of organizational project management capability (Chapter 31). Although research clearly indicates that there is no simple categorization or formula for PMOs (Chapter 31), there is a growing interest in assessing their performance. Available research (Hobbs, 2007) and benchmarking initiatives such as that of Human Systems provide a basis for comparison and baselining and this is often combined with assessment of stakeholder satisfaction through questionnaires and interviews.

PEOPLE IN PROJECTS

Discussion up to this point has focused on measuring performance in terms of outcomes, processes and practices, but, as indicated in Figure 7.1, the competencies and skills of people are also subject to measurement with a view to on-going performance improvement. Assessment and development of competence of the people on projects is also a vital aspect of overall organizational project management capability. Assessment of competence requires standards or guides against which measurement can be made. Knowledge and demonstrable performance (use of project management practices) are the two aspects of competence that are most widely addressed in project management standards or guides produced by project management professional associations or standards setting bodies. Knowledge is the easiest to assess and least controversial aspect of competence and is generally assessed using multiple choice questionnaires such as those used for the Project Management Professional (PMP) exam. Indeed, measures often used by organizations to demonstrate capability to deliver projects are number of training days and number of project personnel who hold qualifications in project management which may include both academic qualifications and those offered by professional associations.

Demonstrable performance or use of project management practices can be assessed against performance-based competency standards such as those of the Australian, British and South African Governments and the Global Alliance for Project Performance Standards (GAPPS). Assessment against performance-based competency standards is generally undertaken by trained workplace assessors. Candidates are required to gather evidence of the use of practices in accordance with performance criteria specified in the standards. The workplace assessor works with candidates, advises and assists them in achieving recognition of competence. Candidates are assessed either as competent at a particular level, or not yet competent. If assessed as competent, a candidate may be awarded a qualification recognized within a government endorsed framework. The Global Alliance for Project Performance Standards (GAPPS) does not award qualifications. It audits and endorses assessment processes and standards as a basis for mutual recognition and transferability of project management and related qualifications. It provides very useful mappings of the comparability of different standards and assessment processes.

Behaviors are the most difficult, expensive and controversial aspects of competence to assess although it is behaviors that differentiate between threshold and superior performance. A number of organizations have developed corporate competency models, identifying the behaviors that are considered desirable and associated with superior performance within a specific corporate context. However these are usually applicable across the organization and not project management specific. Assessment Centers are sometimes used to assess behavioral competencies and can be extremely effective but they are also very expensive.

When dealing with individuals, assessment and development of competence can often be addressed through the certification and qualification processes of professional associations and academic institutions. Professional certification will generally ensure a consistent level of basic knowledge, shared language and threshold performance across a project team. Superior performance may emerge as a result of the reflective processes encouraged in some academic programs. NASA has found that team assessments provide them with the best returns in terms of performance and capability improvement on projects and information about this is available on the NASA APPEL website (<http://www.appel.nasa.gov>).

From an organizational perspective, a resource effective approach to assessment of project management competence is to use knowledge tests and self-assessment as a first cut assessment across the entire resource pool, performance based assessment for a subset of more senior practitioners and then behavioral assessments for those people seen to have potential as superior performers. Results can be aggregated to baseline competency profiles across the resource pool, and provide guidance for training needs.

A number of organizations encourage development of individual project management capability through internal accreditation processes and some larger organizations have established relationships with academic institutions to provide a range of development and assessment programs for more senior project personnel.

There is growing recognition of the role of the Program Manager (Chapter 27). The Project Management Institute has produced standards for both Program and Portfolio Management (Project Management Institute, 2008b,c), and offers a Program Manager qualification, the Program Management Professional (PgMP). The UK Government was first to recognize the program manager role and produced a guide titled *Managing Successful Programs* (Cabinet Office, 2011). Qualifications, including MSP (Managing Successful Programs), MoP (Management of Portfolios) and P3O (Portfolio, Program and Project Offices) are offered on behalf of the UK Cabinet Office by APMG-International.

USING ASSESSMENT TO DRIVE PROJECT MANAGEMENT CAPABILITY IMPROVEMENT

As the saying goes: ‘What gets measured gets done’. To maintain and improve capability, you first need to assess or measure your current capability. You need to know where you are. Using the guidelines discussed above you can determine which aspects of capability you will assess and how to carry out that assessment. Once you have a baseline you can develop a plan for improvement, initiate and resource an improvement program. Benchmarking is important to ensure that your improvement targets are realistic, achievable and relevant. They are also important to ensure that you aren’t fooling yourself about your capability. Networking with other organizations can help you to identify improvements that have worked for others.

Assessing once is not enough. You need to have a regular program of assessment whether this is for single projects or programs, for the PMO, for individuals and teams or for overall project management capability. These assessments drive project management capability improvement providing evidence of success and targets for moving forward. As research into the value of project management has demonstrated, organizations that stop focusing on value, or believe that they are done, stop demonstrating value, and the act of not enhancing value appears to destroy value (Thomas and Mullaly, 2008). Assessment demonstrates both value and improvement. A regular program of assessment maintains improvement momentum.

Measuring Performance for Sustainability and Corporate Social Responsibility

Introduction of formal regulations such as carbon tax and emissions trading schemes, as well as information initiatives such as the Carbon Disclosure Project (CDP) which

uses measurement and sharing of environmental information to influence market forces towards a more sustainable economy, are placing increasing pressure upon organizations to measure and report on their sustainability and corporate social responsibility (CSR) practices. Projects are a good starting point for measurement of sustainability and CSR performance as project level performance can be rolled up to the public face of the business, its interaction with shareholders and ability to provide evidence that it is doing what it says it will do. For those companies that report on sustainability, the primary frame of reference is the Global Reporting Initiative (Global Reporting Initiative, 2011). The GRI is a worldwide, multi-stakeholder network that is collaborating to create and continuously improve a sustainability reporting framework as a basis for facilitating transparency and accountability by organizations – companies, public agencies, non-profits – of all sizes and sectors, across the world. It provides a useful resource for those interested in or required to measure sustainability and CSR performance.

Concluding Remarks

Measuring performance is accepted as a necessary part of project management and this chapter has been written with the intention of providing a clear and straightforward guide for those who are required to develop and implement performance measurement systems in the context of projects, multiple projects, programs, portfolios, organizational project management capability, people in projects and sustainability. However, to quote Streatfield (2001), 'measuring performance is not as simple as it seems'. Streatfield was appointed to a team called Project Dashboard that was charged with putting together a set of performance measures to provide indicators of where his company was and where it was going using a balanced approach combining financial and operational measures. Streatfield's account of his experiences in undertaking this task is recommended reading that highlights many of the challenges inherent in measuring performance. He points out that most approaches to performance measurement adopt a rational, linear view of cause and effect relationships underpinned by the desirability and possibility of 'being in control'. Even the popular idea of a performance dashboard supports this view of a project or organization being hierarchically controlled by feedback from selected performance indicators. As Streatfield says 'it is assumed that people will be motivated when they are involved in a democratic process of designing performance measures as rational, sequential systematic steps' (Streatfield, 2001), but in reality performance measurement tends not to be done either effectively or consistently. In Project Dashboard, Streatfield experienced resistance to measurement, conflicting ideas about what should be measured, doubt as to the value of the proposed measures, expectation of punishment for failure to meet targets, feelings of being threatened and suspicions about what would be done with the data collected. Project Dashboard did not achieve its stated goals but the process raised many issues and gave rise to conversations that increased understanding of performance with the organization.

In summary, performance measurement involves assessment processes that allow us to receive feedback on, or make judgments about or in some way analyze a set of activities, capabilities, capacity, processes or practices. These assessment processes can take many forms but should be directly relevant to their audience, purpose and use. They should measure what they are intending to measure as unambiguously as possible.

Participatory development of measures is desirable to improve understanding and buy-in as meaningful assessment evolves with increasing understanding and ownership. At the end of the day, measuring performance is politically sensitive and is most effectively undertaken in a spirit of learning and improvement.

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Benefits Realization Management

GERALD BRADLEY

What Is Benefit Realization Management (BRM) and Why Have It?

Benefit realization is the neglected treasure. Less than 40% of organizations effectively measure the benefits delivered by projects and programs – an increase from less than 5% 25 years ago. Yet of those which do, an average of about 20% of potential benefits is actually realized, which perhaps explains why so few actually measure. So if only a fifth of business case benefits are actually realized, a business case would have to predict a return of 400% for the project to break even and few business cases predict a return of 400% or more. It seems therefore that there are only two choices:

1. Do only those projects which are capable of returns in excess of 400%; or
2. Apply a proven methodology such as BRM to increase significantly the proportion of potential benefits that are actually achieved.

So what is BRM? It is a well developed and proven process, based largely on common sense, which enables organizations to achieve far greater value (perhaps more than 80% of potential benefits) from their investments in change. These investments may be programs or stand alone projects; however for simplicity in the remainder of this chapter the term 'project' will be used to cover both situations. This improved value is achieved by:

- selecting the most appropriate or highest value projects aligned to business needs;
- shaping or scoping these projects in an optimum way;
- ensuring that the majority of potential benefits are actually delivered;
- measuring to demonstrate the related success of the project.

Its strong focus is to be clear about the end goal that the business is seeking and then to plan and manage with this constantly in mind. Once the end goal has been realistically articulated (normally with clear objectives and benefits, perhaps supporting a vision statement), the BRM process engages business stakeholders at various levels to determine the required changes – effectively creating a route map from the 'as is' to the 'to be'. These changes are usually a combination of enablers (such as new facilities, technologies,

processes and information) and business changes (changes in the way people work and behave, embracing and exploiting the new enablers). In the UK the National Audit Office and the previous Office of Government Commerce identified the top three reasons for project failures as the lack of:

- senior stakeholder engagement and commitment throughout the project life-cycle;
- articulation, ownership and communication of clear and realistic end goals;
- wider stakeholder commitment to ensure that the appropriate business changes are determined, owned and managed.

The application of BRM is likely to cost around 5% of project costs, depending on project size and complexity, and likely to deliver four to five times the worth of benefits than is likely to be achieved without BRM. So its application should be a 'no brainer' especially in the current difficult economic climate. Although I would consider this approach to be common sense, it is unfortunately rather uncommon in practice. Many organizations dream up solutions (or are sold them by persuasive salesmen) and then hunt for benefits to justify the associated expenditure. This backward (cart before the horse) approach needs to be challenged. Ideally this would be done by senior business managers who, if they are worth their salt, should be committed to getting the best possible return on their investments; however if they are neglecting this responsibility, the project manager may need to step in and challenge the proposals. This may be uncomfortable as it may then feel like a challenge to their very existence; however it is rarely as bad as it sounds as there are normally far more project opportunities than there are resources to deliver. Furthermore it may not be too difficult for a project manager to secure the 5% extra funding and related resources to apply BRM and so ultimately become a hero in the current difficult environment.

Purpose and Scope of BRM

The purpose of BRM is to achieve high returns from investment in change, in particular through the delivery of programs and projects. These returns will not always be financial but should be measurable. As mentioned above, the record to date, where measurement has occurred, shows very poor returns relative to expectations, often less than 25% of business case predictions. In my experience BRM properly applied not only delivers more benefits, but also earlier benefits and often reduced project costs all of which combine to achieve a much higher ROI. The reduced project costs arise from a more precise focus on exactly those changes and enabler features which are needed to deliver the expected benefits. This focus also helps to define the project manager's responsibilities and constrain scope creep.

One of the possible reasons for the lack of emphasis on BRM is misunderstanding about its scope. Many still think the primary purpose of benefit activity is to create the justification for the business case; others feel that it is about measuring the benefits to confirm the success. The measurement focus alone can be embarrassing if most of the time projects deliver less than 20% of the potential benefits. I believe it is this narrow

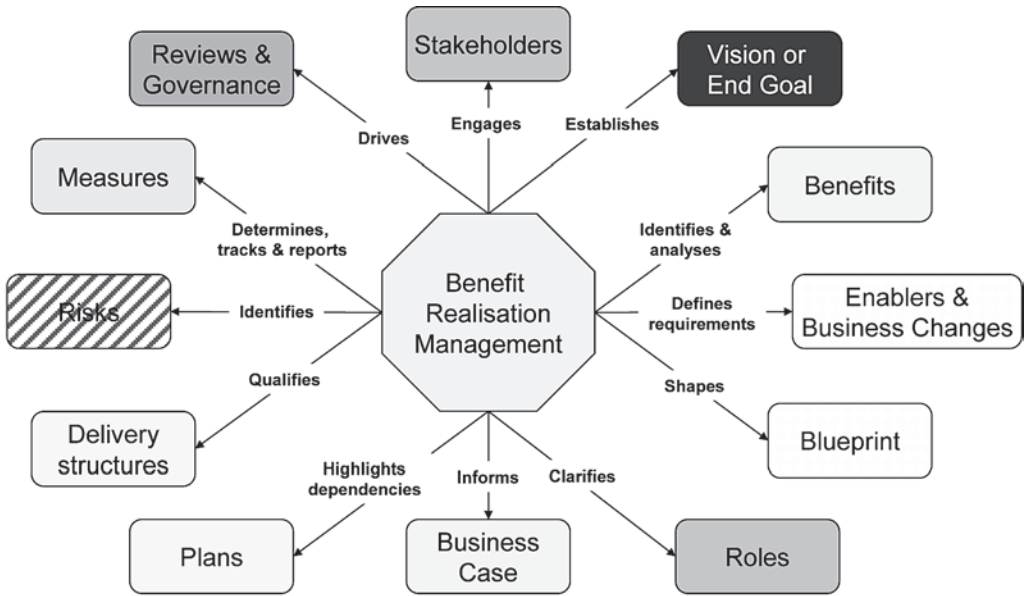


Figure 8.1 Scope and centrality of Benefit Realization Management (BRM)

view that some have had of Benefits Management or BRM that has given rise to the birth of new, but I believe largely unnecessary, initiatives, such as ‘Value Management’. Although BRM generally includes both of the above, its primary focus is managing all the relevant processes to ensure that the majority of planned benefits are actually realized. Figure 8.1 outlines the scope of BRM.

Although Figure 8.1 describes the scope of BRM, emphasizing its fundamental importance and centrality when engaging in change, it does not clearly describe the process sequence, though there is an approximate clockwise chronology starting at the top. A better indication of process and sequence is represented in Figure 8.2, where the six phases are interspersed with review points or gateways.

Engagement and involvement of stakeholders throughout the change life-cycle is a central part of the BRM process and is absolutely critical for the effective realization of benefits. In Phase 1 the engagement should be with senior representatives of the key stakeholders, but as progression continues through the change, larger groups of stakeholders, at lower levels in the organization, need to be engaged and involved. This is vital both to secure their buy-in to the changes but also to capture and utilize the wealth of their knowledge and experience.

Benefit Responsibilities

The ultimate accountability for benefits lies with the Project/Program Sponsors, referred to in *Managing Successful Programmes* (MSP) as the Senior Responsible Owner (SRO)

(Cabinet Office, 2011), who have more of a full-time involvement with benefits and/or who are closer to the relevant business action. This will include:

- Program and Project Managers;
- Change Managers;
- Benefit Owners.

supported by:

- Heads of PMOs;
- Benefit Facilitators.

The role of the *Change Manager* is to promote and coordinate the necessary changes, particularly the business changes, motivating and encouraging required new behaviors throughout the relevant stakeholder communities. This role could sit within a project though if several projects sit within a program, it is probably better that this Change Manager role sits at program level.

A *Benefit Owner* is a person who is responsible for the achievement of a particular benefit. Their brief is normally defined in the profiles of the benefits for which they are responsible. These Benefit Profiles define how the benefits are to be valued and measured, who the beneficiaries are, the enablers and business changes on which the benefits depend, realization risks and timescales and measurement and reporting frequencies. So this Profile describes what is expected of the Benefit Owner and who they may need to chase or influence to enable them to fulfill their responsibility.

A *PMO* is a management office which can be at project, program or portfolio level. It would normally provide support covering:

- Methodologies, tools and techniques;
- Progress monitoring;
- Benefit realization.

and help with the production of documents needed for stage reviews (Chapter 31).

The *Benefit Facilitator* is ideally a permanent role in an organization, generally operating at portfolio level. It would be the Centre of Expertise on benefit realization matters and would both support and challenge individual programs and projects. As a permanent role within an organization it would exist before a new program/project comes into being and so would be an ideal resource to facilitate Phases 1 and 2 in the change process in Figure 8.2, before the program/project is formally established and resourced in Phase 3.

It would also be around after a program/project has completed and the team has disbanded and so could check that the ongoing realization and reporting of benefits continues. Probably the best location for the Benefit Facilitator is within the Portfolio Management Office if such exists.

The above are roles and may be undertaken by a single person, or a small team.

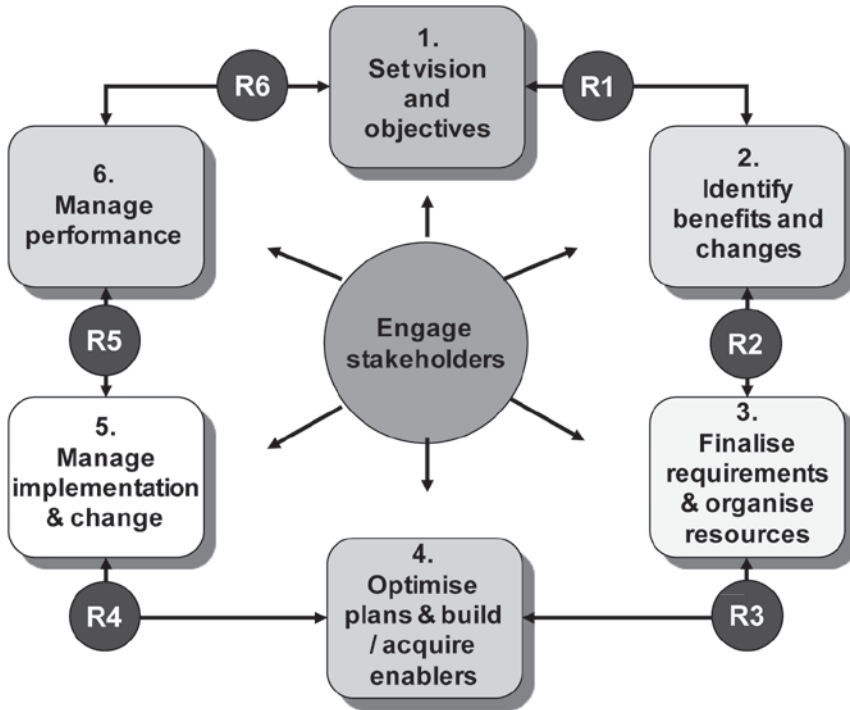


Figure 8.2 Change/BRM process diagram

Applying the BRM Process

SET VISION AND OBJECTIVES

This phase builds on the starting point for the proposed project, which might be a vision set by senior management or just an idea for change, and begins to shape its scope. It involves engaging with senior representatives of the key stakeholders, preferably in a workshop process, to confirm the vision, if one exists, and to determine the objectives for the project. Normally an experienced facilitator, ideally the Benefit Facilitator, would gather the senior stakeholders together for a half-day workshop and present them with a ‘why do we need to change?’ question. The stakeholders will be asked to provide individually four or five separate answers to this question. Similar responses would then be clustered to create independent themes, with each theme summarized with an objective for change. Typically this process generates between 10 and 20 such objectives.

These objectives are rarely independent of one another and so the next step is to establish the cause and effect relationships which link them. This is best done by putting them into a Strategy Map working back from the ultimate goal, which could be the vision or one of the more strategic objectives just identified. An example of such a map, for a potential program to embed BRM within an organization, is given in Figure 8.3.

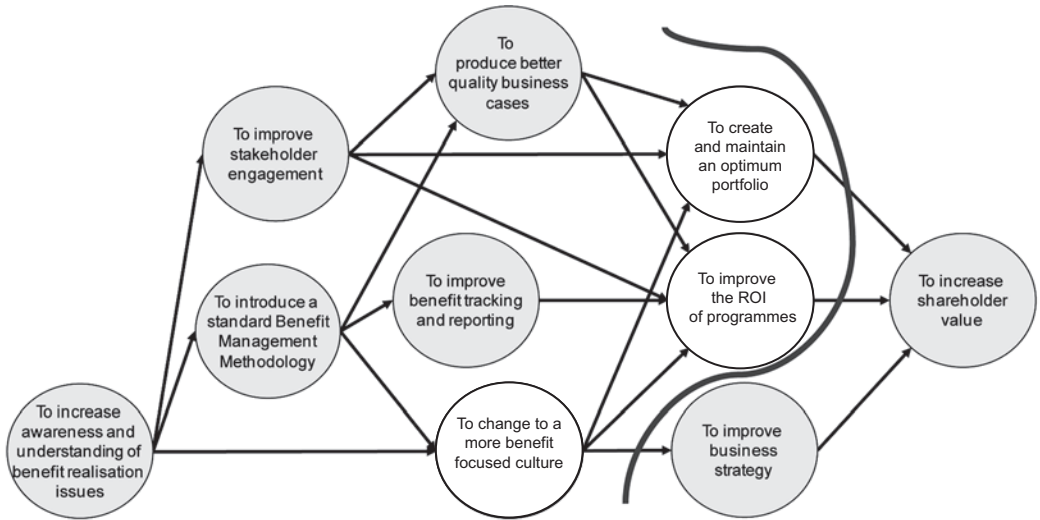


Figure 8.3 Strategy map for a potential project to embed BRM within an organization

The next step is to use the map to determine a small subset (usually two, three or four) of objectives which define the boundary of the potential project. These are objectives which are sufficiently challenging so that the potential funder is prepared to give the project serious consideration but not so challenging that no project manager is prepared to take on the challenge. In the example illustrated in Figure 8.3 there are three such bounding objectives (represented by the circles with white background).

IDENTIFY BENEFITS AND CHANGES

Once the bounding objectives have been determined and agreed, further workshops, generally involving a wider selection of stakeholders, would be facilitated, also by the Benefit Facilitator, to develop for each objective a Benefit Dependency Map. (The Benefits Dependency Map is described in greater detail in the next section.) First a set of end benefits which correspond to each objective are determined. These need to be:

- collectively sufficient;
- individually necessary;
- mutually independent;
- likely to lead to different kinds of change activity.

Once these have been agreed, feeder (intermediate) benefits should be identified using similar logic. By continuing this process, always working right to left, a Benefit Map is developed for each of the bounding objectives. At this stage these Benefit Maps are logically engineered wish lists. The next step is to examine each of the benefits in the map, usually working left to right, and to determine which changes need to occur to deliver the benefit. These changes are normally a mix of enablers and business changes.

By adding them to the map it is transformed into a Benefit Dependency Map. This step is essentially a requirements definition process. If the map is of good quality it will show all the paths needed to maximize the achievement of the objective at the right hand end of the map; however not all paths will make an equal contribution to the objective so it may be prudent, when formulating the project plan, to leave out paths which have a high cost or risk relative to their contribution. A structured approach for doing this is described in the next section.

FINALIZE REQUIREMENTS AND ORGANIZE RESOURCES

The requirements identified during the development of the Benefit Dependency Maps (usually one map for each bounding objective) are generally fairly high level. These will often need to be specified in greater detail in order to build or acquire the required enablers and to implement the necessary business changes. Once this more detailed specification is complete (often amounting to a project brief) the results should be tested against the maps to ensure that they will still deliver the benefits. In order then to finalize requirements, duplicate enablers and changes need to be identified and consolidated. Duplicates may occur within a single map or from among the set of maps developed for the project. Once consolidated the following checks need to be applied to each change:

- Is the consolidated change within the scope of the project?
- Is it likely to be delivered by any other project?
- Is it worth delivering relative to other options? Weighting paths and scoring entities can be used to answer this question (see the next section).

Once it is clear which changes and enablers need to be delivered and in what timescales, the most appropriate change delivery structure (such as a program or project) can be determined, established and resourced.

OPTIMIZE PLANS AND BUILD/ACQUIRE ENABLERS

Acquiring enablers, whether built internally or sourced externally, often involves significant capital investment and a reasonably long lead time; however benefit activity in this phase may be light compared to the previous phases. Though light in effort, benefit considerations may still be extremely important, and as in other phases many of the decisions of this phase should be predominantly 'benefit led'. For example if the main enabler is a computer system, the following decisions should be largely benefit driven:

- Specifying the features, functions and requirements;
- Choosing the software supplier;
- The focus and design of user training;
- Implementation sequence for system roll-out;
- Data load sequence for loading historical data.

Manage Implementation and Change

This phase includes the heaviest stakeholder engagement as the enablers are implemented and the business changes are managed. Both the program/project manager and the business change manager must engage with stakeholders to:

- mitigate the impact of disbenefits;
- manage the smooth transition into business as usual;
- establish with the business an effective and enduring benefit tracking and reporting regime.

Stakeholders who feel they will experience more disbenefits than benefits are likely to feel demotivated and possibly resistant to the changes and will need particularly careful handling. Clear communication of the vision for the organization and the benefits for customers usually helps to increase motivation and mitigate the perceived disbenefits.

MANAGE PERFORMANCE

This phase pulls together all the measurement of benefits, much of which started in Phase 3, to check that the project is on track to deliver the vision and/or bounding objectives. Where benefits are not on target remedial action may need to be taken. During this Phase the Program/Project team will disband and move on to other things as the final part of the transition to the business is completed. This includes the business taking full responsibility for ongoing measuring and reporting of benefits. The Benefit Facilitator on behalf of the Portfolio Board should check that this reporting of benefits continues and that any 'lessons learned' are appropriately disseminated and acted upon.

BRM Techniques, Especially Mapping

BRM contains a range of tools covering:

- Objectives setting and project scoping;
- Benefit identification;
- Benefit classification;
- Validation and evaluation of benefits;
- Benefit mapping;
- Requirements definition;
- Prioritization and option selection;
- Measure identification;
- Baseline determination and target setting;
- Benefit tracking and reporting.

These are all extremely useful and are fully described in my book (Bradley, 2010); however the single most important tool is mapping which I will now describe in more detail.

Within BRM there are three types of map all of which link entities in 'cause and effect' relationships:

- A *Strategy Map* of linked objectives which may also be linked to the vision, if one exists, or to one or more of the organization's strategic objectives. This is used to determine the bounding objectives for the potential program/project.
- A *Benefits Map* which links potential benefits to one of the bounding objectives, determined above. There will usually be a separate Benefits Map for each bounding objective.
- A *Benefit Dependency Map* which is a Benefits Map with the addition of the enablers and business changes on which achievement of the benefits depend. This provides an early view of the Blueprint or Target Operational State.

STRATEGY MAP

The objectives for this map are determined, ideally in a workshop of senior stakeholders, by considering the drivers for change – both fixing problems and exploiting new opportunities (see Figure 8.3).

The map is built starting with the ultimate goal on the right and then working right to left. When linking the objectives, the main considerations are an understanding of the business environment and logic. When considering the feeder objectives for any particular objective the logic tests should ask whether the set of feeder objectives are:

- collectively sufficient;
- individually necessary;
- mutually independent;
- likely to lead to different kinds of change activity.

Once the map has been completed, bounding objectives are determined by considering the responsibilities of two key individuals – the potential funder and the project manager. The bounding objectives will be sufficiently far to the right that the funder would consider making the investment but sufficiently far to the left that the potential project manager is prepared to accept the challenge and take responsibility for their fulfillment.

BENEFITS MAP

This is developed starting with a Bounding Objective at the right hand end and working to the left. The first step is to identify a set of benefits that equate to the objective. These are referred to as End Benefits. They should be:

- collectively sufficient;
- individually necessary;
- mutually independent;
- likely to lead to different kinds of change activity.

Once these have been agreed, feeder benefits need to be identified using similar logic. This continues until the map is complete. As progress moves towards the left, the first and fourth bullet in the above test can be relaxed. Figure 8.4 shows a simple example of such a Benefits Map which I personally developed to reduce my carbon footprint.

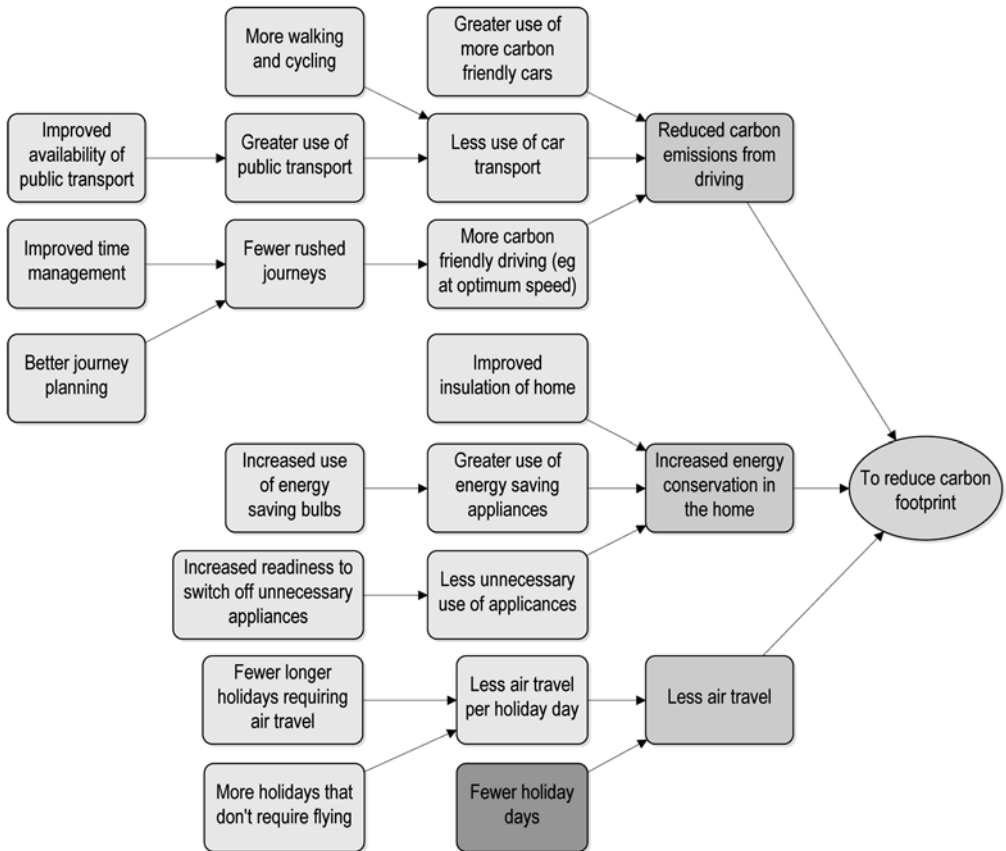


Figure 8.4 Benefits map for the objective – 'To reduce carbon footprint'

Note that all benefits are written starting with an adjective indicating the desired direction of improvement, which is highly recommended. The map also includes a potential disbenefit – 'Fewer Holiday Days'.

At this stage the map is nothing more than a wish list though not a random one. It has been carefully constructed starting from the bounding objective and applying logic and an understanding of the business environment. So if the map is of good quality and all the benefits are realized then the bounding objective will be fully achieved. So the next step is to determine what needs changing to achieve each of the benefits.

BENEFIT DEPENDENCY MAP (BDM)

This map is developed from the Benefits Map by adding the required enabler features and business changes. This process normally works left to right through the Benefits Map examining what change needs to occur for each benefit to be realized. The answer to this question is normally some combination of enabler features and business changes. Once determined these requirements are then added to the map transforming it into a Benefit Dependency Map.

MAP WEIGHTING

A quality map, once completed, defines all the possible contributions to the end goal. So to fully achieve the end goal all the changes and enablers must be delivered and all the paths in the map must function. However the contribution of some paths in the map may be small but the costs and/or risks associated with them may be high. So when building the project plan some parts of the map may be consciously left out; for instance we could settle for 80% of the benefits for 20% of the costs.

One technique for choosing which parts of the map should go into the project plan is Sigma's weighting and scoring process. Working right to left the paths feeding a particular entity are ranked based on their current importance or relative contribution. These relative rankings are normally expressed as percentages. Once this has been applied to the whole map a large round number (such as 1,000) is added to right most entity. This is normally referred to as its 'score' to distinguish it from its value. The arithmetic process of applying the % weightings to scores in a right to left direction will result in each benefit being given a score. This will highlight which benefits, particularly left hand benefits, should be given priority and so provides a structured process for choosing between solution options.

This process is most frequently applied to Benefit Dependency Maps to help determine which enablers and changes should be implemented and in what sequence. It can also be applied to the Strategy Map and the scores can then be cascaded down through the set of BDMs.

An illustration of how this works in practice is given in Figure 8.5 where the process has been applied to the BDM 'To Reduce Carbon Footprint'.

In this map the benefits 'improved time management' has a score of 120 compared to the benefit 'greater use of energy-saving appliances' which has a score of 60. Couple this information with the large cost difference in the feeder changes, namely 'delegate more' and 'more efficient boiler' and it becomes very clear that an early activity should be to delegate more. This will be a 'quick win' which will deliver some early value while funding is acquired for the capital cost of a new boiler.

SUMMARY

To summarize, the maps evolve through the following series of stages:

- A logically engineered wish list;
- A set of feasible options (as enablers and business changes are added);
- A Plan (as some paths are deselected from the map using weightings and scores);
- A vehicle for communicating expectations;
- Progress reports.

Maps are extremely useful for the following:

- Identifying a comprehensive set of benefits;
- Determining required enablers and changes;
- Assessing the impact of unexpected changes – internal and external;
- Aiding prioritization.

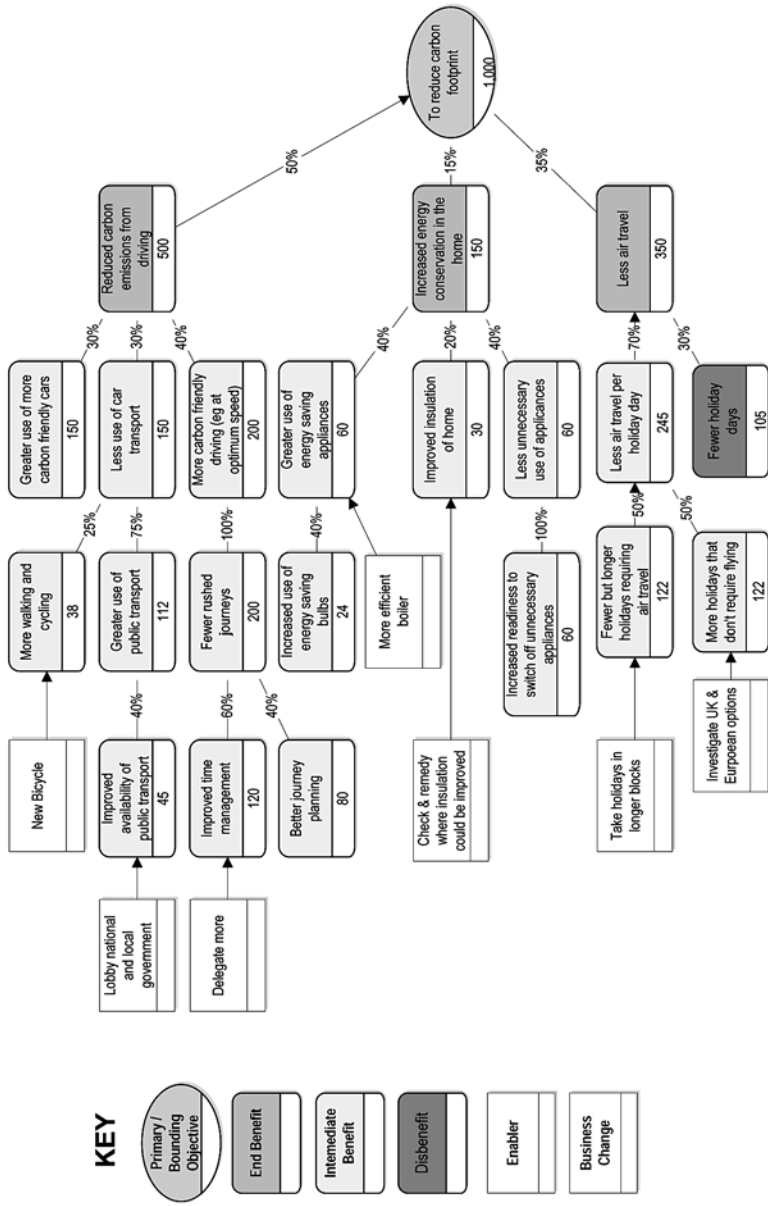


Figure 8.5 Benefit Dependency Map (BDM) with weightings and scores

- Sequencing implementation;
- Communicating expectations;
- Tracking benefits;
- Avoiding double counting of benefits;
- Attributing benefits to their source;
- Maximizing benefit realization.

Measurement and Reporting

I define a measure as the entity whose value is reported regularly to demonstrate realization of a benefit. It would be computed from some combination of raw metrics and often these would be automatically gathered by an organization, generally electronically. For example most organizations capture electronically details of all of their sales, including date of sale, value, vendor, products. From this raw data one could compute the following measures:

- Average value of sales per month;
- Average number of sales per month;
- Number of sales valued at more than £10,000 per month;
- Percentage of sales valued at more than £10,000 per month.

If the sales data were combined with other raw data such as employee data, another possible measure would be:

- Average value of sales per employee per month.

To monitor the success of a project, a number of key decisions must be made, including:

- Which of the identified benefits are to be measured?
- What are the most suitable measures for these benefits?

And for each measure:

- What is its baseline?
- What is its target value?
- What is the expected improvement timescale?

Most if not all of the benefits in a map should be monitored and tracked. The reasons for this are:

- To know that a change in the end benefit can be attributed to the project/program;
- To know that all paths in the map are operating in order to generate the maximum improvement in the bounding objective;
- To satisfy the needs of different stakeholders;
- To have some interim milestones, rather than waiting perhaps several years to see whether the objective had been achieved.

When identifying suitable measures for a benefit some of the useful considerations are:

- Will it motivate behaviors which will contribute to success?
- Will it meet the needs of relevant stakeholders?
- Is it in the most appropriate format (for example ratio or percentage rather than absolute value)?
- Will it be reasonably easy for the relevant stakeholders to determine target values?
- Is the measure already tracked by the organization or can its value be computed from existing metrics?
- Will reporting frequency be sufficient to observe trends but not too frequent to be onerous?
- Can data be displayed in such a way that all relevant stakeholders can easily observe progress?
- Will the data be collected in the same way using the same criteria over the foreseeable future?

Ideally we would have one measure for each benefit though quite often two and occasionally three are required, particularly where complementary or competing measures are required.

If we are tracking the improvement in most, if not all, of the benefits from the maps then the maps can provide a powerful visual vehicle for communicating progress. Using a RAG process with Blue added where blue indicates – not yet due to have reached target value – the map becomes an easily understood reporting dashboard.

Embedding BRM within an Organization

Although I believe BRM is largely common sense it is not common practice, so to embed BRM within an organization can involve significant cultural change. It could easily be a three to four year journey and should be managed as a change program. As a change program it will need:

- senior level commitment;
- appropriate funding;
- a sponsor or senior responsible owner;
- a Program Board and a Program Manager;
- the application of BRM.

If this seems a big step, an easier first step would be to apply Sigma's Benefit Maturity Model. This is particularly good for helping organizations to:

- assess where they are today in terms of benefit realization, using 57 components distributed across four lenses each with 10 dimensions;
- determine where they realistically would like to be and in what timescale;
- utilize Sigma's generic Benefit Dependency Map for embedding BRM within an organization;

- develop a plan for getting to where they want to get to;
- monitor progress towards that plan.

To minimize effort and improve effectiveness this is all done within a simple software tool.

THE PROJECT MANAGER'S DILEMMA

The objective of a project is frequently to deliver an enabler – a new system, some new technology, new buildings or facilities and the related but necessary business changes are often someone else's responsibility, perhaps the program in which the project might sit or perhaps the 'business as usual' organization. In these situations benefits should also be the responsibility of the program manager and ultimately the business; however if benefits have been used as part of the justification for the project, the project manager may be required to be responsible for and to demonstrate their realization. This is a real challenge if the project manager is not also responsible for some of the dependent requirements such as the business changes. It is hoped therefore that whatever the situation, project managers who read this chapter will feel sufficiently enthusiastic about the importance of benefit realization that they will at least seek to influence others to think along the lines of BRM.

SOME CRITICAL SUCCESS FACTORS FOR EFFECTIVE BENEFIT REALIZATION

To summarize, the critical success factors for effective benefit realization are:

- Being clear about the business end goal;
- Keeping this end goal in mind throughout the change life-cycle;
- Engagement and involvement of stakeholders throughout;
- Quality mapping of objectives to determine the bounding objectives;
- For each bounding objective the creation of high quality robust Benefit Maps;
- Rigorous determination of enabler features and business changes using the Benefits Maps;
- Early identification of measures for most if not all the benefits;
- Early establishment of a benefit tracking and reporting regime;
- Effective transition into 'business as usual'.

A fuller treatment of all the processes described in this chapter with numerous illustrations and case examples is given in the author's book (Bradley, 2010).

References and Further Reading

- Bradley, G., 2010, *Benefits Realisation Management: a Practical Guide to Achieving Benefits through Change*, 2nd edition, Aldershot: Gower.
- Bradley, G., 2010 *Fundamentals of Benefit Realization: an MSP Companion Guide*, 1st edition, London: The Stationery Office.
- Cabinet Office, 2011, *Managing Successful Programmes*, 3rd edition, London: The Stationery Office.

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9 *Requirements Management*

DARREN DALCHER

Projects typically arise in response to the needs, wants or wishes of an individual, group, organization or community. Project management endeavors to capture, analyze, prioritize, justify and transform these needs and wants into desired outputs and outcomes that deliver and deploy the required functionality, or performance, to the target community. The conceptual steps that lead to the transformation from a concept or need into a more formal form of a systems requirements document are addressed through the processes of requirements management. Fittingly, the sixth edition of the APM Body of Knowledge published by the UK's Association for Project Management defines requirements management as 'the process of capturing, assessing and justifying stakeholders' wants and needs' (APM, 2012, 140). This chapter looks at the activities and processes that underpin requirements management and the issues and challenges that emerge from its use.

Requirements management is concerned with understanding, formulating and documenting the perceived needs of stakeholders. Before focusing on requirements management, it is essential to gain an appreciation of the role of needs in forming and informing requirements and at the role of needs analysis as the essential precursor to requirements management.

Needs Analysis

Most endeavors begin with a need which is then elaborated and actualized. At a fundamental level, projects are devised to satisfy needs. The APM definition of requirements management talks about capturing stakeholder needs as well as assessing and justifying them; however, very little is normally said about needs and their identification and management. Determining needs is never simple: It involves analysts intimately collaborating with users, clients and stakeholders. One of the crucial skills for analysts involved in needs analysis is the ability to distinguish between needs and wants.

A need is said to emerge from an unfulfilled desire, or an idea for improvement for some part of a system. Needs imply a desire to solve a problem, improve the status quo, meet a business objective, satisfy a legal stipulation or correct a deficiency in current arrangements. This can be done through the provision of new functionality, delivery of new assets or acquisition of new performance capabilities. At its most basic level, a need can be viewed as a gap between current results, and desired results and consequences.

A key point is to express it as a gap that may pertain to a problem (and hence a noun) and not in terms of a potential solution.

Wants typically relate to the wishes of an individual or a stakeholder group and their expectations related to a system or project. While needs relate to the absolute essentials that one has to have, wants are not absolutely necessary as they represent the things that one would like to have. Wants extend beyond needs to reveal the additional wishes and expectations of users and stakeholders. It is worth pointing out that wants can be unlimited; when one want is satisfied, another often arises as expectations are raised. Wants are also context dependent and may vary in time depending on situational contingencies.

Given that there will inevitably be multiple needs and wants, and that the resources and projects available to implement these are limited, it is important to determine the essential nature of what is required and why it is required, as well as who requires it. The main purpose is to establish beyond doubt that there is a recognized need that will require supporting and addressing. The discussion of solutions is deferred to later stages, so needs analysis is always done independently from pre-conceived resolution options as by definition it relates to the actual needs.

Understanding the needs of users and stakeholders is an essential precursor to determining their requirements. Before requirements can be elicited and developed, it is essential to have a well-defined problem where the needs, or gaps, are clearly understood. Stating problems in a clear and unambiguous manner is a crucial art that enables the right problem to be solved. Focusing on problems, rather than solutions allows the measurement of the utility of a given solution against the original needs to determine the degree of satisfaction achieved.

Stakeholders may be stimulated by shortcomings in current capability or systems, or be inspired by the performance of new technology in other areas, which can make new systems and projects possible. It is crucial to understand each need, its origin and its implications before proceeding with a project. Indeed, Frame (2003) asserts that the emergence of needs sets off the whole project process. New capabilities must first be recognized by stakeholders so that they can be evaluated in context. The essential context is defined by the scope of the project, however, needs analysis may point to areas and facets not included in the scope and may help to form a better picture of the essential issues that need to be considered, occasionally forcing a re-consideration of the scope or real dimensions of change. Indeed, many change projects would benefit from extending their scope to consider external business events that relate to the core function of proposed projects. In other words, the boundary drawn around an environment or context can be crucial to how change is viewed and what is deemed possible.

Needs evolve from a vague idea or concept, to some thing tangible that ultimately underpins and directs entire endeavors and projects, yet they also lead to the emergence of constraints and limitations. They are assessed prior to the consideration of any solution to allow the exploration to lead to real requirements and avoid premature selection of or influence by a predetermined solution. Frame (2003) identifies three main stages related to the development of needs: emergence, recognition and articulation (Figure 9.1).



Figure 9.1 Project needs life-cycle

- *Needs Emergence:* Needs are dynamic, altering with time. They arise and materialize out of change. The availability of technology, the growth in social participation, global markets and the accelerating rate of change incite new needs, whilst altering existing ones. New needs and expectations can appear inside the organization or be stimulated by external changes introduced by competitors, or be induced by changes in the external environments.
- *Needs Recognition:* Systematic identification of needs requires regular return visits to the needs and expectations of an organization, its stakeholders and its customers to assess their current needs against the previously recognized set. Attention to anticipated needs in the marketplace can help in planning future initiatives and projects.
- *Needs Articulation:* The meaning and implications of needs are important. Articulation implies an in-depth study of a need. The attempt to describe the essence of a need requires a deeper understanding of the roots of a need, its fine details and true meaning and the implications that it may have. Developing and recording that understanding paves the way to developing the requirements. Once a need is truly understood and carefully articulated, it forms the basis for requirements elicitation as stipulating what needs to be done to meet it, becomes significantly simpler.

Needs analysis is focused on stakeholders and their goals, aspirations and needs with regard to any improvements. Needs analysis requires the identification of users and stakeholders, the articulation of their goals and the identification, recognition and articulation of needs and gaps. The techniques applied draw upon stakeholder engagement and management emphasizing stakeholder identification and stakeholder mapping, whilst particularly focusing on identifying interests and charting influences that play a key part in determining expectations of different stakeholder groups. As was proposed above, systems methods that explore the boundaries of systems and the relevant context are also essential in identifying and exploring issues and positioning projects to address the key aspects required to deliver the change pointed to through the articulated needs. Enterprise modeling methods and business analysis techniques can also play a part in analyzing the as-is enterprise and in determining limitations and identifying deficiencies with respect to the recorded needs. The work completed during needs analysis serves as the preparation for determining, developing and specifying the requirements.

Defining Requirements

Articulated needs serve as the basis for formulating the plans for the project in terms of the agreed aspects that need to be represented in the proposed system. This calls for transforming the defined needs into a set of requirements that will underpin the project. A requirement is a statement that identifies a condition, function or capability needed by a stakeholder in order to solve a problem, or achieve an objective. It is alternatively defined as a condition or capability that **MUST** be met in order to satisfy a contract, standard, specification or some formally imposed document. In some contexts, a requirement may refer to a documented representation of such a condition or capability. While there are many alternative definitions, it is clear that requirements can represent the current or future state of any aspect of an enterprise, particularly in the context of an articulated and clearly specified need.

It is important to distinguish between *user requirements* and *system requirements*. Initially analysts will work with different stakeholders to refine the needs statements into what is known as user requirements. User requirements are captured in a random order, and are clearly focused on the needs of different stakeholders. An increasing trend is to develop the requirements collaboratively with the relevant stakeholders. Sharing and collaboration activities serve to provide greater insight and understanding of what is truly needed. Analysts are thus concerned with turning noisy, unstructured information from users into measurable, testable user requirements that will form the foundation for all subsequent system work. The format of user requirements is simple, so that they are understandable and clear to the users and can thus be used as the basis for agreement and negotiation.

However, the statements made by users and stakeholders are often not sufficiently useful for other developers and professionals. User requirements are short and non-technical, yet are often stated in terms of a solution. The purpose of user requirements is to derive a deeper understanding of the needs, and therefore analysts will endeavor to refine them by focusing on needs rather than solutions. Analysts act as interface between the different communities engaged in project work. Systems requirements evolve from user requirements to define what the system must do to meet the needs. Their role is to assist other professionals further downstream (who will likely not have the benefit of interrogating the different stakeholder groups) by providing a definitive statement of what is needed. Systems Requirements explore the solution in terms of 'what' is needed (not 'how' it might be delivered).

User requirements are akin to expanding the needs assessment described above, while systems requirements are primarily concerned with the development of a working specification that captures the essence of what is needed (and why), and how achievement can be measured. The processes and activities required to deliver this working document are described below.

TYPES OF REQUIREMENTS

We often hear about functional requirements, but in practice there are a number of different types of requirements that will need to be collected and stated. The following classification scheme shows the many different general types of requirements and the diverse concerns they embody.

Business requirements: Higher level statements of goals, objectives, conditions or needs of the enterprise. They may describe the reasons why a specific project has been initiated, the objectives that it will achieve and the proposed measurements to determine its success. Business requirements emerge from *enterprise analysis* and relate to the entire organization, rather than to specific business units or stakeholder groups and may therefore apply across multiple projects. (Note: some organizations will use the term *enterprise requirements* to capture wider organizational issues, reserving the term business requirements to the specific requirements raised by business users. An alternative approach is to split business requirements into the subcategories of strategic, tactical and operational requirements.)

Stakeholder requirements: Statement of needs of a particular stakeholder or class of stakeholders. They will typically specify how that stakeholder will interact with a solution and specify their performance needs and expectations. Stakeholder requirements are elicited and formalized through requirements analysis.

Solution requirements: The technical characteristics of the solution that meets the business requirements and stakeholder requirements. They are identified and refined through requirements analysis and include:

- *Functional requirements* describing the essential behavior and capabilities of the system in terms of operation or responses. These are derived from the fundamental purpose of the product (that is the needs it satisfies).
- *Non-functional requirements* describing environmental conditions under which the solution must remain effective. These may relate to quality capabilities, such as availability, capacity and speed. Non-functional requirements, also known as quality-of-service requirements, may also refer to design and management constraints, which are likely to emerge at each phase of the life-cycle where additional detail is obtained. Non-functional requirements may also encompass:
 - Look and feel requirements, describing the appearance;
 - Environmental requirements, describing the location and conditions;
 - Usability requirements, identifying ease of use;
 - Performance requirements;
 - Operational requirements;
 - Product requirements, identifying key attributes in the product;
 - Maintainability requirements;
 - Security requirements;
 - Political requirements encompassing culture and politics;
 - Legal requirements;
 - Information requirements, including privacy;
 - Interface requirements detailing issues of interacting or communication;
 - Regulatory requirements imposed by relevant regulators;
 - Organizational requirements including applicable broad policies and procedures that apply to the contracting or contractor organizations;
 - Ethical requirements;
 - Future proofing requirements that enable growth in capacity and potential in response to anticipated trends and emerging technologies;
 - Training requirements.

Transition requirements: The specific capabilities required to facilitate transition from the current state to a desired future state. These are temporary requirements that may relate to skill gaps to be addressed or to specific migration and conversion of data and will emerge from the solution assessment and validation activities.

Functional Requirements would thus represent the characteristics of the outputs of a project which delivers the solution. These will hopefully address the stakeholder requirements and needs, while respecting and supporting the business requirements. Transition requirements would enable the delivery and implementation of the solution. In reality, the distinction between the different types is sometimes blurred; nonetheless, the classification is useful in identifying the different types of requirements whilst providing a useful tool for highlighting the different perspectives that may be usefully considered.

Tip: Requirements that do not appear to be independent and may seem to relate to more than one of the classes may merit further investigation to determine and untangle the relationships and dependencies. It is often the case that such requirements harbor assumptions and unidentified concerns that can be unpacked into individual and independent statements.

REQUIREMENTS ACQUISITION ACTIVITIES

Requirements serve as the foundation for developing solutions and delivering projects. Requirements statements therefore need to be complete, concise, clear, correct and consistent. However, they cannot simply be collected as they are often poorly stated, inconsistent, incomplete and ambiguous; instead, a number of interconnected activities begin with more systematic elicitation of requirements from relevant stakeholders. A combination of techniques is used to develop the richness and multiplicity of perspectives and viewpoints. The activities require cycles of interaction between analysts and the stakeholders attempting to describe their needs and the proposed external behavior of the system by focusing on what needs to be done and formulating the evaluation criteria. In this way the need is elaborated through a process of questioning the stakeholder and formulating the problem gap into a clearly understood area of agreement. The full set of activities is discussed below.

Elicitation

Requirements elicitation is concerned with obtaining further information related to the diverse needs, perspectives and expectations of different stakeholder groups. Elicitation relies on a variety of techniques including: brainstorming, interviews, focus groups, Delphi technique, requirements workshops, observation, document analysis, surveys/questionnaires, market research, interface analysis, form analysis, task analysis, scenario analysis, domain analysis, business process redesign, prototyping, story boarding, ethnography, role playing, analysis of natural language, stories and narrative methods. How much of the requirements are known is critical to selecting the most suitable approach: The real art of elicitation is in selecting the methods that will work with a particular group and identifying their needs. Elicitation and continuing engagement with stakeholder groups is likely to lead to further requirements and refinements.

Once sufficient detail has been recorded, it is expected that the requirements analysis phase will begin, possibly in parallel with elicitation.

Analysis

Requirements analysis is concerned with assessment and classification of the elicited requirements to define the required capabilities that will fulfill the identified stakeholder needs. It is concerned with the interrelationships between requirements and the relative importance of each. The analysis will therefore encompass the stakeholders' needs to determine if these are represented, as well as the solution requirements, which identify the essential characteristics and behaviors required to describe a solution in sufficient detail to allow it to be designed, implemented and reviewed for achievement following release.

Organization

Requirements organization classifies requirements into a set of views, perspectives, profiles or roles. Each organized grouping will be comprehensive, complete and consistent from all stakeholder perspectives and enable the identification of interrelationships and dependencies. Structuring and organizing is often useful in questioning the basis and links between requirements, and can often uncover hierarchical or related considerations that will result in uncovering further requirements.

Allocation

Requirements allocation is an iterative process that includes allocation and apportionment of requirements to functional elements. This is often done through systematic decomposition of systems requirements generating a lower level requirements structure. While it is a requirements activity it is closely linked to traceability.

Prioritization (and Negotiation)

Requirements prioritization is concerned with creating new ways of working in response to the needs. Most requirements are negotiable and need to be considered in light of other requirements. Prioritization ensures that both analysis and project implementation are focused on the most important or most relevant requirements. This is often done through prioritization indices, decision making models, utility allocations or very simple prioritization tools that identify the Must Haves, Should Haves, Could Haves and Won't Haves, or look to designate labels such as: Essential, Desirable or Optional.

Requirements prioritization is used to decide which requirements need to be addressed. The prioritization process depends on negotiation, decision making and trade-offs between priorities, values, viewpoints, expectations, risks and urgency or other agreed criteria. By the end of the activity each requirement should have an assigned priority.

It is worth noting that some requirements may not merit a high ranking for their own value but may be needed to support other requirements or to implement regulatory or governance aspects, which may take precedence over the concern of other stakeholder groups. Project negotiation is also likely to be included, where conflicting priorities and requirements are untangled in order to resolve identified conflicts. Prioritization will determine which subset of the requirements can be allocated to a specific project whilst considering the specific characteristics, constraints and stakeholder viewpoints that need addressing. Conversely, the process can also be used to allocate different priorities to the entire collection of requirements, which will enable an agile method to develop a portfolio of requirements suited to each time period.

Specification

The ultimate result of the requirements activities is the creation of an explicit refined specification or model of the system's requirements in a technical language. This document describes the descriptive external characteristics required in any proposed solution that is likely to address the identified needs. The requirements specification reflects the agreed understanding of the steps to be taken (or the problem requiring resolution) and often adds technical details required by designers and engineers further downstream. In other words, it provides a technical specification or a blueprint of what is to be found in the solution (but not of how it will be designed). It is likely to be used as the basis for a contract, as a means of communicating the agreement and sharing it with other professionals (such as designers, architects and project managers), and as a way of measuring compliance with the contract.

Following completion, the delivered system or project is likely to be tested against this definition to ensure compliance with the specification. Ultimately the requirements specification will serve as the gateway to the rest of the project, or life-cycle. Note that the statement specifies the characteristics required but avoids making any reference to a particular solution. The adoption of the requirements specification often marks the beginning of the detailed search for an adequate solution. A good requirement specification would contain sufficient information in order to satisfy stakeholders' needs, and nothing more.

Verification

Requirements Verification ensures that requirements are stated correctly, completely and consistently. The activity also confirms that the model meets the necessary standards of quality and warrants that the requirements have been defined correctly. Verification is done by utilizing rules to establish, check and confirm each model and statement.

Validation

Requirements validation ensures the correct requirements are stated. The intention is to prove that all meet a stakeholder value, satisfy a need and/or deliver value to the

business and also to confirm that stakeholder, project solution and execution are aligned. According to Davis (2005) a valid requirement must pass two tests; namely, the satisfaction of the requirement must be externally observable, and it must help fulfill a recognized stakeholder need.

Formal Acceptance

Requirements acceptance marks the commitment of a requirement to a requirements baseline with a formal sign off to ensure that only controlled changes will be allowed from this point onwards. Requirements management activities will be concerned with maintaining and evolving the baseline during development.

The Requirements Management Process

Not all requirements activities are done early on during the development process: Requirements tasks typically span the entire project life-cycle. Indeed requirements are assumed to be always active and would benefit from progressive elaboration. Moreover, they need to be kept up-to-date throughout development. A useful way of thinking about the process is to view requirements as a form of retained knowledge. This perspective encourages requirements to be considered as a project, and even, an organizational resource thereby justifying investment and attention.

Some projects dedicate 5% of the development resources to requirements related activities. As a rule of thumb it is recognized that 10% is a more reasonable figure, given the range of activities called upon. Empirical research suggests that projects dedicating less than 8% to requirements have a significantly higher likelihood of failing than those in the range of 10–15%. Hood et al (2008) suggest that on the basis of 'best practice', 40% of development time should be allocated to requirements and specification activities, but the range of 10–12% is more typical in many sectors and industries.

While some people talk about using a requirements management process, the fact is that in reality the steps alternate and change between the different activities with some progressing in parallel. Many books describe them as a cycle, a wheel or simply a set of connected activities progressing in parallel. The key certainties are that following identification of the needs, the initial step is requirements elicitation. Indeed, the process related to the development of a requirements specification is iterative by nature and feedback-driven. The pace is uneven as some activities generate further requirements with activities revisited several times. In traditional projects, these iterations will mostly precede the design activities. In agile processes and projects iteration and feedback will be accommodated as part of the development cycles and fit within designated time periods. Gaps and contradictions may be identified later in the process, and these can be explored using the same methods and key activities. For example, missing, incorrect and incomplete requirements will be identified during the analysis phase which may necessitate additional elicitation. Other iterations and cycling through activities are also possible until the requirements are deemed to be complete.

Davis (2005) points out that requirements are transformed from the beginning of elicitation to the end of the requirements specification in a wide variety of ways including:

- *Agreement*: change from suggestions to a fully agreed consensus by all parties;
- *Completeness*: more and more requirements are added as we think about the process;
- *Detail*: change from relatively abstract statements to detailed and considered statements;
- *Precision*: the initial stages tolerate ambiguity, which is reduced as the process progresses;
- *Augmented*: the initial sentences are augmented with models, pictures, annotations, explanations, supporting evidence and cross-references.

The gap between the starting point of the process and the end result has also been described as the difference between 'stated requirements' uttered at the beginning of the process and the 'real requirements' that evolve from the stated requirements during the requirements acquisition activities (Young, 2006).

MANAGING REQUIREMENTS

We now look at the activities and infrastructure required to support the management of requirements during the requirements phases and beyond into the rest of the project. We are concerned with the supporting activities underpinning the management of requirements throughout development and management. Many quality procedures and supporting mechanisms are employed to enable and maintain the requirements.

Requirements Repository

Changes to requirements have to be recorded and managed. Failure to document or track proposed requirements means they might now be utilized. A requirements repository is often used to store requirements including: approved requirements, requirements under development and requirements under review. A system for adding, changing and deleting requirements is normally established. Each individual requirement is likely to have a unique means of identification, which will also be utilized in showing conflicts and demonstrating traceability and linkages. Good requirements will include the following attributes: date, source (or origin of the requirement), its rationale, priority, status and version.

Assumptions

It is also extremely useful to record assumptions. Different people make different assumptions, and where assumptions surface during the elicitation or elaboration process, it is important to identify them. Assumption can be used during risk assessment. They can be investigated during the prioritization and their impact can be decoupled from the relevant requirement during the requirement specification phase.

Baselines and Signoff

Agreed and approved requirements will be baselined following a formal signoff as described above. However, it is naïve to assume that changes will stop following signoff: Requirements will change and new knowledge regarding them will emerge. Failure to respond to required changes is likely to lead to obsolete products or project failure. Instead there is a need to develop systems so that all proposed changes can be considered and authorized by the change control board and recorded by the configuration management system. In many projects requirements are in a constant state of flux requiring changes and updates. In some projects it is not recommended to attempt to freeze the requirements too early in the life-cycle as there is a need to allow for conflict resolution and omissions. Similarly, it is not possible to keep changing forever, as this is likely to lead to requirements creep. The ideal position is somewhere between the two states as reflected in Figure 9.2.

To the left of the line, as we move towards the y-axis, it is too easy to freeze the requirements, while movement to the right towards the x-axis would represent requirements creep.

Configuration Control

All requirements are placed under formal change control. Change management processes are used to authorize changes to requirements and will take into account cost and effort estimates and indication of the expected impact of each change, as well as the relevant benefits and risk. Refinement, corrections and filling in of detail that is uncovered during the process will thus be informed by calculations of impact, risk and importance, which can be fed back to the relevant stakeholders groups and used to manage expectations.

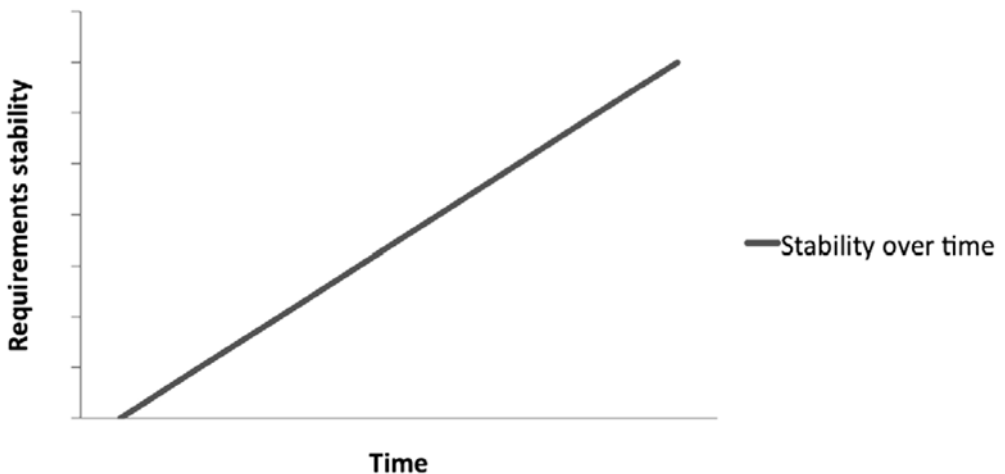


Figure 9.2 Requirements stability over time

Traceability

Tracing requirements back to the business goals and objectives helps in validating whether a requirement should be included. Traceability is also used in requirements breakdown structures to keep track of essential requirements and ensure that they are properly broken down into sub-requirements that are addressed at lower levels. It also aids in limiting scope creep and agreeing on the essential activities required to successfully deliver the project, whilst ensuring that all aspects are covered and no new ones appear without notice. In that sense traceability provides a bookkeeping system for essential requirements. Moreover traceability provides a way of linking those requirements to stakeholders, and their recorded needs, and to other artifacts and requirements.

Traceability also plays a key part in ensuring conformance to requirements, a recognized quality measure, whilst underpinning scope, risk, cost and change management activities. Traceability is closely linked to requirements allocation and flow-down through functional decomposition, and flow-up to validation of needs. Tools that support these aspects include traceability lists, the requirements traceability matrix, traceability manuals and the mapping of requirements to project scope and to work breakdown structure deliverables, as well as mapping requirements to test cases.

Testing

It is important to define the evaluation criteria early on. Testability can be established during requirements elicitation by focusing on the fit criterion. The fit criterion is a measurement of the requirements that enables testers to precisely determine whether the system meets (or fits) the requirement. So a requirement for confirming the identity of each customer immediately may be re-written as: 'Client identity records must be displayed within 10 seconds of an identity request being logged.' Fit criteria provide a way of establishing clear-cut acceptance tests for each requirement (Robertson and Robertson, 2012).

Accountability

Requirements accountability is concerned with ensuring that all requirements have been allocated and addressed.

Future Proofing

Needs analysis and requirements assessment activities are likely to uncover future needs, and requirements that are unlikely to be of use beyond the current project. These can be recorded, tracked and allocated to future projects. It is a useful exercise from an organizational perspective.

Effective Requirements Management

KEY SUCCESS FACTORS FOR PROJECT REQUIREMENTS

The 10 key success factors for delivering good requirements are:

- Initiate your requirements management effort by focusing on needs;
- Identify all relevant stakeholders to determine the needs to be fulfilled;
- Select experienced requirements analysts and experts (and develop them);
- Foster the development of a collaborative environment for cooperation;
- Map requirements against the needs they fulfill;
- Establish objective testing criteria to prove the achievement of needs;
- Allow requirements to evolve, where needed;
- Use the requirements as a way of communicating with the stakeholder groups needed;
- Allow time and resources for the requirements activities;
- Establish clear support from the project manager for the requirements effort.

COMMUNICATING REQUIREMENTS

Requirements communication is increasingly used to ensure all stakeholders have a shared understanding of the proposed project. It is useful in setting and managing the expectations of shareholders and in maintaining their involvement. It is also a useful tool in reaching agreement about the approach and the key requirements that will be used as a test to determine if the delivered project meets the intended requirements. If there are multiple stakeholder groups, the communication process will involve identifying their specific interests and developing appropriate formats for presenting the requirements that suit each group and enable it to engage with the project. This is made easier through working it back to the needs statement developed for the different groups.

Business analysis increasingly relies on securing the approval of key stakeholder groups as a tool for managing the scope of the project and the solution concept that will implement the agreed requirements.

WRITING EFFECTIVE REQUIREMENTS

Requirements are not written by project management experts; instead they are researched and compiled by analysts engaged in an intensive, highly interactive and collaborative process. Poor handling of requirements results in problems further down the line. The key skills associated with the role, include excellent communication skills, strong stakeholder focus, knowledge of business analysis, or a similar domain, organizational research skills and a variety of soft and interpersonal skills. Additional expertise normally includes facilitation, and conflict resolution.

Some guidelines on how to write effective requirements are offered below.

1. Requirements should not identify or focus on a potential solution; they should instead refer to the need and what it means. In order to try to avoid the temptation of thinking about the implementation or a particular solution the writing is normally focused on what is needed, rather than how it might be delivered.
2. The writing style is factual. Good requirements tend to use 'shall', while statement of fact will make use of 'will' and goals are described in terms of 'should'.
3. Use a unique identifier for each new requirement.
4. Avoid undefined words such as best, ideal, optimal, easy, sufficient, adequate, quick, rapid, inexpensive, informed, improved, enhanced, supportive, user-friendly.
5. Avoid ambiguous measures such as some, several, many, few.
6. Clearly identify units of measure next to numbers (for instance make it clear if it is four seconds, minutes, hours or days).
7. Avoid absolute terms such as: always, never, all.
8. Do not use complicated conjunctions: if, when, but, except, unless and although.
9. Avoid using terms such as usually, normally, typically, frequently, occasionally, generally, scarcely, hardly and often.
10. Avoid using terms such as obviously, clearly, certainly.
11. Consider carefully whether words such as downloaded, processed and accessed are specific enough.
12. Resist the temptation to use 'etc.' and 'so on ...'
13. Some common terms such as efficient, effective, minimize and maximize are difficult to use in requirements specifications.

SMART REQUIREMENTS

In order to write effective requirements, it is often suggested that a revised version of SMART is used to challenge and fine-tune each requirement in turn. SMART, initially introduced by Doran (1981), is an acronym where each letter refers to a task in the process of elaborating a clearer definition. By working through the statement using one line of SMART at a time, it becomes possible to elaborate a quality requirement. A slightly revised, and somewhat longer, version of SMARTTT for requirements is:

Specific: be specific and precise;

Measurable: establish a measurable indicator of progress;

Assignable: is agreed by and can be associated with a stakeholder;

Realistic: can be realistically achieved within constraints;

Time-related: using a specific timeframe;

Traceable: full traceability to needs, stakeholder and test;

Testable: define test criteria to confirm achievement.

CRITERIA FOR A GOOD REQUIREMENT:

The quality attributes, or criteria for determining the qualities of a good requirement normally include the following:

Complete: self-contained, without omissions, covering all significant aspects;

Cohesive: supports purpose and scope;

Concise: brief and to the point;

Consistent: same content regardless of format; different parts do not conflict;

Correct: free of errors and satisfying a need;

Feasible: technically, as well as within time, cost and resource constraints;

Modifiable: necessary changes can be accommodated;

Necessary: needed;

Ranked: ordered and prioritized;

Readable: by the right community;

Testable: verifiable; fulfillment can be proven;

Traceable: origin and rationale are visible;

Unambiguous: only one interpretation is possible;

Understandable: by the right communities.

The criteria can be used as a checklist against individual requirements. It is worth noting that some of the attributes are difficult to measure. The value of the list therefore is in forming a view of what would make a good requirement and using it as a quality test, where possible.

Why Requirements Management Is Needed

There are many reasons why requirements are crucial to the success of projects. Information captured during requirements acquisition feeds directly into the activities of bid writing, contracting, project planning and scheduling, risk management, trade-offs, decision-making, project monitoring, acceptance testing, performance management, quality management, change control and reporting. They also feed into the contract and procurement cycles and can be useful in expectation management, relationship management, managing partnerships and, most fundamentally, can underpin communication. Undoubtedly, requirements should underpin many management activities and concerns, while providing a sound basis for subsequent activities. The rest of this section will view requirements through a variety of perspectives, and roles that they enable.

Requirements as a map: A key purpose of the requirements is to provide a blueprint for the development of the project and the required artifacts. The process and resulting documentation are designed to give a better idea about what needs to be done, and how to get there, whilst providing detailed information about the technical aspects. The remainder of the process can be informed and guided by the documented requirements.

Requirements as a test: Continuing with the journey analogy it also provides a means of determining whether the journey has been completed successfully by establishing the specific criteria, or the yardstick, required to test the satisfaction of the stated needs and the achievement of the required functionalities and capabilities.

Requirements as a decision point: The requirements provide managers with a natural go/no go gateway at the beginning of the development and delivery process.

Requirements as insight: The processes of needs assessment and requirement management provide analysts, developers and managers with insights into the issues and concerns of various stakeholder communities. They also enable stakeholders working together with analysts to make better sense of their context and real requirements.

Requirements as communication: The process of identifying needs and eliciting requirements provides a mechanism for engaging with the various stakeholder communities. Intermediate products and statements offer a means and mechanism for facilitating discussion and fostering agreement.

Requirements as a contract: Requirements can be used as the contract that underpins further development. They are often used as a proof of concept and as evidence that developers understand what needs to be done.

Requirements as agreement: Requirements involve negotiation and trade-off between multiple communities, stakeholders, preferences, viewpoints and perspectives. The artifacts employed during the process provide the interface needed to view different positions and reach agreement, documenting the common understanding. The collaborative process of teasing out and ranking the requirements becomes an effective tool for stakeholder engagement and for managing the expectations of the diverse stakeholder communities.

Requirements as management: Managing the set of requirements enables projects to maintain focus on the key needs and agreed requirements. Mapping the requirements offers greater visibility into the activities and processes required in managing the project.

Requirements as quality: Requirements management ensures that the correct system is being built. One of the definitions of quality relates to conformance to requirements. Specifying requirements with test criteria allows the establishment of measures that can be used in measuring the quality of projects and deliverables.

Requirements as history: Requirements provide a historical record of how an idea or concept came into being.

Requirements as interface: Requirements provide a link between business objectives, stakeholder needs, proposed improvements, and specific projects. They provide traceability from specific endeavors to organizational priorities and back to stakeholder concerns, and thus carry, facilitate, record and enable communication and sharing across different levels, communities and concerns.

AND THE COUNTER-CASE: WHY WE CANNOT DO WITHOUT IT

The consequences of wrong, incomplete or messy requirements are rejection of the system by stakeholders whose needs have not been addressed, the need to retrofit and make corrections to released systems, loss of confidence and reputation, loss of money and the potential for ultimate project failure. Young (2006) points out that errors in requirements account for the largest class of errors typically found in a project, using examples of between 41–56% of errors discovered overall. Other evidence also identifies a range of 40–60%. The figures suggest that the greatest impact can be accomplished by correcting, or not making, errors during the requirements activities. Additional effort invested in improving the requirements process may prove a cost-effective investment.

Requirements determination is a particularly volatile phase, as requirements are unearthed during the initiation phases when the level of uncertainty about the project is at its greatest (Figure 9.3, mouth of the cone showing the greatest degree of variance).

Accurate estimates can be made when the requirements are understood and agreed, offering a greater degree of confidence in what needs to be addressed, and what the financial implications might be. The sooner a mutual understanding of the project is achieved, the greater the likelihood of deriving correct products, reflective plans and accurate estimates.

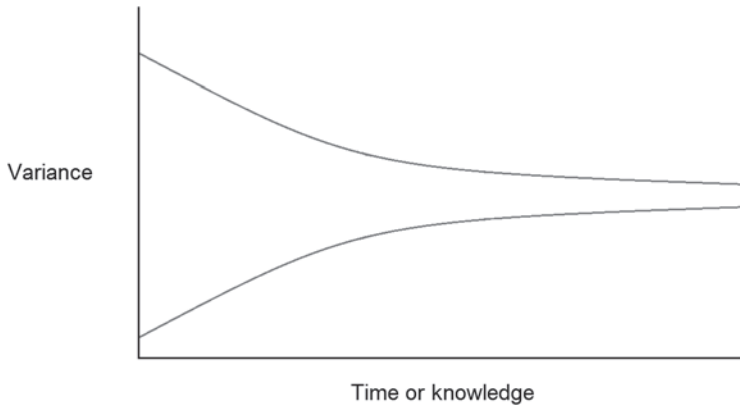


Figure 9.3 Cone of uncertainty surrounding a project

It is now generally accepted in project management that the cost to affect changes and correct errors increases dramatically as the project progresses (Figure 9.4).

When errors are found later in the life-cycle they cost significantly more to trace, address, re-do and integrate. Discovery during acceptance testing will typically cost between 30 to 70 times the cost of correcting the same error during requirements analysis and specification, while correction when the system is operational would fit in the range of a factor of 40–1,000. The relative cost of correcting errors is a function dependent on the phase during which they are corrected. The cheapest and easiest time to make changes is early in the process, when their effects can still be modeled on paper. From a monetary perspective, the ability to cost-effectively control the outcome of the project decreases rapidly in accordance with the life-cycle phase. Consequently, reducing requirements errors and investing additional time and resources in finding and correcting errors and

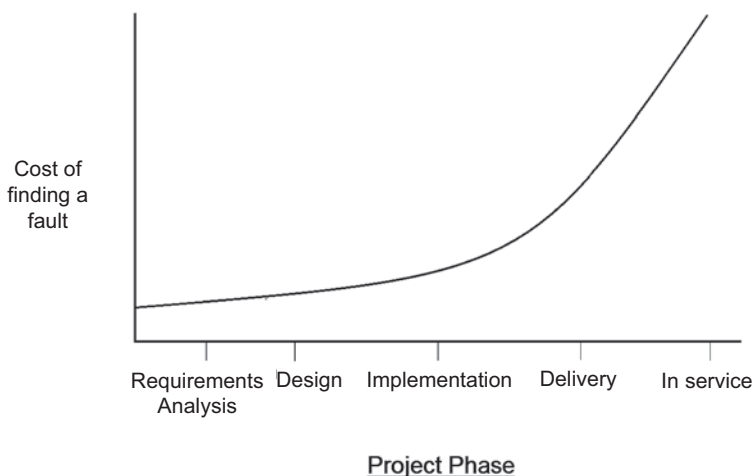


Figure 9.4 The relative cost to fix a problem as a function of time

omissions early on constitute the single most effective course of action that developers and managers can take to mitigate failures and improve project outcomes.

Requirements activities do not fall within the remit of project management. Requirements elicitation, analysis, prioritization and specification require specialist skills which are normally provided by systems analysts, business analysts, requirements analysts, business process reengineering (BPR) specialists, enterprise architects or requirements engineers. However they clearly impact on project outcomes and therefore should constitute a key concern for project managers.

The Standish Group (2010) has been tracking the reason for project failures for two decades. They regularly publish the top 10 reasons for project failure. Figure 9.5 shows the factors from their 2010 report.

<i>Reasons for project to be challenged</i>	<i>Relation to requirements</i>
Lack of user input	2
Incomplete requirements and specification	2
Changing requirements and specification	2
Lack of executive support	1
Technology incompetence	0
Lack of resources	0
Unrealistic expectations	2
Unclear objectives	1
Unrealistic timeframes	0
New technology	0

Figure 9.5 Top 10 reasons for projects to be challenged

The second column shows which factors relate to requirements management with 2 representing a direct impact, and 1 an area that might be improved as a result of greater attention to requirements management. The table indicates that requirements management issues have a clear impact on the outcome and potential failure of projects as major impacts can be identified across at least four of the 10 items, with some impact indicated for at least two additional factors. Hull et al (2011) show a similar exercise

for earlier results of the survey: factors related to failures in requirements management account for 51.6% of project failures, while successful requirements management practices also appear to be associated with 42% of the factors identified as leading to success.

Requirements management clearly plays a key part in the success or failure of projects and therefore merits more attention from the project management community. Young (2006) contends that project managers can provide the focus for requirements activities by:

1. Setting a high standard for project requirements, demanding and facilitating good requirements analysis, and not accepting inferior requirements;
2. Receiving support from project managers for requirements work, including a greater proportion of project resources;
3. Using the requirements, assumptions and risks that emerge from the elicitation and analysis activities to shape and refine project plans;
4. Ensuring that the right requirements practices, methods and approaches are deployed according to the type of project;
5. 'Working behind the scenes' to ensure that all relevant stakeholders are identified and influencing them to support and participate in the requirements activities.

Given the importance of requirements activities we might add an additional requirement:

6. Employing experienced and well qualified analysts to support and underpin the discovery, communication and management of better requirements that underpin successful projects.

Identifying excellent analysts with communication and facilitation skills will be a good first step towards improving the track record of dealing with requirements.

DIFFICULTIES ASSOCIATED WITH NEEDS AND REQUIREMENTS

Table 9.1 shows key difficulties and hurdles associated with instituting and executing requirements management activities on projects.

Not surprisingly, the majority of concerns appear to relate to softer factors associated with people, communication, understanding, politics, knowledge, needs, expectations, conflict, influence, agreement, disagreement and finding good people.

Concluding Remarks

Requirements involve people. Skilled specialists are used to work with different groups to identify their concerns and needs. The difficulties attached revolve around softer issues ranging from politics, to biases, and from expectations to acceptance and collaboration. Yet, requirements also embody strategic considerations. Needs analysis enables organizations to build a bridge between strategic goals and business case on the one hand, and design and deployment of solutions that underpin and support the organization on the other. The requirements management process translates ideas and needs into a formal document which defines and delineates the expectations related to a project, product or outcome. Traceability provides a much-needed link between the

levels and perspectives. Project management is unlikely to succeed without the support of requirements management. Requirements describe how a project will meet the business needs that the organization is endeavoring to address as well as guiding the execution of that action. Without requirements management it is difficult to know what has been achieved and who might be satisfied with the results.

Table 9.1 Difficulties associated with implementing requirements management process

Issues with	Nature of difficulties
Stakeholders	<ul style="list-style-type: none"> • need for stakeholder involvement (and their time availability) • ability to articulate needs • multiplicity of viewpoints and perspectives • conflicting needs • need to reconcile needs of different stakeholder groups • non-negotiable demands • ranking all needs as high priority • changing needs • changing stakeholders
Environment	<ul style="list-style-type: none"> • ill-defined system boundaries • poor understanding of the problem domain • conflicting priorities • changing needs • rapidly changing requirements (a.k.a. requirements volatility) • fragmented information • power and politics
Requirements process	<ul style="list-style-type: none"> • identifying and involving all stakeholder groups • confusing wants and needs • addressing the needs of the wrong stakeholder group • focusing on the 'what' rather than the 'how' • translating needs into requirements • stakeholders specifying unnecessary technical detail that confuses rather than clarifies the objectives • specifying ambiguous requirements • unrealistic trade-offs • ranking all requirements as high priority • determining completeness; establishing if there are any gaps or omissions • measuring the 'value' of requirements • inattention to business requirements
Human resources	<ul style="list-style-type: none"> • problems with natural language as medium • differing interpretations • how do we know that the needs have been understood? • complexity of mapping real needs • poor understanding of the capabilities needed • communication difficulties

	<ul style="list-style-type: none"> • omitting 'obvious' information • identifying assumptions
Analysts	<ul style="list-style-type: none"> • expertise is not clearly defined and stated • need to access tacit and unknown facts and intuitions • analyst's ability to translate between user needs and system requirements • limited user domain knowledge • complexity of integrating multiple perspectives and concerns • premature identification of solution/s • establishing priorities and trading-off needs and requirements • lack of appreciation of politics and power in the organization

By way of a conclusion, the following list inspired by Meyer (1985) offers a re-organization of the seven deadly sins in the context of requirements specifications:

1. *Noise*: The presence of elements containing information that is not relevant to the problem, or unnecessary repetition of the same item.
2. *Silence*: Relevant and important aspects of the problem that were omitted from the formulation.
3. *Over-specification*: Focusing on the implementation of a solution instead of the needs, or the problem.
4. *Contradictions*: Describing the same aspects in two or more different and incompatible ways.
5. *Ambiguity*: Use of language that allows the interpretation of a requirement in two or more ways.
6. *Forward reference*: Features are used before they are defined.
7. *Wishful thinking*: Using fanciful and unrealistic descriptions that cannot be met by a realistic solution or cannot be realistically tested.

Above all the list seems to offer much needed precision and focus to guide the exploration of our needs, and direct the execution of our desires.

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Managing Scope and Configuration

HEMANTA DOLOI

Projects are strategic tools of organizations which help them to achieve their business goals and objectives (Chapter 3). Projects provide different deliverables including products, services, knowledge and so on. Project deliverables create business changes and these business changes help organizations achieve their goals (Chapter, 2, Turner, 2009). In the context of developing a project scope management plan, project scope must include all the activities and only activities that should be performed to provide the deliverables. However, an important issue in scope delivery is how to align business goals and objectives with the project activities. Lack of effective scope management will lead to different issues such as unsatisfied customers and potentially contribute significantly to the failure of the project. Thus, project managers need a comprehensive approach in scope management.

Scope Definition Chain and Errors

Projects are defined when organizations need to align themselves with some necessary changes in business environment. These changes are required because of new opportunities, problems, threats or legislation compliances (Chapter 2, Turner, 2009). On the basis of business changes, mission, vision and finally goals and objectives of organizations may need to be revised. In order to meet organizational goals and underlying business objectives, a project should be defined with a clear goal and objective. The vital point is thus the alignment between business and project goals and objectives. Figure 10.1 shows the scope chain encompassing the business environment and project environment in the scope management context.

This figure illustrates that projects need a sequential top down evaluation to identify the precise and accurate scope. Using the scope chain helps the project team to harmonize all of the project efforts with the business goals and objectives. Scope definition based on the scope chain diagram will be described later in this chapter.

SCOPE IDENTIFICATION ERRORS

In the scope chain process, some errors can potentially occur due to lack of accurate scope definition. These errors can be categorized in five types as depicted in Figure 10.2.

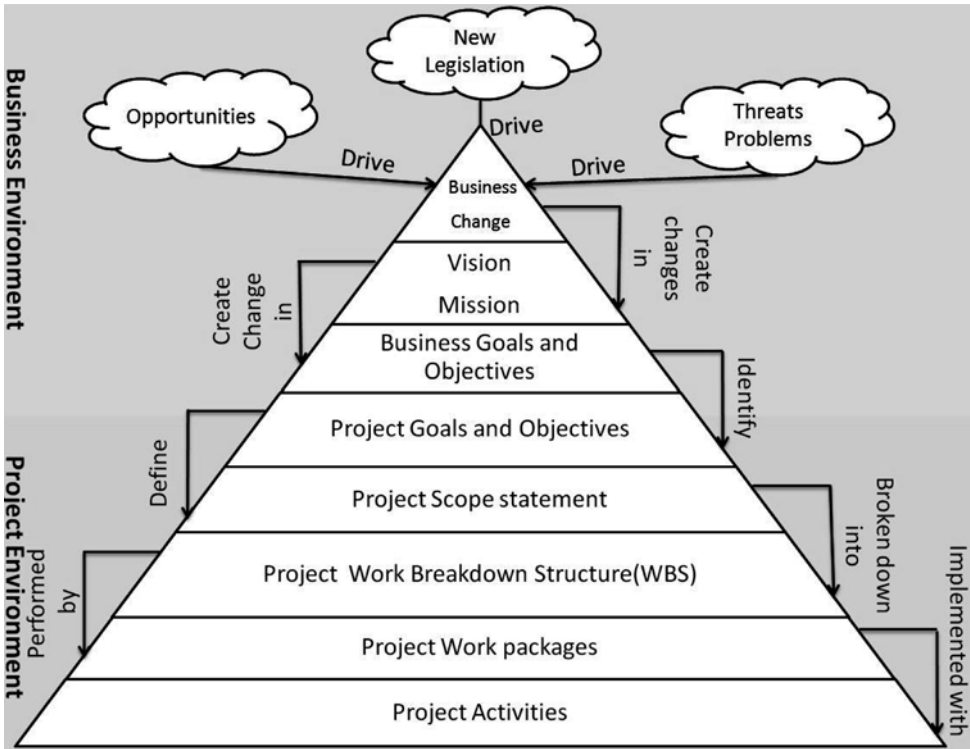


Figure 10.1 Scope definition chain diagram

Error Type 1: Inconsistency between business and project goals and objectives

Error Type 2: Inconsistency between project goals and objectives and project scope statement

Error Type 3: Inconsistency between project scope statement and project Work Breakdown Structure (WBS)/deliverables

Error Type 4: Inconsistency between project WBS/deliverables and work packages

Error Type 5: Inconsistency between project work packages and activities

In order to mitigate these errors, the project manager must orchestrate the project team and other stakeholders so that inconsistency in different levels is prevented. There are two important points to be considered in mitigating the scope errors:

1. Impact of upper errors will be more than the lower levels. For example, if there is not a complete alignment between business and project objectives, the project scope, time and cost will be affected significantly. In the instance of project goals and objectives being unclear, project scope statement, WBS, Work packages and activities will not be comprehensive consequently.

2. Secondly, any error in the upper levels will affect on the lower ones. In other words, if Error Type 2 occurs, there is a definite chance that Error Types 3, 4 and 5 will occur as well. For example, when a project does not have an accurate and comprehensive WBS and it does not cover project goals and objectives in entirety, consequently work packages will be deficient too. Therefore, it is important to prepare a clear scope chain from business goals and objectives to project activities.

PROGRESSIVE ELABORATION

As projects create unique products or services at different times, the projects are new experiences. Although almost always there are some similar experiences, by taking into consideration of the time and location of projects, there is not any similarity between two projects in their entirety. This characteristic of a project creates some impact on project behavior. There are always unknown unknowns in every project and often there is a tendency that projects can be planned without considering them. During the project life-cycle, these unknowns are transformed to known items. Therefore project scope and consequently time, cost and other relevant plans should be revised based on them. In the project environment this phenomenon is called progressive elaboration. It means that during project life-cycle more detailed information about the project is being identified.

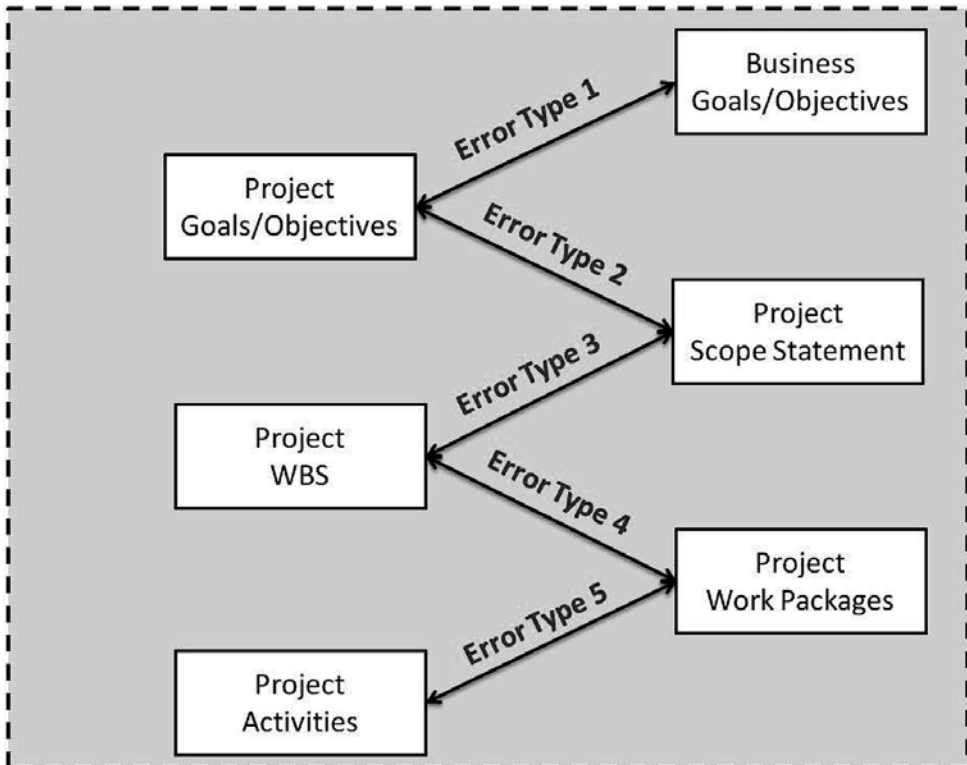


Figure 10.2 Scope definition errors

SCPE CREEP

Changes are an unavoidable part of any project. It is not possible to prevent changes. Some changes are positive for projects and without them, project goals and objectives cannot be achieved. However, it is important to prevent uncontrolled changes in the project especially in project scope. Scope creep is an uncontrolled change in the project scope and it is the project manager's responsibility to prevent the scope creep.

SCPE MANAGEMENT SCOPE

Referring to the scope chain diagram in Figure 10.1, there are seven important stages in defining an accurate, comprehensive, unambiguous scope. However, it is worth noting that this chain is not only the responsibility of scope management but must be managed in conjunction with the other core knowledge areas as well. Defining comprehensive scope management is possible when corporate management, integration management, scope management and time management work closely and are completely harmonized. Figure 10.3 illustrates the responsibilities of each one in the scope chain diagram.

From Figure 10.3, we can see a clear relationship between corporate, integration, scope and time management in order to prepare a precise scope. The integration between these areas is created based on clear deliverables, Figure 10.4.

One of the key inputs to the integration management is the availability of the business goals and objectives. The process and functionalities within integration management results in the project charter. The project charter is the major inputs of scope management. Scope management (as it will be discussed later) evaluates the project charter and defines project scope with detailed information. The major scope management outputs are project scope statement and WBS. Finally time management based on scope management inputs provides project activities.

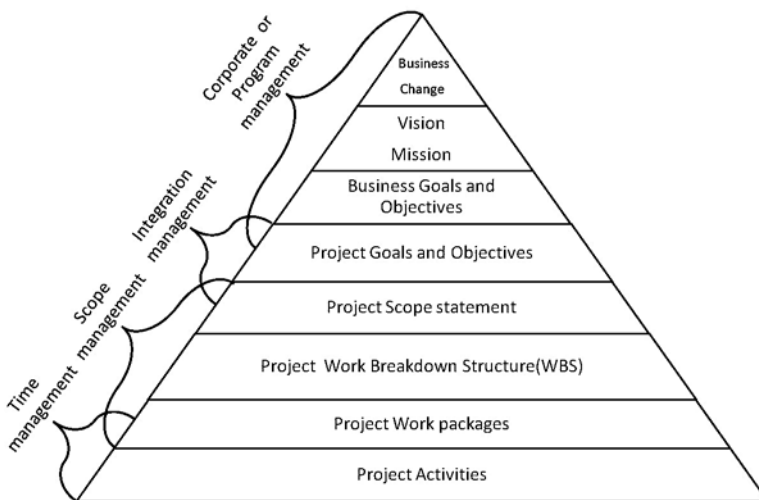


Figure 10.3 Relationship between scope management and other core knowledge areas in scope definition chain

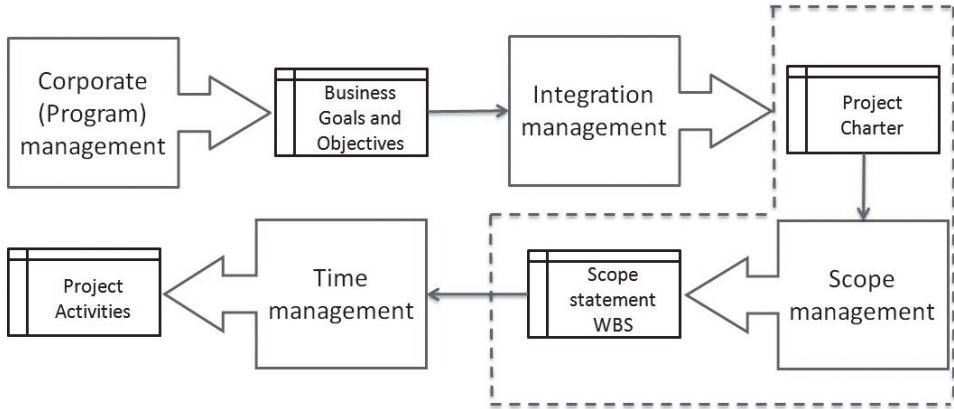


Figure 10.4 Approach to prepare an accurate and comprehensive scope

Current Best Practices

Among many available standards in the project management area, the two major standards are the Project Management Institute's Project Management Body of Knowledge (PMBOK) (Project Management Institute, 2013) and PRINCE2 (Office of Government Commerce, 2009). In fact, most of the location specific standards have been derived from these two key standards across the countries and thus the current review of the best practice is limited to these two key sources in the context of scope management.

PMBOK

The PMBOK contains five process groups and nine knowledge areas. Scope management is one of the knowledge areas within the nine key knowledge areas of project management. It considers five key processes in order to managing project scope as discussed below.

1. *Collect requirement*: Stakeholders are the primary source of identifying project requirements (Chapter 9). These requirements are derived from business goals and objectives. In this process, detailed information about project requirements is sought and analyzed with respect to the underlying project objectives.
2. *Define scope*: Based on the gathered information, project scope should be defined in a detailed manner. The description of the scope of the project within the scope definition document is known as the scope statement. The scope statement should include detailed information about project deliverables and its products.
3. *Create WBS*: In order to provide a clear structure for the project, the project should be broken into more manageable components. The most appropriate way to provide this structure is preparing WBS (Project Management Institute, 2006).
4. *Verify scope*: After identifying detailed information about the project scope including the project scope statement and WBS, project execution is started to provide project

deliverables. After completing each deliverable, it should be formally verified that the project customer or sponsor are satisfied with completed deliverables.

5. *Control scope*: Changes are the inseparable parts of any projects. Any change in the project will have a clear impact on project scope, time and cost. Control scope is one of the key elements to manage any change on project scope during the project life-cycle.

In addition to managing scope changes, control scope evaluates the project status during the project in comparison with scope base line. The control scope processes are the key elements in the context of scope creep prevention.

PRINCE2

Unlike the PMBOK, the PRINCE2 (Office of Government Commerce, 2009) does not have a separate part that directly refers to scope management, but it has a clear approach to scope management, which is distributed into plans and quality themes. PRINCE2 consists of Principals, Themes and Processes. Furthermore, 'Product focus' is a PRINCE2 principal that states that project scope should be defined based on products. In fact, PRINCE2 uses a technique in planning called 'Product based planning'.

In PRINCE2, following are the key processes used to define the project scope:

1. *Write the Project Product Description*: The Project Product Description describes the major project products and customer quality expectation and acceptance criteria.
2. *Create the product break down structure*: Based on the products that were identified in the Project Product Description, product breakdown structure is created. Product breakdown structure is a specific type of WBS that breaks down project scope on the basis of its products.
3. *Write the Product Descriptions*: For each of the identified products in the Project Product Description, a document should be prepared which provides detailed information about them. In other words, project scope detail is provided in this stage.
4. *Managing product delivery*: After providing a detailed definition on project scope, project execution starts and the deliverables are produced in the 'Managing product delivery'. At the same time 'Controlling a stage' reviews work package status and controls the project progress in terms of time, cost and scope management. This process prevents scope creep.
5. *Managing a stage boundary*: 'Managing a stage boundary' may be a most significant part of PRINCE2 and it relates to the progressive elaboration. As stated before, progressive elaboration is an important concept in scope management. In the PRINCE2 model, at the end of each stage, different aspects of the project including business aspect and scope are evaluated and updated again. At this point, new findings can be added to the project scope by considering business, financial and social impacts. Therefore, the project manager should be mindful about the progressive elaboration issue.

Scope Management Process

The scope management process is usually launched after receiving a clear project charter from integration management. Figure 10.5 depicts the general process of scope management.

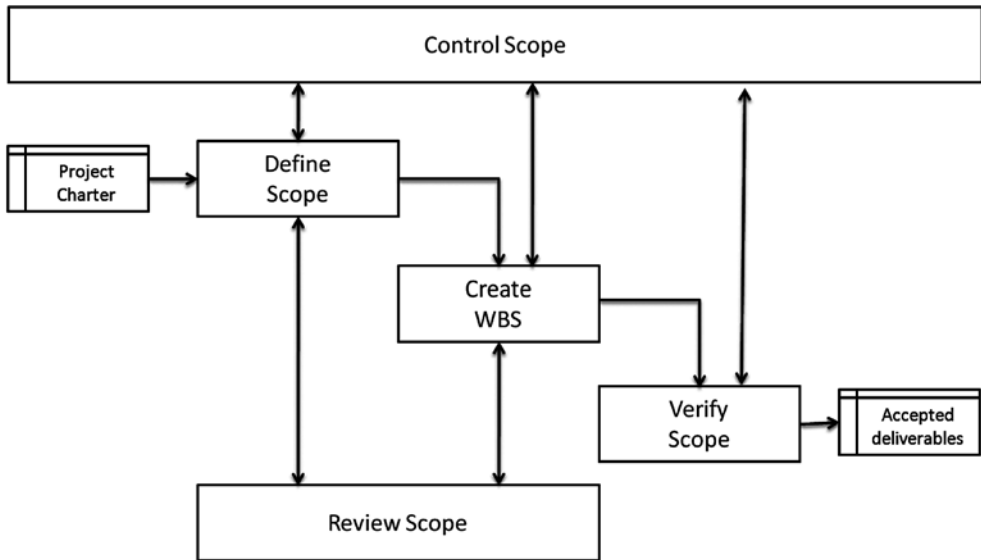


Figure 10.5 Scope management process

As seen, the scope management process consists of five major parts:

- Define scope;
- Create WBS;
- Verify scope;
- Review scope;
- Control scope.

DEFINE SCOPE

Define Scope is the first step in scope management. The main responsibility of scope management is producing a comprehensive statement about the project, based on the project charter. In the project charter the majority of information is of high level including high level definition, requirements and goals and objectives. They are neither measurable nor tangible. Scope definition should define the project as Measurable Deliverables and Products specifically (Turner, 2009).

An effective solution for scope clarification is defining project scope as a set of products. If a project is defined as a set of products, project scope will entail product descriptions. If for each product, detailed and clear information including product purpose, product elements and quality and acceptance criteria is provided, project scope will be clarified as well. This approach, defining scope based on the products, is called product based planning and is a suitable approach for project scope definition. Designing a product break down structure is a helpful approach in illustrating products and their relationship. After defining different products, provided information will be documented in the project scope statement. The project scope statement includes detailed information about the underlying scope of the project such as:

- Project description
- Project products structure
- Product detailed information
- Project assumptions and constraints
- Project exclusions

Project exclusions can be helpful especially in projects where scope is not clear. Referring to Figure 10.2, there are usually two major errors that should be managed by scope definition. Error Type 2 is created when the defined project scope statement does not cover all of the project goals and objectives that are defined in the project charter. Usually, a project benefits map (Chapter 8) helps to prevent this error type quite effectively. By using a project benefits map, each project's goals and objectives can be assigned to project products. This helps to firstly, analyze whether or not there is a clear product or products for each of project goals and objectives and secondly, answering to the question 'do all of the products relate to one or more project goals and objectives'? Figure 10.6 gives an example of a project benefits map for a typical combat planning project.

As seen, the project objectives are clearly mapped with the underlying change processes and the final products. This process clearly helps to avoid any usual errors in the scope statement definition process.

CREATE THE WBS

Although the scope statement includes detailed information about project scope, further planning needs a suitable scope structure. Project management needs accurate estimation of cost and time. The most appropriate approach is dividing project scope into more manageable, measurable and time bounded components. A WBS is one of the best approaches. It helps the project team provide detailed information about works that should be done in the project with a clear exposition of what is included and not included in the project.

Furthermore, the schematic structure of the WBS is the unified and perceptible model between project team, suppliers and customer. The WBS is an appropriate tool that facilitates any debates on project scope among the major project stakeholders.

There are different approaches in defining the WBS. Some of the common approaches are:

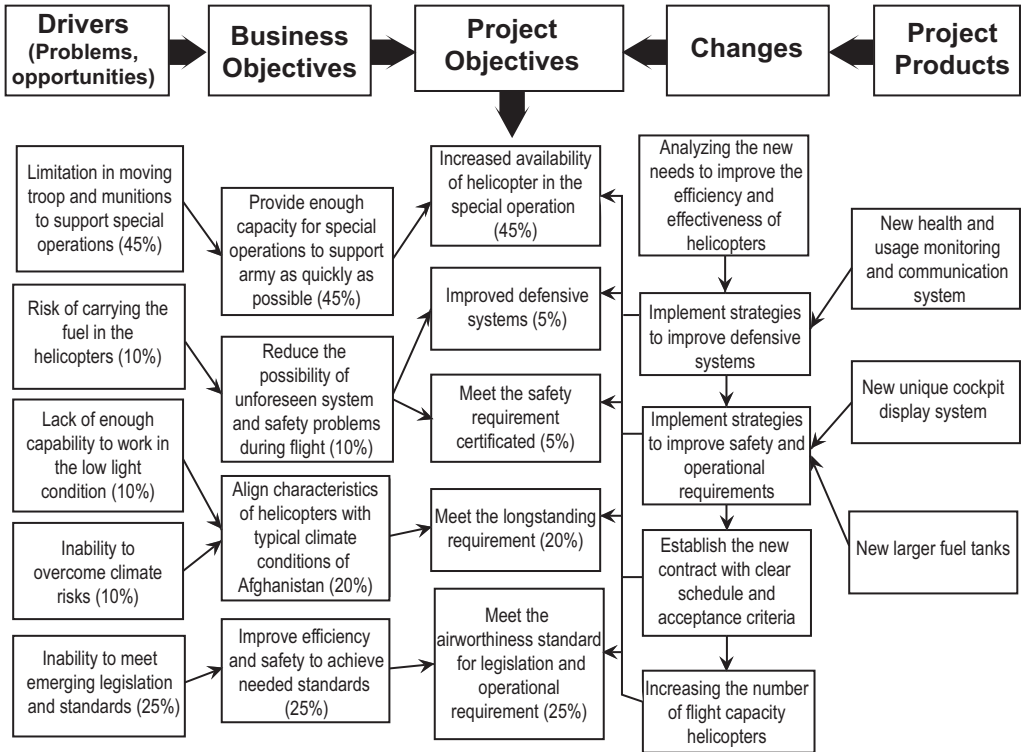


Figure 10.6 Example of a project benefits map

- Phased-based WBS;
- Deliverable-based WBS;
- Geographical WBS;
- Technical process-based WBS.

There is a golden rule in preparing a WBS which is usually called Rule 100%. This Rule states that Project WBS should cover 100% of the works included in the project. This rule is related to Error Type 3 in Figure 10.2. It means that all of the project deliverables identified in the project scope statement and contract should be covered in the WBS. An example of a WBS from a software development project is shown in Figure 10.7.

The lowest level of WBS is called the Work Package. Work Packages are the measurable components in the WBS and they can be estimated with reasonable accuracy. This means that they can be scheduled and their cost can be estimated. Work packages are further broken down into project activities in the time management module. An important point in designing a WBS is the consideration of the appropriate level of scope and required effort details. The level of information that the project needs to know about each deliverable is detailed in the WBS. The project manager and the project team are usually responsible for identifying an appropriate scope and level of detail in the context of developing the WBS in the project. Figure 10.8 illustrates the scope and concept of details in the development of the WBS.

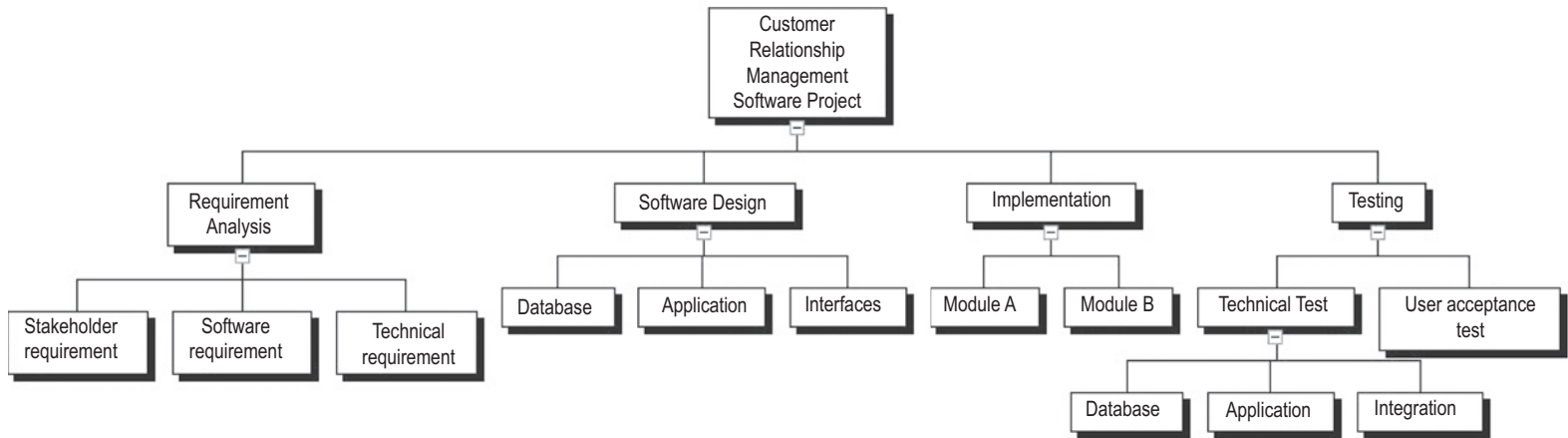


Figure 10.7 Example of a WBS from a software development project

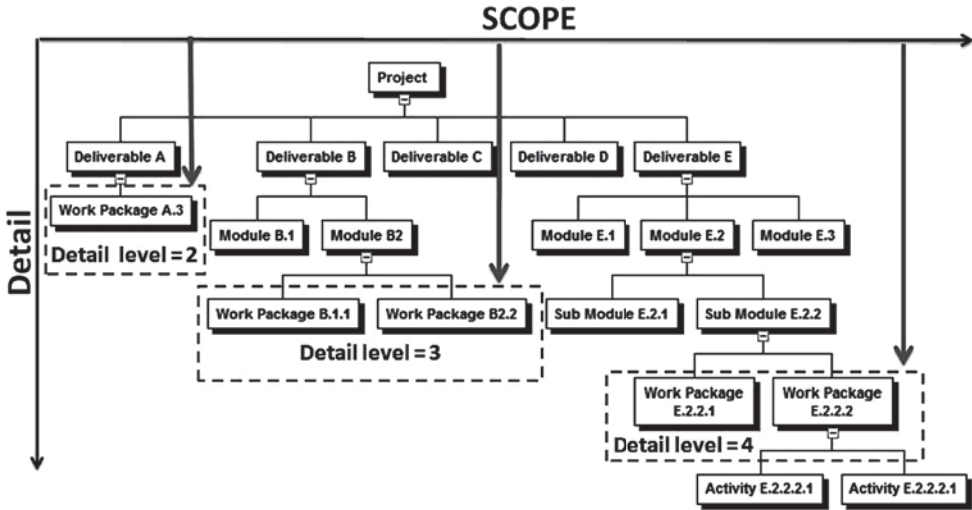


Figure 10.8 WBS scope and detail

As part of the scope management plan and developing the WBS, the project should be divided into smaller components in the WBS hierarchy until the work packages can be defined with the following information:

- Required effort and materials;
- Clear, technical, agreed-upon specifications;
- Quality requirements;
- Acceptance criteria;
- Verification procedure;
- Related milestones.

The above information for all the work packages is then aggregated into the scope plan. A sample template for developing a scope definition plan is shown in the Appendix.

After providing a comprehensive WBS with adequate scope and necessary details, the scope baseline is then established capturing a clear project scope statement, WBS and the scope plan. The scope baseline is a reference for further scope monitoring and control. Scope baseline is the best reference for project manager, project team, customer and other stakeholders to evaluate whether a product, component or functionality is included in project scope or not.

VERIFY SCOPE

Based on the prepared comprehensive scope statement and WBS, project activities are defined in project time management. When project deliverables are completed, the project team should evaluate the deliverables and obtain customer acceptance. At this stage, the project team should compare the characteristics and functionality of the deliverables in comparison with the contract, scope statement and other documents that describe deliverables.

REVIEW SCOPE

As stated above, progressive elaboration is an important issue in the project. Managing progressive elaboration needs an iterative process in scope definition. It means that after specific points throughout the project life-cycle, the project team should evaluate the scope definition chain. Once a new component including product, functionality and/or serviceability is found necessary in the project scope, the project scope document should be updated. The new component should however be accepted by the change control board before finalization. The review scope can be done at any time but a review at the end of each project phase or stage is effective and efficient.

CONTROL SCOPE

Control Scope has three main responsibilities:

Prevent Error Types 2, 3 and 4

As shown in Figure 10.2, there are five major errors in the Scope Definition chain. Three of them, Error Types 2, 3 and 4, are under the control of Scope Management. Scope control always oversees the alignment and consistency between project goals and objectives, scope statement and the project WBS. On the other hand, scope control ensures that all the works stated in the project scope statement are covered by the WBS and get delivered so that the project goals and objectives are met.

Manage Scope Changes and Prevent Scope Creep

Scope Creep is a large issue in project management and control scope thus ensures that project scope is not changed without following agreed upon processes for change management throughout the project life-cycle.

Compare Carried Out Works With Project Baseline

Responsibility for scope control concentrates on integrating accurate scope definition with the scope baseline. When scope control makes certain the definition of scope is clear, it increases the accuracy of the project team's implementation based on an accurate scope baseline. The key significance of controlling scope is thus to ensure project activities are carried out accurately and the final products are produced in accordance with the scope baseline.

Managing Scope Configuration

A project produces new assets or products. These assets should be managed during the project life-cycle. Each project asset that should be delivered on the basis of the scope

baseline is called a configuration item (CI). CIs have two major relationships, internal and external. This means that the project team should consider the relationship between project products (CIs) in relation to the external items, potentially needed to be integrated with the end product after project completion.

For example, consider an IT project delivering project management software that includes different modules including WBS creation, schedule management, cost management and so on. This software will install in the 'X Company' that has other systems such as human resource management, asset management and financial management. Therefore the final project product (project management software) will be added to the existing systems. Figure 10.9 illustrates the relational links between various levels of CIs.

Figure 10.9 shows three main relationships between project CIs and the CIs of other units within the organization. The project technical team should consider these relationships during the design and implementation of the project and the project manager should monitor the underlying efforts associated with the CIs. In addition to the external relationships, different project CIs may be logically or physically related to each other. The project technical team should take into account these relationships as well.

Configuration management is responsible for identifying CIs and controlling their status during project execution and finally verifying them when they are delivered. The configuration management process is quite similar to the scope management process and should be conducted in parallel. Configuration management is more technical while scope management concentrates on the management aspect. Therefore, providing a clear relationship between scope and configuration management is an appropriate approach to create a closed and effective relationship between management and technical team.

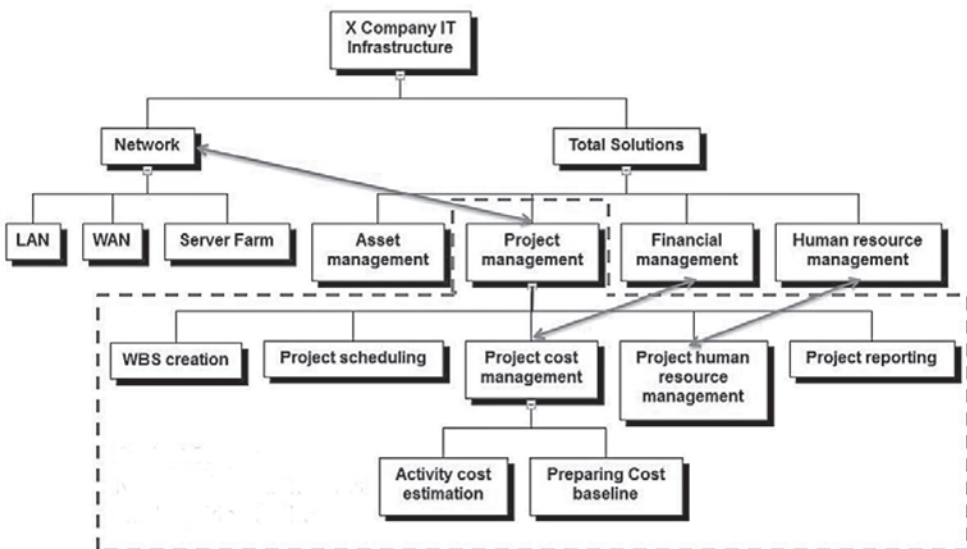


Figure 10.9 Relationship between project CIs and existing CIs

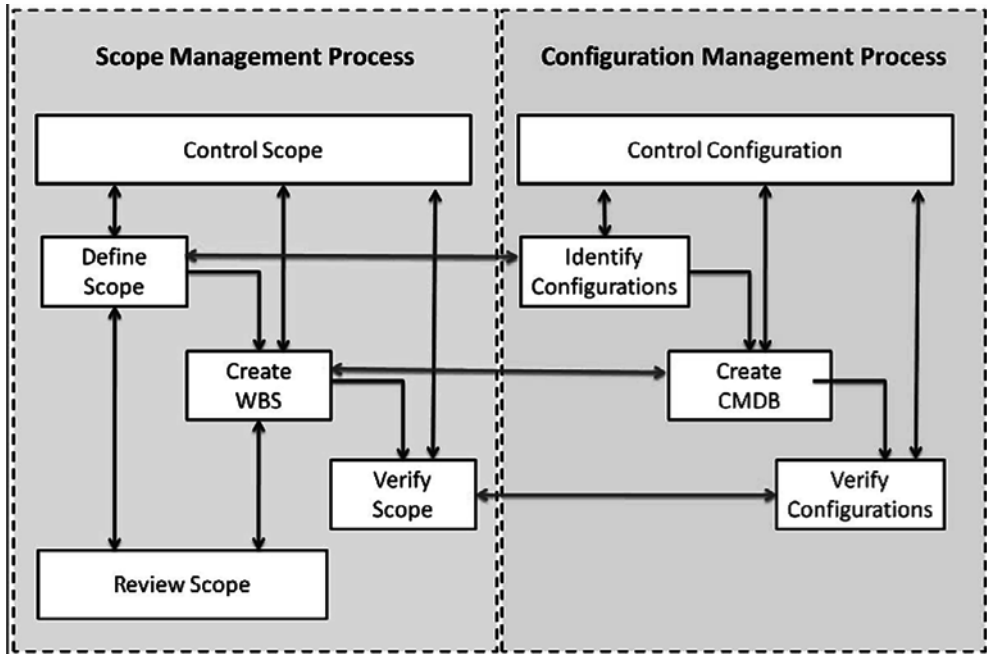


Figure 10.10 Configuration management and its relationship with the scope management process

Figure 10.10 illustrates the configuration management process and its relationship with scope management.

The configuration management process includes four major activities.

IDENTIFYING CONFIGURATIONS

At this stage, CIs that are included in the project scope should be identified. Figure 10.10 suggests that this activity should be carried out at the same time as the define scope process. It means that when the project team defines project scope, project products or deliverables, the configuration management team should identify the CIs that are related to those products or deliverables.

CREATE A CONFIGURATION MANAGEMENT DATABASE

After identifying the project CI, information about them that is needed by the project team should be identified and recorded. Different information can be recorded for different CIs. The document containing configuration information is called the Configuration Management Database (CMDB). Although the CMDB is almost similar to the WBS, there are three major differences between them. Firstly, the CMDB only includes the final project products and their components, while the WBS can include different components including project phasing, geographical locations, planning, control and so on. Secondly, the CMDB generally includes the technical and logical relationship between different CIs (products or their components). Thirdly, the CMDB includes a more detailed level of

information about project products than the WBS. Figure 10.10 suggests that the CMDB should be developed at the same time as WBS.

CONTROL CONFIGURATIONS

The aim of this activity is to ensure that no CI can be added, deleted or changed without clear change management procedure. The nature of control configurations is similar to control scope.

VERIFY CONFIGURATIONS

When CIs are provided completely, their functionality should be evaluated in comparison with the information that is recorded in the CMDB. This evaluation should be carried out within the verify scope process.

Scope Management Using a Life-Cycle Project Management Model

Life-cycle management refers to the management of systems, products or projects throughout their useful economical lives (Doloi, 2008). Projects pass through a succession of phases throughout their lives, each with their own characteristics and requiring different types of management. Project life-cycle usually is a part of the product life-cycle. The product life-cycle has a broader view than the project life-cycle and effective management of project life-cycle is highly significant in meeting target objectives over product life-cycle. Different stages of project life-cycle with respect to product life-cycle are shown in Figure 10.11.

Scope management based on a Life-cycle Project Management (LCPM) perspective can be highly effective. The LCPM allows identification of the project scope encompassing evaluation of opportunities or problems from a very early stage of project creation. It then defines the required functionalities that should be delivered by the project. Based on the identified functionalities, a feasible study is carried out in order to identify the required project scope. A comprehensive and precise feasible study should include financial, economical and social analysis as well. At this stage, the Total Cost of Ownership (TCO) and Value for Money (VFM) are calculated for objective considerations. The TCO not only evaluates the cost of project implementation but also considers the operation and maintenance cost after project closure when products are ready to use. It describes how much money the project sponsors will earn if they implement the project based on the identified scope. Thus they can objectively decide whether to initiate the project or not.

LCPM is a powerful approach in scope management because it defines the scope in the early stage of the product life-cycle and controls any change in scope, cost or time during the project and product. Considering the fact that changes are inevitable during projects and they can have different impact on projects, providing a precise approach to evaluate their impacts on project TCO is a critical success factor over project life-cycle. Within the LCPM model, process simulation capability empowers accurate definition of project scope on the basis of required functionality and operability of the project facility over the product life-cycle. Simulation is a reliable way to evaluate different alternatives

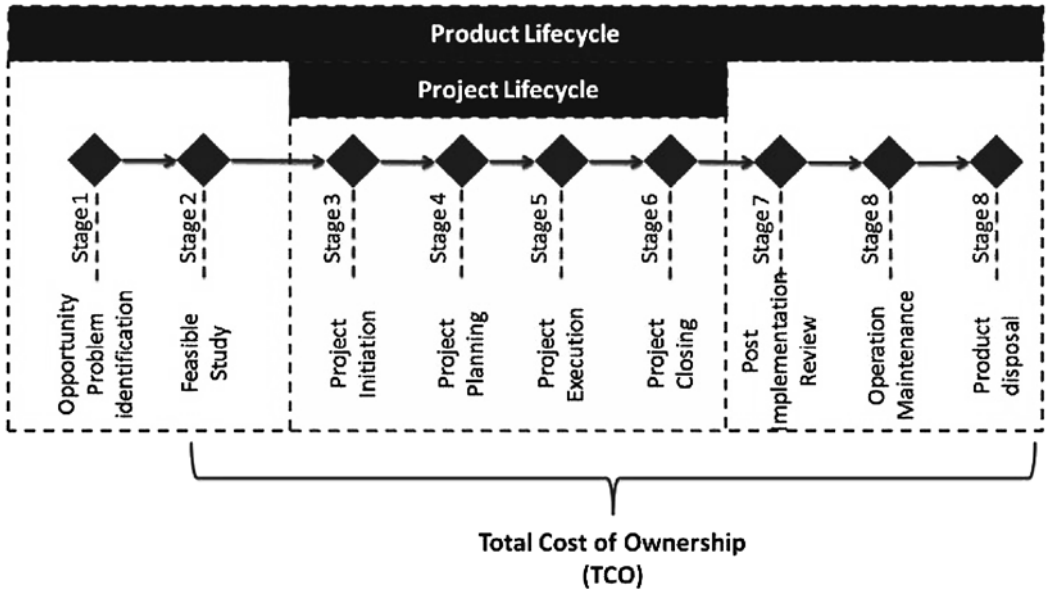


Figure 10.11 Product and project life-cycle

affecting the project scope and making decisions on optimal scope definition. Simulation can help project sponsors to evaluate benefits of any changes in project scope such as adding a new function and making decisions whether requested change is worthwhile or not.

In large projects, changes can be proposed by different stakeholders. These changes may have negative and positive impacts on project objectives. Identifying the precise impact is not easy in large projects. Simulation increases the accuracy of estimation significantly and provides a robust input for the project sponsor to decide about changes during the project life-cycle. Using simulation within the LCPM model has major benefits:

- Map project objectives to business objectives;
- Evaluate and identify the functionality and operability of product life-cycle before deciding on project scope;
- Provide precise information for calculating TCO and VFM; and
- Managing scope changes effectively by considering TCO and VFM.

The use of process simulation within the LCPM model is shown in Figure 10.12.

Concluding Remarks

In summary, scope management is one of the key knowledge areas within the project management context. Understanding the project scope requirement from the long term business objectives and accurate scope definition at the outset of scope planning is crucial in achieving success over both project and product life-cycle. The introduction

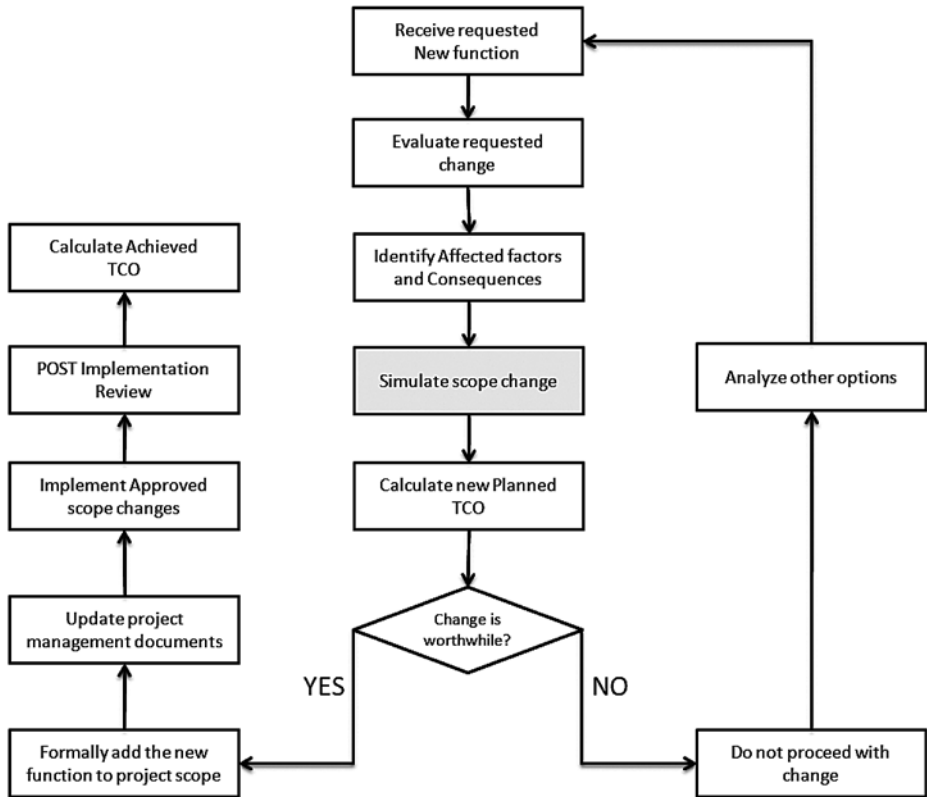


Figure 10.12 Managing project scope using simulation

of the LCPM model for optimal scope evaluation and definition is clearly a significant enhancement in project scope management within the current scientific domain.

Acknowledgement

The author wishes to acknowledge the contribution of Mr. Iman Baradari for his help as research assistant in preparing this chapter.

References and Further Reading

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Appendix

Work package code	Work package title	Description	Efforts/ Materials Required	Cost estimate	Quality Criteria/ Needed specification	Acceptance criteria	Milestones	
							Title	Date

Figure 10.13 Scope plan template

STEPHEN SIMISTER

The value a project contributes to an organization must be clearly defined from the outset if it is to be managed effectively. The pressure for changes to be made during implementation can invariably be traced back to a poor understanding of value at a project's inception. Client organizations are by their very nature multi-faceted. Determining the exact value criteria for a project from such organizations requires a clear framework within which decisions can be made. Structuring this framework at the outset of the project will ensure that not only is value adequately defined, but also that it can be managed during the project life-cycle and ultimately delivered. Clients should go through a series of stages in determining the project definition, producing the following documents at successive steps:

- Client's business case: the financial *raison d'être* for the project;
- Project specific statement of need: an outline document setting out what is required to fulfill the business case;
- Strategic project brief: an outline document stating how the project will fulfill the statement of need; and
- Project definition: a document setting out the exact details of the project, its scope.

In this chapter, I consider the concept of value, and how it is produced by the functionality of the facility delivered by the project. I define value as the relationship between function and cost, and introduce the concept of value management. I then describe a five-step process to define the functionality of a project and managing its associated value.

Understanding Value

The term value is used rather loosely and often the context of its use can change its meaning. Primarily we are interested in value as it relates to a project. It is useful however to examine value at an organizational level as ultimately projects have to contribute at this level. In this context the link with program and portfolio management is very important.

SHAREHOLDER VALUE

Major investors have become more active about company performance. Once it was rare for top executives to be punished for failing to deliver returns; now it is common. A measure often used to measure performance is shareholder value. It has no clear definition but is generally taken as a measure of whether a company has created (or destroyed) wealth for its shareholders. In recent years a more reliable measure has been sought and two methods have been developed; market value added (MVA) and economic value added (EVA).

- a) As a system of analysis MVA aims to strip out most of the anomalies created by accounting standards to paint a truer picture of shareholder value. The basic calculation is to take the amount of money entrusted to management, measured by adding up money raised through shares issued, borrowing and retained earnings, giving a measure of how much outsiders have given to the company since it was founded. It then takes the current value of the company's shares and debt, as a measure of how much money the investors could take out of the business. The difference is the MVA, which measures how the executives running a company have fared with the capital under their control since the company was established. If the MVA is positive that means value is being created for investors, if negative that means investors' money has been destroyed.
- b) EVA takes the after tax operating profit for a company and compares it with its cost of capital. Cost of capital is an economic concept that includes far more than just the interest paid to the bank and the dividend to shareholders. For each company the cost of capital varies, sometimes quite widely. Some industries are naturally more risky than others; investors will accept lower returns from a big established food group than from a young software company because it is more likely the big food group will generate stable returns while it is quite likely the software company will stumble. The EVA figure represents the difference between the profit a company makes and the cost of its capital. The idea is that it is not good enough for a company just to make a profit from its business. It also has to make enough to cover the cost of its capital. If it is not covering the cost of its capital, plus a reasonable margin, then the logical conclusion is that it would have been better if the investor's money had been placed elsewhere, or that a new management team is brought in to make better use of the capital.

If a company is consistently generating EVA every year, over time its MVA should start to rise. Conversely if its EVA is negative, in time its MVA will start to fall. MVA is a great guide to where a company has come from, but EVA is a better guide to where it is going. Of course shareholder value relates to those people who effectively own the company. What of the value of those who use a company's products or services – customer value.

Customer Value

There is debate within the business world on whether companies should deliver value for their shareholders or customers. There is no simple answer, but techniques such as *lean*

production are designed to produce value for the customer. Project duration and cost are considered in project-as-production terms, making concern for total cost and duration more important than the cost or duration of any activity. Co-ordination is accomplished in general by the central schedule while the details of work-flow are managed throughout the organization by people who are aware of and support project goals (as opposed to activity or local) performance. Value to the customer and throughput, the movement of information or materials to completion, are the primary objectives. Improvements result from reducing waste, the difference between the current situation and perfection (defined as meeting the customer's unique requirements in zero time with nothing in stores). Lean thinking focuses attention on how value is generated rather than how any one activity is managed. Whereas traditional project management views a project as the combination of activities, lean thinking views the entire project in production system terms – that is as if the project were one operation.

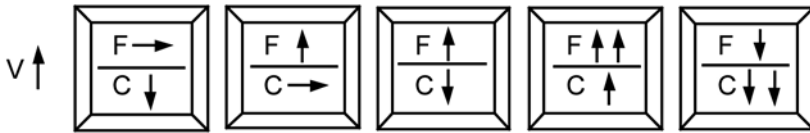
PROJECT VALUE

Organizations add value to their business through a series of processes. Increasingly such processes are undertaken within the context of a project. It is the cumulative effect of projects that decide on the success or failure of a company to deliver value to both its customers and shareholders. An aspect of project value is how this is used at a portfolio level to ensure the right projects are brought forward through the portfolio. When looking across the portfolio to determine the prioritization of projects a key consideration is the value they add to the organization. This reinforces the importance of ensuring that the value a project contributes to an organization is clearly defined and articulated.

In order to create and sustain competitive advantage in the form of effective differentiation and/or cost savings, organizations need the help of their suppliers. The supply chain has recently received considerable attention in the business press. It is raised here because projects bring together a range of suppliers. Increasingly, these suppliers can only add value to a project if there is co-operation between them. This has driven the trend towards projects being undertaken in a spirit of partnership rather than in an adversarial manner.

VALUE MANAGEMENT

Value management is concerned with ensuring the clients' needs are clearly defined and that a true scope of work is produced for the project such that the value a project will provide is defined. Value management has developed from value engineering which has been utilized for over 60 years. Value engineering originated in the United States during the Second World War. Lawrence Miles of General Electric is credited with inventing value engineering as a way of identifying alternative materials to replace those that were in short supply because of the war. Miles developed a technique which could focus on what something did, that is the function, rather than what it was. By focusing on the function of components Miles found alternative solutions which were often cheaper than the original method. Value engineering was identified as a method of reducing procurement costs by the US Navy in 1954. Since then practically all US Federal procurement requires the use of value engineering as a way of demonstrating value in the procurement process.



The arrow pointing upwards means an increase in that item (either F – function or C – cost) arrow downwards means a decrease and an arrow to the left means the item remains the same, a double arrow means a greater increase (or decrease) than a single arrow. So it is possible to increase cost slightly but this could potentially lead to an even bigger increase in function hence value is increased.

Figure 11.1 How value is increased

In value engineering, value is defined as below, while Figure 11.1 shows a number of connotations available for increasing value:

$$\text{Value} = \frac{\text{Function (What does it do?)}}{\text{Cost (How much does it cost to provide that function?)}}$$

Value engineering is useful in situations where the functionality of a product can be clearly defined, typically during the design phase. This has its limitations and another technique has been developed to overcome these limitations – value management. Within many European industries there is a growing view that value engineering is a special case of value management. Value management uses similar tools to value engineering but the scope of the value management goes beyond value engineering.

Value management should commence during the early stages of a project as shown in Figure 11.2.

Value engineering is one technique that can be applied in the value management process during later stages of a project. To utilize value management to its full effect it needs to be started at the concept or briefing stage of the project, when it is used to define the project's requirements. By this it is meant that the criteria that will guide the project throughout its entire life are established. During a project many changes can take place and a high level set of principles needs to be maintained so any changes can be tested against these principals and their suitability judged. Without such principals it is all too possible for a project not to meet all the expectations of the client. By having a benchmark against which to judge changes the project team can ensure that the project will meet

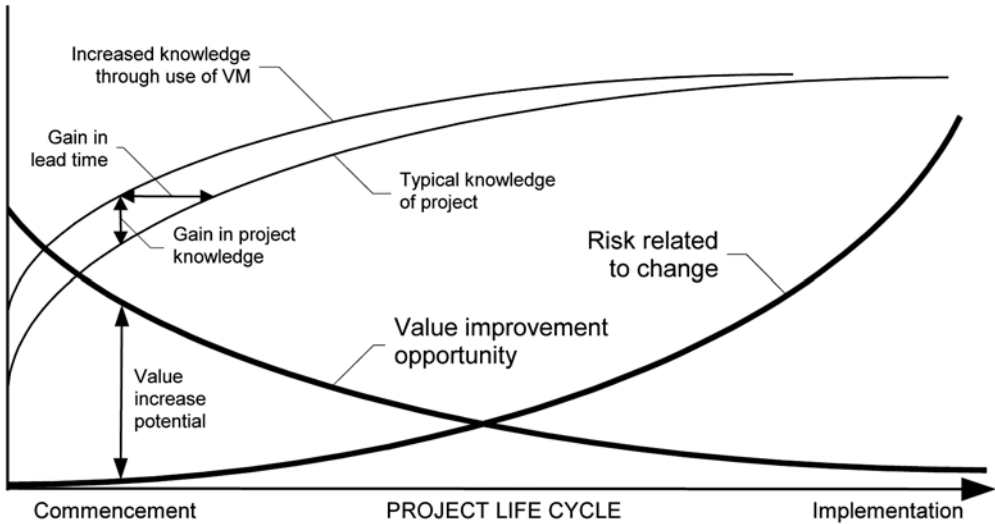


Figure 11.2 The benefits of value management

Source: Adapted from Thiry, 1997

the client's requirements. Value management has been demonstrated to produce such benchmarks.

The benefits of using value management were highlighted in the 2004 report of the Auditor General for Scotland in the investigation of time and cost delays experienced in the construction of the Scottish parliament building (Holyrood Palace):

Whatever construction method is chosen, sufficient time should be available for the planning stage, before construction starts. Good planning will involve (a) getting the construction sequence right to avoid delays and extra costs, (b) assessing and managing project risks, and (c) using value management to assess the contribution of each part of the construction process to remove waste and inefficiency. There must always be sufficient time for procurement to allow the client's requirements to be adequately defined so that it may obtain fixed and firm prices for the work in a competition.

The Value Management Process

Most of the books and articles on value management may leave you with the impression that it is applied once in a project's life. This is not the case. Value management is a process which should be used throughout a project. What happens is that various tools and techniques are available which are applied at different stages to meet the particular requirements of that stage. In this section we are focusing on how the project requirements can be defined. This is the first stage at which value management should be used. Value management at this stage is concerned with producing the client's statement of need as shown below.

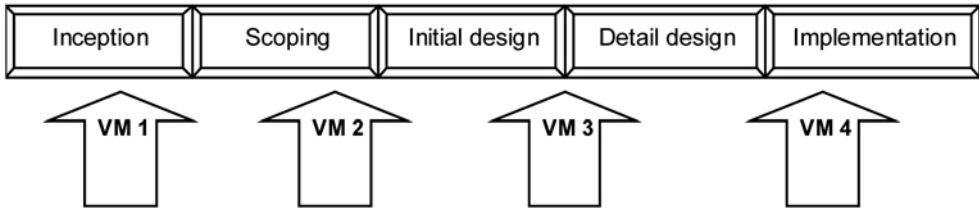


Figure 11.3 Value management workshops during the project life-cycle

The value management process maps directly onto the project management process. Value management is undertaken as a series of workshops which can be considered as intervention points at strategic points in the life of a project (Figure 11.3).

The number and exact timing of intervention points will depend upon the project and workshops being able to be combined where required. Typical deliverables from the workshops are as follows:

- VM1: One of the prime purposes of a workshop at this stage is to present in clear and objective terms the mission of the project and its strategic fit with the corporate aims of the client organization.
- VM2: The aim of this workshop is to convert the output from VM1 into a project scope document which defines and specifies the performance of the elements of the project.
- VM3: Once the scope is defined the project team can begin to test various design options against agreed criteria and determine the most appropriate solution.
- VM4: This workshop can act as a catch-all refining the final stages of concurrently designed elements or dealing with changes in project requirements.

The VM3 and VM4 workshops are often referred to as value engineering exercises. A typical value management workshop consists of a five step process referred to as a job plan. The generic outputs of each of the steps for the early stages of a project are given in Figure 11.4.

In utilizing value management for the early stages of a project the main technique being used is that of facilitated decision making within a workshop environment. The five step process is used to structure the agenda for each workshop and depending on the stage of the project and required outputs, various tools and techniques may be used in each of the steps.

STEP 1 – INFORMATION

Think about the early stages of a project. The client is aware that there is a problem but does not know its exact nature. This obviously makes trying to define the project requirements very difficult. To define the project's requirements you need to have a clear understanding of the problem you are trying to solve. The client may know that they need more office accommodation. So should you provide a building for 200 people or 300? Should you use this opportunity to re-engineer some of the business processes and relocate staff to other areas, or consolidate organizational functions in existing office

Job plan steps – Value management output	
Information	An information gathering process which focuses attention on the client's business drivers for the project. Particular importance is given to the use of facilitated workshops.
Speculation	Creative thinking techniques are used to generate alternative ways to provide the business drivers identified in step 1.
Evaluation	The solutions generated are evaluated in terms of their feasibility and cost. Ideas are combined and consolidated to produce a list of, say, five or six ideas which are worthy of further consideration.
Development	The surviving ideas are developed in detail, ensuring that all of the interfaces with the client's business are fully accounted for.
Recommendation / Implementation	The most suitable solution is identified and a formal recommendation made to the client for implementation.

Figure 11.4 Generic outputs for value management workshop

accommodation? There are a multitude of questions the client needs to consider and then brief the project team accordingly. Value management is used to allow the client a forum for providing the answers to some of the questions that need asking.

At the early stages of a project the information is typically not held in documents but is held in the minds of people. The issues which gave rise to the need for a project are often locked up in the minds of the people who are running various functional departments. To get the true picture of the problem this information needs to be extracted and documented in such a fashion as to be available to the project team. The most appropriate method to get to the core information is to use a facilitated workshop. The facilitated workshop brings together all the key stakeholders from within the client organization and the project team and at this stage in the project life-cycle would be a VM1 type (see Figure 11.5).

The workshop will typically last for two days and is used as a forum for obtaining the core information that will form the client's statement of need. Typically the facilitator

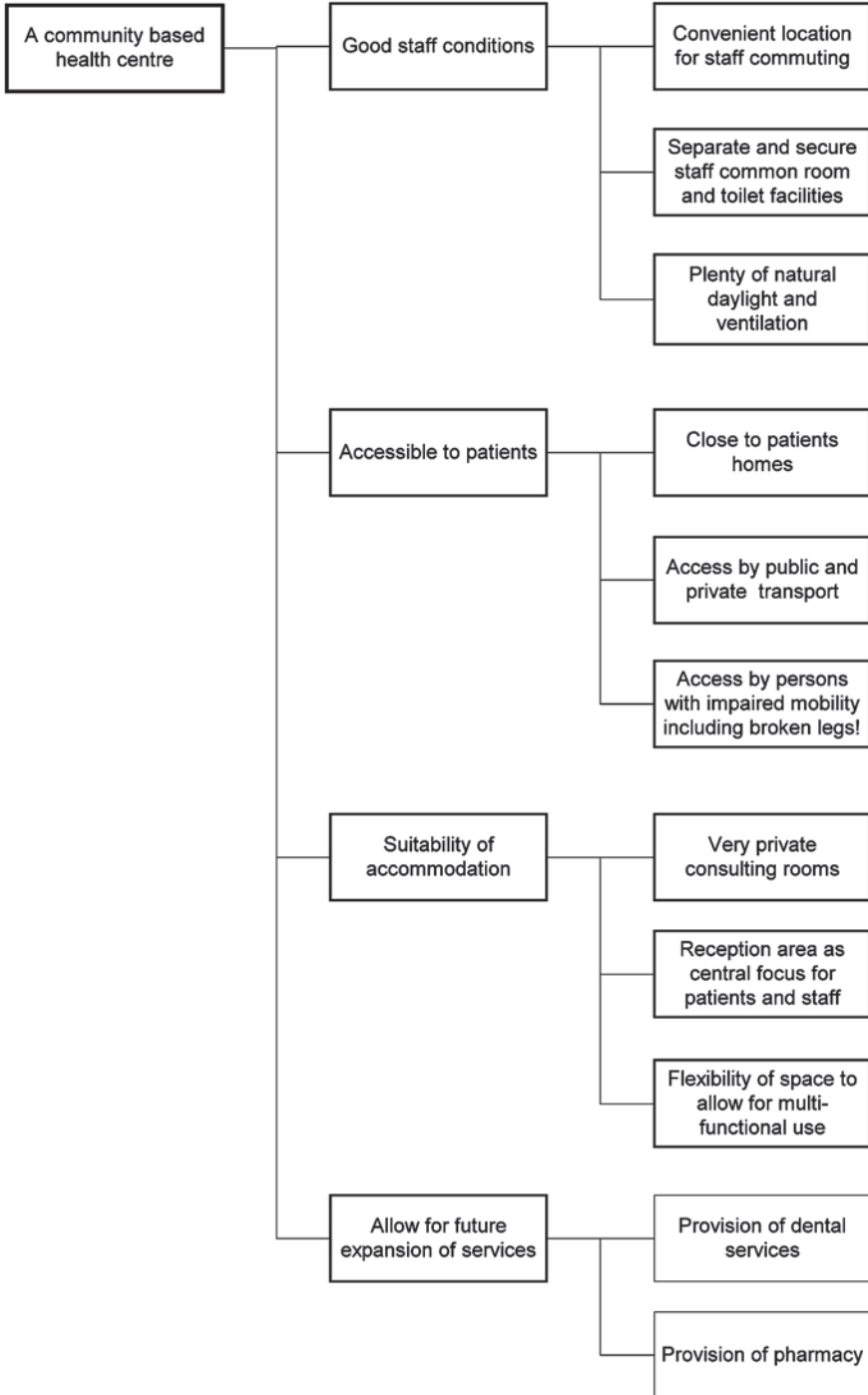


Figure 11.5 Value tree for a community health care center

is not a member of the project team. This person is an expert in the value management process and focuses on managing the process of the workshop and not its content. This facilitator will provide a structure around which the stakeholders can discuss the key elements of the problem which the potential project is aimed at solving. To commence the workshop the facilitator will ask each of the stakeholders in turn to outline their objectives, constraints and risks for the project. This information is listed onto flip charts by the facilitator under these three headings.

This basic information is then used as a starting point for facilitated discussion. This initial workshop will often be the first time that the key stakeholders have all met at the same time to discuss the project. The workshop provides the time needed to discuss the project properly. It is often the case that senior executives are not prepared to take time out of their busy schedule to discuss a project which could be vital to the future well being of their company. They will however be forced to make time later on should the project go wrong. Once there has been discussion on the objectives, constraints and risks of the project, the next phase is to organize this information into a graphical representation called a value tree.

The value tree is a way of organizing the information in such a manner as to allow people to visualize which are the most important elements of the project. Another key feature of the value tree is the ability to show the scope of the project. Often there are elements of a project upon which the client cannot decide until some initial design and costs work has been undertaken. By making explicit the areas which the client would like to include but are currently considered outside the scope of the project, the design team has a clearer remit upon which to work. A value tree for a new health center is shown in Figure 11.5. The value tree shown above demonstrates that whilst the internal layout of the health center is important, its actual physical location in the community is of paramount importance. While this is ultimately a decision for the client to make, it reinforces to the design team that the facility they are designing has to be used by people with whom they will not have any contact. All information is second hand in being provided by the doctors who will work out of the health center. One of the features of value management is the highlighting of such issues. It may be appropriate in this instance for some of the patients who use the health center to be interviewed to find out what they would like to see in the building.

During later stages of the project, where a VM2 or VM3 workshop is held, a variant of the value tree is used called Function Analysis and Systems Technique (FAST). The concept in FAST diagrams is similar to value trees' but more emphasis is given to defining functions. Following on from this information step, the next step is to generate ideas as to how some of the elements identified in the value tree can be provided.

STEP 2 – SPECULATION

During this step the team focuses on generating ideas as to how to provide the key elements identified in the previous step. For instance, are five consulting rooms adequate or should four be provided and provision made to provide a fifth at a later date? The principal feature of the speculation step is to stimulate creativity. The four golden rules are:

- Suspend judgment – no criticism or evaluation; that comes during the next step;
- Freewheel – the odder the ideas the better;
- Quantity – the more ideas the better;
- Cross-fertilize – combine and improve on the ideas of others.

The main technique used in the speculation workshop is brainstorming, where the team generates ideas, which are written onto flip charts. Creative thinking is essential to this step if the situation where the same old ideas are used to solve design problems is to be avoided. A constrained, conservative environment is detrimental to innovation, as shown in Figure 11.6.

1895	<i>Heavier than air flying machines are impossible.</i>	Lord Kelvin, President, Royal Society, UK
1899	<i>Everything that can be invented has been invented.</i>	Charles Duell, Director US Patent Office
1923	<i>There is no likelihood man can ever tap the power of the atom.</i>	Robert Millikan, Nobel prize winner in Physics
1975	<i>There will not be a woman prime minister in my lifetime</i>	Margaret Thatcher
1977	<i>There is no reason anyone would want a computer in their home</i>	Ken Olson, founder of Digital Equipment Corp

Figure 11.6 The need for creative thinking

It is therefore necessary to ensure that the opposite environment prevails. Once the ideas for providing the key elements have been generated, the next step is to evaluate them.

STEP 3 – EVALUATION

In the evaluation step, ideas are sifted to identify those that might be worth investigating further. It takes time and money to develop ideas and therefore only the most promising can be chosen. During the speculation step it is normally very easy to generate as many as 200 ideas; these must now be pruned down to about 20 that will be developed further. Justification is the keyword of the evaluation step. The exercise should focus on justifying why an idea should be developed and, if no justification can be found, then it can be

rejected. This process ensures that ideas are not simply dismissed because they will not work: the dismissal must be justified by a rational explanation of *why* they will not work.

STEP 4 – DEVELOPMENT

During this step the ideas that survived the evaluation step are developed further. Sufficient development work needs to be done to refine potential solutions to the point where they can either be rejected or taken further still and perhaps be incorporated into the client's brief. The amount of time and effort expended on any one proposal is only sufficient to allow the client to decide what their brief will contain.

STEP 5 – RECOMMENDATIONS/IMPLEMENTATION

This is the final level of the five step job plan. The findings of the value management exercise are written up into a formal report for presentation to the client. The purpose of the report is to provide an accurate record of the exercise for future reference. The report will often form the basis of the client's statement of need and therefore its accuracy is paramount. This report can be used in later VM studies to ensure consistency of decisions and act as an audit trail.

The five step job plan allows the client to define their project in such a manner as to ensure that there is little room left for ambiguity during the later phases of the project. It is the structure of the five step process that ensures all decisions are made in a consensus manner and against agreed, common criteria.

Summary

If project teams are to deliver successful projects they need to know what the client means by 'successful'. Successful is invariably measured in terms of 'does the project meet the needs of the client and does the client believe they have received value for money?' The value of a project can only be managed effectively on the client's behalf if the value itself is adequately defined in the first place. Clients are increasingly seeking guidance from their project teams concerning how projects can enhance their business processes. Project teams need to respond to this challenge positively and take on board new responsibilities and techniques to deal with this situation.

It has only been possible to provide a brief overview of the value management process. Suggestions for further reading have been made below.

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NEVAN WRIGHT

There are two elements to Quality: Client Satisfaction, often known as the Voice of the Customer (VOC), and Resource Utilization, also known as the Voice of Business (VOB). Often these elements can be in conflict. The level of client satisfaction provided must be affordable to the provider. There is no point having a happy client if the project management company has run at a loss. On the other hand if efficient use of resources in the form of cost saving is the dominant element, customer satisfaction will suffer. This chapter considers; what the client wants and efficient resource utilization, approaches to quality and the over-coming of common project problems using a Six Sigma approach.

Client Satisfaction

From the client's point of view Quality has two levels: a basic level and a higher level. At the basic level common definitions, 'fitness for purpose', 'getting it right first time' and 'right thing, right price, right time' apply. In project management this refers to scope, time and budget. Achieving the scope, keeping to budget and coming in on time are needed to provide basic client satisfaction. Scope, time and budget are factual and can be measured. But for the client to experience a quality project, higher level needs, often intangible and therefore hard to measure, are required. These intangibles are judged by the client's perception or interpretation of what they see and experience during the course of the project and, often equally important to the client, after delivery, service and support. Some of these intangibles are the availability of personnel, courtesy, prompt replies to queries, overall helpfulness, useful advice and explanations, timely information, openness, no adverse surprises, accuracy of invoices, the level of finish, project delivered in a pristine state, site cleared of debris and so on.

Garvin (1984) developed eight quality dimensions which we have adapted for project management. They are:

- *Performance*: refers to the efficiency (for example return on investment) with which the project achieves its intended purpose;
- *Features*: attributes that supplement the project's basic performance, for example tinted glass windows in a building;

- *Reliability*: the capability of the project to perform consistently over its life-cycle;
- *Conformance*: meeting the scope of the project, usually defined by numeric values;
- *Durability*: the degree to which a project withstands stress without failure;
- *Serviceability*: the ease of maintenance and/or repair;
- *Aesthetics*: sensory characteristics such as look, sound, taste and smooth finish;
- *Perceived quality*: based upon client opinion.

The above dimensions of quality are not mutually exclusive, although they relate primarily to the quality of the delivered project. Neither are they exhaustive.

Service quality is more difficult to define than product quality. Parasuraman et al (1985) developed a set of service quality dimensions. Our adaptation of their set for project management is:

- *Tangibles*: physical appearance of facilities and people;
- *Service reliability*: ability of the project team to perform dependably;
- *Responsiveness*: willingness of the project management to be prompt in delivering to the agreed timetable;
- *Assurance*: ability of the project team to inspire trust and confidence;
- *Empathy*: ability of project staff to demonstrate care and to understand client concerns;
- *Availability*: ability to provide service at the right time and place;
- *Professionalism*: encompasses the impartial and ethical characteristics of the project management team;
- *Timeliness*: delivery of the project within the agreed lead time;
- *Completeness*: delivery of the project in full;
- *Pleasantness*: good manners and politeness of the project team.

The two sets of dimensions are widely cited and respected. Drawing from Wild (2002) we add that the quality of a project is the degree to which its client requirements are met and is influenced by:

- Design quality: the degree to which the scope of the project satisfies requirements;
- Process quality: the degree to which the project, when delivered, conforms to scope.

An important dimension of quality not clearly visible in the above models is the quality of the organization (Basu and Wright, 2003). When a project organization develops and defines its quality strategy, it is important for all project team members including contractors and sub-contractors to share a common definition of quality so that they can work towards the same quality objective. Project quality should contain defined attributes of both numeric specifications and perceived intangible dimensions as per the list above derived from Parasuraman et al (1985). Basu and Wright (2003) add it is only when an organization changes its approach to a holistic culture emphasizing a single set of numbers based on transparent measurement with senior management commitment that the 'organizational quality' germinates a set of key organization quality dimensions.

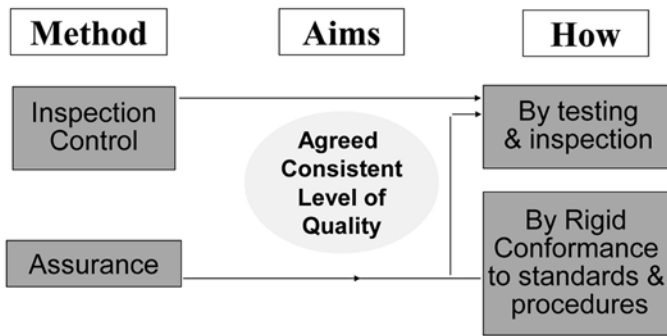


Figure 12.1 Quality hierarchy

Hierarchy of Quality

In this section we discuss the various ways in which quality can be managed. We also discuss the strengths and weaknesses of each method. Our 'hierarchy' of quality, Figure 12.1, approximates the evolution of quality management from simple inspection to a full Total Quality Management (TQM) system.

QUALITY BY INSPECTION

Traditionally in manufacturing, the concept is of quality related to conformance to certain dimensions and specifications, the cliché being 'fitness for purpose'. Quality control was achieved by inspection and supervision. The basic approach is quality by inspection. With quality by inspection, if every deviation from the desired standard is detected and corrected before final delivery, the client will be provided with an acceptable product. Although an acceptable product might satisfy the basic needs of the client it is our contention that a competitive edge can be only be gained by providing the client with more than they expect.

Quality inspection is an expensive method of achieving a basic level of client satisfaction. It requires the employment of people to check the work of others which does not add value to a project but certainly adds to the cost! The stage of the project when the inspection takes place is important. If the only inspection is at the end of the project or at the end of an intermediary milestone and errors are discovered, the cost of reworking (putting right) could well double the cost. If a deviation from scope is not detected until delivery, the client becomes the 'quality inspector', by which time it is too late and the project management will have the problem of making good and in extreme cases expensive penalties and litigation will result. Litigation, especially in construction projects, is an all too well known phenomenon. The resulting loss of reputation will lead to lost business opportunities. As Crosby (1979) said, it is always cheaper to do things right the first time.

At a higher level of inspection, materials are inspected on receipt and then probably tested again before used. Of course all these tests and checks take time and money. The costs of relying on inspection by people other than the worker are three-fold:

1. A level of error becomes accepted as standard and is included in the costing;
2. Workers are not encouraged to take responsibility for their work;
3. Inspectors do not add value to the product. Inspectors are an added cost.

Next in the hierarchy is quality control.

QUALITY CONTROL

With quality control, the aim is not only to monitor the quality at each stage of the project but to identify and eliminate causes of unsatisfactory quality so that they are not repeated. Whereas inspection is an 'after the fact' approach, quality control aims for mistake prevention. With quality control, you would expect to find in place drawings, material testing, intermediate stage testing, self-inspection by workers, keeping of records of failure and feedback to supervisors of errors and resulting costs.

QUALITY ASSURANCE

Quality assurance includes all the steps taken under quality control and quality inspection. It includes, for example documentation and check lists for dimensions, tolerances, raw material grades and safety standards. With quality assurance we move from detection of errors to correction of process so as to prevent errors. One would expect a comprehensive quality manual, recording of failures to achieve quality standards and costs.

TOTAL QUALITY MANAGEMENT

The fourth and highest level in our hierarchy of quality is TQM. The lower levels – quality inspection, quality control and quality assurance – are aimed at achieving an agreed consistent level of quality, first by testing and inspection, then by rigid conformance to standards and procedures, and finally by efforts to eliminate causes of errors so that the defined scope is achieved. This is a cold and sterile approach to quality and it is top-down. The bosses determine the level of quality to be achieved, and then the bosses decide on the best method to achieve the desired level of quality. Control methods of inspection and supervision are then set in place to ensure that the required level of quality is maintained. This does not mean that the project manager is not taking into account what the client wants. But it does mean that the project manager believes that he knows what is best and how this can be achieved. In such a culture, supervision and inspection become an important method of achieving the aim with little input expected from team members or contractors and sub-contractors.

TQM is on a different plane. TQM includes all the previous levels of setting standards and the means of measuring conformance to standards. However, an organization that has embraced TQM will have a culture whereby every member of the project including

contractors and sub-contractors will have accepted the responsibility of eliminating waste and of doing things right the first time.

The vision of TQM begins with the chief executive of the project company. Project managers in a TQM organization will have very visible overt support from the chief executive. If a passion for quality at the highest level can be transmitted down through the organization, then, paradoxically, the ongoing driving force will be from the bottom up. *Generally, it is the lower-paid members of the organization who will physically make the product or deliver the service, and who are in the position to take short cuts and to waste materials and time.* The sum of the efforts that each individual puts into their part of the project will determine the overall quality of the final delivered project. *Likewise it is at supervisory and middle management level where contact with suppliers, contractors and sub-contractors is made on a daily basis.* Thus supervisors and middle managers are in a crucial position to ease break downs in communication, to gain co-operation, to enlist support to expedite the flow of materials or equipment when required and generally to manage and smooth relationships.

Quality, once the culture of quality has become ingrained, will be driven by supervisors and middle management supported by direction from the top. The project manager will naturally have to continue to be responsible for planning and for providing the resources to enable the workers to do the job. But, unless all members of the project team, including key suppliers, contractors and sub-contractors are fully committed to quality, TQM will never happen.

Role of Key Suppliers

As indicated above, TQM goes beyond the staff of the organization – it goes outside the organization and involves suppliers, clients and where applicable local authorities. Once a relationship has been built with a supplier or contractor, they are no longer treated with suspicion (in some cases almost as an adversary). Instead of trying to screw the best deal possible out of the supplier or contractor, they become a member of the team and are involved in the day-to-day problems and concerns of the project and are expected to assist, help and to advise. Right at the beginning, when tendering, a trusted supplier, and contractors, can become part of the planning team. Price and discounts will no longer be the crucial issue. Instead they will be judged on delivery of the correct materials and quantities at the right time. Once a supplier proves reliable, the checking and testing of materials will become less crucial. Ideally, the level of trust will be such that the materials can be delivered direct to the site when required rather than held on site. A side benefit of this is that this will ease congestion. Consider the benefits for a project manager if the required materials or equipment were always there on time, were of the right quantity and quality and if each worker knew the standards and got the job right the first time every time. In theory the project would not need anyone involved in checking anyone else's work. Supervisors and middle management would no longer be policing each step of a job. However the very nature of project management is uncertainty and problems will occur. A project is not a production line where each step can be timed to the last second. Supervisors and middle management are the key to keeping the project on track.

The Customer

At the end of the project is the client. TQM organizations are very client conscious. As the supplier is regarded as part of the team so too is the customer. This is more than just casual slogans such as 'the customer is always right'; this means really getting alongside the client and finding out exactly what they want. The ultimate is that the client, like the supplier, becomes part of the process.

Cost and Benefit of TQM

The cost of TQM can be measured in money terms. The emphasis will be on prevention rather than detection, thus the cost of supervision and inspection will go down. Prevention cost will go up because of the training and action-orientated efforts. But the real benefits will be gained by a significant reduction in failures, scrap, rework, idle waiting time, and external, chasing contractors and suppliers, disputes and penalties for late delivery and so on.

APPROACHES TO TQM

There are several approaches to achieving TQM. Here we look briefly at PRINCE2 and in a little more detail Six Sigma.

PRINCE2

PRINCE2 is a structured approach to project management endorsed by the United Kingdom government as the project standard for public projects. PRINCE2 was initially released in 1996 as a generic project management method. It combined the original PROMPT methodology (which evolved into the PRINCE methodology) with IBM's MITP (managing the implementation of the total project) methodology. PRINCE2 provides a method for managing projects within a clearly defined framework. PRINCE2 describes procedures to coordinate people and activities in a project, how to design and supervise the project and what to do if the project has to be adjusted if it does not develop as planned.

In the method, each process is specified with its key inputs and outputs and with specific goals and activities to be carried out. This allows for automatic control of any deviations from the plan. Divided into manageable stages, the method enables efficient control of resources. On the basis of close monitoring, the project can be carried out in a controlled and organized manner. PRINCE2 provides a common language for all participants in the project. The various management roles and responsibilities involved in a project are fully described and are adaptable to suit the complexity of the project and skills of the organization. Included in the PRINCE2 methodology is the Quality Review Technique whereby the defined set quality criteria are constantly reviewed at

meetings of all parties who have an interest in the projects outputs (client, project management team, main contractors and suppliers where applicable). Problems are not solved at these meetings but people who are able to address issues are identified.¹

Six Sigma

Mathematically Six Sigma represents six standard deviations (plus or minus) from the arithmetic mean. As a measurement of quality Six Sigma means the setting of a performance level that equates to no more than 3.4 defects per 1 million opportunities. The target of Six Sigma of 3.4 defects per million opportunities is daunting. For many this target of near perfection would seem to be impossible. Likewise Basu and Wright (2003) show that it is not necessary for every operation to achieve the perfection level of 3.4 errors per million opportunities. Not all organizations need the intensive and expensive 'all or nothing' investment required by Six Sigma. Basu (2001) coined the term *Fit Sigma* whereby Six Sigma methodology is adapted to 'fit' any organization including project management. Fit Sigma has three important aspects:

1. Six Sigma should fit the requirements of the organization rather than the organization striving to fit an imposed mathematical formula;
2. Fit Sigma should be a holistic approach that integrates all functions to get the organization as a whole 'fit';
3. The third aspect is sustaining the benefits gained.

The approach is to establish a base line of organizational fitness, to understand in what areas it needs to get fit and to build on strengths and to strengthen weaknesses, and once fit to sustain fitness. This is not unlike joining a gym; your personal trainer will determine your level of fitness, find out why you want to get fit (to run a marathon, or to swim the channel), devise a set of exercises and a diet which will get you fit for the purpose. Once fit the challenge will be to keep fit! As an aside many organizations have moved to Lean Six Sigma, but have interpreted Lean to mean to reduce fat in the system, which in their eyes meant reducing staff numbers. Losing weight alone will mean getting weaker, getting fit includes adding muscle. With FIT Sigma the approach is primarily to add value, not merely to cut costs.

Common problems in the management of projects are the over run in time and budget and incomplete achievement of the original scope of the project. Projects generally have four basic elements, scope, time, budget and quality. Subsidiary to these and cutting across all four are; work break down (activities), milestones, responsibilities, cost estimation, control of costs, estimation of time, scheduling time and resource, controlling time, risk identification and management, controlling risk, balancing objectives, execution and control, finalization and close out, follow-up after hand over, team leadership and administration, and choice of information system (Turner, 2009). With the FIT Sigma philosophy a whole systems approach is taken to each of the *four basic elements* and subsidiary issues.

¹ Details of PRINCE2 and how to obtain certification can be found at <http://www.prince-officialsite.com>.

The Terms of Reference for a project establish the overall scope, budget and time frame. The Brief follows the Terms of Reference and gives depth to the Terms of Reference. The Terms of Reference gives what is required; the Brief identifies what has to be done to make the project happen (Turner, 2009). The requirements of the Brief are reasonably accurate estimates of resources and key steps or tasks and the skills required for each step. The Brief will also endeavor to establish for each step cost, time and precedence. It is likely that the Brief will also consider responsibilities and authority for the supply of resource. The Brief should not be limited to the above but should include any issue that will affect the successful outcome of the project, such as establishing stakeholders. Once stakeholders are identified, especially those who are not enthusiastic concerning the outcome, the seasoned Project Manager will seek to find what the concerns are and if possible to reassure them or to find ways around the concerns (Obeng, 1994; Turner, 2009).

All of the above, especially the brief, is based on estimates. By definition each project is unique, and seldom can any planned activity be taken as a certainty. It is a recognized fact that many Information Technology type projects are not completed as per the original Terms of Reference, indeed many are never completed at all! A well published example is the UK government's project to introduce smart cards for social welfare beneficiaries. This project ran for several years and was finally abandoned in 2000 at a cost, according to the National Audit Office, of a billion pounds to the British taxpayers. When the project was abandoned it was said that the first three months target had not been achieved. The very valid reasons given by project managers for these types of failure often are:

1. The client didn't know what they really wanted, and
2. The client kept on changing their mind and kept adding extra features.

In reply the customer could well say that the project manager did not listen and/or understand the customer's needs. The truth will be that there will be faults on both sides due to imperfect communication. Irrespective of who is at fault when things go wrong, the reputation of the project manager will be at stake.

FIT Sigma; Three Recommendations for Achieving Scope

Turner (2009) explains the mechanics of scope management. He emphasizes that the purpose is to ensure that adequate work is done and that *unnecessary work is not done*. In FIT Sigma parlance this means that the purpose of the project must be kept firmly in mind and for every proposed action, it has to be asked if this is really necessary for the achievement of the project.

The first scope recommendation is to be generous in estimating the resources and time needed for inclusion in the Brief, and then to make sure that the client understands that, due to the novel nature of projects – each is unique and each will have its own set of unexpected problems – estimates of time and money for resource is based on best guesses. Some clients will press for a fixed cost project. If the project is as relatively simple as building a house where materials can be calculated and costed this might be possible. But even here allowance should be written in to enable the constructor to recover major price increases of materials and for other contingencies such as problems with foundations,

water tables and so on. It does not serve the client well if the construction company goes bankrupt and walks off the job!

The second scope recommendation is to communicate with the client. Project managers have to remember that they don't 'own' the project. They are providing a service on behalf of the client. When the Terms of Reference were first written it could well have been that the client had emphasized finishing on time as being crucial. This does not give the project manager carte blanche authority to spend extra money above budget in trying to make up lost time when delays occur. Likewise if it becomes apparent that the specified completion date is under threat, the project manager has a duty to advise the client as early as possible.

The third scope recommendation is to be meticulous in providing variation reports. If a client asks for a change, such as would it be possible to add, or amend and the project manager enthusiastically agrees, often the changes are made and the project manager believes that the client has given a firm directive to go ahead. But eventually there is a day of reckoning and the client gets the bill. This will be a problem if, when the client asked for the variation, they did not realize that there would be an extra cost. For example at an early stage of house construction, a request to move a window a meter to get a better view might not seem a big effort (after all the window exists and the house is still at the frame work stage of construction), but this could well take the builder several hours of labor, for which he will charge. The culmination of several such minor changes, all at the request of the client (and perhaps even some suggested by the builder) might add up to several thousand pounds not budgeted for by the client. The FIT Sigma approach is that no matter how sensible the suggestion and no matter how minor the cost, for each variation to the Brief that a cost variation should be approved by the client before the change is made.

Milestones

The next level of planning is the determination of milestones. Milestones are each intermediate product or deliverable which builds to the final objective of the project. The benefits of milestone planning are to:

1. Set controllable chunks of work;
2. Show how each chunk of work is related and builds towards the final objective
3. Set fixed targets;
4. Foster a common vision for all those involved including contractors and sub-contractors.

With the FIT Sigma philosophy the milestone plan is transparent for all to see:

1. For the client it will enable them to follow progress;
2. For the project manager it provides a means to monitor and control progress;
3. For team members it will enable them to understand their responsibilities;
4. For everyone it will show the overall vision.

A good milestone plan is understandable to everyone, is controllable both quantitatively and qualitatively, and focuses on necessary decisions. Turner recommends that no matter how large the project, there should be no more than 25 milestones and with no more than four result paths. No matter how big the project, limiting the milestones to no more than 25, gives an easy to comprehend picture of the whole and each milestone becomes manageable. Each milestone is made up of chunks of work. Obviously within these chunks of work there will be key areas to be monitored, and each chunk will in turn be broken down to have its own set of milestones (Turner, 2009; Wysocki et al, 2000).

With FIT Sigma detailed planning for each milestone before the project begins is NOT recommended. The approach is to only prepare fully detailed plans for activities that are about to start. Planning 12 months out will be out of date within a matter of weeks.

TIME

With computer packages it is possible to calculate and show Early Start, Late Start, Baseline Start, Schedule Start, Actual Start, Duration, Float, Baseline Float, Remaining Float, Remaining Duration, Early Finish, Late Finish, Baseline Finish, Schedule Finish and Actual Finish for each activity. Baseline refers to the original plan and normally should not be changed. The other times and floats should be upgraded as each activity is completed. It is not uncommon for people to say that their project has come in on time and on budget, but overlook that the baseline has been long discarded, so that in fact they are only coming in on time and against budget due to repeatedly changing the schedule at each review meeting.

A change in any one of scope, time and budget will cause a change in one of the others. For example more scope will mean more time and more cost and less scope might mean less time and less cost. But when things go wrong, such as a key activity has fallen behind schedule the decision will be between reducing scope and finishing on time, or adding extra resource (cost) to try and make up lost time, or not changing the scope and finishing late. Not changing the scope and finishing late will generally result in increased cost. Thus although time in itself is not the be all and end all of a project, a time delay might mean a change in scope and almost certainly will add to the cost.

The management of time begins in knowing the desired completion date, and working back and determining the date that each milestone must be finished by if the overall target date is going to be achieved. From this backward pass at scheduling the amount of time available for each milestone and for each subordinate activity making up the chunks of work can be calculated. Knowing how much time is available for each activity will have a bearing on how much resource will be needed. As several tasks can be carried out in parallel, generally shown as 'paths' on a precedence diagram, it will be found that there is a float of spare time for some activities within the overall time limit of the project. Some activities will have no float, and these activities will be critical to the overall project completing on due date. The obvious approach is to give these critical activities special consideration so that they do not fall behind schedule and delay the completion date. The problem that then arises is that if other activities are not sufficiently monitored, delays can occur for these activities and they can fall behind schedule to such an extent that they in turn put achievement of the desired completion date in jeopardy.

With FIT Sigma we recommend allowing a buffer of time between every activity including critical activities when scheduling resources. As Obeng (1994) says this buffer should be considered as a separate activity in its own right. Goldratt (1997) demonstrates how float gained by the early completion of an activity will be lost if resource is not made available for subsequent activities right through the whole project.

With FIT Sigma the six steps to control time are:

1. Set the start time, the amount of time (duration), and the finish time for each activity. Treat float as a separate activity and where there is no float build in a buffer activity. This will become the base line schedule which should not be changed.
2. Do not be overly concerned with the calculations of early finish/late finish scenarios, but concentrate on the actual progress of each activity.
3. Manage and schedule resources to be available for the start date, monitor to ensure that activities finish on time, but by having a built in buffer do not be unduly concerned if some of the buffer for each activity is consumed.
4. At the end of each activity update the schedule, but do not change the base line. If a buffer has not been consumed move all activities forward and schedule resource accordingly. Add unused float or buffer to subsequent buffers (unless already behind the base line).
5. If an activity falls behind schedule and the buffer or float is in danger of being used up for that activity, make the client aware of the situation, and the likely effect on whether the final base line is going to be achieved.
6. When delays occur that will affect the overall finish date, after consultation with the client agree on remedial action.

Budget

Resources cost money thus working out the time schedule provides the basis for cost calculations. As generally there will be a budget in the Terms of Reference and a time line, these time and costs are mutually dependent – a change in one will almost certainly mean a change for the other. In the same manner as the time baseline was calculated, a budget baseline should also be set at the outset, which will include a budget for each activity. The control of the baseline budget is similar to the monitoring and control of any expense budget. Computer printouts will provide, budget to date, actual to date, variance for the whole project and likewise for each activity and for each milestone. The aim should be to get budget and actual cost reports as soon as possible, but often it will be several weeks before invoices have been received from suppliers and entered into the computer. Thus budget reports are received after the money has been committed.

The FIT Sigma approach is for the project manager to identify the big costs and the fixed costs, and to make a daily allowance for all other costs. Wages (a major cost for most projects) will be a known cost and if keeping to the base line will be a fixed cost. The wage amount for each person used on the project should be calculated in advance to give a daily or even hourly rate. Other major costs will be subcontractors, but again their charge on a daily basis should be known in advance. The hire of special equipment might be a major cost, but there is no reason why this cannot be calculated on a daily basis

in advance. All other costs should be allowed for as one fixed figure which can be termed the ongoing cost. Ongoing cost can be allowed for at a daily rate based on actual costs incurred in previous projects. The ongoing cost figure should be a constant, until actual costs are reported by the accountant (usually six weeks after the event). Once the actual costs are known it might be necessary to increase the ongoing cost daily figure.

The project manager can have a 'feel' for the daily cost of a project on an ongoing basis when the daily wages and the daily cost of hired equipment and sub-contractors is known (there is no valid reason as to why these costs can't be known in advance) and if a daily allowance for all other costs is added. It might be necessary to have an assistant to keep this record, but if the project manager concentrates on only the major costs and does not get bogged down in precise details to the last decimal place, then a rough calculation can be made daily within 30 minutes.

If it is obvious that costs are ahead of the baseline budget then the client should be immediately informed. If the costs are not recoverable from the client, then the project manager's senior management will need to be informed! It is a forlorn hope that costs can be recovered at a later stage. Even if it is thought that savings can be made it is best to be upfront when the problem occurs, and to suggest remedial action. This last point – suggesting remedial actions is important. It is not enough to say *we have a problem, it is the duty of the project manager to suggest ways of alleviating the problem.*

QUALITY

Quality in projects as perceived by the client is generally based on intangibles. That the achievement of scope, budget and time will be achieved will initially be taken for granted by the client. Thus quality from a client's perception refers to the basics of scope, cost and time PLUS the intangibles of working relationship with the team, ability of project team to accommodate changes to the scope, open communication, ease of transfer/implementation from project to ongoing operation, training and follow-up service after hand over. For tangible projects (such as for a construction project) quality will also include a judgment on the standard of finish, cleanliness of site and so on.

From the project manager's point of view quality includes all of the above plus the costs of non conformance resulting in delays, overtime, rework, wasted materials, idle time, putting right and so on. One of the key issues for project managers is the building of team spirit and fostering a quality culture with all sharing the same 'can do' philosophy. It goes without saying that the safety and health of people doing the work must be of paramount importance to the project manager.

Project managers have to co-ordinate a number of complex issues, including the human, social, environmental, technological and financial inputs to their projects, which are not always identified during project review meetings. Therefore it is a good practice to carry out periodic 'health fitness checks' covering all aspects of the project including the softer issues related to human resource management. It is said that project management is good at 'harder' management issues such as cost and time but relatively weak on the 'softer' issues of human resource management (Turner et al, 1996). FIT Sigma is strong on learning and cultural features which can be adapted to project management to address this gap. Good human resource management includes open communication, transparency and trust (Deming, 1986; Drucker, 1995; Kaplan and Norton, 2004; Wright and Race, 2004).

Handover and follow-up

If through poor management of the client or lack of training of operators the project does not achieve full ongoing benefits, the shortcomings will be blamed on the project manager. It is therefore in the project manager's interest for the completed project to work the way it was intended. A good project manager follows up, and provides 'after sales service'. This is nothing less than sound business practice and can lead to further business from the client or referred business.

FIT Sigma Methodology and Tools for Project Management

The key stages of a Fit Sigma program is the traditional plan-do-check-act cycle, as shown in Figure 12.2.

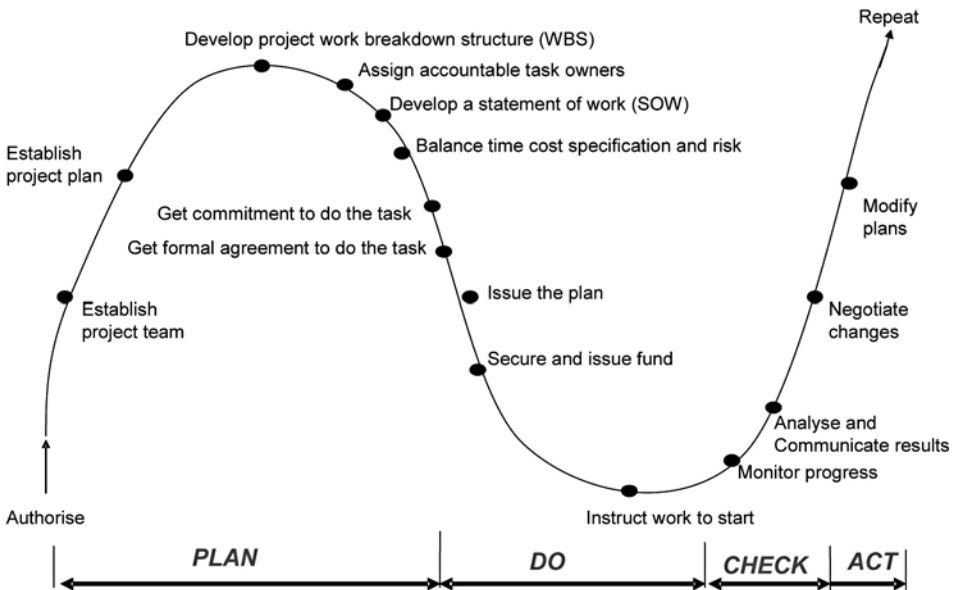


Figure 12.2 The BS 6079 project management process flow and Fit Sigma

The PLAN stage of Fit Sigma corresponds to 'authorize' to 'issue the plan'; the DO stage relates to 'secure and issue funds' and 'instruct work to start'; the CHECK stage is from 'monitor progress' to 'negotiate changes'; the final ACT stage is 'modify plans' and 'repeat'. Although quality is one of the four key elements of project management, traditionally project managers focused on time and budget and quality was accepted as meeting the specifications (achieving the scope). Thus various guidelines to quality in project management have been documented to address this gap. One such document is ISO 10.006: Guidelines to Quality in Project Management. Ten project management processes are identified in the guide but it does not identify specific techniques or develop how these areas should be managed. It provides a good checklist around four

key elements – scope, time, cost and quality. The FIT Sigma approach complements the guidelines of ISO 10.006.

Without a doubt project management has to be flexible to meet changing needs during the various stages of a project. Fit for purpose and maintaining fitness does not mean a rigid conformance to standards, it requires an open mind and a willingness to listen and to adapt.

A core methodology of Six Sigma, that is DMAIC (Define, Measure, Analyze, Improve and Control) can also be closely linked to the methodology, rigor and stages of the life-cycle of a project. In projects there are many repetitive processes and/or processes requiring design. In both situations DMAIC can be applied. DMAIC has added the rigor of project life-cycle to the implementation and close-out of Six Sigma projects.

Concluding Remarks

This chapter has centered on the key aspects of scope, time, budget and quality in project management. None of these four can be considered in isolation. A change in any one will have an effect on the other three. Nonetheless as the standard approach in project literature is to discuss these issues under separate headings this paper has followed the same pattern and added FIT Sigma wisdom to each. It is contended that the adoption of FIT Sigma will make the project manager's life easier, increase customer satisfaction and reduce costs.

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MONIQUE AUBRY

Managing multiple, concurrent projects poses major challenges for organizations. Because projects are temporary endeavors, their management differs significantly from that of regular operations. More often than not, both types of activities – operations and projects – are undertaken concurrently. The ability of organizations to operate simultaneously in two complementary fields is frequently referred to as ‘ambidexterity’: the *exploration* of new ways of doing things and the *exploitation* of what we already know (March, 1991). This applies to every type of organization, whether project-based or project-oriented. There is no single and perfect solution to these challenges when it is time to make a decision on the organizational design to succeed in the management of multiple concurrent projects. Context is a prime consideration whether in terms of the external or internal environment. Acknowledging organizational history also helps identify the strengths to build upon and the best solution for anticipating future challenges. The notion of *fit* best captures the alignment between the resulting project function within the organization as a whole.

Organizing for projects also involves a dynamic process of organizational transformation, considering that today’s organizations and their surrounding environments change frequently. Organizing for projects not only involves implementing the best processes, tools and practices, it also implies a major organizational transformation that generates different ways of thinking about work, structure and practices. It often requires a transition from a hierarchical approach to an organic and dynamic way of working. This occurs pervasively, at all levels. To address the issue of organizing for projects in a more holistic way, one needs to go over the matrix structure approach in order to account for multiple other components. Combined, these components form what we can call the project function (Aubry et al, 2012).

This chapter aims to present an overview of organizing for projects based on the project function framework. After introducing the project function framework, we will discuss each of its components: dynamic relation with the organizational strategy, governance, structure and processes and tools. The major implications are then presented to shed light on the multidimensional aspects of organizing for projects to be taken into consideration. Lastly, the conclusion focuses on the people aspects of project organization.

The Project Function

Within an organization, a function can be defined in two ways (Mintzberg, 1979):

1. The sum of the means used by an organization to divide work;
2. The mechanisms used to coordinate these tasks.

The structure of an organization often reflects its different functions that is, business units, functional units, regional units and so on. Nowadays, organizations frequently adopt a multi-dimensional structure to place the customer at the core of their concerns (Galbraith, 2010). Essentially, a definition of the project function must answer these two questions:

- What tasks are involved in the management of multiple projects?
- What mechanisms are used to coordinate them?

The unique feature of the project function is that tasks and coordination mechanisms are widespread throughout the organization.

Figure 13.1 illustrates the four main components of the project function and its dynamic relationship to strategy:

- Dynamic relation to the organizational strategy;
- Governance;
- Structure;
- Processes and tools.

Each component involves decisions that drive the overall approach to managing multiple, concurrent projects.

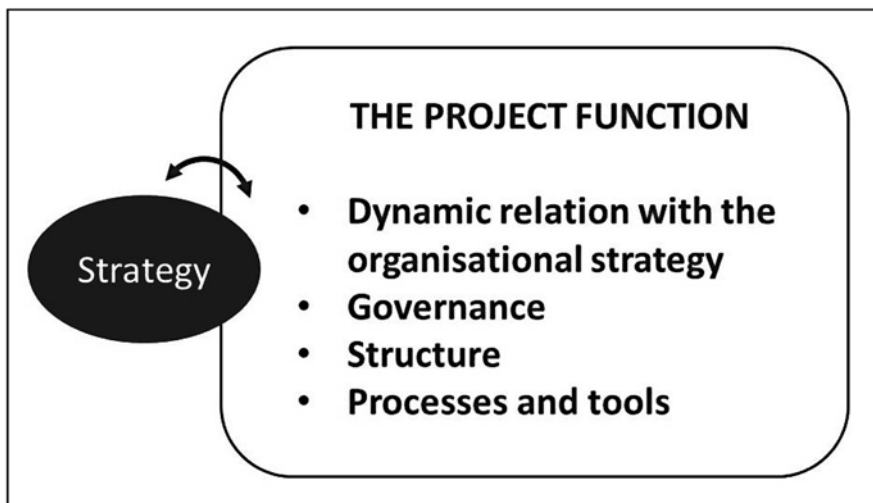


Figure 13.1 The project function

DYNAMIC RELATIONSHIP TO ORGANIZATIONAL STRATEGY

Strategy formulation in organizations does not suffice *per se* to secure the benefits it is expected to produce. Strategy implementation is mandatory and occurs through a portfolio of programs and projects that become the means for putting the strategy into action (Morris and Jamieson, 2004). The dynamic relationship between strategy and projects has two complementary components. First, in the changing world we now live in, a planned strategy must be continuously reviewed to account for changes in the environment or to take advantage of new situations giving rise to an emergent strategy. Programs and projects should then be adapted to emergent aspects of the strategy within a dynamic process. Second, programs and projects should not only be considered the consequences of strategy, the knowledge developed through programs and projects should help shape strategy. Moreover, the term 'strategizing-structuring' has been coined to describe the dynamic relationship between strategy and structure (Pettigrew et al., 2003). Organizational strategy and structure co-evolve in dynamic environments. Acknowledging this helps account for the frequent changes made to project structures to support and enhance organizational strategy.

GOVERNANCE

The objective of this chapter is not to examine the governance field in detail. That is described in Chapter 30. However, governance structure forms part of the project structuring process. Governance must therefore be considered within the overall governance approach to ensure that appropriate structures and mechanisms are established in an efficient way. Yet providing organizational structures to deliver projects is not enough to ensure a close connection between strategy and projects, programs and portfolios. Proper structures are necessary in a project-based organization to support project, program and portfolio governance in line with corporate governance. In large organizations, an impressive number of entities may be involved in governance at various levels. If governance mechanisms are not organized, they could develop into widespread, invisible networks that may not always conform to the organizational strategy. Müller (2009) suggested a project governance hierarchy model that connects all levels within a top-down governance structure. In reality, concurrent governance entities may coexist for projects, programs and portfolio. Care should be taken to identify and position these entities with clear roles and responsibilities to avoid confusion, duplication and hyper-control (Figure 13.2).

This example provides a simplified view of the governance structures in a large, project-based organization. Steering committees exist at four levels (shown in grey in Figure 13.2):

- Corporate project portfolio steering committee;
- Portfolio steering groups for business unit portfolio (A) and functional unit portfolio (B);
- Programs steering groups for the program A in direction A, and for the program B in direction B;
- Project A steering group.

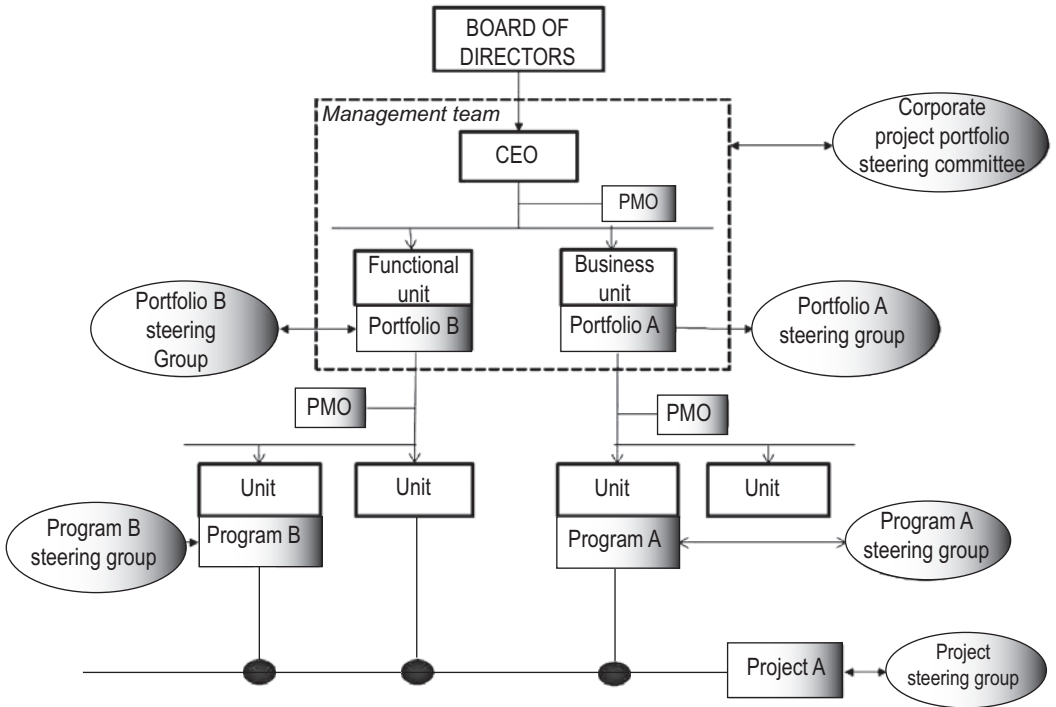


Figure 13.2 Example of governance structures in a project-based organization

The four governance paradigms should help guiding the governance structure (Chapter 30):

- Flexible economist;
- Versatile artist;
- Conformist;
- Agile pragmatist.

STRUCTURING FOR PROJECTS

Structuring the Projects (Categorization System)

In a simplified approach, strategy management includes two major components: strategy formulation and strategy implementation. Following strategy formulation, several high-level initiatives or projects form the organization's overall project portfolio. This set of projects represents the overall investment in bringing in new products/services, or processes. Usually, these investments are divided into a number of parts based on the specific organizational logic (business units, strategic objectives, products and the like). Categorization of projects in unique projects, programs and portfolios is a major milestone in the structuring of project-based organizations (Crawford, Hobbs, and Turner, 2005).

The following attributes can be used to categorize projects in a hierarchical, parallel or composite system:

- Strategic importance;
- Application area (business units, functional unit, etc.);
- Scope of the projects (cost, risks, complexity, etc.);
- Deliverables (information system or technology, construction, processes, etc.).

The categorization system must then be mapped along with the organizational structure. A decision must be made concerning how each specific project, program and portfolio will best fit within the organizational structures. The following is largely inspired from Hobbs and Ménard (1993).

Organizational Structures

The differentiation between operations and projects is now generally well understood. It results from the pressures placed on organizations to accelerate their pace of innovation, through new products or services or greater process efficiency. A limited number of projects can easily be handled through the operational structure. However, large, complex and multiple concurrent projects require specific coordination mechanisms that deviate from normal operations. The inspiration for project structuring came from the field of innovation where creativity and invention gave rise to organic-type structures in contrast to the more repetitive operations of a hierarchy system (Burns and Stalker, 1961). Experimental forms of organization have been tried (cellular, network, spaghetti, etc.), yet the hierarchy form persists along with a variety of project structures (Pettigrew et al, 2003).

Different approaches have since been proposed to position projects within the organizational structure in a way that allows room for innovation and the emergence of projects. A variety of organizational structures are used for projects. In a sample approach, this variety can be represented as a continuum where projects are carried out subject to strong decision-making authority within a hierarchical organization on the

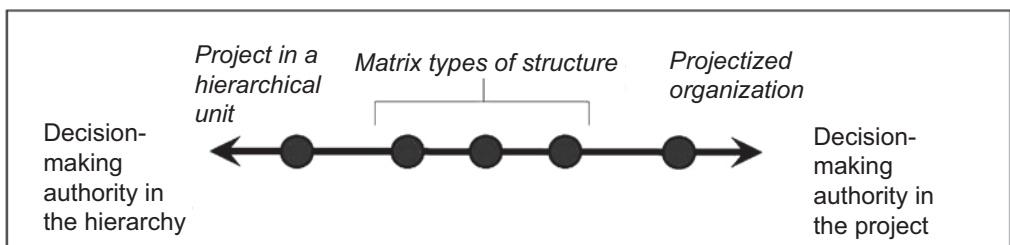


Figure 13.3 Project structuring continuum

one hand or a strong decision-making authority within a projectized organization on the other (Figure 13.3).

This approach is often mentioned in the literature (Hobbs and Ménard, 1993; Hobday, 2000; Larson, 2004; Kerzner, 2006) and in the project management bodies of knowledge (for example, Project Management Institute, 2012). Three basic types of structure can be identified based on the major focus of where the projects are conducted:

- Projects in the hierarchy (extreme left);
- Projects in matrix-types of structure (center position);
- Project structure (extreme right).

Bear in mind that a large number of variations exist between these three basic organizational forms. Moreover, in large organizations, all three basic forms could easily coexist, adding to the complexity of the project function.

Projects Within a Hierarchy

In this type of structure, the project is carried out within the limits of a hierarchical unit, whether a functional unit, a business unit or a regional unit and so on. Project decision-making authority within this type of structure is held almost exclusively in the hands of the hierarchical entity's managers. The advantages and disadvantages of this approach are shown in Table 13.1.

Table 13.1 Main advantages and challenges of the hierarchical structure for projects

Main advantages	Major challenges
Development of technical excellence	High interdependence
Clear objectives and priorities	Coordination difficulty between hierarchical entities
Careers for specialist	Conflicting priorities between hierarchical entities
Supervision by specialists	No one responsible for multi-entities projects
Synergy among specialists	Contribution to overall performance difficult to measure
Stable relations	Adhesion to the point of view of the hierarchical entities
Control of quality and performance (within the unit)	The subordination of managerial objectives to technical objectives

Its main characteristics are:

- Organization by specialties (functional, business, regional, etc.);
- Resources grouped by area of specialization;
- Mono-functional projects: within functions;
- Pluri-functional projects: across functions.

Projectized organization

The projectized organization is structured 'hierarchically' around projects. Based on the value of full accountability, all of the organization's support functions tend to form part of the project structure, such as finances, human resources and information technology. Overall support functions tend to be minimal. The advantages and disadvantages of this approach are shown in Table 13.2.

Table 13.2 Main advantages and challenges of the projectized organization

Main advantages	Major challenges
Customer centric orientation	Duplication of resources and effort
Clear overall responsibility and priorities	Limited development of know-how
Easier performance evaluation	Loss of corporate memory
Coordination of interdependencies, integration	Employment instability
Schedule and cost consciousness	Temporary structure
Interdisciplinary contact	Depreciation of specialists
Identification with project, motivation	May scarify technical quality to cost
Clear communication channels with stakeholders	Loss of uniformity
Adaptability	

Its main characteristics are:

- Self-sufficient structures;
- Operational freedom;
- Autonomous;
- Project management fully accountable.

Matrix structures

Currently, however, the most widely accepted organizational approach to project structuring is still the matrix-type structure based on the division of decision-making authority between the hierarchical structure and the projectized structure. The advantages and disadvantages of this approach are shown in Table 13.3.

Table 13.3 Main advantages and challenges of the matrix-type structure

Main advantages	Major challenges
Combines the advantages of both hierarchical and project structures	Administrative complexity
Avoids their disadvantages	Decision-making complexity
Trade-offs and equilibrium among: cost-time-quality and projects	Conflicts
More efficient use of resources	Costs: more managers and dual information system
	'Meetingitis'

Its main characteristics are:

- Double division of labor;
- Superimposition of the project structure on the hierarchical structure;
- Adaptive distribution of influence between the two structures (strong, balanced or weak matrix).

PROCESSES AND TOOLS

Project management is often referred to uniquely as a set of processes and tools. Project management requires much more than processes and tools, although they are extremely important to ensuring some degree of standardization and assist in achieving project management efficiency. Project organization must take account of the desired degree of process formalization and the tools supporting these processes. In general terms, there are three main bodies of knowledge in the field of project management describing the processes and their associated tools:

- Project management;
- Program management;
- Portfolio management.

Identifying and categorizing projects, programs and portfolios (as mentioned above) is not enough to ensure they will deliver the desired outcomes. The objective of this chapter is to ask a few questions about organizing projects, programs and portfolios management before proceeding with their implementation.

- Methodology;
- Degree of formalization;
- Uniformity throughout the organization;
- Agility;
- Degree of automation for project management tools.

Project management processes and tools should also be regarded as part of a global organizational system. The management of projects, programs and portfolios often crosses the strict boundaries of organizational entities. Multiple stakeholders participate in project organization and form a political system that cannot be overlooked. The interfaces between projects, programs and portfolios processes and other organizational processes should also be considered. Accounting processes or quality management processes are examples of these interfaces, among others.

IMPLICATIONS OF ORGANIZING FOR PROJECTS

Organizing for projects is a multidimensional activity. In this sense, it does not occur in a vacuum. Organizing for project is part of organizational life; decisions put in place or made to enhance the management of multiple projects affect a number of other organizational components, whether people, processes or other structures. The following section identifies four impacts that merit special attention when organizing projects. Other impacts could surely be mentioned, but these appear key for decision-makers in organizing for projects.

1. *Contribution to organizational performance:* The ultimate reason for organizations to undertake projects is to gain value from growth that would not otherwise be achieved through normal operations. Organizing for projects forms part of this logic and the resulting project organization should contribute to organizational performance. Organizing for projects should be clearly linked to strategic initiatives, but also the performance assessment process (for example, business scorecard).
2. *Change management:* Environments are dynamic. Projects are temporary. It therefore seems more likely that project organization will also have some 'temporary' characteristics. This results in frequent organizational changes that can be incremental or radical in nature. Most of the time, however, these changes have significant impacts on the way work is performed through projects, programs and portfolios, and on the people assigned to them. The capacity to manage project-related changes seems more readily apparent than the capacity to manage internal organizational change and transformation. However, the ability to fluidly manage frequent organizational changes is likely of greater assistance to organizations in maintaining an alignment between organizing for projects and context.
3. *Uncertainty:* An important characteristic of the changing context confronting organizations is uncertainty. Amid conditions of uncertainty, organizations should deliberately establish mechanisms to anticipate changes and prepare to adapt to change. One consequence of this uncertainty is to develop flexibility in organizing for projects. Gaining flexibility or organizational agility means to be ready to abandon a very strict and ordered approach (Geraldi, 2009). A need exists to ensure project organization that provides the necessary control while maintaining the flexibility to

change in a rapid and timely manner. This is a major challenge for decision makers in organizing for projects.

4. *Customer centric*: A major trend in today's approach to organizing is to make the customer the central focus (Galbraith, 2010). The customer's place is firmly acknowledged in the project management field as key to defining the project. This is especially apparent in lean or agile type projects. In organizing for projects, it is more likely that overall project organization will see the customer as a structural dimension of portfolios, programs and projects.
5. *Learning in organizing for projects*: Nowadays, knowledge is considered an organizational asset. Temporary organizations create challenges in learning and knowledge management (Williams, 2007). This is particularly true at the organizational level where organizing for projects lays the groundwork for generating knowledge. Three major learning impacts must be considered when organizing for projects:
 - Impact on learning in the individual project, program, portfolio and PMO;
 - Impact on learning among projects, programs and portfolios;
 - Impact on learning from organizing for projects.

For the two first impacts, organizing for projects affects context primarily by promoting a climate of openness and transparency. Some specific mechanisms should be identified and implemented to provide opportunities for generating and sharing knowledge (for example, communities of practice or other dynamic and collective *spaces*).

The third impact is directly linked to organizing for projects. It involves using frequent changes as a learning mechanism to acknowledge:

1. The positive outcomes from one organization and organizing process;
2. The critics.

This approach will more likely be geared toward evidence-based decision making (Rousseau, 2012), thus improving both the learning experience and quality of decisions. For this, accurate feedback about previous decisions and based on reliable organizational facts is needed. In addition, access to scientific findings (such as this book) could contribute to the decision making process on organizing for projects.

Concluding Remarks

As presented in this chapter, organizing for projects is multidimensional, including the relation to organizational strategy, governance, structure, processes and tools. Organizing for projects relates not only to the position of projects in the organization and in a matrix type of organization, but also the components to consider at the organizational level. The implications of the choice of organization have been explored. However, beyond the different aspects of project organization already discussed, the approach stresses the role of decision makers in organizing for projects. This role not only governs the technical aspects of a structure, but also includes capabilities related to aspects discussed less often in the literature on project organization.

- *Organizing for projects is a creativity activity*: It acknowledges that there is no such thing as ‘one size fits all’ project organizing. Since no models or recipe can be copied or followed, somewhere along the line, someone should make sense of the organizational context and undertake a reflection with all available information to make a decision. This activity is a creativity activity and produces a unique model for a unique situation.
- *Making sense of the environment to anticipate change*: The point made above requires that someone should have the capacity to make sense of the environment or that proper mechanisms be put in place. The objective of this sense making activity is to anticipate change in the external or internal environment. This may provide better readiness for the entire organization to face the dynamic environment (Petit and Hobbs, 2012).
- *Being prepared to change*: Organizing for projects means being flexible or agile. Project governance, structures, processes and tools will probably not survive as they stand for long (see the Chapter 31 on PMOs for an illustration of this point).
- *Leading organizational change in organizing for projects*: Frequent changes happen in the organizational life to keep pace with environmental changes. A change leader is needed to clearly show the direction to follow. This leader should have the capability to mobilize the people around changes.
- *Human aspects in organizing for projects*: The importance of managing the human aspects in the management of individual projects and programs is currently quite well acknowledged (Müller and Turner, 2010). Complementary to this, it is as much critical, when organizing for projects, to consider the management of human resources with as much attention as when considering technical aspects of a new organizational design (Huemann, Keegan, and Turner, 2007).

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CHAPTER 14 *Managing for Stakeholders*

PERNILLE ESKEROD AND MARTINA HUEMANN

Every project needs financial and non-financial contributions from persons, groups and entities in order to be accomplished and to create value. The non-financial contributions may be approvals from decision makers, work efforts from project team members, deliveries in the right quality from suppliers and inputs on expectations from end users. At the same time each project will affect persons, groups and entities, for example positively by creating future income and learning opportunities, and negatively by creating side effects like pollution and stressful working conditions. All persons, groups and entities able to affect or in a position of being affected by the project are called the project stakeholders. Even though stakeholder management has been a core activity within project management for many years numerous unsuccessful projects related to unsatisfied stakeholders are reported. It may for example be that the project outcomes do not meet the stakeholders' needs, or the project process is not carried out as expected by the stakeholders.

All project stakeholders make their own subjective assessments of the (potential) project success. These assessments take place prior to the project start, during the project course as well as afterwards and relates to whether the process and the stipulated outcomes are expected to meet the stakeholders' needs and expectations. If the stakeholders don't believe that the project outcomes or process have the potential to meet or exceed their needs and expectations, they may refuse to contribute as needed to the project. If they assess the project to be unsuccessful after the project, they may refuse to contribute to future related projects. They may even influence other project stakeholders to perceive the project as unsuccessful. The stakeholders may not only be concerned with their own needs and expectations, they may also refuse to contribute or even undertake actions against the project if they think other stakeholders are or will be negatively affected in unacceptable ways. A contemporary societal request for sustainable development places new demands on how to treat project stakeholders, for example by considering long term ecological, social and economic impacts.

For these various reasons, a new understanding of project stakeholder management is needed. In this chapter we describe how stakeholder management focusing more on the project stakeholders' needs, expectations and satisfaction can be carried out. Selected methods to support this project stakeholder management are offered.

The Essence of Project Stakeholder Management

WHO ARE THE PROJECT STAKEHOLDERS?

Project stakeholders are all individuals, groups or entities who can affect or be affected by the project outcomes or the project process (Freeman, 1984; Andersen, 2008). Examples are the project investor, project client, project personnel, suppliers, partners, authorities and communities. Due to their capacity and opportunity to contribute or threaten the project success each stakeholder has a help potential and harm potential (see Figure 14.1).

A high help potential implies that the stakeholder can provide significant contributions to the project whether these are financial or non-financial. A high harm potential implies that the needed contributions from this stakeholder are difficult or impossible to replace or that the stakeholder is able to affect other stakeholders' contributions or perceptions of the project. The stakeholders with high potential to help and/or harm the project success are called the key stakeholders, and thereby differentiated from the whole group of stakeholders. Be aware that the status as key stakeholder may change during the project course.

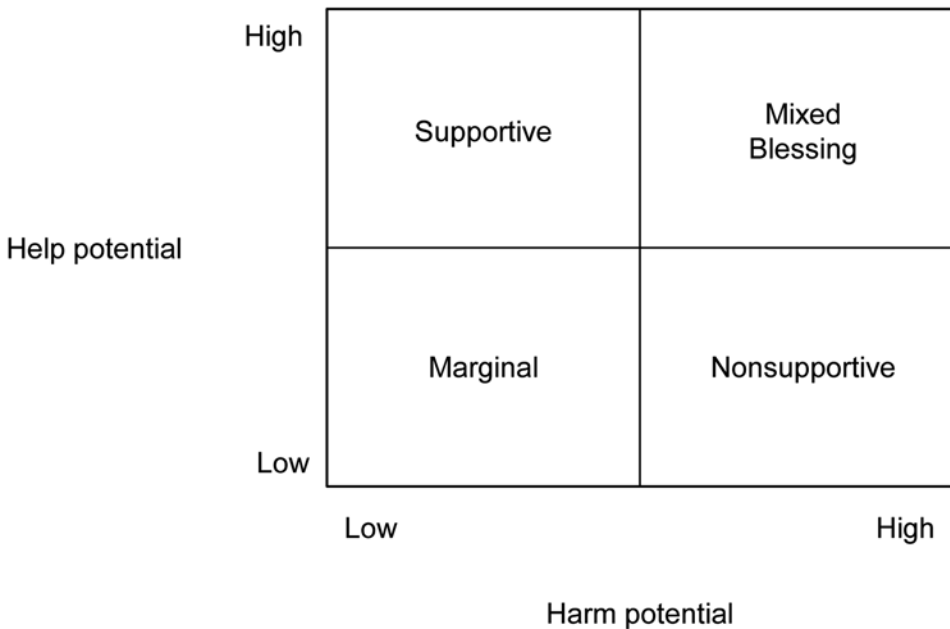


Figure 14.1 Help versus harm potentials (after Savage et al, 1991, p. 65)

WHAT IS PROJECT STAKEHOLDER MANAGEMENT?

The purpose of project stakeholder management is to increase the likelihood of project success by procuring contributions needed by the project and by enhancing that (key) project stakeholders perceive the project as a success. Building on Eskerod and Jepsen (2013) we define project stakeholder management as *all purposeful stakeholder-related activities carried out in order to enhance project success*. Project stakeholder management consists of two main types of activities:

1. Doing stakeholder analysis;
2. Interacting with the stakeholders in purposeful ways.

The stakeholder analysis must provide information about the (key) stakeholders' requirements, wishes and concerns related to the project, along with their project success criteria and their potentials to help or harm the project. The purposeful interactions concern engaging and disengaging the stakeholders on the basis of information from the stakeholder analysis. The two types of activities are intertwined as engaging with the stakeholders typically is necessary in order to provide information needed for a proper stakeholder analysis, and that engaging with the stakeholders during the project course calls for new stakeholder analyses.

WHAT ARE THE CORE CHALLENGES OF PROJECT STAKEHOLDER MANAGEMENT?

A number of challenges when doing project stakeholder management exist:

- First of all, it may be difficult to identify the (key) stakeholders – as many persons, groups and entities may potentially affect or be affected by the project.
- Secondly, it may be difficult to get proper knowledge about the stakeholders' requirements, wishes, concerns and success criteria as the stakeholders may not be sufficiently conscious about them or able to express them. Further, for each stakeholder they may be in conflict, or they may change over the project course.
- Thirdly, the various stakeholders may have conflicting requirements, wishes, concerns and success criteria, implying that negotiations and trade-offs acceptable for the stakeholders must take place.
- Fourthly, the members of the project organization do not have unlimited resources for making stakeholder analyses and interacting with the stakeholders. In order to enhance project success they must figure out how to spend their scarce resources for stakeholder management in efficient ways.

Stakeholder Management Approaches

Stakeholder theory within general management literature offers a distinction between two approaches, a management of stakeholders (or managing stakeholders) approach and a management for stakeholders approach (Freeman et al, 2007; Freeman et al, 2010).

The two approaches can be viewed as two mindsets for stakeholder management that builds on different values.

MANAGEMENT OF STAKEHOLDERS

The management of stakeholders approach is an instrumental approach – and stakeholders' importance are assessed on their potentials for helping and harming the project. The purpose of stakeholder management is to procure contributions needed by the project and to prevent stakeholders from undertaking actions against the interests of the project. Stakeholders are seen as means to obtain project success for the project investor and the members of the project organization – and project stakeholder management is about making stakeholders comply with the needs of the project. When two or more stakeholders have conflicting demands and wishes, trade-offs between the stakeholders are based on their help and harm potentials, that is the more important you are for the project success the more likely it is that your interests will get highest priority. Stakeholders who are not perceived to be very important for the project success will not receive much attention or be objects for any ethical considerations.

MANAGEMENT FOR STAKEHOLDERS

In contrast, the management for stakeholders approach is an ethical approach – in which the core thought is that all the stakeholders are valuable in their own right – and that they are entitled to receive management attention regardless of their help and harm potentials. When demands and wishes of two or more stakeholders are conflicting, an important part of stakeholder management is to search for win-win situations – and if this is impossible to reach – that the negative effects for each stakeholder are minimized as well as the decision making process is transparent so that the stakeholders understand decisions and actions related to the project. Fairness, transparency and participation are examples of underpinning values of the management for stakeholders approach.

COMPARING THE APPROACHES

The two approaches can be seen as extreme positions on a spectrum, both with their limitations. The management of stakeholders suffers from its manipulative orientation, lack of ethical consideration and narrow focus on the interests of the project (investor). As the perception of project success is influenced by the stakeholders' subjective assessments, the project investor and project organization typically need to interact with the stakeholders in the future, and a societal request for fair treatment of current and future generations, a narrow and selfish orientation may give very short sighted benefits if any at all. The management for stakeholders approach suffers from its lack of focus on the most important stakeholders owing to the request for inclusiveness and equal treatment of stakeholders. Long lasting searches and negotiations for win-win situations risk to delay project progress or even stop the project, so that the stipulated value for the beneficiary project stakeholders (which typically are not only the investor and the project organization) is not created. By not accepting conflicts and unpleasant trade-offs the management for stakeholders approach may lead to non-ambitious solutions – and by that put a hindrance to innovation and increased prosperity in society.

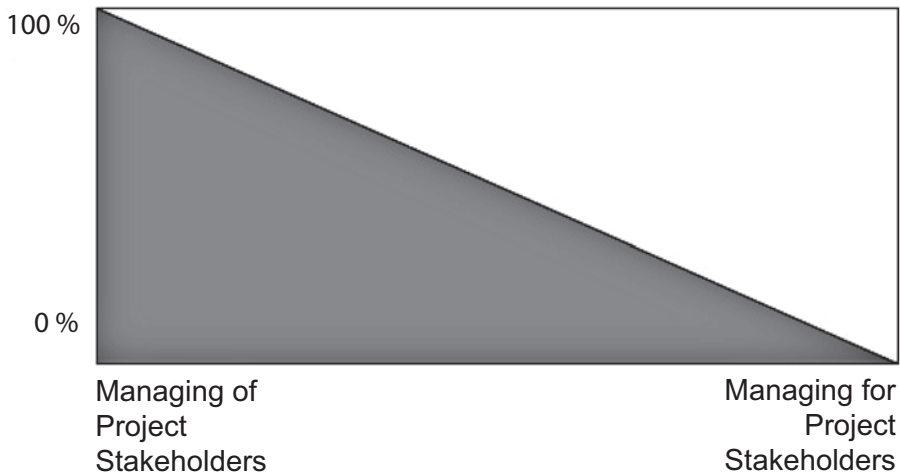


Figure 14.2 Managing of and for project stakeholders continuum

A way to take advantage of the strengths of both approaches is to combine them. Using the instrumental focus of the management of stakeholders approach to enhance project progress, that is by giving most attention to the key stakeholders so that they will help and not harm the project, while at the same time using the ethical focus of the management for stakeholders approach to ensure that the requirements, wishes, concerns and success criteria for a broad range of stakeholders are determined and incorporated in the project plan. Figure 14.2 shows the two approaches as a spectrum.

It is up to the people who are in charge of planning the stakeholder management to decide the right integration of the two approaches. Please note that we are dealing with an abstraction here – or two mindsets based on different values. So the aim of the figure is to promote discussions among the stakeholder management decision makers of the two mindsets and the implications for the actual project. Contemporary society's request for sustainable development as fair treatment of all stakeholders lead to a general shift towards the management for project stakeholders approach as the underpinning values of this approach are in line with the underpinning values of sustainable development.

Project Stakeholder Management Process

As mentioned previously, project stakeholder management consists of stakeholder analysis and purposeful stakeholder interactions. This is the case regardless of the approach chosen. A project stakeholder management process consists of three sub processes:

1. Project stakeholder analysis;
2. Project stakeholder engagement;
3. Project stakeholder disengagement.

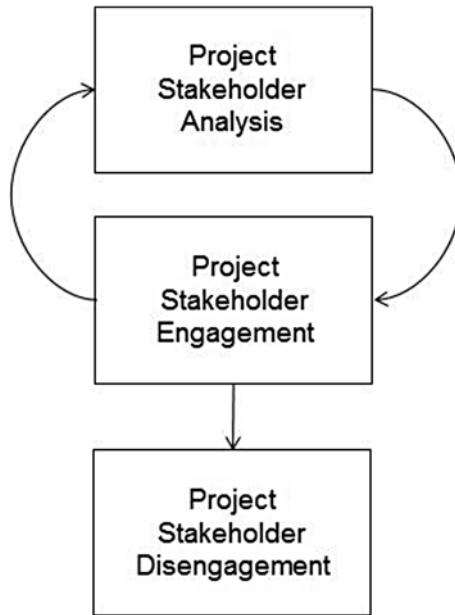


Figure 14.3 Project stakeholder management sub-processes

The two first sub processes should not be seen as linear, but as circular (Figure 14.3).

In order to create a solid foundation for your stakeholder interactions, you should perform more stakeholder analyses during the course of the project. Ideally, the first analysis is done even before the project is established to find out whether there are powerful stakeholders who will want or be able to hinder the project (Andersen 2008). When the project is established, stakeholder analyses should be carried out several times along the project course as more detailed information becomes available and in order to incorporate potential changes.

The last sub process takes place when an active relationship between the project and the project stakeholder is not of relevance any more. The contents of each process are described in the sub-sections below.

PROJECT STAKEHOLDER ANALYSIS

Project stakeholder analysis consists of four activities:

1. Identify project stakeholders;
2. Assess project stakeholders;
3. Prioritize project stakeholders;
4. Plan stakeholder engagement and disengagement.

In order to be able to determine who to target in your project stakeholder management, you need first of all to find out who can affect or be affected by the project – identify the stakeholders. When you have identified the project stakeholders you have to assess how they need to contribute to secure project success, and whether and why they can be expected to contribute as needed – *assess* needed contributions, help and harm potentials as well as their needs, expectations and success criteria. In addition, all the project stakeholders have information and communication needs which must be identified. Core questions include:

- How can each stakeholder contribute to create project success?
- What will constitute satisfaction for each?
-

While the assessment focused on each stakeholder, the next step requires you to compare the stakeholders and their characteristics to decide to whom you currently or for a specific issue need to pay most attention to – prioritize the stakeholders. It may be one of the stakeholders has an urgent need, for example, for the supplier to get to know certain specifications of the construction site at which the project takes place. Stakeholder prioritization involves assessing the relative power of the stakeholders as well as their attitude towards the project and various issues connected to the project. The help versus harm potential model introduced earlier in this chapter may be used to make the prioritization. It includes also a strategic component of stakeholder management, as in this step the project manager and the project team agree on strategies how to treat the particular stakeholder, which will then set the scene for planning engagement and disengagement activities with the particular stakeholder.

Based on the former activities in the stakeholder analysis you must *plan how and when to engage and disengage* each stakeholder. You may want to address more stakeholders simultaneously by inviting them for a project event or by providing them with mass produced info materials about the project, or you may plan to engage with them on an individual basis – and even ask the project owner to be their contact person. In the same way, you may plan to disengage the stakeholder in a way that encourages the stakeholder to work with you again in a future project. Part of the planning stakeholder engagement and disengagement is to figure out how to spend resources for stakeholder management in efficient ways.

PROJECT STAKEHOLDER ENGAGEMENT

In this process (which actually lasts as long as the project is being executed) the tasks are to create awareness of the project; to create relationships with the stakeholders; to negotiate aimed-for benefits, scope and constraints as well as mutual expectations for the project outcomes and the project process with the stakeholders; and to sustain relationships as long as they are relevant for the project. The interactions with the (key) stakeholders typically begin in the pre-project phase and in the project formation phase in order to incorporate the stakeholders' ideas and interests at an early stage. The interactions continue until it is relevant to disengage the particular project stakeholder. For some stakeholders interactions may last for the whole project course, while for others, for example suppliers, the interactions are tied to specific parts of the project.

PROJECT STAKEHOLDER DISENGAGEMENT

When the project or part of the project has being accomplished, and the relevant stakeholders need to be disengaged, close-down activities with the particular stakeholder are performed, that enhance the possibility that the stakeholders will perceive the project as successful – also when they think back on it in the future. Further, the activities may include reflections on experiences and learning from the project; also the members of the project organization are released from their roles.

Project Stakeholder Management Methods

The management of stakeholders approach and the management for stakeholders approach differ in values and in attitudes towards the stakeholders. In the above section it was described that the sub processes in the project stakeholder management process can be the same for both approaches. The methods for project stakeholder management may also be the same, but with a different focus and emphasis. In current project management literature plenty of methods for project stakeholder management are offered. At the same time, the management of project stakeholders approach is dominant (Eskerod and Huemann, 2013). In this section, we, therefore, present selected methods for stakeholder management which are especially suitable to reflect a management for stakeholders approach. In Table 14.1, an overview of the selected methods related to the project stakeholder management sub processes is offered. Each method is described below.

Table 14.1 Overview of Selected Project Stakeholder Management Methods

Project stakeholder analysis	Project stakeholder engagement	Project stakeholder disengagement
Inclusive stakeholder definition	Info materials	'Thank you'
Analysis workshops	Stakeholder workshops	Celebration event
Explicit mutual expectations	Integrated project organization	Future-oriented evaluations
Stakeholder reflections		
Scenario developments		
Systemic board		
Systemic constellation		

Please notice that the selection of methods should be perceived as a catalogue to choose from based on the characteristics and complexity of the project and the project stakeholder management task at hand. It may not be necessary to apply all methods in the same project.

SELECTED METHODS FOR PROJECT STAKEHOLDER ANALYSIS

Inclusive Stakeholder Definition

A management for stakeholders approach implies an inclusive project stakeholder definition is applied when, whereas a management of stakeholders approach implies that it is most important to identify stakeholders with high potential for influencing the project success. For the stakeholder definition to be inclusive it must contain stakeholders who are affected by the project but not necessarily able to affect the project, such as future generations. A way to operationalize the definition is to incorporate dimensions relevant for sustainable development when identifying stakeholders. Gareis et al (2013) suggest taking into consideration more interests (economic, ecologic and social), as well as broadening the temporal (short, medium, long) and spatial scales (local, regional, global).

Analysis Workshops

A management for stakeholders approach implies that the stakeholders' needs, interests, wishes, concerns and expectations must be properly determined. By inviting more people to an analysis workshop it may be more likely that a comprehensive analysis can be carried out as more people may be able to feed different perspectives and more knowledge into the analysis. The people attending the workshop may be members of the project organization, selected stakeholders and experts.

Project Stakeholder Analysis														
	Project Expectations					Stakeholder Expectations								
Stakeholder		Economic	Ecologic	Social	Local	Regional	Global		Economic	Ecologic	Social	Local	Regional	Global

Figure 14.4 Project stakeholder analysis form with mutual expectations (after Huemann et al, 2013)

Explicit Mutual Expectations

In a management for stakeholders approach it is important to make expectations from the project's point of view as well as from the stakeholder's point of view explicit in order to be able to align them. In order to capture the mutual expectations they may be documented in a specific form. Huemann et al (2013) offer a form in which both the project expectations and the stakeholder expectations should be written (see Figure 14.4).

Please notice that the form contains columns to determine whether the expectations relate to various measures within sustainable development, such as economic, ecologic, social, local, regional and global impacts. These measures may not be considered relevant for the project at hand. If this is the case the columns can be removed – or replaced if other measures seem more relevant.

Stakeholder Reflections

Even with the best intention of applying a management for project stakeholders approach it may be difficult to make stakeholders reveal their needs, interests, expectations and concerns. A classical method to enhance this is to ask the stakeholders to reflect on their relevant previous experiences (Eskerod and Jepsen, 2013). This is especially valuable when it comes to discussing and planning the project process. Examples of reflection questions:

- Mention three good and three bad experiences you have had in former projects – and that you find relevant for this project
- What did you especially like or dislike concerning communication in your former projects?

By discussing their personal experiences stakeholders may find it easier to identify and articulate their requirements, wishes and concerns – and the members of the project organization may find it easier to understand what they mean. It may be advantageous to ask for the reflections in a workshop, so that the other participants will be able to benefit from the reflections and build a comprehensive understanding of a particular stakeholder as well as reflect on their own answers to the reflection questions.

Scenario Developments

Stakeholder reflections presented above draw on the stakeholder's past experiences. In contrast to this, scenario developments make the stakeholder's image of the future explicit (Freeman et al, 2007). The underlying idea is to invite the stakeholder to tell how the project can be expected to create value for him or her. This may include how the stakeholders will make use of the project deliverables, for example the end users of a new IT-system or the consumers of a new product – or by making the stakeholder give feedback on a mock-up or prototype of a project deliverable. Role plays may also be used. As in the case of stakeholder reflections the purpose is to create a more comprehensive understanding of the particular stakeholder's situation relevant for the project at hand.

Systemic Board

A systemic board can help visualize relations between project stakeholders and between stakeholders and relevant elements in a project, like the project itself, project roles, certain interests, conflicts and values. The stakeholders and the elements are represented by blocks of different shapes (and sometimes colors) and placed by the person who is constructing the board, such as the project manager. A facilitator helps the person in charge to reflect on the board by asking questions. A relevant audience, for example members of the project organization, may be present so that they also can benefit from seeing the board and listen to the dialogue between the facilitator and the person. A variation is that more persons work together on the construction of the board and the dialogue, such as the project manager and a couple of team members. The method helps to abstract a situation and simulate possible solutions. The systemic board is well-suited for dealing with the increased complexity that the management for stakeholders approach adds to the project stakeholder management. Thus the systemic board is especially suitable in development or change projects (Huemann and Zuchi, 2014), or other projects with an extremely varied stakeholder landscape. Figure 14.5 shows a sketch of a systemic board work setting, while Figure 14.6 shows an example of a systemic board applied for an infrastructure project (Huemann et al, 2013).

Systemic Constellation

A systemic constellation resembles a systemic board. The difference is that the stakeholders and the elements are represented by persons instead of blocks. This means that they can take on the roles of the stakeholders and the elements – and speak on behalf of them. Further, the person doing the constellation can try the various positions – and feel

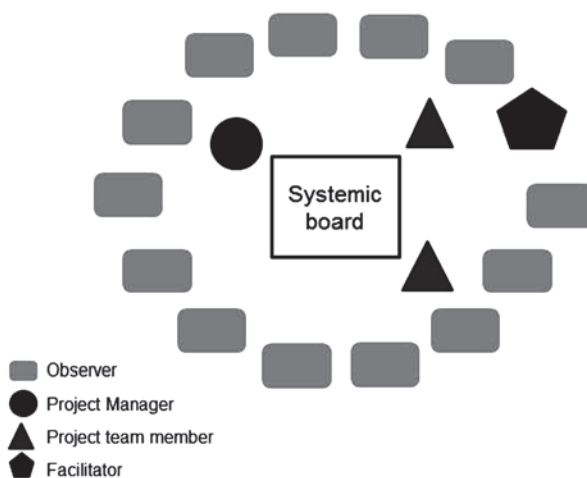


Figure 14.5 Systemic board work setting

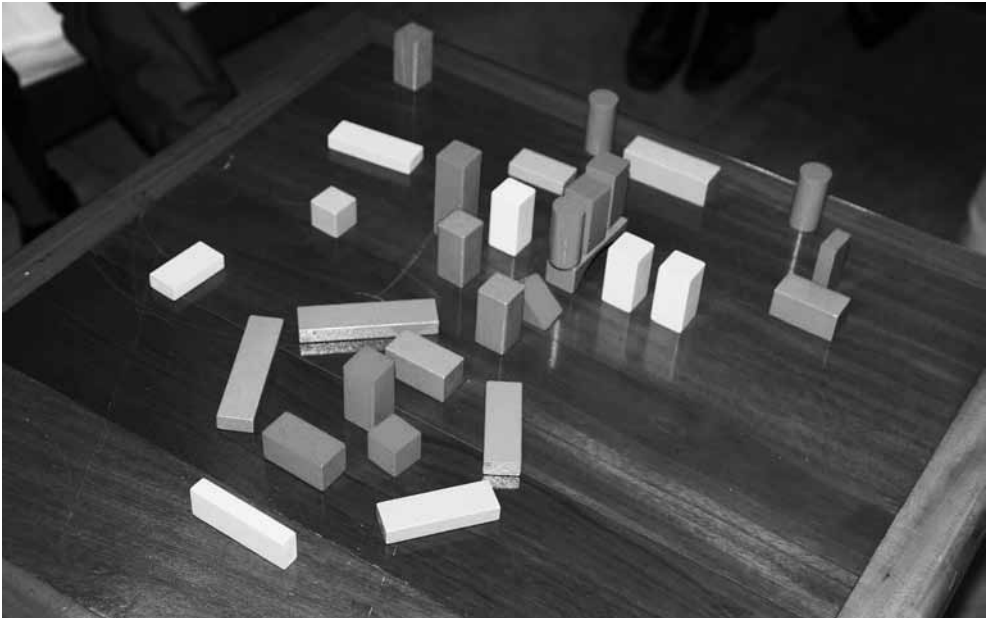


Figure 14.6 Example of a systemic board

how this stakeholder or element (in the person's perception) relates to the project. This gives a deeper understanding of the relations between the stakeholders and the selected elements, as well as opportunities to try out various solutions. The method requires an experienced facilitator as well as a number of people to undertake the representations. Figure 14.7 shows an example of a systemic constellation applied for the stakeholder analysis of a development project of a municipality in Denmark.

The analysis was part of a research project Rethink!PSM Rethinking Project Stakeholder Management funded by Project Management Institute and in which the two authors are principal researchers. The man on the table represents the vision of the project. He was placed on the table so that he can be visible for all stakeholders. The woman on the right is the facilitator. She asks well-thought questions to make all the participants reflect about the situation at hand. The Systemic Constellation can be best applied for analyzing the stakeholders for complex settings such as change projects or public investment projects.

SELECTED METHODS FOR PROJECT STAKEHOLDER ENGAGEMENT

Info Materials

A classical way to engage project stakeholders is to provide them with info materials, like project brochures, project newsletters and a project website. Info materials may be a cost-effective way to inform the project stakeholders about the project. This is very much in line with active project marketing and selling of the project to the stakeholders.



Figure 14.7 Example of a systemic constellation

However, a two-way communication with the stakeholders is typically more suitable for a management for stakeholders approach as it may be difficult to take on their perspective without direct communication with them. Info materials should therefore be seen as a method to supplement other engagement methods. The application of info material is especially useful if the project needs to deal with large groups of stakeholders, such as the people living in the community in which a new tunnel is built.

Stakeholder Workshops

Stakeholder workshops are well suited for engaging the project stakeholders in a management for stakeholders approach because they give the possibility for project representatives and stakeholders to interact on a real time face-to-face basis. Thereby it is more likely that they can get a better understanding of each other's situations, interests and expectations – and search for or develop (innovative) win-win solutions. If this is not possible it may be easier to work on trade-offs that are less harmful than if the project organization came up with trade-offs without involving the stakeholders. A stakeholder workshop may address one project stakeholder (group) only, or it may be an arena for more stakeholders to meet.

Integrated Project Organization

Another method to engage the project stakeholders is to integrate them in the project organization. By giving them a formal project role they will be involved in decision making in the project as well as having a legitimate arena to voice their points of view on a continuous basis. Further, to accept a formal role is also a way for the project stakeholder to show commitment and willingness to take on responsibilities for the project outcomes.

SELECTED METHODS FOR PROJECT STAKEHOLDER DISENGAGEMENT

'Thank You'

When continuous interactions between the project and the project stakeholder are not relevant any longer the members of the project organization must find a way to thank the stakeholder for project contributions provided. Various means of communication can be chosen, like, for example a personal letter, a telephone call and acknowledgement statements in reports, books or on websites. This method may be combined with the next method presented, a celebration event. A management for stakeholders approach would imply that all (or at least many) stakeholders are thanked – not only the ones who are relevant for future projects.

Celebration Event

To arrange a celebration event is another way of showing the project stakeholders appreciation of their contributions to the project. Such an event may vary in magnitude, participants and costs. Varying from having coffee and cake when a project team member leaves the team to breath-taking events at special locations – with fancy project presentations, celebrity guests, gala dinner, shows, media coverage and so on. Sometimes big events are meant more as marketing activities than to show appreciation to the stakeholders. A management for stakeholders approach would imply that many stakeholders are invited to the event, and that the event is organized in a way that is appropriate for the stakeholders.

Future-Oriented Evaluation

In the management for project stakeholders approach it is acknowledged that a broader time perspective than the project duration should be applied in order to take care of the project stakeholders' long term interests. This means that it may be relevant to evaluate the project process and outcomes in relation to the future, such as to discuss lessons learned relevant for the stakeholder as well as the members of the project organization. This may be done in a stakeholder workshop as mentioned in the section on stakeholder engagement methods.

Project Stakeholder Management Roles

It is important to notice that project stakeholder management both has a strategic and an operative side, and that it may be persons in different roles that take care of them. The strategic project stakeholder management concerns overall decisions on how to relate to each stakeholder, that is whether the stakeholder should be engaged in the project by giving him or her a formal project role in the project organization or by inviting the stakeholder to project events or be on a distribution list for a project newsletter. The operative project stakeholder management concerns the continuous interactions with the project stakeholder regardless if it is planned within the strategic considerations or emergent due to upcoming needs initiated by the project or by the stakeholder.

A management for stakeholders approach implies that a comprehensive understanding of the project stakeholder's needs, interests and expectations should be developed and those continuous interactions should take place in order to sustain the understanding and take care of eventual changes. This implies that it may be a good idea to involve a number of project roles in both the strategic and operative project stakeholder management, like the project manager, the project owner, project team members and project workers. In big infrastructure projects in Holland the stakeholders' interests are even more in focus as the law says that a specific project stakeholder manager must be appointed. Thus the challenge lay in coordinating the tasks and the consistency of the behavior of the different roles involved in stakeholder management on a project to provide a coherent message to a particular stakeholder.

Concluding Remarks

The chapter draws a distinction between a management of project stakeholders approach and a management for project stakeholders approach. Whereas the first one applies an instrumental approach to the stakeholders, the second is a more ethical approach. The two approaches can be seen as extremes on a spectrum. Classical project stakeholder management literature is dominated by the management of project stakeholders approach. In this chapter we point to implications of choosing a management for project stakeholders approach. This includes developing a more comprehensive understanding of each stakeholder's needs, interests and expectations, regardless of the stakeholder's potential to harm or help the project. The core difference between the approaches lies in the underpinning values, and not so much in the processes and methods. Still some methods are more suitable than others to incorporate a management for stakeholders approach. Regardless of approach, a comprehensive stakeholder management process consists of three sub processes: stakeholder analysis, stakeholder engagement and disengagement. In the chapter selected methods related to each sub process and appropriate for a management for stakeholders approach are offered and the roles for project stakeholder management are briefly discussed.

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HOMAYOUN KHAMOOSHI

Over the past couple of decades project management (PM) has become recognized as a major area of increasing importance within the management discipline. The application domains of management could be classified into strategic management, project management and operations management. Project management is the implementation arm of strategic management, used for implementing any change, whether hard or soft, whereas the operations management is about managing day to day operations of the organization. Management is about control, making sure that the system is operating well and moving in the right direction. But as Peter Drucker said, we cannot manage it if we cannot measure it. Project planning and scheduling provides us with the set of tools and techniques and a system to develop the needed yardstick to measure and assess the health of our project. Not too long ago network analysis was the only technique widely known to the PM community but even that was little used. However during the last 20 years project management has matured and developed into a comprehensive set of tools and techniques, methods, strategies and systems that when effectively and efficiently applied contributes drastically to successful delivery of project objectives and goals. Project planning and scheduling is the heart of PM as most of the tools and techniques are introduced and applied within this particular knowledge area.

In this chapter first we briefly review the basic principle of scheduling and what it takes to schedule a project, then we review the findings of researchers and developments in the domain of project scheduling, next some guidelines, best practices and latest trends are introduced and at the end the chapter is closed with some conclusions and recommendations.

Project Planning and Scheduling: Data and Terminology

As the literature, tools and techniques of planning and scheduling have evolved the technical words, expressions and terminologies needed to understand the topics of scheduling a project have grown. In this chapter we use only a limited set of words and expressions including the following data labels and terminologies to address planning and scheduling issues and topics:

Activity Name or Code: is used to identify the activity easily. It could also be used for sorting and filtering the activities fitting into one or more category or criteria defined by the planner/scheduler. For example you may need all the engineering activities, design activities or activities associated with the procurement.

Activity Description: describes the content and context of the activity and what is supposed to be done. It could also include the acceptance criteria, quality standards and specification.

Activity Sequence: it is also referred to as precedence relationship, logic, order of operation. It specifies which activities need to be done before starting the next.

Network Diagram (ND): is a pictorial presentation of flow of the work or the sequence in which the activities are logically needed to be done to deliver the project. It is essential not to consider or incorporate any resources constraints in the development of the network diagram.

Activity Resources Requirement Estimate: with the detailed description of the activity in hand we need to identify all the resources needed to do it and estimate the amount of each. This is a critical data as it is dependent on the volume of the work for the activity and the assumed productivity for each resource, none of which could be determined with certainty.

Activity Duration Estimate: estimated duration for each task is provided by the expert in the field and the people who will be doing the task or at least this is a recommended best practice. The duration will be estimated using an assumed number of resources working on the job. The number of each resource used per time period is referred to as resource intensity. For example when two software engineers are assigned to an activity, we say software engineer resource intensity is two. If these resources are expected to work for three weeks (five days per week), then we need $2 \times 3 \times 5$ or 30 man-days of software engineer. The total software engineer required is also referred to as effort.

Activity Cost Estimate: once we have decided on the planned duration of the task which is a function of resource intensity and Volume of Work (VOW) and the productivity of the resources, we are in a position to estimate the costs and to start scheduling of the project.

Earliest Start (ES): is the earliest time an activity could start given all the work that has to take place before it.

Earliest Finish (EF): is the earliest time an activity could finish.

Latest Finish (LF): is the latest time an activity could finish given all the work that has to be done after it.

Latest Start (LS): is the latest time an activity could start.

Total Float/Slack (TF): is the amount of time an activity could be delayed without delaying the completion of the project.

Free Float/Slack (FF): is the amount of time an activity could be delayed without delaying any other activity.

Critical Activity: is an activity with no slack/float. Delaying a critical activity will delay the completion of the project.

Critical Path: is the longest path in the project network and the minimum possible time to finish the project. It consists of a sequence of critical activities linking the start of the project to its end.

With that introduction we can proceed to the next section and discuss how scheduling is done.

What It Takes to Schedule a Project

The basic and important function of planning and scheduling is to provide a time, cost, quality and scope control tool for effective and efficient implementation of project management. In other words planning and scheduling is about *coordination and integration* of all the efforts for optimum execution of project after initial project approval which will continue till project closing. While sometimes planning and scheduling are used synonymously, we believe that planning is about data collection and intelligence gathering and organizing our thoughts, and making decisions about how we want to do the project, whereas scheduling is focused on time, resources and costs. It is about analyzing the feasible scenarios using the available data, assumptions and constraints and developing a blueprint (baseline) for execution of the project. One can think of planning for a project to consist of the following steps:

- Developing the scope documents;
- Developing work breakdown structure;
- Developing the list of activities;
- Collecting and developing data for all the activities;
- Developing the network diagram;
- Developing all the assumptions and constraints needed for scheduling.

Once planning is taken care of and we know what we are going to do, the analysis phase or scheduling could be started. Scheduling is about fixing the position of each activity on the time axis that is deciding when to start and finish each activity as a result of which the project as a whole is scheduled. There are many scenarios a project planner/scheduler could face. Depending on strategies, aims, objectives, assumptions, constraints, characteristics of the project, availability of resources and many other variables the approach could be varied and quite diverse. However, in principle, development of a so called baseline schedule or blueprint for execution of a project could be achieved by taking these steps:

- Time only analysis (scheduling the project ignoring resource constraints);
- Resource based schedule analysis;
- Cost analysis and budget assessment;
- Optimal schedule development (integrates time, cost, quality and scope into the schedule).

The end product of this lengthy process is an agreed upon baseline schedule which will be used for monitoring and control of the project and directing the project to successful delivery of end product and closing the project. It has to be emphasized that planning and scheduling processes and products are not static but quite flexible and dynamic. In what follows we discuss how the dynamism and flexibility must be integrated in the processes and products (plans and schedules). The objective is to design a flexible and dynamic system of scheduling which is capable of dealing with all sorts of uncertainty and potential ongoing change.

DEVELOPING SCOPE DOCUMENT, WORK BREAKDOWN STRUCTURE AND LIST OF ACTIVITIES

The scope development process starts with initiating a project and developing a project brief. Later on more details are added in preparation of RFP (Request for Proposal), or may be even when writing a proposal. Much more detail is added during further development of project initiation documents or the process of getting the final version of the scope approved. Even though we do our best to solidify the scope and minimize any uncertainty associated with the project deliverable, depending on the nature and characteristic of the project, minimal to extreme changes to the scope are unavoidable and part of the process with a diminishing rate as we move the project forward and get closer to the end. The recommendation or the best practice is to have a formal scope document agreed on by all the stakeholders to be used for planning and scheduling of the project. The scope document should clearly state and define the boundary of the project. What is the major deliverable? What are the main functionalities expected from the system or the project? What is part of the system and what is not? This clear descriptive statement defining the boundary of the system will provide the basis upon which the definitive list of elements will be captured, partitioned and structured. The method used, to explicitly address and account for all the elements which must be delivered by the project, is Work Breakdown Structure or WBS. There are a number of approaches or ways one could use to develop a WBS. The ways refer to the basis on which the logic of breakdown lies. You could break a project down using project life-cycle or chronology, phases of a project, geographical or location of parts or zones, functions or many other bases. The most widely used and recommended approach is DWBS or Deliverable Work Breakdown Structure. In this approach we start with the project as a whole at the very top (the final deliverable). Then break the project down into smaller deliverable at the next level. This breaking down process continues until we reach a desired level of granularity or manageable elements called work packages. A similar approach is also used and recommended as part of the PRINCE2 (Office of Government Commerce, 2009), under the heading of product breakdown structure, where the project is broken down into technical, management and quality products (deliverable). The DWBS is the backbone of schedule and scheduling. The lowest level elements of the breakdown as discussed above are called work packages (WP). Work packages in a DWBS are used to define the courses of action or list of activities. In other words by defining a work package and what will be delivered we must clearly know what the work content of the work package is and how that content could be delivered via actions (activities). So each WP should have a number of activities associated with it.

We now introduce an example project which we use to demonstrate the implementation of these tools and techniques in scheduling. As the schedule for almost any real life project includes hundreds and sometimes thousands of activities, the following theoretical example with a small number of activities is used for illustrative purposes.

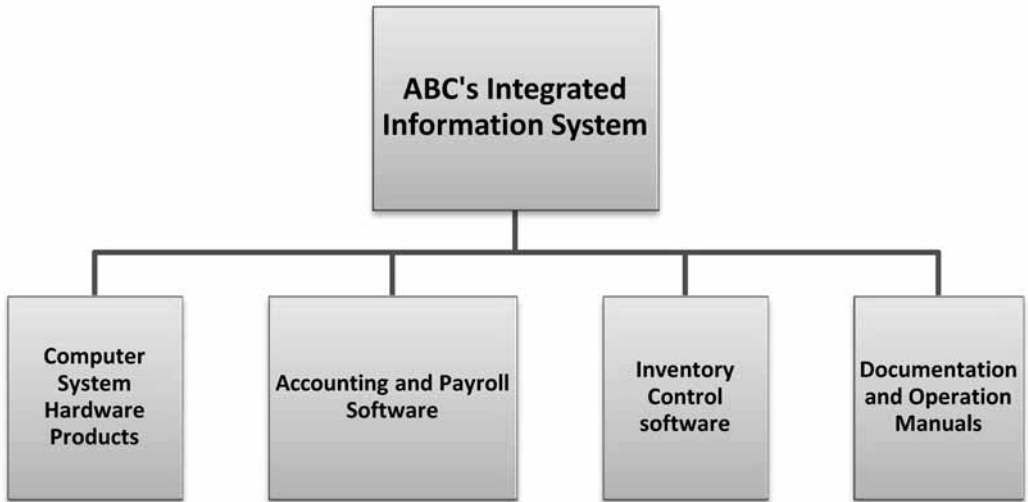


Figure 15.1 Work breakdown structure for the example project

EXAMPLE PROJECT

The ABC Company has approved the implementation of an integrated information system to support their healthy growth. The system to be delivered has been broken down into four major elements including:

- Computer system hardware products (CSHP);
- Accounting and payroll software (APS);
- Inventory control software (ICS);
- Documentation and operation manuals (DOM).

Almost all the project management software packages on the market provide the functionality of showing the WBS via presenting the project data (for example numbering system or indentation). However sometimes it may be useful to make a visual/graphical presentation of the work breakdown structure (Figure 15.1). The plan is to develop a high level schedule, thus there is not a lot of detail included in the breakdown and there will only be two levels: the main deliverable and its four major components as shown below. Real life projects normally are broken down into multiple levels before we get to work packages at the lowest level which are then translated into activities or tasks.

After developing the WBS, each work package or the elements at the lowest level are used to define the activities required to deliver those work packages. For our project Table 15.1 presents the DWBS, tasks/activities, estimated durations and predecessors for each task. The activities are always tied to the lowest level work packages.

Table 15.1 Basic data including WBS (Work Packages), list of activities/tasks, estimated duration and predecessors for each activity

WBS ID	Activity	ID	Task Name	Duration	Predecessors
1		1	ABC's Integrated Information System	42 wks	
1.1		2	Computer System Hardware Products	24 wks	
1.1.1	CSHP1	3	Compare the alternative options and make a decision	6 wks	
1.1.2	CSHP2	4	Order the hardware and wait for arrival of purchased equipment	16 wks	3
1.1.3	CSHP3	5	Install and test computers	2 wks	4
1.2		6	Accounting and Payroll Software	31 wks	
1.2.1	APS1	7	Recruit the software development specialist	1 wk	3
1.2.2	APS2	8	Conduct system analysis, design and coding for payroll	6 wks	7
1.2.3	APS3	9	Conduct system analysis, design and coding for accounting	12 wks	7
1.2.4	APS4	10	Integrate payroll and accounting system and make the final changes	8 wks	8,9
1.2.5	APS5	11	Test the integrated system for functionality	3 wks	10
1.2.6	APS6	12	Revise and retest developed system	3 wks	11
1.2.7	APS7	13	Test payroll and accounting programs on installed new computers	2 wks	12,5
1.2.8	APS8	14	Implement payroll and accounting systems	2 wks	22,13
1.3		15	Inventory Control software	36 wks	
1.3.1	ICS1	16	Select the external management scientist/consultant	10 wks	3
1.3.2	ICS2	17	Design and develop preliminary inventory management and control system	9 wks	9,16
1.3.3	ICS3	18	Make the required changes and approve the designed and developed version	8 wks	10,17
1.3.4	ICS4	19	Test inventory management and control system	2 wks	18,5
1.3.5	ICS5	20	Implement inventory management and control system	3 wks	23,19
1.4		21	Documentation and Operation Manuals	12 wks	
1.4.1	DOM1	22	Develop payroll and accounting system and processes manual	3 wks	11
1.4.2	DOM2	23	Develop inventory control systems and processes manuals	3 wks	18
1.4.3	FIN	24	Project Closed	0 wks	14,20

One important question that could be raised at this juncture is how one goes about breaking down the work content of the work packages into activities. How many activities should be in each work package? The answer is not clear and in fact there is no right or wrong answer. Some have recommended between three to five activities. It really depends on the size of the work package which itself is a function of the purpose and design of the plan and schedule as a control system to be used for managing the project.

DEVELOPING ASSUMPTIONS AND CONSTRAINTS AND DATA FOR ACTIVITIES

Now that we have established all the activities required to deliver the WPs, it is the time to capture and document all the information needed for scheduling the project. To start with one needs to have the following data finalized for each and every activity listed for the project:

- Name or code;
- Description;
- Sequence, logic or precedence relationship;
- Resources requirements;
- Estimated duration;
- Estimated cost.

All the assumptions and constraints need to be explicitly stated and recorded. The calendar(s) to be used for scheduling has to be decided. The working hours, days and holidays for each activity, resource or project as a whole must be declared. The sources of data and how we are going to establish the duration and cost for each activity should be established. We cannot go ahead with scheduling if the required information is not provided.

DEVELOPING NETWORK DIAGRAM

We could start developing the network by assuming end to start relationship for all the activities (this assumption will be relaxed later when more advanced and complex relationships between the predecessor and successor activities are introduced). After entering the data in project management software, the network diagram and the Gantt chart are generated automatically on the basis of input predecessor/successors relationships. These graphical presentations of the order of operations and sequence of activities/tasks are very useful tools and could serve multiple objectives. They are used to show the flow of the work, status of the project, work under construction, future activities, training of the project and project management teams and so on. Development of a network diagram for large and complex projects that is establishing the flow of work and precedence relationship between activities could be a daunting task. The job becomes harder when more complex types of relationship in the Precedence Diagramming Method (PDM) are used in developing the network of the project. There are four different types of relationships we could use to link two activities:

- E-S or end to start relationship is used when the start of the successor activity is dependent on completion of the predecessor.
- S-S or start to start relationship is used when two activities could start at the same time or with a time delay or lag.
- E-E or end to end relationship is used when completion of one activity is dependent on completion of the other with or without lag.
- S-E or start to end relationship is used when completion of one activity is a function of start of the other activity.

For all the above relationships one could introduce lead or lag that is we could say for example B can start three days after or three days before completion of A. It is to be noted that there are other much less popular network diagramming techniques such as activity on arrow (AOA), which is not discussed here simply because it is outdated and not used in the field for practical purposes. The precedence diagram network of the example project is shown below in Figure 15.2.

Research on the Scheduling of Projects

Over the past 10 to 15 years, quite a lot of research into project scheduling has been published. We cannot give a comprehensive review, but we can demonstrate the diversity of issues, approaches and models used in conducting project scheduling research. While many worked on particular scheduling problems, some did survey research on project scheduling (Herroelen et al, 1998; Kolisch and Padman, 2001; Herroelen and Leus, 2005; Shabtay and Steiner, 2007; Hartmann and Briskorn, 2010; Weglarz et al, 2011). Review of the literature shows that during the past decade, the resource-constrained project scheduling problem (RCPS) has been at the centre of project scheduling research. This is not surprising as RCPS is the most natural setting for almost any project. In most of these studies the objective is to minimize the project duration or a proxy to this objective.

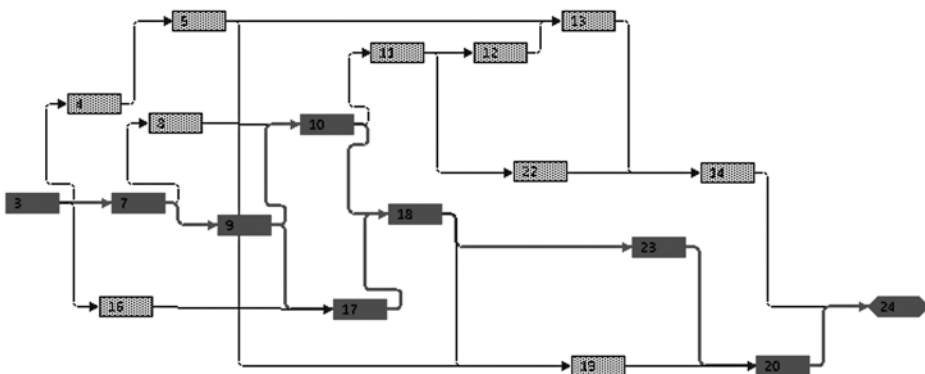


Figure 15.2 Precedence network diagram for the example project

The project duration focused category include objectives like minimization of the project duration or minimization of the weighted earliness and tardiness (Viana and Pinho de Sousa, 2011; Vanhoucke et al, 2001), minimization of the weighted sum of all activity completion times (Nudtasomboon and Randhawa, 1997; Rom et al, 2002), or minimization of the penalties caused by running activities outside their time frames (Vanhoucke, 2006). This approach could shorten the duration of the project, but the schedule developed will not be flexible and robust.

Knowing the issues of project duration minimization approach, other groups of researchers have targeted another set of objectives which includes robustness or quality of the schedule (Khamooshi, 1999), also called proactive scheduling which minimizes the effect of delays on the schedule (Kolisch and Hartmann, 2006; Vonder et al, 2008). These models could have multiple objectives like minimization of project duration and maximization of flexibility (Al-Fawzan and Haouari, 2005; Abbasi et al, 2006).

In the past, deterministic models where all the planning data are assumed to be known with certainty, dominated project scheduling. However recent work has focused on risks and reliability, and takes uncertainties of the data into account. In spite of extensive research on different aspects of deterministic project scheduling, it is clear that almost all the project activities are subject to variability and uncertainty which may disrupt the schedule. The sources of uncertainty are many, ranging from estimation uncertainty to lack of exact knowledge about the job and uncontrolled internal and external variables. According to Herroelen and Leus (2005) there are a few approaches to deal with these uncertainties, such as reactive, stochastic robust scheduling, scheduling under fuzziness and sensitivity analysis. These are all similar approaches as we develop a deterministic schedule knowing we need to be prepared to implement changes as and when they occur. The concept of reactive scheduling is basically repairing the baseline schedule to cope with unexpected events, which in the extreme might lead to full rescheduling of the project. Calhoun et al (2002) use a goal programming approach to revise project's schedule and minimize the number of changed activities.

In summary, the review of the literature suggests most of these findings are quite theoretical and they have not been translated into practical solutions and tools for planning and scheduling of large and complex projects in a very volatile and dynamic environment. Practitioners of planning and scheduling for projects are still facing the same hard classic problem of developing a dynamic schedule for a variety of projects, within a rapidly changing and complex setting. These problems include single project scheduling, multi-project scheduling, single resource or multi-resource, limited or unlimited resource, deterministic or probabilistic estimates for each and every variable. While all the aforementioned models and approaches could be very useful in a particular situation, industry or environment, few of the suggested approaches are generic, widespread and practical enough to be included in an off the shelf project management software. It is the responsibility of the project planner and scheduler to take advantage of these finding and fitting and tailoring the model to their needs if possible at all. In what follows we focus on practical and pragmatic issues in project planning and scheduling and provide some guidance on how scheduling of projects could be improved.

Unified Scheduling Method: A Practical Way Forward

Knowing that the traditional PERT/CPM (deterministic and probabilistic) models do not fulfil the ever increasing demand for flexibility and dynamism in scheduling projects, Khamooshi and Cioffi (2012) developed a scheduling approach which focuses on potential variability and reliability of the estimates and how that uncertainty must be accounted for in managing the schedule for projects. The Unified Scheduling Method or USM is an approach that could take into account almost any level of uncertainty associated with the time and cost estimates resulting from scope variation, productivity and so on. Here is a brief overview of the algorithm and how it works:

1. Establish a single planned estimated duration for scheduling each task.
2. Determine the level of confidence that is the reliability of estimated planned durations.
3. Develop the schedule with these planned durations to establish the project's baseline schedule and minimum total project duration.
4. If a distribution for task duration is available, truncate it to the left of the planned duration and presume that the remainder of the distribution is the distribution of the error associated with each task's planned duration. If the duration distribution is not available, estimate the size of the maximum error as a single point estimate or assume a distribution for it. The distribution's shape can be uniform, decreasing or even increasing. We suggest the following approximations to establish the average size of the error as a point estimate:
 - For a single-point estimate and a uniform distribution, assume the average error of one-half the maximum error.
 - For a decreasing distribution of the error, use about one-third of the maximum error. For an increasing distribution, use about two-thirds of the maximum error.
5. If the task error distributions are available or assumed, one can use the planned durations and their given reliabilities with the assumed distributions of the errors in a Monte Carlo simulation with branching to generate a distribution of project completion times (with the minimum completion time equal to the planned critical path's duration). Use the distribution of the project duration from the simulation to estimate the buffer needed to secure a target completion time with a chosen (statistical) level of confidence.
6. If the task error distributions are not available or if you do not want to simulate the project network numerically, find the average reliability and use the binomial approximation detailed below to calculate the buffer.
 - Identify the critical activities of the project.
 - Record the estimation data for each identified task including planned duration, reliability of the estimate, size of the error (possible extension to duration of the task), chances of overruns which is the same as $p=1$ -reliability.
 - Find the average probability of occurrence (overrun) for all the critical activities.
 - Use Excel or binomial tables with a desired level of confidence to find out 'a', the potential number of delays occurring knowing p , probability of over run and n , the number of activities on the critical path (from n activities on the critical path only some may need longer duration to finish them. This number is labelled 'a'). Alternatively,

- If the number of activities on the critical path is more than 20, the approximation equation given below could be used to decide on the potential number of delays occurring with a 99 percent certainty level.

$$a = 1.2 * n * p + 3.5$$

- Sort the potential errors/extensions for all the critical activities in descending order.
 - Add the sorted delay/extension values for top 'a', activities and allocate that value as contingency buffer for the schedule.
7. As the project continues, the number of remaining tasks decreases, and so the buffer calculated via USM will change. Thus, re-run USM to account for this change as well as other changes, such as changes in the critical path, or changes in the reliability of future tasks or the size of task errors. This proactive approach provides the needed flexibility.

For calculating cost contingency we need to consider the cost and associated uncertainty of all project activities. Thus instead of critical path activities we include all the project activities when dealing with cost uncertainty for setting budget contingency to provide the needed flexibility.

Some Recommendations

We can offer the following tips when scheduling your project:

Define your objectives and priorities: Many schedulers never establish their objectives. It is important to know your objective(s) up front, for example minimizing project duration, minimizing project cost or maximizing flexibility, highest quality schedule and so on. In case of having multiple objectives you need to decide which objective is more important than the others. Improving any of these objectives could change the measures of the others. So when aiming at multi-objective scheduling we need to compromise to optimize.

Focus on collecting planning and scheduling data: The data collection phase should not be rushed and enough time must be spent to come up with the most reliable data you can afford. Make sure the scope of the project is defined as accurately as possible. The WBS is sound and covers the whole project. In other words vertical integration of the structure leads to delivery of the deliverable. The work packages are right sized and manageable. The activities assigned to each WP leads to delivery of the work package and can be monitored and controlled. Assign the resources needed to each activity with the right number leading to optimal estimated duration. When developing the network diagram make sure the summary tasks are not linked and the connections are established by precedence relationships defined for activities. Make sure there are no dangles (an activity with a loose end). Define a start and end milestone and link all the starting activities to the start milestone and all the ending activities to the end milestone. Try to develop a network which is fat and short, that is have as many parallel paths as logically possible. Do not use the resource constraint to establish the network logic or sequence activities. Identify and define a suitable number of milestones.

Implement the schedule but be ready for change: The selected optimal baseline schedule with planned flexibility via contingency will be implemented and monitored knowing that every part of it is subject to change and you should be ready (flexible and dynamic) to accommodate the required changes.

Use a systemic approach to develop the schedule: This process can be very time consuming. An appropriate method needs to be adopted and used for developing the schedule.

Input the planning data into project management software of your choice: Make sure all the activities are assigned resources as per planning data. Conduct time analysis to get a feel of possible project duration. Review the resources requirements. The resources requirements should be reviewed using Resource Loading Charts (RLC) or Resource Graphs or Resource Allocation Tables. These reports show the demand of each resource over time (life of project). Input or impose the limits on availability of each constrained key resource (you can assume other resources are not limited). Run levelling resources to develop the schedule. Analyse and evaluate the schedule against the set objectives. Perform multiple iterations. If needed, perform manual levelling and fine tuning and decide on the best possible schedule bearing in mind duration, cost, quality and risk of the project.

Perform schedule risk analysis: The schedule risk will be taken care of by assuming a distribution for the duration of each task (the same applies to estimated costs uncertainty). That is the uncertainty associated with scope, environment, resources productivity and other similar factors will be accounted for by estimating the size of possible errors or an extension to planned duration. Use Simulation, USM, Critical Chain or any other Stochastic scheduling tools of your choice to establish the buffer or contingency needed to deal with any under estimation. Finalize the baseline schedule and get ready for implementation.

Concluding Remarks

Overemphasis on shorter project duration as a prime scheduling objective and lack of proper emphasis on scheduling risks and unreliability of estimates are two of the major causes of scheduling failure for many projects. The most questionable model is to use deterministic values for cost and duration estimates as input to planning and scheduling, whereas everyone agrees that 100 percent reliability can never be assumed. In case of large, complex, innovative projects, this assumed certainty is noticeably much worse. Thus the recommendation is to choose a suitable objective and develop a flexible and dynamic schedule. Approaches like USM could support this strategy.

USM stresses the process of schedule development and not just a probabilistic prediction of total project duration and cost (which is the primary focus of Monte Carlo simulation modelling). Single estimates with associated reliabilities provide the information needed for the development of more realistic, stable schedules but at the same time emphasize the responsibility of planner/scheduler for providing accurate data. USM provides ancillary advantages. The reliability of the estimates is expressed explicitly, putting responsibility on those involved in developing plans and schedules. This emphasis on the reliability of individual task duration and cost directly addresses issues such as overestimation for self protection (padding) and underestimation for political reasons. Thus it should improve the estimation culture. As it has been emphasized all the way, flexibility and dynamism are required characteristics of planning and scheduling of projects today. USM provides

a dynamic way to estimate schedule and budget contingencies directly. These planned contingencies increase the chances of project success and provide a much-needed flexibility and responsiveness lacking in the traditional CPM approach to scheduling. As the project progresses, schedule and cost buffers can be modified easily, making USM a more readily dynamic approach to scheduling. The pragmatic recommendations suggested in this chapter should help practitioners develop more reliable schedules, reducing the chances of failure caused by unrealistic planning and scheduling.

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Managing Cost and Earned Value

MARIO VANHOUCKE

In this chapter we look at the management of costs on projects, and in particular at the use of the Earned Value Management system. Earned Value Management (EVM) is a methodology used to measure and communicate the real physical progress of a project and to integrate the three critical elements of project management (scope, time and cost management). It takes into account the work completed, the time taken and the costs incurred to complete the project and it helps to evaluate and control project risks by measuring project progress in monetary terms. The basic principles and the use in practice have been comprehensively described in many sources (for an overview, see Fleming and Koppelman (2005)). Although EVM has been set up to follow up both time and cost, the majority of the research endeavors and practical applications have been focused on the cost aspect. It is only recently that the time dimension has received attention from both practitioners and academics. This chapter reviews the basic key metrics used in EVM, describes their usefulness for measuring both a project's time and cost performance and highlights the importance of integrating EVM with risk management.

Managing Costs

Measuring the performance of a project in progress requires a certain point of reference and knowledge about the basic metrics used in an EVM system. Since project performance should be measured throughout the entire life of the project at regular time intervals, the ideal point of reference is a fixed time frame known as the *baseline schedule* of the project. This project schedule can be constructed using well-known project scheduling techniques such as the critical path method (CPM) and defines start times (and finish times) for each project activity. Having knowledge about activity costs, this baseline schedule can be translated into a *time-phased planned value* for each activity and for the total project. A project baseline schedule plays a central role in an EVM cost control system, as we shall see.

In the remainder of this article, the following abbreviations will be used and illustrated on fictitious projects.

1. The planned duration (PD) equals the total project duration as a result of the constructed CPM schedule or its resource related extensions and is often referred to as schedule at completion (SAC) (Anbari, 2003).

2. The actual time (AT) defines the number of time periods (for example, weeks) the project is in progress at the current time instance. Consequently, this measure is used to calculate the project progress and the number of time increments that the project is running and is used to define the reporting periods for performance measurement from the start to the finish of the project.
3. The real duration (RD) defines the real final project duration known upon the project's finish.
4. The budget at completion (BAC) is the sum of all budgeted costs for the individual activities.

KEY METRICS

Planned Value: The Planned Value (PV) is the time-phased budget baseline as an immediate translation of the schedule constructed from the project network using well-known CPM project scheduling techniques. It is a cumulative increase in the total budgeted activity cost given the start and finish times stipulated in the baseline schedule. The PV is often called budgeted cost of work scheduled (BCWS). Figure 16.1 displays a straightforward project schedule of a project network with five activities in series.

Each activity has a duration of one week and a budgeted cost of €20,000, leading to a schedule with PD = 5 weeks and a total expected cost of BAC = €100,000. The translation of the baseline schedule displayed at the top of Figure 16.1 into monetary terms leads to the PV curve as displayed in the figure.

Actual Cost: The Actual Cost (AC) is often referred to as the actual cost of work performed (ACWP) and is the cumulative actual cost spent at a given point AT in time. The fictitious actual cost line of the five-activity project is given in Figure 16.2.

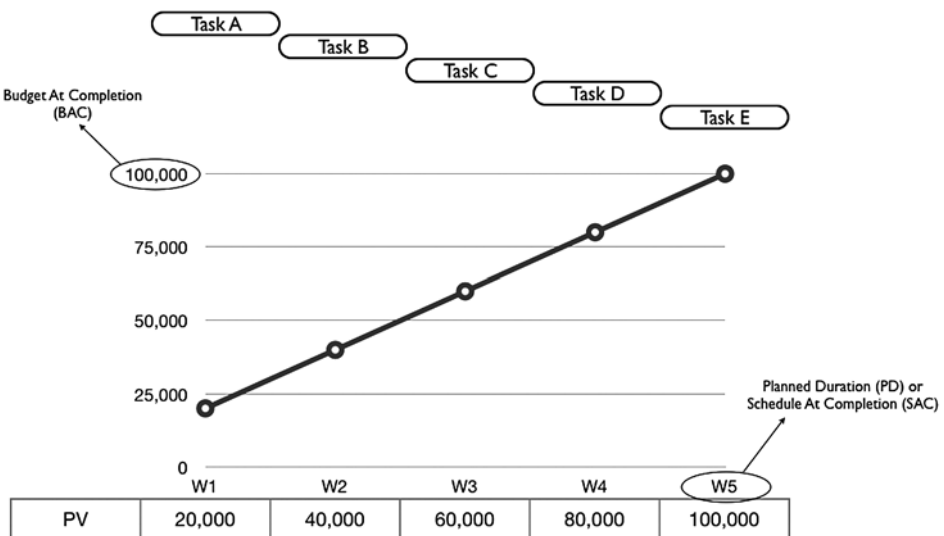


Figure 16.1 Planned Value of a five-activity project with BAC = €100,000 and PD = 5 weeks

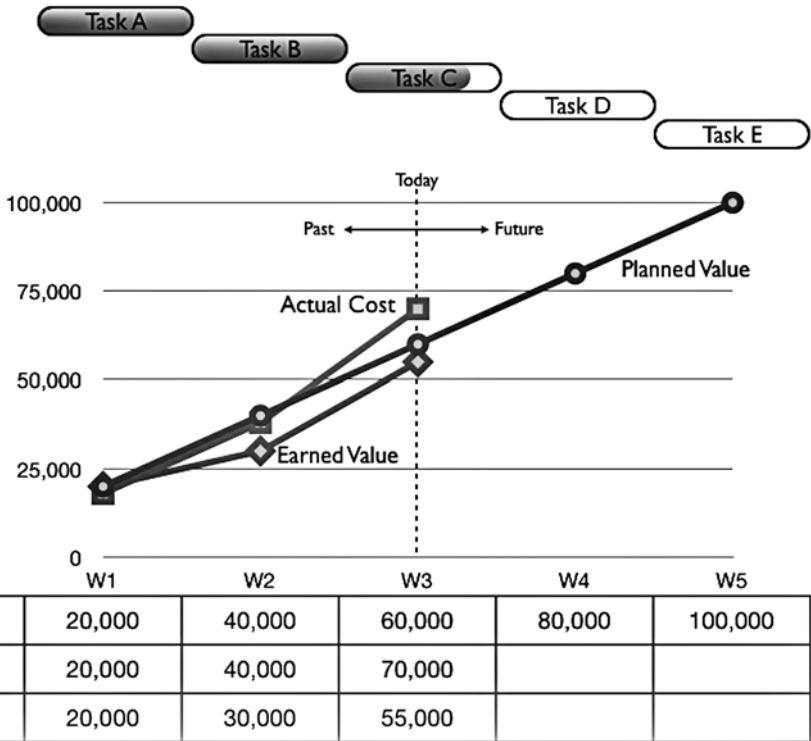


Figure 16.2 The planned value, actual cost and earned value at week 3

It shows that the actual costs are in line with the PV curve for the first two weeks, but exceed the PV curve at the current time (week 3). Note that the PV curve is known for all five weeks of the project life-cycle, as a result of the baseline schedule. Obviously, the actual costs are only known up to today, which is assumed to be week 3.

Earned Value: The Earned Value (EV) represents the amount budgeted for performing the work that was accomplished at a given point AT in time. It is often called the budgeted cost of work performed (BCWP) and equals the total activity (or project) BAC multiplied by the percentage activity (or project) completion (PC) at the particular point in time (= PC * BAC). It is assumed that 55% of the work has been finished by the end of week 3 (this is the estimate of the project manager in collaboration with his/her team). The total EV = 0.55 * BAC = €55,000.

PERFORMANCE MEASUREMENTS

The key parameters of the previous section can be used to measure the current and past performance of the project in progress. In the example, the values for the three key parameters are as follows. Since

- the EV curve measures how much value has been earned at the current time (W3) given the work that has been done up to now, which is equal to €55,000;

- the PV curve measures how much value should have been earned according to the baseline schedule at W3, and is equal to €60,000;
- the AC curve measures the actual cost incurred up to the current time (W3) given the work that has been done and equals €70,000,

the following conclusions can be made:

- Since the baseline schedule (PV) stipulates that €5,000 more should have been earned than actually earned (EV) at week 3, the project is clearly late.
- Since the value of the work done up to now (AC) exceeds the value that should have been earned with that current work done as stipulated in the baseline schedule (EV), the project is clearly over budget.

These time and cost deviations (underruns and overruns) can be expressed by variances or unitless indicators, as discussed in the two following sections.

Variances: Project performance, both in terms of time and cost, is determined by comparing the three key parameters PV, AC and EV, resulting in two well-known performance variances:

SV schedule variance ($SV = EV - PV$)
 = 0: project on schedule
 < 0: project delay
 > 0: project ahead of schedule

CV cost variance ($CV = EV - AC$)
 = 0: project on budget
 < 0: budget overrun
 > 0: budget underrun

Given the two dimensions (time and cost) and their possible variances (zero, positive or negative), nine different project performance situations might occur.

Scenario 1: late project, over budget: $SV < 0$ and $CV < 0$

Scenario 2: late project, on budget: $SV < 0$ and $CV = 0$

Scenario 3: late project, under budget: $SV < 0$ and $CV > 0$

Scenario 4: on time, over budget: $SV = 0$ and $CV < 0$

Scenario 5: on time, on budget: $SV = 0$ and $CV = 0$

Scenario 6: on time, under budget: $SV = 0$ and $CV > 0$

Scenario 7: early project, over budget: $SV > 0$ and $CV < 0$

Scenario 8: early project, on budget: $SV > 0$ and $CV = 0$

Scenario 9: early project, under budget: $SV > 0$ and $CV > 0$

The five-activity project example of Figure 16.2 shows that the $SV = -€5,000$ and the $CV = -€15,000$, denoting a project being late and over budget. Figure 16.3 shows a graph for the CV (top) and SV (bottom) indicators for the example project.

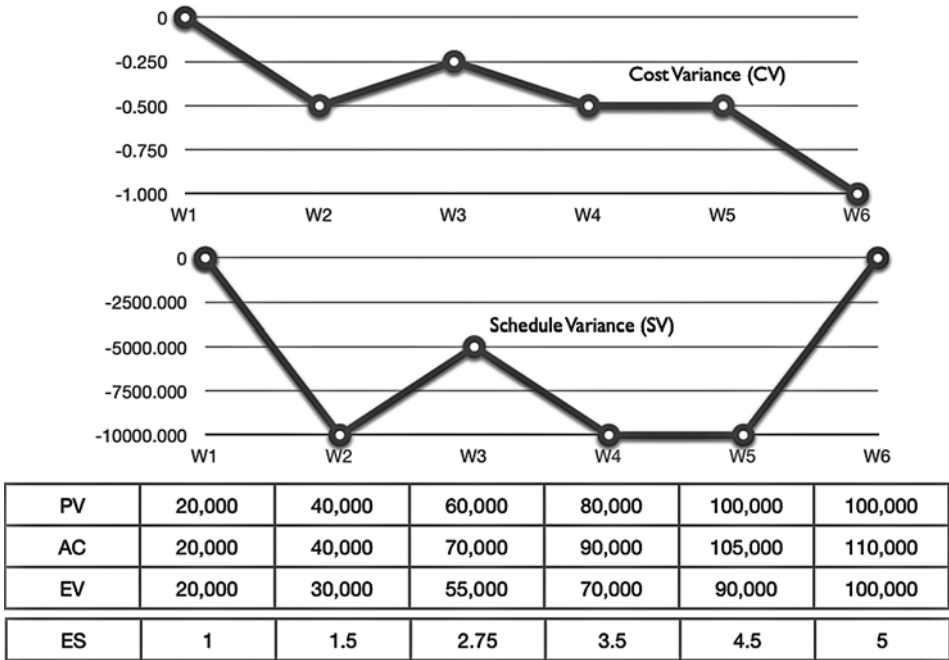


Figure 16.3 The SV and CV graph for the five-activity example project

The figure clearly shows that the SV metric ends at 0, which is an indication that the project finishes on time, although the project ends one week later than originally planned. Obviously, since PV = EV at the end of the project (always!), the SV metric will always end at zero, regardless of the real project performance. This strange behavior was one of the main reasons why a new metric, known as the earned schedule (ES) metric, has been developed as an alternative and more reliable metric to measure the time performance of a project (see below section ‘Time is money’). This unreliable effect does not occur, however, for the CV metric. The unreliability of the traditional time metrics will be further explained in the following section.

Indicators: Variances are expressed in absolute monetary terms and their values depend on the measurement unit (euro, dollar, days, weeks ...). When project performance is measured by a unitless metric, the time and cost metrics can be replaced by the schedule and cost performance indices, which express a project’s performance as a percentage of the baseline performance (which is assumed to be equal to 100%). These performance measures can be calculated as follows:

- SPI Schedule Performance Index (SPI = EV / PV)
- = 1: project on schedule
- < 1: project delay
- > 1: project ahead of schedule

CPI Cost Performance Index ($CPI = EV / AC$)
 = 1: project on budget
 < 1: budget overrun
 > 1: budget underrun

The five-activity project example of Figure 16.2 shows that the SPI = 0.92 and the CPI = 0.79, still denoting that the project is late and over budget at week 3.

Time Is Money

NEW KEY METRIC

Both the PV and the EV metrics show a (planned and earned) increase of a project in monetary terms, while EVM has been constructed to monitor both time and cost of a project. The ES is an extended version of the EV and PV metrics and can be calculated as follows:

$$\text{Find } t \text{ such that } EV \geq PV_t \text{ and } EV < PV_{t+1}$$

$$ES = t + EV - PV_t / PV_{t+1} - PV_t$$

with

ES Earned Schedule
 EV Earned Value at the actual time
 PV_t Planned Value at time instance t

The cumulative value for the ES is found by using the EV to identify in which time increment t of PV the cost value for EV occurs. ES is then equal to the cumulative time t to the beginning of that time increment, plus a fraction $EV - PV_t / PV_{t+1} - PV_t$ of it. The $EV - PV_t / PV_{t+1} - PV_t$ fraction equals the portion of EV extending into the incomplete time increment divided by the total PV for that same time period, which is simply calculated as a linear interpolation between the time-span of time increment t and $t+1$. Note that the formula description is not completely mathematically correct in case $EV = PV_t = PV_{t+1}$.

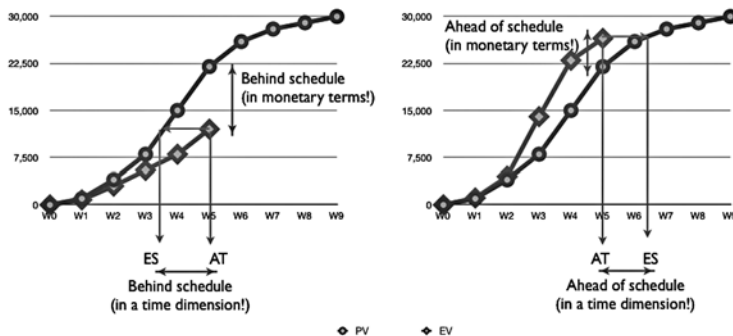


Figure 16.4 The ES metric for a late (left) and early (right) project

In this case, the ES is equal to the earliest period t for which $EV = PV_t$. Figure 16.4 illustrates the translation of the EV into the ES metric for two possible scenarios to clearly show whether a project is behind (left) or ahead of (right) schedule.

The ES metric for the five-activity example project at the current moment (week 3) is equal to $2 + (55,000 - 40,000) / (60,000 - 40,000) = 2.75$ weeks.

New variance: Since time variances (SV) are expressed in monetary units, the ES metric can be used to translate this variance to time units, using the following performance variance:

$$\begin{aligned} SV(t) & \text{ Schedule Variance with earned schedule (} SV(t) = ES - AT \text{)} \\ & = 0: \text{ project on schedule} \\ & < 0: \text{ project delay} \\ & > 0: \text{ project ahead of schedule} \end{aligned}$$

where (t) is used to make a distinction with the traditional SV time indicator.

The $SV(t)$ metric of the five-activity project is equal to $2.75 - 3 = -0.25$ weeks, clearly denoting a project which is currently behind schedule.

New indicator: Using the ES concept, an alternative to the traditional SPI indicator can be defined as follows:

$$\begin{aligned} SPI(t) & \text{ Schedule Performance Index with earned schedule (} SPI(t) = ES / AT \text{)} \\ & = 1: \text{ project on schedule} \\ & < 1: \text{ project delay} \\ & > 1: \text{ project ahead of schedule} \end{aligned}$$

The five-activity project example of Figure 16.2 shows that the $SPI(t) = 0.92$, denoting that the project is late at week 3.

Advantage of earned schedule

An advantage of the ES based performance indicator $SV(t)$ is that, unlike the SV indicator, it can be expressed in a time dimension. However, the main advantage of using the $SV(t)$ and $SPI(t)$ indicators not only lies in the time dimension of a project's performance measurement. Lipke (2003) criticized the use of the classic SV and SPI metrics since they give false and unreliable time forecasts near the end of the project, as illustrated in Figure 16.3 for the SV metric. It was for this very reason that he provided the time-based ES measure in order to overcome the strange behavior of the SV and SPI indicators. Instead, he provided time performance measures ($SV(t)$ and $SPI(t)$) that do not suffer from this unreliable effect at the finish of the project. The SPI is an unreliable indicator towards the end of the project, whereas the $SPI(t)$ is reliable from start to finish.

The reasons why the SPI is unreliable at the end of the project are similar to the reasons why the SV metric fails to provide a reliable time deviation at the project finish. The Schedule Performance Index (SPI) is equal to EV/PV . Since the EV metric is equal to $PC * BAC$ and, by definition, $PC = 100\%$ at the end of the project, the SPI is always equal to 1, regardless of the real project status (early, on time or late). Figure 16.5 shows the

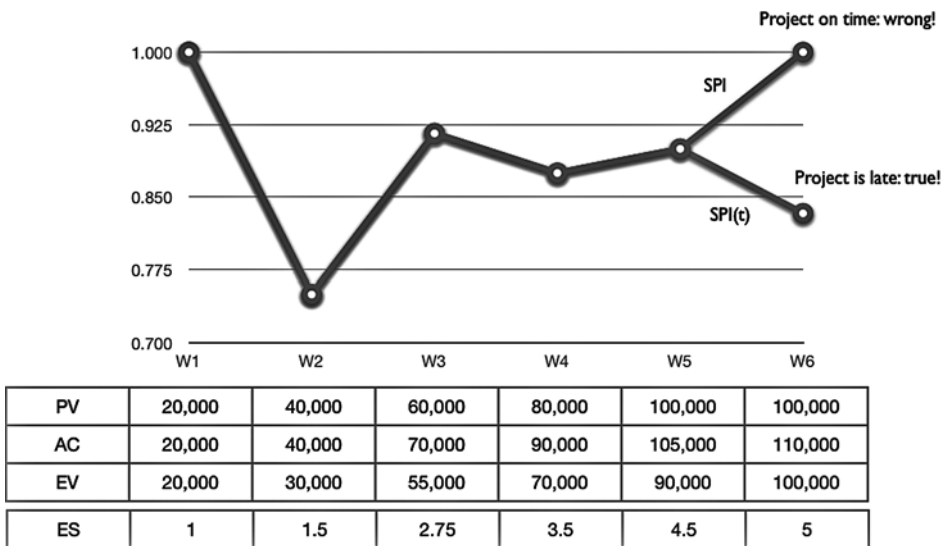


Figure 16.5 The SPI and SPI(t) graph for the five-activity example project

SPI and SPI(t) graph for the five-activity example project under the assumption that the project status is known: a one week project delay and a cost overrun of €10,000.

It illustrates the unreliability of the SPI metric for the example project and shows that $SPI = 1$, although the project is late (similar to the $SV = 0$ unreliability in Figure 16.3). The unreliability of the SV and SPI metrics at the end of a project results in an unreliable zone towards the project end where these metrics cannot be trusted. In the figure, the SPI and SPI(t) metrics have similar values except at the project end. In more realistic settings, the SPI indicator shows a clear trend towards 1, regardless whether the project is early, on time or late, which results in a certain point in time where this performance measure provides unreliable results.

The reasons why the ES based performance measures (SV(t) and SPI(t)) do not suffer from this unreliable trend towards one at the project finish are similar to the previously mentioned reasons. The ES metric is always equal to the PD at the project finish (similar to $EV = PV$ at the project end) and hence, the SPI(t) metric, calculated as ES / AT (with AT the actual time or actual duration of the project which can be bigger than, equal to or smaller than the PD at the project finish), can be different from one, reflecting the real time performance of the project from the start until its finish. Figure 16.6 shows the unreliability of the SV and SPI metrics at the end of a project on another fictitious project example with $PD = 9$ weeks and $RD = 12$ weeks.

The last review periods of the project are unreliable since both the SV and SPI metrics clearly show an improving trend. At the end of the project, both metrics give a signal that the project finishes on time ($SV = 0$ and $SPI = 1$ at the end of the project), although it is 3 weeks late. The SV(t) and SPI(t) metrics give a correct signal along the whole life of the project. The SV(t) equals -3 at the end of the project, which is a reflection of the three weeks delay.

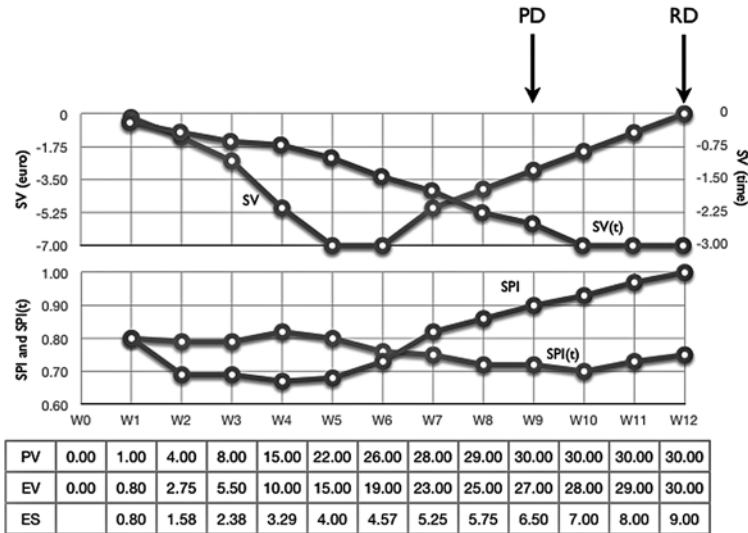


Figure 16.6 The SPI and SV versus SPI(t) and SV(t) performance measures

Forecasting

One of the primary tasks of a project manager is making decisions about the future. EVM systems are designed to follow up the performance of a project and to act as a warning signal to take corrective actions in the (near) future. Forecasting the total project cost and the time to completion is crucial to take corrective actions when problems or opportunities arise and hence, the performance measures will be mainly used as *early warning signals* to detect these project problems and/or opportunities. EVM metrics are designed to forecast these two important performance measures (time and cost) based on the actual performance up to date and the assumptions about future performance. The general formula for predicting a project's total duration is given by the Estimated Duration At Completion (EAC(t)), as follows:

$$EAC(t) = AT + PDWR$$

with

EAC(t) Estimated Duration at Completion

AT Actual Time (or Actual Duration)

PDWR Planned Duration of Work Remaining

The general and similar formula for predicting a project's final cost is given by the Estimated Cost At Completion (EAC), as follows:

$$EAC = AC + PCWR$$

with

EAC Estimated Cost at Completion

AC Actual Cost

PCWR Planned Cost of Work Remaining

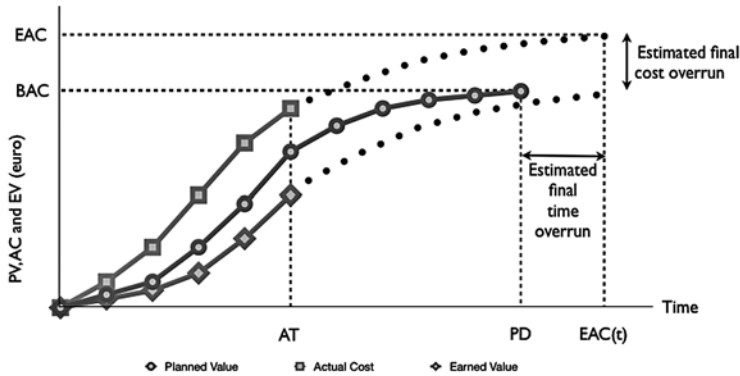


Figure 16.7 Expected cost and time performance

Note that the abbreviation EAC is used for cost forecasting and a t between brackets is added (that is, $EAC(t)$) for time forecasting. Figure 16.7 shows the general idea of the time ($EAC(t)$) and cost (EAC) forecasting methods on a fictitious project.

The time overrun $EAC(t) - PD$ is often referred to as the project slippage and the estimated final cost overrun is equal to $EAC - BAC$. Mathematical details of both forecasting methods are outside the scope of this chapter. More information and mathematical details can be found in the books of Vanhoucke (2010a), Vanhoucke (2012a) and Vanhoucke (2014) and in the papers by Vandevoorde and Vanhoucke (2006) and Vanhoucke and Vandevoorde (2007).

Dynamic Scheduling

The main (and probably only) reason why project managers should use EVM techniques is to control their project to take timely actions in case problems or opportunities arise. However, in order to control the time and cost performance of a project, a well-understood project baseline schedule and an extensive comprehension of its risk are necessary. This is known as *dynamic scheduling*, a term which is used to refer to the dynamic interplay between its three components: baseline scheduling, schedule risk and project control.

Baseline Schedule: The construction of a baseline schedule plays a central role in a dynamic scheduling environment, both for measuring the schedule risk and for project control, as illustrated in the fictitious project example of Figure 16.2.

Schedule Risk: Analyzing a project baseline schedule's risk using Schedule Risk Analysis (SRA) techniques measures the sensitivity of project activities in order to predict the expected influence of variability in activity durations/costs on the project objective.

Project Control: Measuring a project's performance using EVM metrics compares the project performance relative to the baseline schedule and generates early warning signals that serve as triggers for corrective actions. In the remainder of this article, project *tracking* will also be used as a synonym for project *control*.

The focus of this section is on the importance and crucial role of the baseline scheduling component for the two other components, and the integration of the schedule risk and

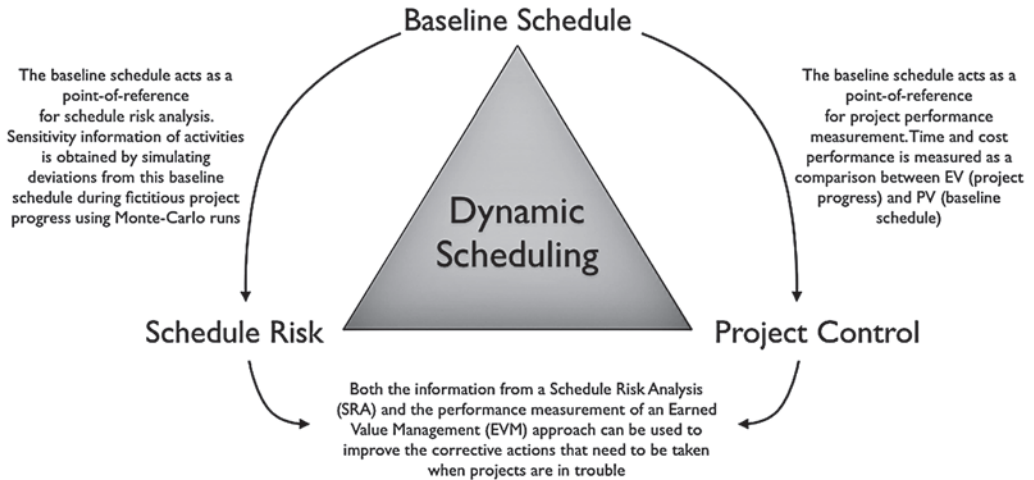


Figure 16.8 Dynamic scheduling: integrating scheduling, risk analysis and control

project control component in order to support better corrective action decision making when the project is in trouble. It aims at providing (partial) answers to the question ‘can schedule risk analysis and EV management be integrated into a project control approach to better support the decision making process of corrective actions?’, as illustrated in Figure 16.8.

Figure 16.8 shows the three building blocks of dynamic scheduling and shows the relevance of the baseline schedule as a point of reference for both schedule risk and project control.

In the next two sub-sections, the main conclusions of a large ‘dynamic scheduling’ research study are summarized, without going into too many technical details.

TOP-DOWN PROJECT TRACKING USING EVM

Project tracking using EVM should not be considered as an alternative to the well-known critical path based scheduling and tracking tools. Instead, the EVM methodology offers the project manager a tool to calculate a quick and easy sanity check on the control account level or even higher levels of the work breakdown structure (WBS). In this respect, an EVM system is set up as an early warning signal system to detect problems and/or opportunities in an easy and efficient way, which is obviously less accurate than the detailed critical path based scheduling analysis of each individual activity. However, this early warning signal, if analyzed properly, defines the need to eventually drill down into lower WBS levels. In conjunction with the project schedule, it allows taking corrective actions on those activities that are in trouble (especially those tasks which are on the critical path). This top-down tracking approach is also called a project based tracking method (Vanhoucke, 2011).

BOTTOM-UP PROJECT TRACKING USING SRA

SRA is a technique to measure the sensitivity of project activities and to predict the expected influence of variability in activity durations/costs on the project objective. An SRA study is done based on Monte-Carlo simulations that repetitively simulate project progress and compare each project run with the baseline schedule (Hulett, 1996). The detection of activity sensitivity information is crucial to steer a project manager's attention towards a subset of the project activities that have a high expected effect on the overall project performance. These highly sensitive activities are subject to intensive control, while others require less or no attention during project execution. This approach is referred to as an activity based tracking approach to denote the bottom-up control and tracking approach to take corrective actions on those activities with a highly expected effect on the overall project objective. Figure 16.9 displays an illustrative simple WBS to illustrate the project based project tracking approach of EVM (top-down) and the activity based approach of SRA (bottom-up).

Top-down project control is efficient for projects with a serial activity structure, while bottom-up project control is more efficient for parallel projects

PROJECT TRACKING EFFICIENCY

In a previous study (Vanhoucke, 2010a), I tested experimentally the efficiency of the two alternative project tracking methods shown in Figure 16.9. In that study, the efficiency of corrective actions taken on a project in trouble was measured for various projects, ranging from parallel to serial projects. Those corrective actions are triggered by information obtained by an SRA (bottom-up) or an EVM warning signal (top-down). Figure 16.10 shows an illustrative graph of this tracking efficiency for both tracking approaches, as follows:

- The x-axis shows the network topology of all study projects. The network topologies of the projects are measured by the Serial/Parallel SP indicator (Vanhoucke et al., 2008) and range from completely parallel to completely serial networks.
- The y-axis displays the efficiency of the project control phase. The lower the effort is for a project manager in controlling a project in progress and the higher the positive return is of corrective actions taken by the project manager in case the project is in danger, the higher the tracking efficiency is.

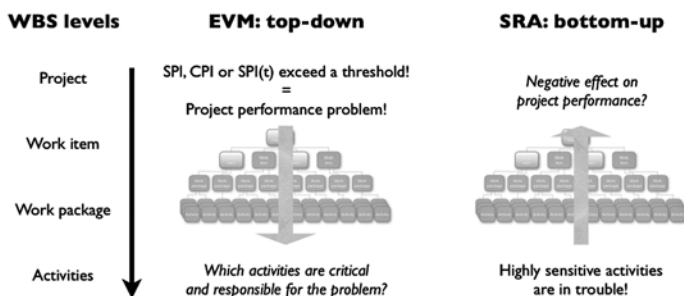


Figure 16.9 The top-down (EVM) and bottom-up (SRA) control approach

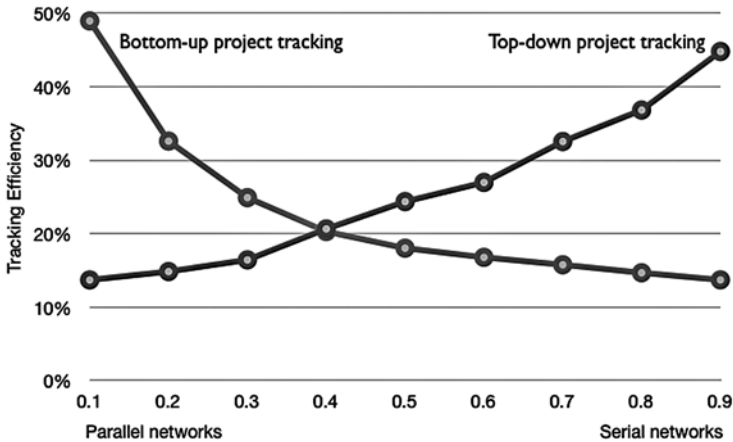


Figure 16.10 The tracking efficiency of a bottom-up and top-down control approach

The graph demonstrates that a top-down project based tracking approach using the EVM performance measures leads to a very efficient project tracking approach when the project network contains more serial activities. It should be noted that this top-down approach makes use of the SPI(t) indicator to predict the final duration, and not the SPI indicator, which is known to provide unreliable predictive performance results. The bottom-up activity based tracking approach using sensitivity information of activities obtained through a standard SRA is particularly useful when projects contain a lot of parallel activities. This bottom-up approach requires often subjective distribution information of individual activities, which implies a certain activity risk estimate, but simplifies the tracking effort to those activities with a high expected effect on the overall project objective. Mathematical details of the study that has been performed to draw these conclusions can be found in Vanhoucke (2010b, 2011). A link with empirical data can be found in Vanhoucke (2012b).

Concluding Remarks

In this chapter, the use and relevance of EVM has been discussed, with a specific focus on its ability to act as an early warning signaling system during project control to trigger corrective actions in case of project performance problems. The main conclusions of this article and the research projects that have been done to write this article can be summarized along the following lines:

1. The construction of a realistic baseline schedule using a sound methodology is a key component when using EVM during a project. Since time and cost performances are always measured relative to the baseline schedule, a realistic baseline schedule plays a central role in the accuracy of the project control phase. Moreover, an easy extension of the traditional EVM approach, known as the ES concept measures the project's time performance in a correct way from the project start until its finish.

2. It is recommended to use the EVM metrics on the project level, or at least on high WBS levels and not on the individual activity level. Since EVM is a methodology to provide an often quick sanity check of the project health on the cost control account level or even higher WBS levels, it cannot be considered as an alternative to the often time-consuming activity-based CPM. Despite this, the EVM tracking approach often offers a full alternative to the detailed project tracking of each individual activity, triggering the need to drill down to lower WBS levels if necessary to take corrective actions (see Figure 16.10).
3. Project tracking and control can be divided into two extreme approaches. A top-down project tracking approach is used to refer to performance measurement systems (EVM) that serve as triggers at high WBS levels to drill down into lower WBS levels, while a bottom-up project tracking relies on traditional activity based CPM project tracking, extended with project sensitivity information. It has been shown that EVM project tracking provides reliable results in case the project network contains many critical activities. Consequently, in these cases, there is no need for detailed activity based CPM project tracking, but instead, rough project based EVM performance measures can serve as reliable triggers to drill down into lower WBS levels (down to the activity level) to look for possible problems to take corrective actions. CPM project tracking combined with SRA provides reliable results in case the project has many parallel activities. Moreover, the sensitivity information obtained through risk analysis enables the project manager to reduce the effort of CPM project tracking to those activities with a high expected effect on the project performance. Hence, a clear focus on only sensitive activities in order to reduce the tracking effort still leads to reliable results.

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VITTAL ANANTATMULA

Resource is defined as the total means available to a company for increasing production, service or profit. Resources include people, equipment, materials, tools and licenses. In the context of projects, resource refers to anything that will cost money to obtain, and is necessary for the completion of a work such as labor, equipment, licenses, taxes and so forth. What counts as a resource? Money is not necessarily a resource; it is used as a common denomination of all resources; money represents the primary means by which resources are provided. Resource expenditure is viewed as an indirect measure of project cost, which is measured in monetary terms. However sometimes, money is often not the exchange medium internally funded project. If required resources are in abundance, managing resources will not be an issue. However, it is not the case in most situations. Typically, organizations will have more prioritized projects at hand that available resources cannot manage. Under these circumstances, project selection process is impacted by resource availability, which is not an ideal scenario. In certain cases, procurement of services or equipment and tools using contracts is an option but it does not always work favorably.

The Resource Management Process

RESOURCE CONSTRAINTS

Resource availability, specifically human resources, is a major constraint for projects. Many times we need these resources for simultaneous execution of project activities to reduce project duration and to utilize resources efficiently. Caution must be exercised to avoid overloading or assigning multiple tasks at the same time. Critical Chain method, to some extent, addresses this issue by avoiding such overload and we will discuss this later in the chapter.

Physical constraints and limitations, environmental issues, contractual terms and conditions, materials availability of required quality and quantity, technical limitations (of equipment and available technology) and, finally, budget limitations are some of the constraints we face in managing resources. Failure to understand and consider these resource constraints in project planning would prove to be costly. Furthermore, intricate relations among these resources and interactions in using them in a project often add additional layers of complexity, which could be problematic. Compounding

the complexity of the issue further is assigning these resources to multiple projects simultaneously.

In assessing resources for a project, one has to be realistic and make sure that flexibility exists in using these resources. Otherwise, projects may get delayed. The Project Manager should plan, estimate and manage all tasks and their respective resources independent of where the resources reside, administratively or physically. If a people resource item is part of an outside organization that the project manager intends to hire for an individual task, as a general rule, that task and its associated resources should not be regarded as part of the project at hand. All in-house resources required for a project should be identified and assigned. For this purpose, resource breakdown structure (RBS) is a very useful tool.

RESOURCE BREAKDOWN STRUCTURE

Similar to work breakdown structure (WBS) in which breakdown facilitates effective management of project work, in-house resources of the project should be examined through the creation of the RBS during the very early stages of the project planning. An RBS classifies and catalogues the resources needed to accomplish project objectives. The RBS has its analogue in the well-known WBS. In many ways, the RBS claims similar advantages in improving communication, integration, planning and estimating. Similar to what WBS does for the deliverable elements of a project, the RBS provides a consistent framework for dividing the resources into small units for planning, estimating and managing.

Rather than developing a new RBS for each project, the organization might choose to develop various RBSs for families of projects. In some cases, the project manager might modify and use the resource structure that was previously prepared by those charged with accounting for the overall organizational resources. Figure 17.1 shows an example of RBS.

As shown in Figure 17.1, resources can be classified on the basis of resource type. Broadly resources are classified as:

- people;
- materials and equipment;
- tools and machinery;
- fees and licenses.

Software can be classified under licenses. Figure 17.2 shows RBS required for Stack Project that serves as an example and demonstrates how to develop a good and practical RBS.

One of the principles of developing RBS is to keep dividing the resource pool until the lowest level items reflect the level of resource details that is of interest to the estimators and schedulers. For example, people can be divided on the basis of the following:

- skill;
- professional discipline;
- work functions;
- location;
- equipment, supplies, tools and material;
- size;
- function;
- technical area.

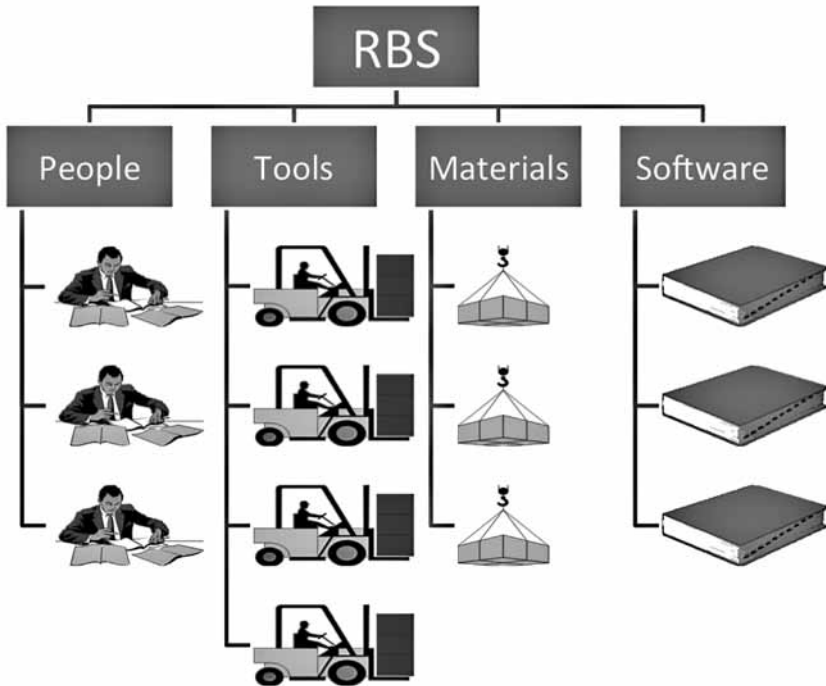


Figure 17.1 Resource breakdown structure (RBS) (adapted from Rad and Anantamula, 2010)

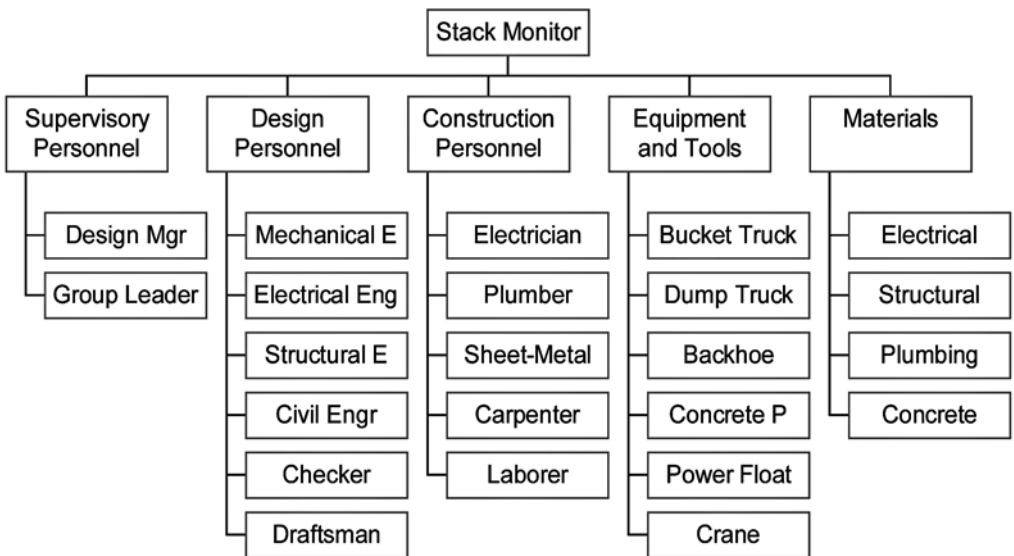


Figure 17.2 RBS for stack project (adapted from Rad and Anantamula, 2010)

For each resource, RBS contains units of measurement such foot, pound, cubic yard, equipment-hour, engineer-hour or meter, kilogram, cubic meter, equipment-hour and engineer-hour. We should not mix FPS and SI measuring units in the same RBS. Likewise, time measuring unit should be consistent; you can adopt only one measure among several time measuring units such as hour, day, week, month or year. It is preferable not to use a combination of these measuring time units. Further, cost of a single unit of the resource is reflected in a well-developed RBS such as \$200 per programmer hour, \$10,000 per equipment-hour. In other words, rate is ‘some quantity measured per unit of time’ and a worker’s cost rate could be measured in local currency. Another example of RBS with details such as cost, unit and comments is provided in Figure 17.3.

In addition to items shown in Figure 17.3, a few discrete items that get consumed entirely in a project can be measured as ‘each’ such as installed motors, doors, computers and hard disks. As shown in Figure 17.3 time-related elements are measured using hours. Likewise, length can be measured in one of the following: inches, feet, yards, centimeters, meters, kilometers; and volume can be measured in gallons, cubic yards, cubic centimeters and cubic meters. It is desirable to maintain similar consistency for all other dimensions and combinations of dimensions involved in the project. To illustrate the importance of this consistency in the measurement, one can think of the example of the Mars Climate Orbiter, which failed in September 1999 because one navigating group worked in English

Hierarchal Resource Breakdown Structure (RBS) - Updated

Resources		Unit	Rate	Comments
R-1.0 Personnel				
R-1.1 Staff		All staff fully burdened, includes overhead		
R-1.1.1	Project Manager	Hr	\$65	
R-1.1.2	Engineer	Hr	\$52	
R-1.1.3	Surveyor	Hr	\$52	Includes transit and reflectors
R-1.1.4	Scheduler	Hr	\$45	
R-1.1.5	Purchaser	Hr	\$45	
R-1.1.6	Estimator	Hr	\$45	
R-1.1.7	Draftsman	Hr	\$36	Includes lofting and shop drawings
R-1.1.8	Traceability Clerk	Hr	\$18	Also forklift operator to manage material flow
R-1.2 Craft				
R-1.2.1	Superintendent	Hr	\$55	
R-1.2.2	Welder	Hr	\$42	Includes welding unit
R-1.2.3	Pipe Mill Operator	Hr	\$42	Pipe Mill operations in burdened rates
R-1.2.4	Fitter	Hr	\$40	Includes cutting equipment
R-1.2.5	Rigger	Hr	\$38	
R-1.2.6	Painter	Hr	\$30	Performs blasting and painting
R-1.2.7	Scaffolder	Hr	\$28	
R-2.0 Equipment				
R-2.1	Crane	Hr	\$100	Includes operator in hourly rate
R-2.2	Cherry Picker	Hr	\$10	Operated by craft personnel
R-2.3	Grader	Hr	\$75	Includes operator in hourly rate
R-2.4	Generator	Hr	\$25	Power souce for welding units, lights
R-2.5	Compressor	Hr	\$25	Supports gouging, painting, pneumatic tools
R-2.6	Man-Lift	Hr	\$10	Operated by craft personnel
R-2.7	Scaffolding	Hr	\$25	Includes all materials and tools
R-2.8 Gang Boxes				
R-2.8.1	Welding	Hr	\$10	Includes all handtools and equipment
R-2.8.2	Rigging	Hr	\$10	Includes all handtools and equipment
R-2.8.3	Scaffolding	Hr	\$10	Includes all handtools and equipment
R-2.8.4	Painting	Hr	\$10	Includes all handtools and equipment
R-3.0 Materials				
R-3.1 Structural		Material costs only		
R-3.1.1	Plate	Ton	\$650	Plate rolled into various sized tubulars
R-3.1.2	Tubular-18" X .500	Ln Ft	\$60	Vertical Bracings
R-3.1.3	Tubular-18" X .375	Ln Ft	\$50	Horizontal Bracings
R-3.1.4	Tubular-6" X .375	Ln Ft	\$18	Deck Framing
R-3.1.5	Tubular-4" X .375	Ln Ft	\$12	Seafastenings
R-3.1.6	Grating	Sq Ft	\$4	Includes attachment clips
R-3.2	Anodes	Ea	\$1,200	Includes delivery to fabrication site
R-3.3	Paint	Gal	\$25	Includes all primers and topcoats
R-3.4	Handrails	Ln Ft	\$75	Includes shop fabrication labor and materials

Figure 17.3 RBS for construction project (adapted from Rad and Anantatmula, 2010)

(FPS – foot-pound-second) units and the other in metric (MKS or SI – meter-kilogram-second) units (Kerr, 1999).

RBS is a helpful tool as it applies directly to projects, and classifies and catalogues resources to provide a consistent framework for planning and estimating, and managing resources. RBS structure will greatly help in assigning the resources, and scheduling them in projects. If the internal resources need to be augmented for the purposes of the project, RBS would include project-specific resources that the manager must obtain from outside the organization. Unlike human resource or budget models, which are used for personnel and financial evaluations respectively, RBS is unique as it applies directly to project management.

As project managers plan each new project, they might select only those portions of the common RBS that apply to the project. The project RBS, and the enterprise RBS, must be kept up-to-date, current and accurate, with respect to its resource contents, and with respect to the costs of individual resources so that project managers can plan the project with greater assurance of the reliability of the resource data. Resource cost is either direct cost or total cost, that is, excluding or including the overhead. In Figure 17.3, total cost is shown for some of the resources. However, one should keep in mind that all resource costs should be listed with identical or consistent measurement units, either with or without overhead, and not a blend of the two.

RESOURCE PLANNING

Resource planning involves several important steps. It starts with the project sponsor or the senior management of the executing organization identifying the right person for the project manager position. Once the project manager is identified, the project manager will develop a list of roles and responsibilities for successful completion of the project. Many times identifying project roles and responsibilities is not given its due. It is the foremost and a critical activity that has to take place before resource planning. WBS and RBS would help in identifying roles and responsibilities of project team members in accomplishing major project activities.

The next logical step would be to document roles and responsibilities, authority, responsibility and the required competency for each role. Once these are determined, reporting relations can be established using a project organization chart and subsequently, a staff management plan can be developed. Concurrently, the project manager, in consultation with the senior management team, has to pay close attention to identifying and selecting the right people for project roles.

Once the roles and responsibilities of project team members are identified with WBS activities, it is captured as a responsibility matrix. It serves as a good staff management plan, and helps the project manager to promote teamwork and productivity.

The WBS identifies project activities yet it includes no estimates of time, resources or project costs. However, it facilitates the process of integrating project plans for time, resources and scope. Obviously, the WBS list of activities precedes schedules or time and cost estimates. For developing the WBS, we divide the total work on the basis of function/product/service/location. The WBS should be initially developed at a high level of work elements and expanded to include activities to meet detailed specifications as you incorporate additional requirements of the project. As a next step, you will develop the first two or three levels of the WBS, which essentially contain deliverables.

These higher-level work elements are broken down into smaller and smaller work packages so that you can have manageable tasks to complete at any given point in the project. The work package list is both inclusive and exhaustive; therefore, it must include:

1. All the tasks needed to complete the project;
2. Only those tasks that are required to complete the project.

Preferably, these tasks should be at level 3 or lower. Remember that a good WBS encourages a systematic planning process, reduces the possibility of omission of key project work elements and simplifies the project by dividing it into manageable units.

RESOURCE ESTIMATING

The most accurate and reliable estimate for a project can be developed when all the elements of the WBS have been identified with a reasonable degree of reliability and when the RBS has been defined with the desired degree of certainty. This estimate is referred to as the bottom-up estimate and it is derived from detailed information that is contained in the WBS and RBS at the time of the estimate. Detailed and accurate estimates require substantial definitive information about the project. Further, they require a relatively large block of time and effort for the estimating task. Therefore, one needs to strike a balance between the time spent on estimating, the accuracy of the results, and the degree of accuracy required by the stakeholders at the point in the project life. Among many methods, usually resource estimation is done using one or a combination of the following:

- Expert judgment;
- Parametric estimating;
- Analogous estimating.

Some software applications can be developed to support the resource estimation process. Expert judgment is often used when an activity is not performed previously or if it is a work element that is unknown technically. Expert judgment is also used to validate the estimate using experience and understanding of the experts. Parametric estimating involves some mathematical modeling and it is used when we do not have detailed information about the work content. In parametric estimating we use historical data as the model for estimation. Analogous models are normally used for early estimates that are called order of magnitude, conceptual or ballpark estimates. They are usually rough estimates.

RESOURCE ALLOCATION

The project manager is responsible for assigning resources to project activities. While doing so, the focus will be on scarce and critical resources. Once the network illustrating a logical flow of work elements in the project is developed, the project manager can assign (or assume) resources to each activity and develop initial task time estimates. These estimates are then aggregated across the network to calculate its critical path, and the slack times associated with each activity. Important questions to address while assigning resources are:

- What other activities must be completed before this activity can start?
- What is the earliest date this activity could start, assuming that resources are available?
- If there is a shortage of resources, for how long could this activity be delayed without affecting the project completion date?
- If there are other activities requiring the same scarce resource at the same time, which of these should be started at once and which could be delayed until the resource again becomes available? In other words, which activity has the highest priority?

The next element of project planning is to assign costs for each defined activity. To estimate cost for a work element, we need the following information:

- Resources required (people, equipment, tools, materials);
- Duration of usage (time unit);
- Cost rate for time unit.

Duration may not be relevant for materials, which are absorbed for completing the work. Number of resources for each resource multiplied by its duration and the rate will provide an estimate of that resource cost. Adding all the resource costs will give you an estimate of the activity cost. We sum up all these activity costs of the project to determine the total estimated project cost. These costs must then be managed and controlled along with the schedule throughout the project execution phase.

Effort is the product of workers and time, measured in units such as engineer-hours, manager-days or analyst-months. The number of resources that would be present during the execution of a given task will be called the resource intensity for the task. It is this intensity that will become the input to the schemas by which resource loading histograms are prepared, which in turn would flag *overloading* of resources. The resource overload is either remedied by hiring more resources for that specific time frame, or it is avoided by virtue of a schedule expansion, commonly referred to as *resource leveling*.

Units must be retained in cost and resource arithmetic to translate effort to cost with the correct cost rate per worker, for example, worker-hours multiplied by dollars per hour per worker yields dollars. If three workers are used for four days, we have used 12 worker days (Figure 17.4).

Then multiplying by the cost rate yields the cost for that effort. Calculating the cost of equipment is similar except that now the quasi-effort is measured in equipment days. These figures demonstrate schematic representation of estimating the cost of using personnel, or equipment, over their respective duration.

RESOURCE-LOADED PROJECT SCHEDULE

Estimating the cost of higher-level WBS elements, and of the project, is achieved by a simple rolling up of the costs of the lower level elements. However, estimate of the duration of the higher-level WBS elements, and of the project, is determined by adding the duration of a selected suite of elements as determined by the execution sequence of the lowest WBS elements. The logical sequence of the elements of the schedule network serves as the basis for planning, resource allocation and resource leveling and it is the foundation of the scheduling process. However, project network times are not a schedule until resources have been assigned. The implicit assumption is that resources will be

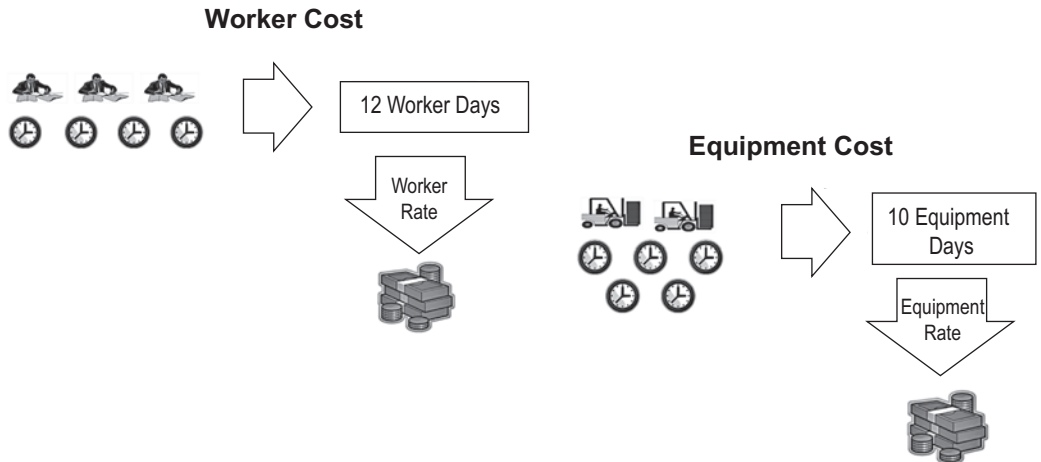


Figure 17.4 Worker cost and equipment cost (adapted from Rad and Anantatmula, 2010)

available in the required amounts when needed. Adding a new project requires making realistic judgments of resource availability and project durations. Likewise, cost estimates are not a budget until they have been time-phased.

Typically the durations are set with normal resources, and the schedule is calculated with no assumed resource limit. In reality this is clearly not the case. The Critical Path Method (CPM) by itself does not address the issue of resource availability. Resource usage is bounded by the number of resources available during the project execution time. Therefore, schedule is either time-constrained or resource-constrained. The extremes that the Project Manager may be confronted with are:

- *Time-limited projects:* The project must be finished on time with resources applied as necessary.
- *Resource-limited projects:* The project must stay within set resource limits and the schedule is allowed to drift as necessary.

It is important to note that if schedule, cost and specification (scope) are all fixed, it is unlikely that the Project Manager can succeed. Generally, at least one of these three variables must be allowed some flexibility. In most cases, project scope is not compromised. The Project Manager may also encounter system-constrained tasks that take a fixed amount of time and resource. No tradeoff of time or resource is possible with these.

In the first case of a time-limited or time-constrained project, you may apply more resources and complete the project on time or ahead of time. Also, if early completion benefits an organization's profitability compared to costs associated with outsourcing, you would prefer to outsource and complete the project ahead of time. A typical example is when the production cannot meet the market demand. It often happens in the petroleum sector in developing nations and in such cases, it is advisable to outsource and reduce the project duration.

In the second case of resource-limited or resource-constrained project, available resources are limited and time is flexible. Resource constraints could be the absence or shortage of a resource, or it could be unique. In some cases, interrelationship and interaction characteristics of resources might require a particular sequencing of project activities. People, materials or equipment are considered different kinds of resource constraints.

Taking it into consideration, the project executing organization or the project manager will determine the schedule while making optimum and effective use of available resources. In product-oriented projects, it is often the case as bottlenecks in production tools and equipment, availability of skilled technicians and projects under execution would determine the duration of a new project. In a resource-constrained project, activities are scheduled using heuristics (rules-of-thumb) that focus on:

- Minimum slack;
- Smallest (least) duration;
- Lowest activity identification number.

The parallel method is used to apply heuristics in an iterative process starting at the first time period of the project and scheduling period-by-period the start of any activities using the above three priority rules. Gray and Larson (2009) suggest that a resource-constrained schedule:

- reduces delay but reduces flexibility;
- increases criticality of events;
- increases scheduling complexity;
- may make the traditional critical path no longer meaningful;
- can break the sequence of events;
- may cause parallel activities to become sequential and critical activities with slack to become noncritical.

In both the time-constrained and resource-constrained projects, logistics associated with assigning resources to a project are similar. *Resource Loading* is the amount of resource required by a task during a specific time frame. This information can be easily displayed using tools like Microsoft® Project.

For effective planning and monitoring resources for projects, it is critical to determine the level of intensity (or how many) of each resource that is necessary by all tasks at a given point during the project. Depiction of resource usage over time is normally determined and displayed using a vertical bar chart histogram, and commonly referred to as the resource histogram. With the resource requirements available for each WBS element, and ultimately for the project and for the entire time period of the project, one can develop a resource histogram for each of the project's resources. Resource utilization and resource histograms must take the work calendar into consideration (Figure 17.5).

The resource histogram is an excellent tool for determining the resource demand for a particular scenario that involves shorter duration of some of the project activities. On the other hand, if there are resource limitations, one can conduct a leveling process on the network (Figure 17.6).

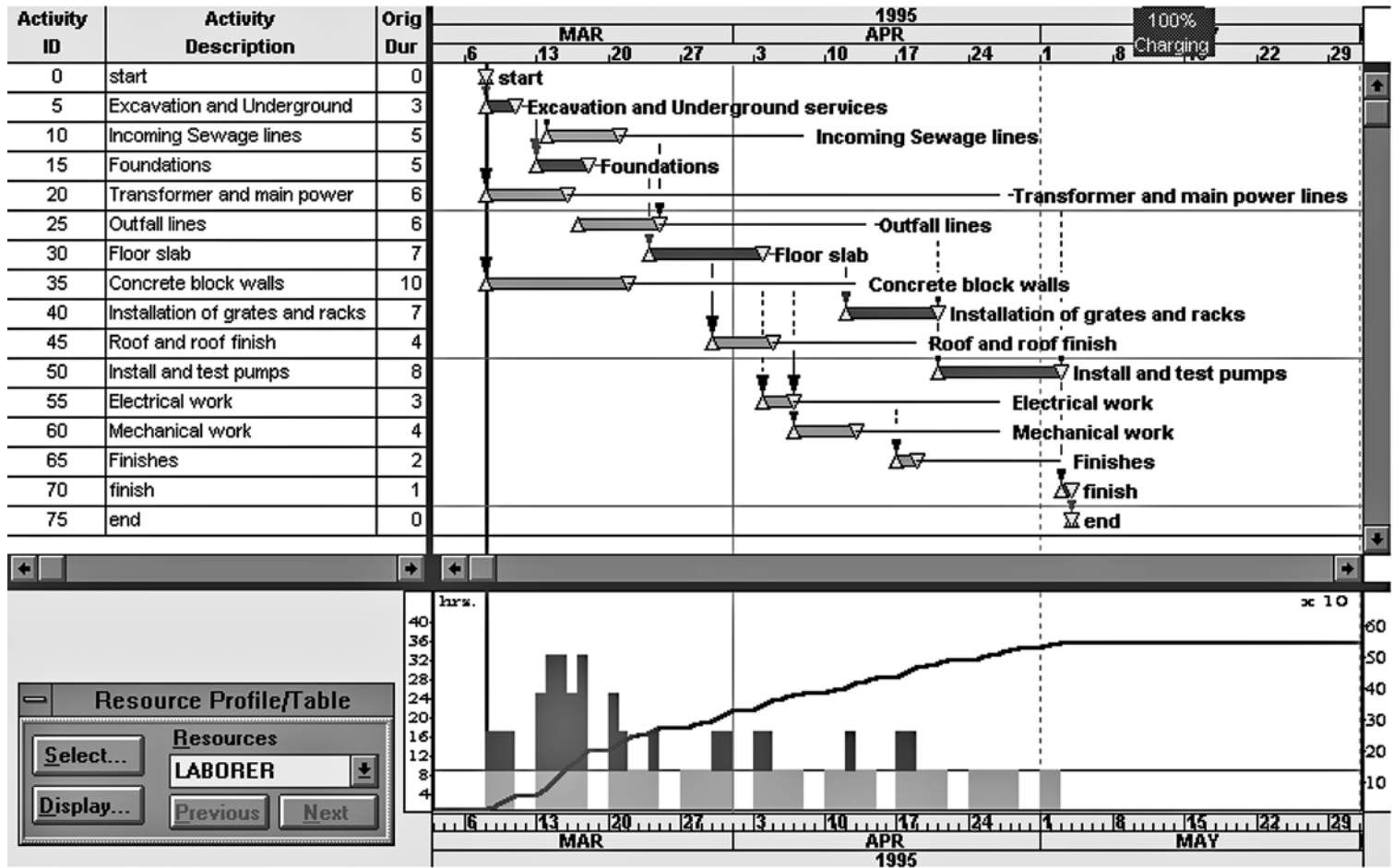


Figure 17.5 Project schedule and histogram (adapted from Rad and Anantatmula, 2010)

With Overload

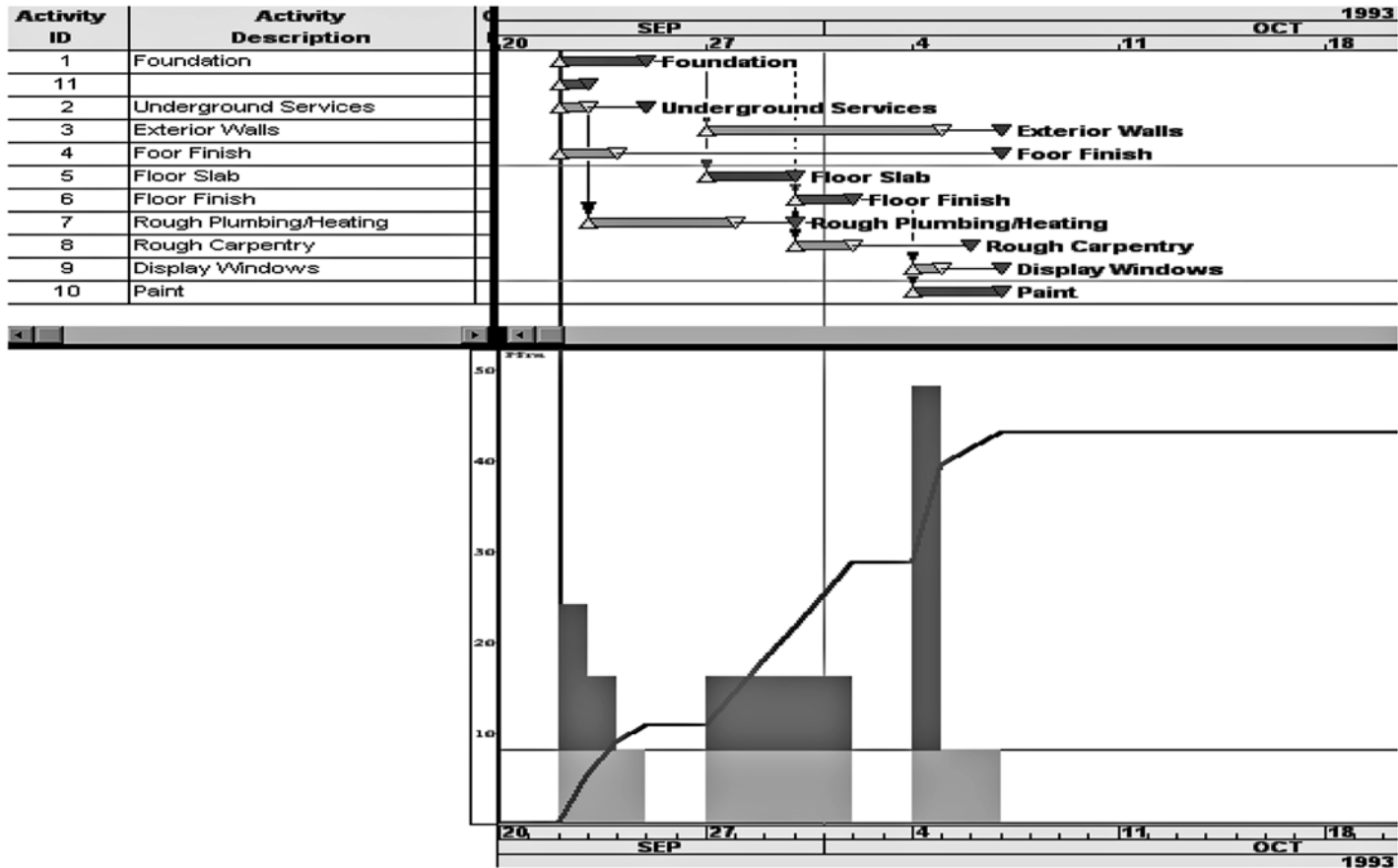


Figure 17.6 Resource histogram with overload (adapted from Rad and Anantatmula, 2010)

The leveling process refers to the process of delaying activities of the project to reduce the overall resource demand for a particular resource.

Resource leveling: Typically the first resource-loading pattern coming from a CPM schedule may encounter a few problems. Usually, either the peak load exceeds the availability of resources or the variation in load is too extreme from one time period to another time period. In many cases, both problems will occur simultaneously. Resource leveling attempts to solve these problems by shifting activities within their slack so that the project is executed without delays. There are many advantages to a level resource plan including improved employee morale and reduced administrative costs. Leveling resources manually is difficult in projects that have many tasks and it is beneficial to use tools like Microsoft® Project and Primavera.

Resource loading/leveling and uncertainty: Typical manning graphs show periods when the demand is both above and below the availability. Often management assumes that if the aggregate demand exceeds the aggregate supply then everything is okay. Two problems, however, can occur from this situation. The first is that during the under capacity times, the staff still needs something to do. If they are not adding value during those times, then that production is lost forever. The second problem occurs if the aggregate demand exceeds 85 to 90% of the supply. Research has shown that if a manufacturing process is run at more than 85% capacity, it has no resources available to deal with the inevitable disruptions in flow. Once behind, the process can never catch up.

If the project duration would need to be compressed below the optimum duration in order to comply with the client request for an early delivery date, then the resource histogram of the compressed schedule would provide an indication of the additional resources that might be necessary to effect the desired schedule compression. Alternately, if the project cannot be delayed, and if additional resources can be obtained, the histogram will help determine the amount of additional resources that must be obtained in order to meet this emerging client expectation (Figure 17.7).

Constrained resource scheduling

Heuristics and optimization models are used for scheduling in a constrained resource environment. Heuristics apply rules of thumb to determine which activities receive constrained resources first whereas an optimizing model attempts to calculate the best solution using mathematical models. Of the two, *Optimizing Methods* use mathematical programming or enumeration. These methods have limited applicability and are found to be useful for small projects and their effectiveness is not known.

Heuristic methods – The heuristic method typically starts with a schedule calculated using the CPM. Then it steps through the schedule period by period. For each period it determines if sufficient resources are available. After assuring that sufficient resources are available, it proceeds to the next period and repeats the process. Further, if insufficient resources are available, Heuristic Methods employ a priority rule to determine which activities in that time period receive the resources. Activities that do not receive resources are delayed to the next time period and the process is repeated. The most common priority rules are:

Leveled

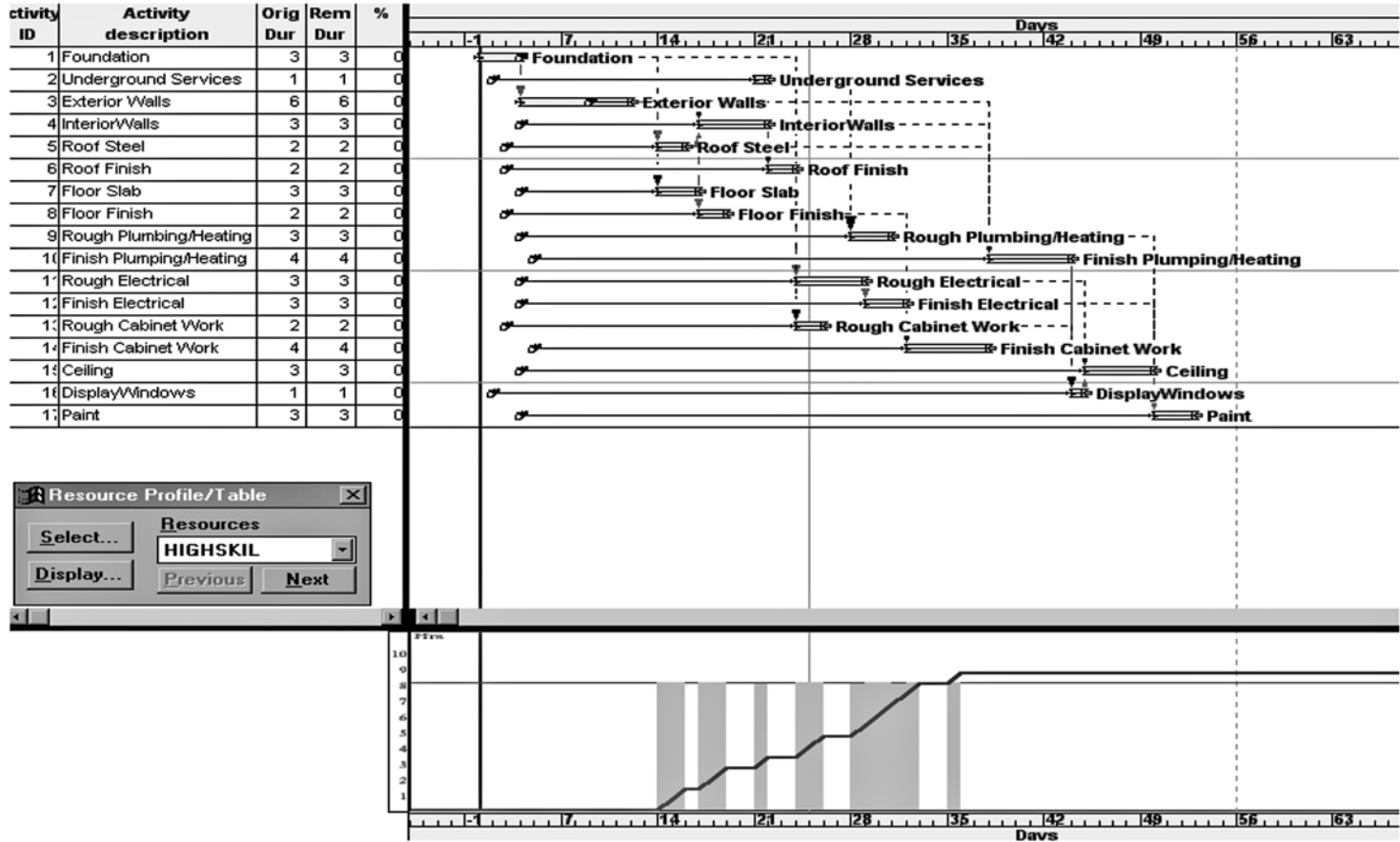


Figure 17.7 Resource histogram leveled (adapted from Rad and Anantatmula, 2010)

- *As soon as possible*: This is the general rule for scheduling tasks using CPM.
- *As late as possible*: This rule attempts to delay activities as much as possible to defer their use of resources.
- *Shortest task first*: This rule sorts the competing tasks by duration and assigns resources starting at the short end of the list. This rule causes the most activities to be completed in any given time period.
- *Most resources first*: This rule sorts the competing tasks by the amount of resource required and assigns resources starting at the highest end of the list. This favors tasks with high resource consumption under the assumption that they are more important.
- *Minimum slack first*: This rule sorts the competing tasks by the amount of slack they currently have and assigns resources starting at the low end of the list. This rule favors activities on or close to being on the critical path. Tasks that are delayed lose slack and so have a relatively higher priority in the next time period.
- *Most critical followers*: This rule sorts the competing tasks by the number (count) of critical path activities that follow each one. Resources are assigned starting at the high end of the list.
- *Most successors*: This rule sorts the competing tasks by the number (count) of successors that follows each one. Resources are assigned starting at the high end of the list.
- *Arbitrary*: Resources are assigned in some other way. This may involve a value judgment like which customer is perceived as most important.

Research has shown that, in general, the minimum slack rule works the best. Heuristics can also employ simulation techniques where a number of possibilities are tested and the best is kept.

Multi-project scheduling and resource allocation

Resource loading and leveling in a resource-constrained project would become even more complicated in the multi-project environment. Typically the problem is treated as if the multiple projects were combined into one large one. Three metrics are used to measure the effectiveness of any resource allocation solution:

- *Schedule slippage*: the amount that any project slips schedule;
- *Resource utilization*: the effectiveness of the resource leveling activities;
- *Amount of in-process inventory*: how many activities are in process at any given time, with less being better.

A good predictor of the effect of adding a new project into a resource-constrained environment is the average resource load factor. This factor measures the average resource requirement during a set period divided by resource availability. Several methods are available for dealing with multi-project resource scheduling:

- *Manufacturing process models*: Many of the heuristics are derived from shop floor scheduling techniques. Research shows that if the shop floor is loaded too close to but under capacity then cycle times explode. Some organizations have applied

this concept by deliberately limiting the number of projects they have running concurrently.

- *Mathematical programming*: Mathematical programming has been used to solve some multi-project scheduling problems. Other than for small projects, this method has not proven to be useful.
- *Heuristic techniques*: Similarly to the single project problem, multi-project scheduling can benefit from the application of heuristics. In addition to the rules described in the previous section, some additional rules have been applied to the multi-project problem. They are:
 - *Resource scheduling method*: This method compares pairs of activities and finds the one that causes the minimum increase in project duration.
 - *Minimum late finish time*: The earliest late finisher gets the resources first.
 - *Greatest resource demand*: This method favors activities or projects with the greatest resource demand.
 - *Greatest resource utilization*: This rule favors the combination of activities that gives the best utilization of resources during the period.
 - *Most possible jobs*: This rule favors the largest combination of activities that can be scheduled in any given period.

Multi-project Scheduling Heuristic method depends on the development of a network based schedule for each project. Then the networks are linked together, either through real dependencies or through artificial 'dummy' links. To allocate resources across the project, each activity is recognized to be in one of four states during any given time period:

- Ongoing;
- Stopping;
- Waiting and able to start;
- Waiting and unable to start.

Activities that are ongoing are resource users. Those that are stopping are resource contributors, while those that are waiting are resource demanders. Activities are assigned resources on the basis of the minimum slack rule. If insufficient resources are available, non-critical activities can be either slowed or stopped to free up more resources. This heuristic, like others, makes the simplifying assumption that all like resources are completely interchangeable, which may not be a safe assumption.

Critical Chain Method

Goldratt (1997) addresses the constrained resource problem based on his Theory of Constraints. Some of the problems addressed in this theory are:

- Thoughtless optimism;
- Management's desire to set capacity equal to demand in spite of evidence to the contrary coming from the shop floor;

- The student syndrome, which describes the tendency of people to put tasks off until the last minute;
- Multitasking used as a justification by management to reduce idle time;
- Complexity of networks makes no difference;
- People need a reason to work hard used as a justification by management to cut back on durations;
- Game playing wherein workers inflate estimates under the (correct) assumption that management will arbitrarily cut them.

Another significant assumption in probabilistic modeling of schedules is that early finishes and late finishes cancel each other out. However, in reality, it may not happen. In other words, late finishes always cause late starts of successor activities, but early finishes rarely lead to early starts of successors. Goldratt recommends that projects be scheduled on the basis of the availability of the key resources. He also recommends that individual activities should have such short durations to which workers cannot apply the Student Syndrome. To manage uncertainty, however, he recommends that discrete buffer time be added to the overall project duration. Finally, Goldratt recommends ordering activities into paths based on their resource dependencies as well as their predecessor/successor relationships. The longest path is the critical chain. Activities on the critical chain are given the priority for resources. Buffers are also introduced into paths that feed the critical chain to insure that delays off the critical chain never slow it down.

CPM is applicable to cases where there are limited resources and a fixed deliverable. It is also applicable where resources whose volume cannot be quickly increased. Furthermore, inflexible funding level leads to trade-offs. Critical chain is applicable to cases where there are unlimited resources and a flexible deliverable. It is also applicable where volume of resources can be increased quickly. Furthermore, funding level could be highly flexible and need for trade-offs is minimal.

Clearly, the buffer concept, and lack of emphasis on cost, are departures from the traditional project management and CPM methods. However, all other concepts, such as multitasking and student-syndrome, apply equally to both Critical Chain Project Management (CCPM) and CPM.

Past research has identified several issues with the CPM, particularly in the context of resource management. Although advances and proliferation of project management concepts have improved practices, accuracy of project scheduling continues to be adversely affected by uncertainty and variation. CCPM is considered to have success in addressing CPM shortcomings. However, organizations are still hesitant to adopt CCPM for various reasons such as economical constraints and reluctance to change. One must ensure that promoting CCPM does not lead to discrediting and abandoning CPM.

CRITICAL CHAIN CASE STUDY

Before selecting these projects, the heavy engineering division (HED) would ensure availability of completed and approved drawings, machinery, resources and material to ascertain that efficiencies were increased during project execution, and resource constraints and delays between operations (processes) were eliminated. Consequently, multitasking was minimized or eliminated. The underlying assumption of HED was being approximately right rather than precisely wrong. Variability of task duration was used to

determine the buffer size and activity duration. As long as the percentage progress of both the task and buffer use were in tandem, no corrective action was taken. While selecting the project, the modified approach on the HED shop floor was to ensure the following aspects before the project was started:

- All the detailed specifications were developed with absolute clarity.
- Detailed design and drawings were finalized.
- Full kit for each project process (operation) was available on day one of the project.
- Optimum resources were available and their uninterrupted deployment was ensured.
- Highest level of preparation was in place on day one of the project.

After making sure that the division was completely prepared for the execution, the project was allowed to start with maximum speed. Optimum resources were deployed and the highest-level performance was achieved. The focus remained on critical chain throughout to ensure that the project was executed without any interruption. By adopting this approach and practicing it for about six months, the HED workshop experienced 100 percent increase in output. It also led to efficiency gains resulting in higher job satisfaction and improved morale. The approach adopted is similar to Hopp and Spearman's (2001) suggestion that in a factory setting, a compelling argument can be made to limit the total work in process effectively.

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CHAPTER 18 *Managing Risk*

DAVID HILLSON

Projects are risky. This self-evident and axiomatic assertion is uncontroversial, as anyone who has ever been a project stakeholder or participant would agree. But the simple generic statement hides a range of complex questions that are not so easy to answer for a particular project. For example:

- How risky is this project?
- Is this project too risky?
- What are the real risks?
- Are we sure about our assessment of risk?
- What should we do about risk?

Most project-based organizations include a formal risk process as part of their project management approach, and risk management has become a recognized and accepted part of project management. Indeed, many project teams rely entirely on the risk process to address risks, assuming all they need to do is follow a series of structured steps. This is reinforced by guidance from some of the leading project management professional bodies. For example the Project Management Institute (PMI) includes a risk management chapter in its *Guide to the Project Management Body of Knowledge, PMBOK Guide* (Project Management Institute, 2013). This presents a six-step process, with each step described in terms of Inputs/Tools and Techniques/Outputs. The implication is that by following these rather mechanistic steps, risk will be properly managed on the project and all will be well.

Unfortunately this is not the case. Managing risk is about much more than following a process. Of course a structured approach is necessary but it is not sufficient. Other factors must be considered if risk management is to be fully effective. A full discussion of the complete range of these contributors to successfully managing risk in projects is beyond the scope of this chapter, but they cannot be ignored. As a result, while the bulk of this chapter addresses the details of the risk process, three other important topics also find a place:

- The necessity for accurate risk concepts;
- The role of people in managing risk;
- The link between projects and the wider organization.

We deal first in this chapter with concepts because they underlie everything else. Thinking correctly about risk then allows us to implement an effective process to deal with it properly. After describing a generic risk process we conclude the chapter with some thoughts on the people aspects and the broader context of managing risk in projects.

Risk Concepts

Before we can manage risk we first need to know what it is. Unfortunately, there are a number of significant conceptual limitations in the way that most people think about risk. Firstly, when most project managers and their team members consider risk in their project, they tend to focus only on *risk events*. In other words they are seeking to identify specific discrete things that might or might not happen in the future, but which if they did happen would have a significant effect on achievement of one or more project objectives. While risk events are undoubtedly a source of risk to the project, they are not the only source. This is recognized in the definitions of risk used by leading project management professional bodies. For example, the PMI *PMBOK Guide* says that project risk is:

an uncertain event or condition which, if it occurs, has a positive or negative effect on a project's objectives.

The *Project Risk Analysis & Management (PRAM) Guide* from the UK Association for Project Management, APM (2004), says a risk is:

an uncertain event or set of circumstances that, should it occur, will have an effect on achievement of one or more of the project's objectives.

Both of these definitions are wider than mere uncertain events, including 'uncertain conditions' (*PMBOK Guide*) and 'uncertain set of circumstances' (*PRAM Guide*). The intention behind these phrases is to include all sources of uncertainty in the definition of project risk, not just uncertain events. Unfortunately this refinement seems to be lost on most project teams, whose risk registers only contain uncertain events. Other sources of uncertainty also pose a risk to achievement of project objectives, including ambiguity, variability, complexity and change. These should all be encompassed within the project risk management approach (Chapman and Ward, 2002).

Other definitions of risk have been developed to recognize this wider scope of risk as including any type of uncertainty. One approach is to see risk as 'uncertainty that matters' (Hillson, 2009), allowing any source of uncertainty to be considered as long as it has the potential to have a significant consequence on achievement of objectives. A similar definition has been adopted by the international risk management standard ISO31000:2009 where risk is 'effect of uncertainty on objectives'.

Another important characteristic of risk arises from current definitions of risk by international and project management standards, namely that not all risk is bad. Uncertainties will also matter if their occurrence would lead to a positive impact on achievement of objectives, by saving time or money, enhancing performance or productivity, improving competitive advantage or reputation (Hillson, 2004; Chapman

and Ward, 2011). The ISO31000:2009 standard includes a footnote to its definition of risk, saying that

an effect is a deviation from the expected – positive and/or negative.

The PMI *PMBOK Guide* risk definition quoted above explicitly includes the words ‘positive or negative’, and the APM *PRAM Guide* also makes it clear that the concept of risk includes both opportunities (upside risks) and threats (downside risks).

So managing risk in projects is not just concerned with uncertain events, but should consider *all sources of uncertainty*. And the risk process should actively address *both threats and opportunities* in an equitable and integrated manner. Unfortunately the risk process as typically implemented in project-based organizations does not take this wider view.

There is another important conceptual limitation commonly found among organizations seeking to manage risk in projects. This is highlighted when one attempts to answer the question ‘How risky is this project?’ An exclusively event-based approach to risk makes it hard to answer this question. The event focus leads to production of a risk register that lists a series of uncertain future events, prioritized in some way for attention and action, with responses and owners allocated to each risk (Association for Project Management, 2008). But it is very difficult to see how a list of risk events can provide an adequate answer to the ‘How risky?’ question. Some other metric is needed, which in turn requires us to use a different concept of risk.

This has been addressed, at least in part, by some of the guidance produced by project management professional bodies. For example the second edition of the APM *PRAM Guide* (Association for Project Management, 2004) uses two distinct definitions of risk in projects. The first is the familiar *risk event*, whose definition we have seen above. However this is complemented by a second concept of *project risk*, which is ‘the exposure of stakeholders to the consequences of variations in outcome’. The PMI *Practice Standard for Project Risk Management* (Project Management Institute, 2009) similarly defines *individual risk* as above, but also includes a definition of *overall project risk* as ‘the effect of uncertainty on the project as a whole’.

This dual concept of risk is important and useful when considering how to manage risk in projects. At one level the project manager is responsible for identifying, assessing and managing *individual risks*. At another higher level the project manager is also required to account to the project sponsor, the project owner and other stakeholders for the *overall risk of the project*. These two levels might be distinguished as *the risks in the project* and *the risk of the project*. Consequently, managing project risk requires action at both of these levels. The typical project risk process only addresses the lower level of individual risks within the project, which are recorded in the risk register. It is far less common to consider the overall risk exposure of the project as a whole, or to have any structured approach to managing risk at that higher level. Clearly this represents a gap in the way risk management is implemented for the majority of projects, and this may contribute to the view that risk management is merely a technical discipline that belongs within the confines of the internal project management process.

Recently some work has been done to fill this gap, considering how overall project risk can be identified, assessed and managed. While the thinking is less mature or well developed in this area than for traditional project risk management of individual risks, the outlines of an approach are becoming clear. The first place to address overall project risk

is during the pre-project or concept phase, when the scope and objectives of the project are being clarified and agreed. Here the project sponsor or owner is required to define the benefits that the project is expected to deliver, together with the degree of risk that can be tolerated within the overall project. Each decision about the risk-reward balance involves an assessment of overall project risk, representing the inherent risk associated with a particular project scope and its expected benefits. At this level, overall project risk is managed implicitly through the decisions made on the scope, structure, content and context of the project. Once these decisions have been made and the project is initiated, then the traditional project risk process can be used to address explicitly the individual risks that lie within the project. At key points within the project it will be necessary to revisit the assessment of overall project risk to ensure that the defined risk thresholds have not been breached, before returning to the ongoing task of managing individual risks within the project. Figure 18.1 illustrates this distinction and relationship between implicit/explicit risk management at the two levels.

This section has illustrated the importance of being clear about what risk management is for. Risk management manages risk. But for most project-based organizations and their teams, the concept of risk is limited to individual uncertain future events that might or might not occur, and which if they did happen would have an adverse effect on achievement of the project's objectives. We have seen that this conceptual limitation needs to be expanded in three important ways:

1. *Risk arises from all sources of uncertainty*, not just from uncertain events, and the risk process must address any 'uncertainty that matters'.
2. *Risk includes both opportunity and threat*, with upside and downside impacts, and since both matter then both need to be managed proactively.
3. *Risk exists at the overall project level*, which is different from individual risks within the project, and needs to be managed differently.

As Figure 18.1 illustrates, the typical project risk management process is focused explicitly on individual project risks, although it can be used to address non-event risks as

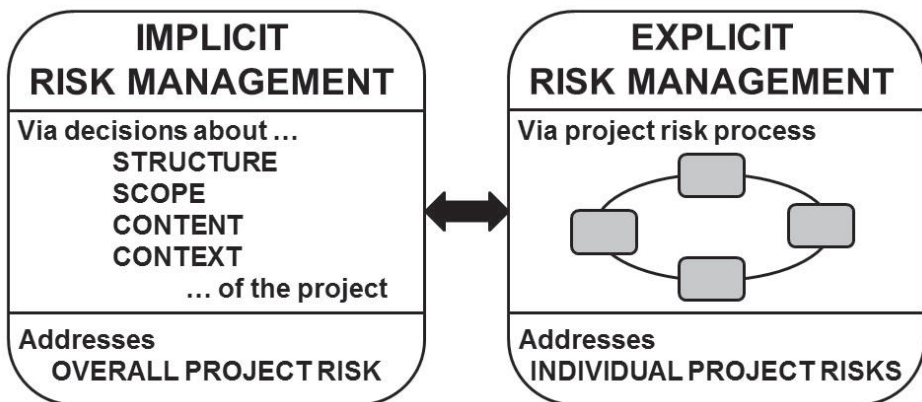


Figure 18.1 Implicit and explicit risk management

well as risk events, and it can also handle both threats and opportunities in an integrated fashion. The standard risk process does not however deal well with overall project risk, which is implicitly managed through strategic decisions about the project's structure, scope, content and context.

Having clarified the conceptual basis of risk, we can now proceed to describe the risk management process that is used to manage individual risks within a project.

Introducing the Risk Process

Any project manager is likely to ask themselves a series of simple questions as they seek to bring their project to a successful conclusion, namely:

1. What are we trying to achieve?
2. What could affect us achieving this?
3. Which of those things are most important?
4. What shall we do about them?
5. Did we do what we said we would do?
6. Who needs to know?
7. What has changed and what should we do now?
8. What did we learn?

These eight questions translate into the basis of an intuitive risk management process, with the following steps:

1. *Getting started:* We have seen that risks within projects only exist in relation to defined project objectives. This means we cannot start the risk process without first clearly defining its scope, in other words clarifying which objectives are at risk. It is also important to know how much risk key stakeholders are prepared to accept in the project, since this provides the target threshold for risk exposure on the project. These factors must be addressed in the first step of any risk process, to ensure that scope and objectives are well defined and understood.
2. *Finding risks:* Once the scope and objectives are agreed, it is possible for us to start identifying risks, which are those uncertainties with the potential to affect achievement of one or more of our objectives (addressing all sources of uncertainty and including both threats and opportunities). We could use a variety of risk identification techniques, each of which has strengths and weaknesses, so it would be wise to use more than one to ensure that as many risks as possible are identified. The aim is to expose and document all currently knowable risks, recognizing that some risks will be inherently unknowable and others will emerge later in the project. This is why the risk process needs to be iterative, coming back later to find risks which were not evident earlier on. In addition to considering individual risks within the project, risk identification should also address the overall risk exposure of the project.
3. *Setting priorities:* Of course not all the risks we identify are equally important, so we need to filter and prioritize them, to find the worst threats and the best opportunities. This will inform how we respond to risks. When prioritizing risks, we could use

various characteristics, such as how likely they are to happen, what they might do to project objectives, how easily we can influence them, when they might happen and so on. We should also consider the degree of overall project risk exposure, for example by categorizing risks to find out whether there are any significant hot-spots, or by using simulation models to analyze the combined effect of risks on the final project outcome.

4. *Deciding what to do:* Once we have prioritized individual risks and understood the degree of overall project risk exposure, we can think about what actions are appropriate to deal with individual threats and opportunities, as well as consider how to tackle overall project risk. We might consider radical action such as cancelling the project, or decide to do nothing, or attempt to influence the level of risk exposure. We should also look for someone who can make a difference and involve them in responding to the risks.
5. *Taking action:* Of course we can make great plans to address the risks in our project, but nothing will change unless we actually do something. Planned responses must be implemented in order to tackle individual risks and change the overall risk exposure of the project, and the results of these responses should be monitored to ensure that they are having the desired effect. Our actions may also introduce new risks for us to address.
6. *Telling others:* After completing these various steps, we are in a position where we know what the risks are and how they would affect the project, and we understand which ones are particularly significant. We have also developed and implemented targeted responses to tackle our risk exposure, with the help of others. It is important to tell people with an interest in the project about the risks we have found and our plans to address them.
7. *Keeping up to date:* We have clarified our objectives and found the risks that could affect them, then prioritized the important ones and developed suitable actions – so have we finished? Actually no, because risk poses a dynamic and changing challenge to our project. As a result we know that we have to come back and look again at risk on a regular basis, to see whether our planned actions have worked as expected, and to discover new and changed risks that now require our attention.
8. *Capturing lessons:* When the project ends, should we heave a sigh of relief and move quickly on to the next challenge? As responsible professionals we will wish to take advantage of our experience on this project to benefit future projects. This means we will spend time thinking about what worked well and what needs improvement, and recording our conclusions in a way that can be reused by ourselves and others.

These eight steps correspond to various versions of the risk process as described by risk management standards and guidelines, although different terminology is used.

Table 18.1 maps the steps into their more common process names, and Figure 18.2 presents these as an iterative process which can be repeated throughout the life of the project.

Table 18.2 maps the generic risk process steps to some of the most widely-used risk standards, indicating the degree of commonality.

Table 18.1 Informal and formal risk process steps

Informal step	Formal process	Purpose
1. Getting started <i>[What are we trying to achieve?]</i>	Risk process initiation	To define the scope, objectives and practical parameters of the project risk management process
2. Finding risks <i>[What could affect us achieving this?]</i>	Risk identification	To identify all currently knowable risks, including both individual risks and sources of overall project risk
3. Setting priorities <i>[Which of those things are most important?]</i>	Qualitative Risk Assessment	To evaluate key characteristics of individual risks enabling them to be prioritized for further action, and recognizing patterns of risk exposure
	Quantitative Risk Analysis	To evaluate the combined effect of risks on the project outcome and assess overall project risk exposure
4. Deciding what to do <i>[What shall we do about them?]</i>	Risk Response Planning	To determine appropriate response strategies and actions for each individual risk and for overall project risk
5. Taking action <i>[Did we do what we said we would do?]</i>	Risk Response Implementation	To implement agreed actions, determine whether they are working and identify any resultant secondary risks
6. Telling others <i>[Who needs to know?]</i>	Risk communication	To inform project stakeholders about the current level of risk exposure and its implications for project success, including both individual risks and overall project risk, as appropriate
7. Keeping up to date <i>[What has changed and what should we do now?]</i>	Risk Review	To review changes in identified risks and overall project risk exposure, identify additional actions as required and assess the effectiveness of the project risk management process
8. Capturing lessons <i>[What did we learn?]</i>	Post-Project Review	To identify risk-related lessons to be learned for future projects

Two interesting points arise from the comparison of risk standards and guidelines (Table 18.2). The first is the absence of an explicit or distinct step in most standards for implementation of agreed risk responses. With the notable exception of the UK-based standards (the *APM PRAM Guide*, and *Management of Risk (M_o_R)* from the Office of Government Commerce, 2010), the vital step of actually doing something is either omitted or covered within another step. It is likely that this has contributed to a common shortcoming in risk management as performed in a significant number of organizations, whereby risk exposure is analyzed to a greater or lesser extent and documented in risk registers and risk reports, but the analysis is not turned into action. Consequently the process of risk management fails to actually manage risk. For those risk standards in Table 18.2 where risk response implementation is not explicitly included in the risk process,

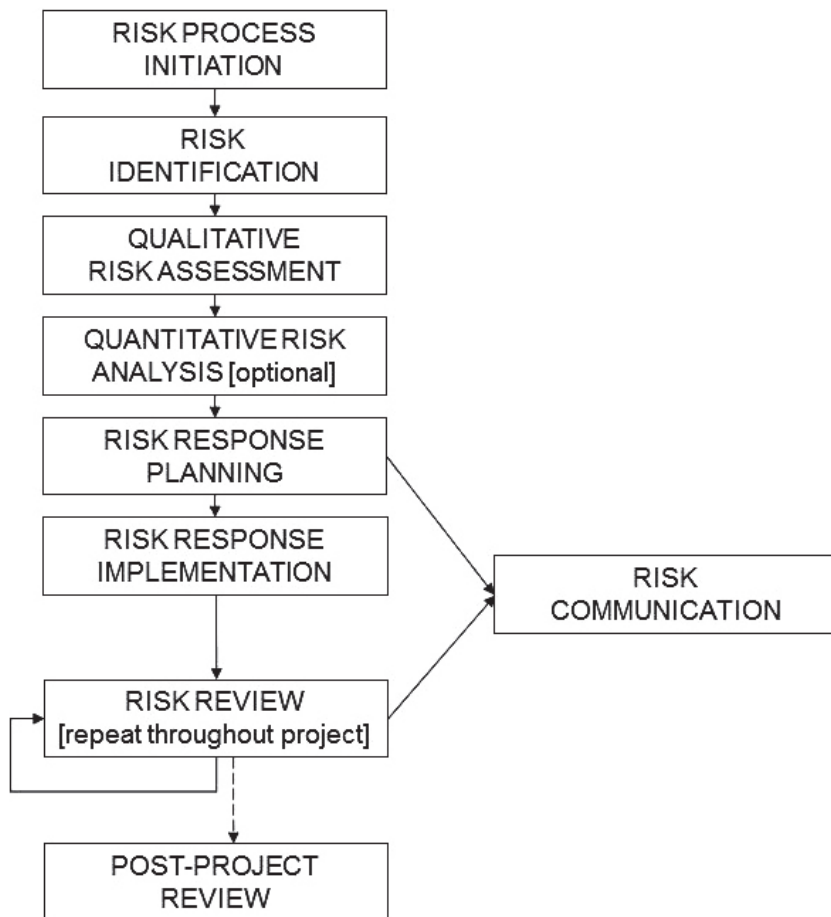


Figure 18.2 A typical risk management process

there is an assumption that having defined and agreed actions, these will naturally be performed, perhaps controlled under the general project management process. Experience indicates that the analysis-to-action link is often not made, and inclusion of a formal risk response implementation step is therefore wise. Our generic risk process described in this chapter does not make the mistake of assuming action.

The second notable observation from Table 18.2 is the lack of a final step at the closure of the project to learn risk-related lessons for the benefit of future projects and the wider organization. Among the international risk standards listed, only the international standard ISO31000:2009 includes any mention of the need to capture lessons, and even this is only incorporated as a small part of a wider 'Monitoring and Review' step. Organizations that fail to conduct post-project reviews deny themselves the benefit of experience, and are increasing the chances of repeating the same mistakes in the future. There are risk-related lessons to be learned from every project, and ideally these should be captured during a routine post-project review exercise. Where such a wider step is missing from the project process, it should at least be included in the risk process, as in the generic risk process described in this chapter.

Table 18.2 Mapping generic risk process to risk standards

Informal process step	Formal process step	APM Project Risk Analysis & Mgmt (PRAM) Guide (2004)	PMI PMBOK guide Chapter 11 Project Risk Mgmt (2013)	ISO31000: 2009 Risk Mgmt Principles and Guidelines (2009)	OGC Mgmt of Risk (M_o_R) (2010)	IRM/AIRMIC/ALARM Risk Mgmt Standard (2002)
Getting started	Risk process initiation	Initiate	Plan risk management	Establishing the context	Identify context	[Organization strategic objectives]
Finding risks	Risk identification	Identify	Identify risks	Risk identification	Identify risks	Risk identification Risk description
Setting priorities	Qualitative risk assessment Quantitative risk analysis	Assess	Perform qualitative risk analysis Perform quantitative risk analysis	Risk analysis Risk evaluation	Assess – estimate Assess – evaluate	Risk estimation Risk evaluation
Deciding what to do	Risk response planning	Plan responses	Plan risk responses	Risk treatment	Plan	Risk treatment
Taking action	Risk response implementation	Implement responses	–		Implement	
Telling others	Risk communication	–	Monitor and control risks	Communication and consultation	Communicate	Risk reporting
Keeping up to date	Risk review	Manage process		Monitoring and review	Embed and review	Monitoring and review
Capturing lessons	Post-project review	–	–		–	–

Describing the Risk Process

Having developed from first principles a generic process for managing risk on projects, we can now describe what is entailed in each step. The description that follows is necessarily high level and does not present all of the possible tools and techniques in exhaustive detail. Such information is available from a wide variety of risk management textbooks and is outside the scope of this chapter (see for example Cooper et al., 2014; Chapman and Ward, 2011; Hillson and Simon, 2012). Instead we present the key techniques involved at each step with sufficient detail to ensure that their purpose is understood.

THE RISK PROCESS

Risk Process Initiation

Since risk is defined in terms of objectives, the essential first step of the risk process is to define those objectives which are at risk. This gives us the scope of the risk process, and is the main purpose of the Risk Process Initiation step. It is also important to recognize that risk management is not 'one-size-fits-all'. Since every project has a different level of risk exposure, it is necessary to scale the risk process to meet the risk challenge of each particular project. Projects which are highly risky or strategically important will require a more robust approach to risk management than those which are more simple or routine. The depth and complexity of the risk process which is to be applied to the particular project at hand needs to be decided during the Risk Process Initiation step.

This step also involves a number of other important decisions which must be made before we can start the risk management process. The first of these is to set thresholds for how much risk is acceptable on this particular project, stated against each of the key project objectives, and based on the risk tolerances of key stakeholders. Agreed risk thresholds can then be transformed into definitions of the scales to be used for qualitative assessment of probability and impact on the project, related to specific project objectives. Table 18.3 gives an example of such definitions.

Table 18.3 Example definitions of probability and impacts to reflect risk thresholds

Scale	Probability	+/- Impact on project objectives		
		Time	Cost	Performance
VHI	>50%	>6 months	>\$1,000K	Very significant impact on overall functionality
HI	26–50%	3–6 months	\$501K–1,000K	Significant impact on overall functionality
MED	11–25%	1–3 months	\$101K–500K	Some impact in key functional areas
LO	6–10%	1–4 weeks	\$10K–100K	Minor impact on overall functionality
VLO	1–5%	<1 week	<\$10K	Minor impact on secondary functions
NIL	<1%	No change	No change	No change in functionality

These impact scales can be used to assess both opportunities and threats, since they can be interpreted positively when assessing upside risks (for example saving time or cost) or negatively for threats (time delays, increased cost and so forth).

A final component of the Risk Process Initiation step is to define potential sources of risk to the project. This is often presented as a hierarchical Risk Breakdown Structure (RBS), perhaps drawing on an industry standard or an organizational template. An example RBS is given in Table 18.4.

Table 18.4 Example risk breakdown structure (RBS)

RBS level 0	RBS level 1	RBS level 2
0. All risks	1. Technical risk	1.1 Scope definition
		1.2 Requirements definition
		1.3 Estimates, assumptions and constraints
		1.4 Technical processes
		1.5 Technology
		1.6 Technical interfaces
		1.7 Design
		1.8 Performance
		1.9 Reliability and maintainability
		1.10 Safety
		1.11 Security
		1.12 Test and acceptance
	2. Management risk	2.1 Project management
		2.2 Program/portfolio management
		2.3 Operations management
		2.4 Organization
		2.5 Resourcing
		2.6 Communication
		2.7 Information
		2.8 Health, Safety and Environmental (HS&E)
		2.9 Quality
		2.10 Reputation
	3. Commercial risk	3.1 Contractual terms and conditions
		3.2 Internal procurement
		3.3 Suppliers and vendors
		3.4 Subcontracts
		3.5 Client/customer stability
		3.6 Partnerships and joint ventures
	4. External risk	4.1 Legislation
		4.2 Exchange rates
		4.3 Site/facilities
		4.4 Environmental/weather
		4.5 Competition
		4.6 Regulatory
		4.7 Political
		4.8 Country
		4.9 Social/demographic
		4.10 Pressure groups
		4.11 Force majeure

A number of important scoping decisions are made during this Risk Process Initiation step, and these need to be documented and communicated to the project team and other key stakeholders. The key output from this step is a clear definition of the scope of the risk process to be employed for this particular project, and this is documented in a Risk Management Plan.

Risk Identification

There are many good techniques available for risk identification, the most common of which include:

- Brainstorming in a facilitated workshop setting, perhaps structured as a SWOT analysis to identify organizational strengths/weaknesses and project opportunities/threats;
- Checklists or prompt lists to capture learning from previous risk assessments;
- Analysis of project assumptions and constraints to expose those which are most risky;
- Interviews with key project stakeholders to gain their perspective on possible risks facing the project;
- Review of completed similar projects to identify common risks and effective responses.

For each of these techniques, it is important to involve the right people with the necessary perspective and experience to identify risks facing the project. It is also helpful to use a combination of risk identification techniques rather than rely on just one approach – for example perhaps using a creative group technique such as brainstorming together with a checklist based on past similar projects. The project manager should select appropriate techniques on the basis of the risk challenge faced by the project, as defined in the Risk Management Plan. The project's RBS can be used as a framework for risk identification, to make sure that all possible sources of risk are considered, to identify gaps and to act as a prompt list. It is also a good idea to look out for immediate 'candidate' responses during the Risk Identification phase. Sometimes an appropriate response becomes clear as soon as the risk is identified, and in such cases it might be advisable to tackle the risk immediately if possible, as long as the proposed response is cost-effective and feasible.

Each identified risk should be clearly described, together with its causes and impacts. A structured risk statement can be produced using risk meta-language with the form: 'As a result of <one or more causes>, <risk> may occur, which would lead to <one or more effects on objective(s)>.'

Many of the most common risk identification techniques focus on risks within the project, but are not generally used to consider sources of overall risk to the project. These are also important and should be identified in a structured way. They include uncertainties around the scope and purpose of the project, its role in delivering benefits to the wider organization and other types of ambiguity where available information is insufficient.

Each identified risk should be allocated to a risk owner who will be responsible for ensuring that it is assessed properly and managed effectively.

Having used a variety of techniques to find risks, the Risk Identification step ends by ensuring that these are documented in the project Risk Register. The type of data held in a typical Risk Register is listed in Table 18.5.

Table 18.5 Typical risk register data

Project data	Project reference number, project title Project manager Client
Risk data	Unique risk identifier Risk type (threat or opportunity) RBS reference (source of risk) WBS reference (area affected by risk) Risk title Risk description (cause-risk-effect) Risk status Risk owner Date risk raised
Assessment data	Probability of occurrence – rating Impacts against objectives – rating and description Related risks
Response data	Preferred response strategy Actions to implement strategy Action owners Action planned start and completion dates Action status Secondary risks Trigger conditions Review date Date risk closed/deleted/expired/occurred

Qualitative Risk Assessment

Risk Identification usually produces a long list of risks, perhaps categorized in various ways. However it is not usually possible to address all risks with the same degree of intensity, due to limitations of time and resources. And not all risks deserve the same level of attention. It is therefore necessary to be able to prioritize risks for further consideration, in order to identify the worst threats and best opportunities. This is the purpose of qualitative risk assessment. The definition of risk as ‘uncertainty that matters’ indicates that risk has at least two important dimensions: uncertainty, and its potential effect on objectives. The term ‘probability’ is usually used to describe the uncertainty dimension, though other terms such as ‘frequency’ or ‘likelihood’ are also common. ‘impact’ is most often used to describe effect on objectives; alternatives are ‘consequence’ or ‘effect’. For qualitative assessment, these two dimensions are assessed using the previously agreed scales (see the earlier example in Table 18.3). This assessment is often done by the project team in a workshop setting, although it is possible for the relevant risk owner to assess their own risks. The two-dimensional assessment is used to plot each risk onto a Probability-Impact Matrix, with high/medium/low priority zones. These zones are often colored following a traffic-light convention, with red used for high-priority risks to be treated urgently, yellow designating risks of medium priority to be monitored and the green zone containing low-priority risks. It is common to use a double ‘mirror’ matrix format plotting threats and opportunities separately, and creating a central zone of focus containing the worst threats and the best opportunities, as shown in Figure 18.3.

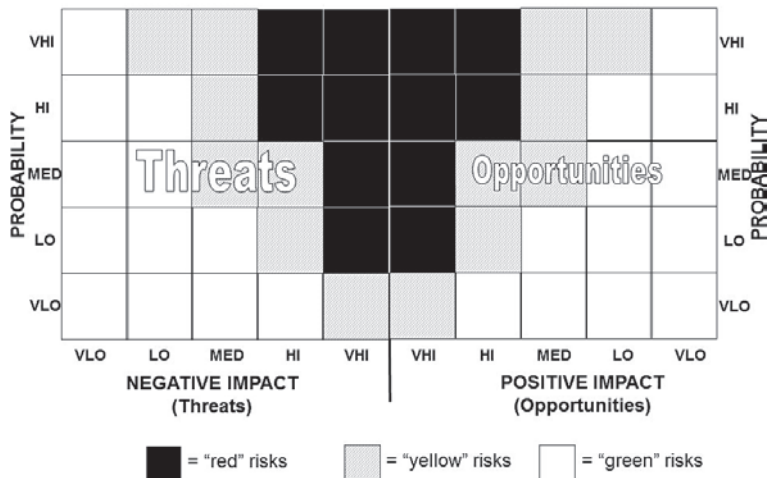


Figure 18.3 Double probability-impact matrix

Some larger projects may enhance the Probability-Impact Matrix by using a probability-impact scoring scheme as shown in Figure 18.4.

These calculated P-I Scores allow risks to be prioritized in more detail than the simple three-zone traffic-light approach.

Of course risks have other characteristics in addition to probability and impact, and these can also be assessed and used to prioritize risks for further attention. Such factors might include:

- The degree to which a risk can be managed (manageability);
- Its potential to affect the wider organization directly (propinquity);
- How soon the risk might occur (proximity);
- The time window when action might be possible (urgency).

The traditional Probability-Impact Matrix does not allow these additional factors to be used in risk prioritization, and other techniques are required if they are to be taken into account. Examples are discussed in the *Prioritising Project Risks* guide (Association for Project Management, 2008).

The results of qualitative risk assessment for each risk are documented in the Risk Register, together with any supporting information to justify or explain the basis for the assessment.

Another important output from qualitative assessment is to understand the pattern of risk on the project, and whether there are common causes of risk or hot-spots of exposure. This can be assessed by mapping risks into the RBS to determine whether any particular causes are prevalent, and by mapping risks into the work breakdown structure (WBS) to identify areas of the project that might be most affected. This mapping can be conducted simply by counting the numbers of risks in each category, or more accurately by weighting the risks in each category using their P-I Scores.

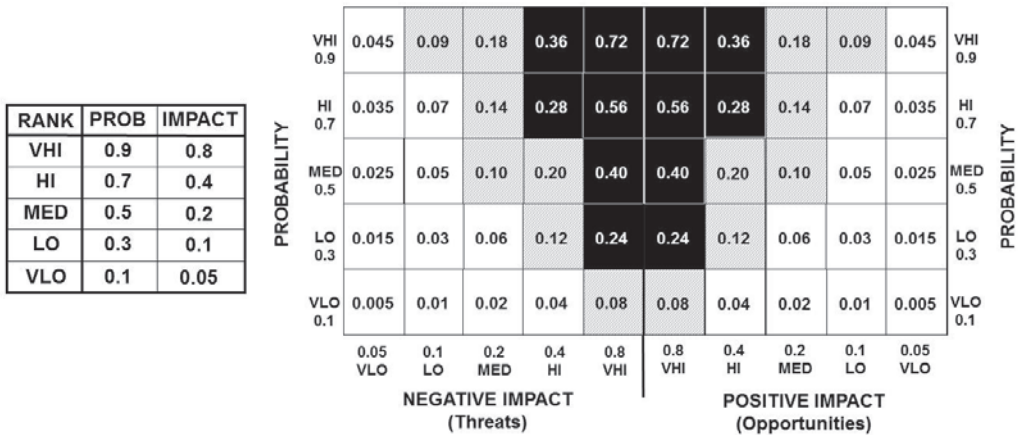


Figure 18.4 Example probability-impact scoring scheme

The techniques mentioned above are useful for prioritizing individual risks, but cannot be applied to assess the overall level of project risk exposure. This requires use of quantitative risk analysis techniques.

Quantitative Risk Analysis

Risks do not happen one at a time. Instead they interact in groups, with some risks causing others to be more likely and some risks making others impossible. Qualitative risk assessment considers risks individually, and allows development of a good understanding of each one (although grouping risks into categories can give some insights into patterns of risk exposure). It is however sometimes useful to analyze the combined effect of risks on project outcomes, particularly in terms of how they might affect overall time and cost. Indeed this is often the only way to obtain an accurate assessment of the overall risk exposure of the project. This is the purpose of the quantitative risk analysis step.

Various quantitative risk analysis techniques are available. Monte Carlo simulation is the most popular because it uses simple statistics, it often uses existing project data as its baseline, and there are many good software tools to support it. Decision trees are however often used for analyzing key strategic decisions or major option points. It is not possible here to provide detailed advice on conducting a Monte Carlo risk analysis, and information is available in other dedicated textbooks (for example Hulett, 2011). It is however important to ensure that risk models reflect the complexities of the risks facing the project. In particular, simply taking single values of duration or cost in a project plan or cost estimate and replacing them with three-point estimates is not sufficient to model risk quantitatively. Other modeling techniques should be used to reflect reality, including:

- Different input data distributions, not just the typical three-point estimate (for example the modified triangular, uniform, spike/discrete or various curves);
- Use of stochastic branches to model alternative logic (these can also be used to model key risks);

- Correlation (also called dependency) between various elements of the model, to reduce spurious random statistical variability.

The main output from a Monte Carlo simulation is the S-curve, presenting a cumulative probability distribution of the range of possible values for the parameter being analyzed (for example total project cost, overall duration, end date and so forth). An example is shown in Figure 18.5.

Various elements of useful information can be obtained from the S-curve, including:

- The likelihood of the project meeting its objectives (taken as the cumulative probability of achieving a given target value);
- The degree of overall uncertainty in the project parameter (derived from the range of possible simulation outputs);
- The predicted 'expected value' which would occur on balance if the situation remained unmanaged (taken from the mean of all possible results);
- Output values corresponding to particular confidence levels (for example the 85th percentile from the S-curve represents the value for which we can have 85% confidence of it not being exceeded).

S-curves can be produced for the overall project, or for interim milestones or specific subprojects, allowing analysis of the components of overall project risk. It is also possible to produce a series of overlaid S-curves, indicating the cumulative effect of addressing individual risks, showing the relative contribution of planned responses towards overall project risk exposure.

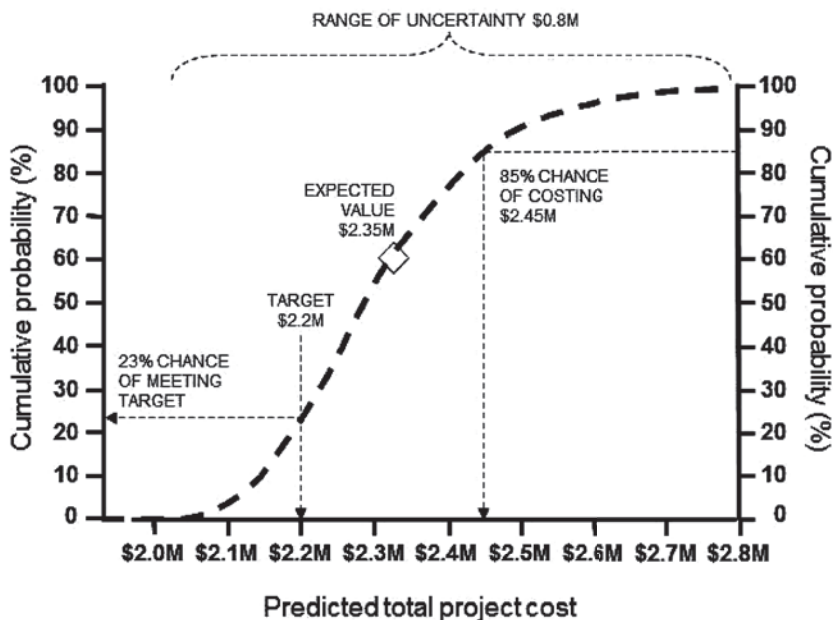


Figure 18.5 Example S-curve from Monte Carlo analysis

Risk Response Planning

Having identified and analyzed risks, it is essential that something should be done in response. It is usually the responsibility of each risk owner to decide what type of response is most appropriate, though they will often seek help and advice on this. When developing risk responses, it is important to adopt a *strategic* approach in order to focus attention on what is being attempted. Too often project teams resort to a 'scatter-gun' approach, trying a wide range of different responses to a given risk, some of which may be counterproductive. It is better first to select an appropriate strategy for a particular risk, then to design actions to implement that strategy, producing a more focused 'rifle-shot' aimed at managing the risk effectively.

Distinct risk response strategies are available for both opportunities and threats, as follows:

- *Avoid/Exploit*. For threats the aim of an avoidance strategy is to eliminate the risk to the project, making the threat impossible or irrelevant. To exploit an opportunity means to make it definitely happen, ensuring that the project gains the additional benefits.
- *Transfer/Share*. These strategies require involving another person or party in managing the risk. For threats the pain is transferred, together with the responsibility for managing the potential downside. In a similar way the potential gain from an upside risk can be shared, in return for the other party taking responsibility for managing the opportunity.
- *Reduce/Enhance*. Reduction of a threat aims to reduce its probability and/or impact, while enhancing an opportunity seeks to increase them.
- *Accept*. For residual threats and opportunities where proactive action is either not possible or not cost-effective, acceptance is the last resort, taking the risk either without special action or with contingency.

These strategy types are usually only considered as relating to individual risks within a project, but they are also applicable to address the level of overall project risk. For example:

- The *Avoid* strategy might lead to project cancellation if the overall level of risk remains unacceptable. An *Exploit* response may lead to an agreed expansion of the project scope, or the launch of a new project.
- *Transfer/Share* strategies could result in setting up a collaborative business structure in which the customer and the supplier share the risk.
- *Reduce/Enhance* strategies can be achieved at the overall project level by re-planning the project or changing its scope and boundaries.
- *Accepting* an overall level of project risk means that the project will be continued without significant change, though the organization may make contingency plans and monitor exposure against predefined trigger conditions.

There are a range of important considerations when selecting an appropriate response strategy including:

- Availability of resources to implement the chosen response (resourcing);
- The likely cost of addressing the risk compared to its possible impact (cost-effectiveness);
- The degree to which the probability and/or impact might be modified by the chosen response (risk-effectiveness);
- Whether the chosen response will introduce additional risks (secondary risks).

Selecting the appropriate response to each risk is not a trivial task and requires careful thought. The various options should be analyzed in order to pick the one most likely to achieve the desired result in a way that is appropriate, affordable and achievable. Having chosen response strategies for each individual risk, as well as identifying strategies to tackle the overall level of project risk exposure, the risk owner (perhaps with the help of the project team) should then develop specific actions to put these strategies into practice. Each action is then assigned to an action owner for implementation. The selected response strategy and associated actions are documented in the Risk Register.

Risk Response Implementation

The key to making sure that risk responses are implemented is not to allow risk responses to be seen as 'extra work', to be done only when project tasks are complete. Risk responses are genuine project tasks, because they are work which has to be done in order for the project to succeed. They should therefore be treated like any other project task. Each risk response should be fully defined, with a duration, budget, resource requirement, completion criteria and so forth. Associated actions will have been allocated to action owners who have the necessary ability and availability to complete them. A new task should then be added to the project plan for each agreed risk action, and these should be completed, reviewed and reported on like all other project tasks.

An important part of this risk response implementation step is to monitor the effect of actions after they have been taken. For example the 'risk-effectiveness' of each proposed response should have been considered during the risk response planning step, as an indication of the change in risk exposure which can be expected as a result of implementing the chosen response. Having completed the action, the risk owner and/or action owner should assess the actual result to decide whether the risk has been changed in the manner predicted. The status of actions and their results are documented in the Risk Register.

One possible side-effect of taking action to address risks is particularly important. In some cases, actions taken in response to one risk may introduce new risks that previously did not exist. Such risks are called 'secondary risks', not because they are less important, but because their existence is dependent on a prior action being completed. Some secondary risks will have been identified during the risk response planning step, but more may come to light when responses are actually implemented. These new risks should be documented and addressed during the risk process as part of the risk review step (see below).

Risk Communication

This step involves producing risk reports at various levels and for different stakeholders. It is important to communicate the results of the risk process, since the aim is to actively manage the risks, and this is likely to require action by stakeholders outside the immediate project team. Risk reports should form a basis for action, and include clear conclusions ('What we have found') and recommendations ('What should be done'). The outputs of the Risk Communication step must be targeted to the information needs of each recipient group, rather than simply issuing risk registers to everyone. So some stakeholders might require only a high-level summary of risk exposure at the overall project level, while others might need details of the individual risks that relate to a particular area of the project. In some cases a graphical 'risk dashboard' might be suitable, and at other times a written report containing detailed analysis and narrative may be necessary. Risk communication should be planned and intentional, delivering accurate risk information in a timely manner, targeted to the specific needs of each stakeholder.

Risk Review

The purpose of this step is to ensure that the responses that were implemented have achieved what was expected, and to develop new responses where necessary. It is also important to determine whether new risks have arisen on the project, and to assess the overall effectiveness of the risk management process. These aims are best achieved through a dedicated risk review meeting, though it is possible on smaller projects to review risk as part of a regular project progress meeting. The results of the risk review step are documented in an update of the Risk Register, and may also result in a new set of risk reports.

Post-Project Review

As soon as the project has been completed, it is common for the project team to be disbanded and reassigned to their next project. This should not be done however without taking time to capture the lessons which can be learned from this project and applied to benefit similar future projects. Post-project review should be a routine part of the standard project management process, but it is often omitted (see Chapter 24). Where it is conducted, then the organization should ensure that the post-project review includes consideration of risk-related aspects. In the absence of a formal review at project level, the risk process needs to include a final step to ensure that useful information is not lost. Whether it is done as part of the wider project management process or specifically focused only on risk management, the post-project review step should consider a range of important risk-related questions, including:

- What were the main risks identified on this project (both threats and opportunities)? Do any of these represent generic risks that might affect similar projects in the future?
- Which foreseeable threats actually occurred, and why? Which identified opportunities that could have been captured were missed, and why?

- Which issues or problems occurred that should have been foreseen as threats? Which unplanned benefits arose that should have been identified as opportunities?
- What preventative actions could have been taken to minimize or avoid threats? What proactive actions could have been taken to maximize or exploit opportunities?
- Which responses were effective in managing risks, and which were ineffective?
- How much effort was spent on the risk process, both to execute the process, and to implement responses?
- Can any specific benefits be attributed to the risk process, for example reduced project duration or cost, increased business benefits or client satisfaction and so forth?

Addressing these questions will ensure that the organization gains the full benefit from undertaking the project, not simply producing a set of project deliverables, but contributing to organizational learning and knowledge.

MORE THAN A PROCESS

It is a common fallacy to think that risk management is just a process. Indeed many of the risk standards and guidelines reinforce this impression, by focusing on the practical steps required to manage risk. This makes it easy to think of risk management as merely a combination of tools and techniques put together in a structured framework. This leads to the view that all the project team has to do is follow the process and risks will be managed effectively. Of course a process is important, but it is not the whole story. There are several other significant factors in addition to the process that influence how well risk is managed on projects. Two of these are addressed briefly in the following sections, namely:

- The role of people in managing risk on projects;
- The interface between project risk and the wider organization.

Risk and People

Computers, machines, techniques, tools or processes do not manage risk. Risk is managed by people making judgments, decisions and choices in the face of uncertainty as they see it (Hillson and Murray-Webster, 2012).

But different people see the same risk differently, and this influences the way they behave towards it. Some will feel driven to caution, afraid of what might go wrong. Others might react more positively, hoping to exploit the risk to their benefit. These internal responses to risk are called *risk attitudes*, and they affect every aspect of the risk process, even if people are unaware of it (Hillson and Murray-Webster, 2007; Murray-Webster and Hillson, 2008). Risk attitude can be defined as '*a chosen response to uncertainty that matters, influenced by perception*'. It exists as a continuous variable, although it is commonly referred to using only a few terms such as risk-averse (uncomfortable with uncertainty), risk-tolerant (no strong response), risk-seeking (welcoming uncertainty) and risk-neutral (taking a long-term view). These basic risk attitudes are summarized in Table 18.6.

Table 18.6 Risk attitude definitions and characteristics

Term	Definition
Risk-averse	A conservative risk attitude with a preference for secure payoffs. Risk-averse individuals and groups are practical, accepting and value common sense. They enjoy facts more than theories, and support established methods of working. They may feel uncomfortable with uncertainty, with a low tolerance for ambiguity and be tempted to seek security and resolution in the face of risk. They may also tend to over-react to threats and under-react to opportunities.
Risk-seeking	A liberal risk attitude with a preference for speculative payoffs. People who are risk-seeking are adaptable and resourceful, enjoy life and are not afraid to take action. They may underestimate threats, seeing them simply as a challenge to be overcome. They might also overestimate the importance of possible opportunities, wishing to pursue them aggressively.
Risk-tolerant	A balanced risk attitude with no strong reaction to uncertain situations. Risk-tolerant individuals and groups are reasonably comfortable with most uncertainty, accepting it as normal, and taking it in their stride with no apparent or significant influence on their behavior. They may fail to appreciate the importance of threats and opportunities, tending to be reactive rather than proactive. This may lead to more problems from impacted threats, and loss of potential benefits as a result of missed opportunities
Risk-neutral	An impartial risk attitude with a preference for future payoffs. People who are risk-neutral are neither risk-averse nor risk-seeking, but rather seek strategies and tactics that have high future payoffs. They think abstractly and creatively and envisage the possibilities. They enjoy ideas and are not afraid of change or the unknown. For both threats and opportunities they focus on the longer-term and only take action when it is likely to lead to significant benefit.

Risk attitudes are active at individual, group, corporate and national levels, and different risk attitudes can be adopted by individuals and groups in response to the same uncertainty, driven by their varying perception of the associated risk exposure. Risk attitude is important because it determines behavior towards risk (attitude leads to action). Sometimes the risk attitude initially adopted by an individual or group may not support effective management of risk or may lead to counterproductive or inappropriate behavior, for example if a product innovation team is risk-averse, or if a nuclear safety inspector is risk-seeking. In these cases action may be required to modify risk attitude.

Recent advances in the field of emotional intelligence and emotional literacy provide a means by which attitudinal change can be promoted and managed, for both individuals and organizations. This is based on recognizing that risk attitudes are a choice, and they can therefore be modified. Detailing the use of emotional literacy techniques to address risk attitude is beyond the scope of this chapter. But as with other applications of emotional literacy, these techniques can and should be applied in both individual and group settings. Project managers and risk practitioners should address these issues for themselves first as individuals, in order to ensure that they are adopting a risk attitude that is appropriate in the light of the uncertainty currently faced by the project and the decisions that need to be taken. They can then seek to assist the project team as a group towards adopting a shared risk attitude that will support the required behavior.

Depending on the circumstances of the project, this may be extended to other project stakeholders, including client and user representatives, project sponsors, project review boards and so forth.

INTERFACING PROJECT RISK WITH WIDER ORGANIZATION

Projects do not exist in isolation within an organization. Properly understood, a project is part of the delivery mechanism for the overall strategic vision of the organization (Hillson, 2010). Organizations exist to create benefits for their stakeholders, and the corporate vision or mission statement defines the scope and extent of those benefits, as well as the change that is required to create them. However vision alone does not create business benefits, and many organizations use projects as the change vehicle to deliver the capability which leads to the required benefits, often managing related projects through higher-level programs.

It is clearly important for projects to be tightly coupled to strategic objectives, so that successful completion of each project and generation of its deliverables will make a positive contribution to creating value for the organization and its stakeholders. In the same way, effective management of project risk is essential to achieving overall business benefits. In order to make this contribution, project risk management must have a clear working interface with the next level up the hierarchy, namely the program level (Hillson, 2009).

Programs exist at a higher organizational level than projects, and their purpose is to deliver strategic benefits. In effect programs sit between strategy and projects (although there may be other intermediate levels above programs). Since programs sit between

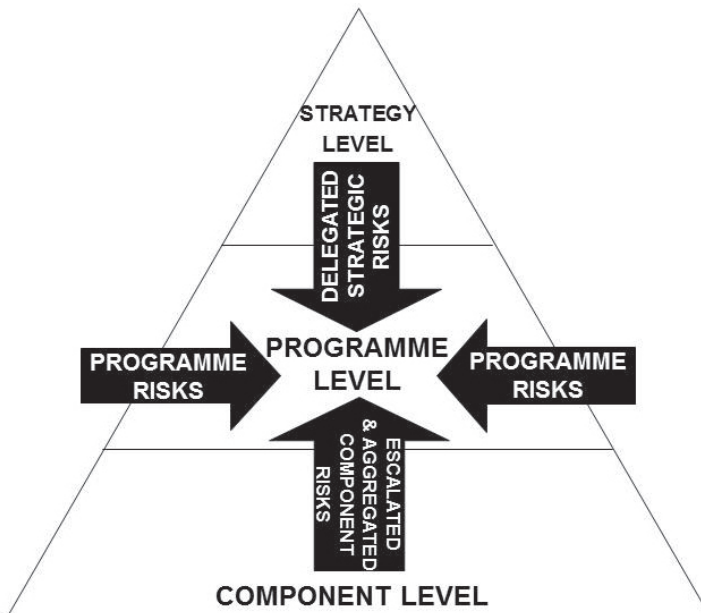


Figure 18.6 Sources of risks at program level

projects and organizational strategy, risks could arise at program level from three directions, as illustrated in Figure 18.6, namely up from the components of the program, down from organizational strategy level or sideways from the program level itself.

The scope of program risk management must include all three sources of risk.

This is where overall project risk as defined earlier in this chapter becomes relevant, since the risk of the project succeeding or failing will have an impact at program level, and must therefore be considered within the scope of program risk. Indeed management of the higher-level program forms part of the implicit risk management of overall project risk illustrated in Figure 18.1, as this is where decisions are made about the structure, scope, content and context of the project.

Concluding Remarks

This chapter provides an overview of the management of risk at project level, but it includes more than a mere description of the typical project risk management process. In order for risk management to manage risk properly, we first need a clear understanding of what it is. However most project-based organizations have significant conceptual limitations in the way they understand risk, leading to shortcomings in their approach. This largely comes from the view that project risk arises only from uncertain future events within the project that would have an adverse effect if they were to happen. The chapter therefore starts by providing a wider view of project risk, in three respects:

1. Project risk arises from all forms of uncertainty, not just uncertain events.
2. Project risk encompasses both threats and opportunities.
3. Overall project risk is different from individual project risks.

Having laid this conceptual foundation, the chapter then proceeds to outline a generic process for managing risk in projects, focusing on the main elements of the process rather than detailing individual techniques. The process is structured intuitively to answer real management questions, and addresses both individual risks and overall project risk.

Finally this chapter recognizes that risk is managed by people not processes, and that projects exist within a wider organizational context. Both of these facts need careful consideration if risk in projects is to be successfully managed. The project risk challenge requires more than simple adherence to a structured process if our projects are to avoid and minimize the threats at the same time as exploiting and maximizing opportunities. Instead we need to understand the influences of risk psychology on the way people behave towards risk, and we should also take proper account of the interface between our projects and the rest of the organization, especially at program level.

Managing risk in projects is not difficult if it is approached with a combination of structure and common sense. With forethought and care, it is possible to meet the risk challenge associated with our projects in way that optimizes project outcomes and delivers maximum benefits to the organization.

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RODNEY TURNER

In the books I have edited and written over the years, I have tried to get people to write about international projects, or write about them myself (Turner, 2009, first edition 1993; Turner, 1995). People have always said that international projects are different from those conducted in our home contexts. But when I or others have tried to write about the nature of those differences the results have been disappointing. However, with globalization, the nature of international projects has become more diverse.

Previously, I identified three types of international projects (Turner, 2009), depending on whether the client is on their home territory or overseas, and the contractor is in their home territory or overseas. (Both working in their home territory is not an international project.) That view is rather unitary in nature. The client or the contractor or both are either wholly at home or wholly overseas. The problems I identified in those cases are cultural and socio-legal, being able to work in unfamiliar contexts with different legal traditions, and dealing with a client or contractor that has different cultural traditions to you. An alternative view, based on the ideas of Evaristo and van Fenema (1999), is to consider whether the project is being undertaken on one or more sites and whether one or more companies are involved. The sites may be in one or more countries and the companies from one or more countries. That leads to four types of project, all of which can be international. Projects being undertaken on multiple sites are more diverse than what I considered above, but are quite common in the modern, globalized world, and lead to issues of communication, culture, leadership and team management.

Many communication issues arise from language (and body language). When we are having a conversation, up to 70% of the actual communication takes place by body language, including tone of voice. People who suffer from Asperger's Syndrome cannot read body language and so miss out on up to 70% of communication. Interestingly most books on body language deal only with the physical aspects of body language – hand, eye, foot movements and so forth. They don't deal with tone of voice, but that is also very significant. It is tone of voice that is missing in e-mail, so you don't know whether what somebody has said is hugely insulting or a joke. Emotions help overcome that. But I also find it helpful if you know how somebody talks, and so as you read their e-mails you can hear them talking. That is why I think that if you do have a virtual team it is worth the air-fares to fly everybody to a project start-up meeting (Chapter 22), so everybody meets at least once. The technology of video conferencing, including Skype, is such that you can pick up most of the body language. As someone who deals a lot with the Chinese one

thing I find a bit frustrating with them is they don't see any need to say, 'Roger, over and out', at the end of an e-mail exchange. I want to know that they heard what I said and that they are happy that is the end of the exchange.

I was at a meeting of the Academy of Management once where a speaker suggested you have a virtual team whenever you have a barrier that increases the cost of communication. We usually think of virtual teams being when people are working apart. Evaristo and van Fenema (1999) identified 11 degrees of distance, and physical distance was just one of them. Others included culture, language, working patterns, time zone and so forth. As somebody who lives in the south of England but works in the north of France, I find the one hour time difference very frustrating. Although Lille is closer to my home than Manchester, the one hour time difference creates a barrier. But even people working in offices next to each other can be distant if the culture of the organization does not encourage them to meet and talk: if there is no coffee machine or a habit of taking lunch together. When I worked at Henley Management College in the early 1990s there was a culture of middle and senior managers meeting in a room called the Blue Room for morning coffee. When e-mail first became popular the deputy principal refused to use it. He said he wanted people to come to talk to him face to face. The airline industry has adopted the international alphabet to avoid problems of language. There was a film made in the 1950s of some people in London who stole gold from a bank. One of the robbers also had a business where he sold souvenirs in Paris. In particular, he sold models of the Eiffel Tower. He told his co-conspirators that he had told his staff in Paris not to open any boxes with the letter R on them. So they converted the gold into models of the Eiffel Tower and shipped them out to Paris. They went out a bit later and found that the boxes had been opened and these models of the Eiffel Tower made from pure gold sold. He asked his employees why they had opened the boxes. They said that the boxes didn't have the letter A (pronounced *ah* in French), but R (pronounced *aire* in French). Of course if he had told them not to open crates with the letter *romeo* on them there would have been less risk of a problem.

With the first typology of international projects I introduce above, team issues are not so important. The team is on one site, and so standard team management issues apply. There are employee well-being issues in cases where the contractor is overseas and their employees are thus expatriates. However, with the second typology, with people working on more than one site, we meet virtual teams, and there are issues of team building and motivation. Perhaps surprisingly, there is evidence that people working virtually have higher motivation and are more productive than those working together. They are more productive because they don't waste time commuting and in idle chatter at work. But they appear to be better motivated because there is much less social loafing. In a large office it is very easy for several people to rely on others to do the work (like Wally in the Dilbert cartoons). People working virtually can set their own time and pace, but everyone can see when they fail to deliver.

However, in this edition of the book, I have dropped the section on people issues. The issues relating to people working in international projects should be dealt with in a book dealing with people issues. So instead I just focus on three issues relevant to other chapters of this book; risk, quality and offshoring.

Risk on International Projects

The issue of risk management on international projects is not so much how to manage the risks – standard methods can be applied – (Chapter 18), but the nature of those risks. In the past, when managing those risks, people tended to just extrapolate standard risk management. They apply risk management according to the PMI *PMBOK Guide* (Project Management Institute, 2013), or other standards, and then think of additional risks that arise because they are doing projects overseas. That may well work if you are doing projects in another developed country, but risks in developing countries can be of a different dimension or of a different order of magnitude. I have two PhD students researching risk management in West Africa, one is Nigerian looking specifically at Nigeria, and the other is from Senegal, but looking at several West African countries. He identified a project in Nigeria where the project manager was kidnapped when the project was 75% complete. The project stopped for three years and did not start again until the project manager was released. (I don't know why they didn't find someone else to be project manager, but perhaps nobody wanted to do it.) That completely destroyed the cash flows and although the project was completed it was never profitable. A German colleague of mine in a former life was working on a project in Nairobi. He said that English colleagues were regularly abducted, beaten up and dumped. They were never killed, but they were always on the next plane home. It never happened to him, perhaps because he was German.

John Eweje, Ralf Müller and I identified the following risks on international projects (Eweje et al, 2012):

- Project contract and procurement management;
- Relationships with the host government – the decision mechanisms of host governments are often unclear and can lead to significant complications;
- Relationships with the host community;
- Management of joint venture interfaces;
- Health, safety, security and environmental matters;
- Management of multi-site fabrication and facilities integration;
- Use of local content;
- Project governance;
- Management of the project team, individual aspirations and job satisfaction;
- Attainment of cohesion within the broad team;
- Multi-cultural leadership within the project.

The United Nations have identified eight principles of good governance of nations (Sheng, 2008). The risk associated with doing business in a country will depend significantly on the extent those principles operate in a country:

1. *Participation*: is a cornerstone of good governance. Participation could be either direct or through legitimate intermediate institutions or representatives. Participation needs to be informed and organized. For example, it is not always possible to engage with the government department where you would obtain planning permissions.
2. *Rule of law*: Good governance requires fair laws that are enforced impartially. It also requires protection of human rights, particularly for minorities. Impartial enforcement of laws requires an independent judiciary and an impartial and incorruptible

police force. The example of the project manager being kidnapped is a case in point. Corruption is another example.

3. *Transparency*: Decisions taken and their enforcement are done in a manner that follows rules and regulations. Information is freely available and directly accessible to those who will be affected by such decisions and their enforcement. Adequate information is provided and is easily understandable. For example, the process by which you obtain planning permission and the criteria by which your application is judged is not clear.
4. *Responsiveness*: Institutions and processes try to serve all stakeholders within a reasonable timeframe. For example, people are biased in their decision making. Corruption will not help here.
5. *Consensus oriented*: Different interests in society reach a broad consensus on what is in the best interest of the community. There is a broad and long-term perspective on what is needed for sustainable development and how to achieve that. This can only result from an understanding of the historical, cultural and social contexts of a given society. For example, pressure groups can lead to one policy being favoured over another for irrational reasons.
6. *Equity and inclusiveness*: A society's well being depends on ensuring its members feel they have a stake in it and do not feel excluded. This requires that all groups, but particularly the most vulnerable, have opportunities to improve or maintain their well-being. For example, the local community feel they do not have a stake in the project and so resist it.
7. *Effectiveness and efficiency*: Processes and institutions produce results that meet the needs of society while making the best use of resources. Efficiency also covers the sustainable use of natural resources and the protection of the environment. Government bureaucracy is slow, leading to delays in planning permission. I have a PhD student researching poor infrastructure in sub-Saharan countries in Africa. Poor infrastructure results from and causes poor effectiveness and efficiency resulting in delays.
8. *Accountability*: This is a key requirement of good governance. Not only governmental institutions but also the private sector and civil society organizations must be accountable to the public. Accountability cannot be enforced without transparency and the rule of law. Government agents are not accountable for their decisions and so they are based on bias and corruption and not sound argument.

Item 6 above suggests that acceptance of the project by the local community is a risk (Eweje et al, 2012). Projects can meet very strong resistance from the local community. This can be one of the most significant risks faced by project managers on large overseas projects. Examples include:

1. Oil projects in the Niger Delta are meeting increasingly strong resistance from the local community.
2. A Finnish company was trying to build a paper mill on the Uruguayan side of the river that forms the Uruguayan-Argentinean border. The Argentinean side was an area of natural beauty and a tourist resort and the paper mill was going to be an eyesore. It created significant cross border strife.
3. I was interviewing somebody recently for a project I am doing investigating ethics on

projects (Müller et al, 2012). He was relating a story of a project he was involved in to develop an aluminium smelter on India. He was working for one of two Western companies in a joint venture with three Indian companies. The land the smelter was to be built on was farmed by a primitive hunter-gatherer tribe the Indians treated as inferior to the untouchables. The consortium had bought the land, but it was not owned by the farmers. Then the project was delayed by two years while the consortium partners argued, and the farmers continued to farm the land. Then they came to ask the farmers to move and they refused and started demonstrating. Because they were below untouchables, the Indian partners thought nothing of killing them. There was also a generational difference. The population had been growing and the young people wanted the jobs, but the older people only knew farming and could not learn to do the new jobs. My interviewee's company ethically could not continue with this. The other Western company continued for a bit but then also had to withdraw.

There is an issue in project management whereby people mainly focus on technical risks, whereas from the discussion above you will realize most of the risks on international projects are people risks. An example is the project to build the fixed link between Sweden and Denmark, from Copenhagen Airport to Malmo (Turner, 2009). By identifying and managing 10 major risks they managed to reduce the project duration by six months. The 10 risks were:

- Interface management;
- Element fabrication;
- Owner's organization;
- Joint venture;
- Bridge accidents;
- Tunnel accidents;
- Tunnel design;
- Labour and materials;
- Weather;
- Road test conditions.

They are primarily people risks, and you won't find them in standard lists of risks. In 1987, I was at a meeting of an organization called the Major Projects Association. The after-dinner speaker was a man called Lord Pennock, then chairman of the Channel Tunnel Consortium, which was just beginning to build the Channel Tunnel. The audience was full of senior managers from British industry, directors and general managers. After his speech, Lord Pennock took questions, and the first was what were the major risks of the project? Lord Pennock said the major risks were:

- They wouldn't get the bills through the British or French parliaments.
- They wouldn't raise the necessary finance.
- The people of Kent or Calais would block the project.

The audience, said, 'No, no, no. They weren't interested in those sorts of risks. They were interested in the technical risks'. Lord Pennock said there weren't any. It was basically an easy project; building a railway tunnel. The audience, said, 'No, no, no. It couldn't be.

This was the biggest project ever undertaken in Britain at that time'. Sorry, said Lord Pennock, the risks were people risks. That I hope is the major lesson when you are undertaking international projects. Don't forget about the local population (especially the politicians).

Quality and Safety on International Projects

I consider Health and Safety to be a sub-set of quality. That is sometimes controversial because people say Health and Safety is special. Yes, it is special, but it is a subset of quality. We are talking about the quality of the working practices and working environment and the quality of the health of the stakeholders.

The main quality issue arising on international projects is, *Do contractors working overseas apply the quality standards from their home country or those of the country in which they are working?* Of course if the quality standards are higher in the country in which you are working, then you need to apply those. But if they are lower, then you have to decide whether to apply your home standards or the host country's standards. You may think it is cheaper to apply lower quality standards. However, Crosby (1979) suggested that quality is free, and it may actually cost you money to lower your quality standards, either through more failures or reduced customer satisfaction, or it may just cost you more to do things differently from your normal methods.

The state of New South Wales in Australia, for instance, has the highest safety standards in the world. So if you are working in New South Wales, you must obey their safety legislation. On the other hand, compared to Western countries, safety standards in China are very lax. (I find it strange. The Chinese are very concerned about catching bugs – they measure your temperature as you go through immigration in Beijing Airport. They will also tell you at great length what food combinations are or are not healthy. But their safety standards on a construction site are a nightmare. And I find as a lecturer, often the jumble of wires on the floor in front of me is a terrible tripping hazard. So there are different standards, and different areas of concern.)

As part of a research project I was doing into ethics on projects (Müller et al, 2012), I spoke to a senior manager from a Norwegian client organization. He said that if they were more than a 50% shareholder on a project in another country they would insist that Norwegian quality and safety standards are used. But if they own less than 50%, they cannot insist, but they will still invest in the project even if inferior standards are used. I asked him what his position would be if somebody was killed when Norwegian safety standards would have saved their life. He said they would argue for Norwegian safety standards but could not insist on them, and sometimes in business you have to make difficult choices.

As part of the same research project, I asked somebody from a Norwegian contractor what standards they apply. He said that they had been doing a project in Northern Germany, and were trying to apply Norwegian quality standards, but local contractors were getting upset, because they thought that this would set new standards that local clients would now want to be applied and that would raise their costs. Crosby (1979) said that quality is free. The idea is that in the short term you need to spend more on quality assurance, but in the medium term the amount you spend on failures and quality control falls to more than compensate for the extra you have spent on quality assurance.

The local German contractors are looking to the short term and the extra they would have to spend on quality assurance. But perhaps the Norwegian contractor fears that if they reduce their quality standards it will cost them more.

This issue takes a slightly different turn when you are working on a virtual team. Now people from several sites will be working on one project. The project team has to decide at the start of the project what quality and safety standards will be used. For instance, if it is a project to design an electricity generating station or large chemical plant that will operate somewhere in the European Union, it must be designed in accordance with European law. European law requires that construction safety must be taken account of in the design process, so that the plant is safe to build. So if you have design engineers working in China, India, London and Australia, you can't have the engineers in China, India and Sydney all applying their local construction safety standards. They must all be working in accordance with European law. But that might create a problem for the people working in Sydney, because the standards in New South Wales may be stricter than European standards and that might create similar problems to those faced by the Norwegian contractor above, that it might create problems to lower their standards, but applying New South Wales standards in Europe might create other problems.

Offshoring

Offshoring is a special case of outsourcing where the contractor is overseas, and so it is a new form of international project in the modern world. The idea of outsourcing is of course millennia old. The Egyptian pharaoh used his own slaves to build the pyramids, and the Chinese emperor used his army to build the great wall. But the Romans used contractors to build their roads and aqueducts. Whenever we use a contractor to do part of the project for us, we have outsourced that element of work. And when contractors use sub-contractors, they have outsourced work. Many people say we should focus on our core competence and outsource the rest. But that really is too simplistic. Oliver Williamson in his work on transaction cost analysis, for which he won the Nobel Prize (Williamson, 1995), effectively says you outsource things when it is better value for you to do so, and do the work yourselves when that gives you better value. He makes the point that the management of quality and risk is part of the value function, and if we think the contractor will give us worse quality, we should do the work ourselves. In the early 1990s, I worked at Henley Management College when we got a new principal. We talked about whether there was anything we should outsource. We were a management college. You might say our core competence was the management and delivery of management courses. But about 90% of the course delivery was done by contractors. They could do it as well as any of the faculty. But the College also had a 100-bedroom hotel and a kitchen serving breakfast, lunch and dinner every day. I asked the new principal why didn't we outsource that. He said that the quality of the rooms and the food was a key part of the experience of somebody attending a course. So it wasn't that cooking was a core competence and teaching wasn't, but we needed to control the quality of the hotel function more but we could get good quality teachers to do the teaching. So you outsource when you think it will give you better value than doing it yourself. Increased value comes from lower wage costs. But reduced value comes from higher risk, lower quality and loss of knowledge. Many is the organization that has given a contractor a five-year contract to do work on

their behalf. The organization then forgets how to do the work for themselves. So at the end of the five years they are beholden to the contractor who can then charge a hugely increased fee to renew the contract. Oliver Williamson talks about a fundamental transformation. As soon as the ink on the contract is dry, the contractor knows more about the work than you do, and you are beholden to them. Many people when outsourcing work focus just on the cost savings and not the things that reduce value. Beware of them.

Organizations considering offshoring should treat its adoption as a project with four stages:

- Concept;
- Design;
- Implementation;
- Finalization.

Concept: Preparation for the decision to offshore should start at the earliest stages of the project. There are four key steps.

- Strategic conceptualization: Assess if it is appropriate and obtain support if necessary.
- Tactical conceptualization: Decide where and how.
- Operational conceptualization: Develop a business plan with options.
- Planning: Plan time and budget.

Design: Now the detail design work is done. There are qualitative and quantitative issues to consider. Risks and threats should be included in the quantitative analysis, and quality in the qualitative issues. Quality is a key factor in the decision to outsource. It is imperative; it is a significant source of value.

Implementation: There are four key areas to be considered in the implementation phase:

1. Change management
 - barriers
 - strategy and planning
 - staff resistance
 - sponsorship
 - communication
 - training
 - business continuity
2. Contract management
 - agreement
 - specification
 - terms and conditions
 - administration
3. Stakeholder management
 - customers
 - employees
 - communities
 - shareholders

4. Relationship management
 - depth
 - scope
 - assets
 - culture

Finalization: The key issue here is to manage the transition to the new arrangement. ...

Concluding Remarks

We have considered just three issues of international projects, risk, quality and outsourcing, but they are elements that are relevant to this book. International projects will become increasingly relevant in the modern world, and I believe those three issues will get increasing attention. I have several PhD students working on risk management in the developing world, who have identified it as a significant issue in attracting investment and obtaining economic growth. Also I have been doing the research into governance, ethics and trust (Müller et al, 2012), which impacts on the adoption of risk and safety standards. Offshoring combines both risk and quality in the assessment of value, whether it is better to offshore the work or do it yourself.

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GILBERT SILVIUS AND RON SCHIPPER

Projects are instruments of change, to prepare or adapt organizations to developments in their competitive environment. New developments change the marketplace every day, whether resulting from technological progress, new regulations, globalizing economy or inventive competitors. Organizations must continuously react to these developments, or anticipate new ones, by introducing new products and services, improving business processes, changing resources, expanding their activities or terminating obsolete ones. Selecting the right changes and organizing and managing them in an effective and efficient way are for many organizations a critical success factor for business agility and sustainable success.

An increasingly dynamic environment is not the only development organizations face. In the last 10 to 15 years, the concept of sustainability has grown in importance. The pressure on companies to broaden their reporting and accountability from economic performance for shareholders, to sustainability performance for all stakeholders has increased (Visser, 2002). The financial crisis of 2009–2011 may even imply that a strategy focused solely on shareholder value is no longer viable. Awareness seems to be growing that a change of mindset is needed, both in consumer behavior and in corporate policies. How can we develop prosperity without compromising the life of future generations? Proactively or reactively, companies are looking for ways to integrate ideas of sustainability into their marketing, corporate communications, annual reports and actions (Hedstrom et al, 1998; Holliday, 2001).

The concept of sustainability has more recently been linked to project management (Gareis et al, 2011; Maltzman and Shirley, 2010; Silvius et al, 2012a and 2012b). Tom Taylor, President of the Association for Project Management, suggests ‘the planet earth is in a perilous position with a range of fundamental sustainability threats. ... Project and program managers are significantly placed to make contributions to sustainable management practices’. In her keynote address to the 22nd World Congress of the International Project Management Association (IPMA), Vice-President Mary McKinlay stated ‘the further development of the project management profession requires project managers to take responsibility for sustainability’. Her statement summarized the vision that project managers need to take a broad view of their role and to evolve from ‘doing things right’ to ‘doing the right things right’. This implies taking responsibility for not only the process of executing a project, but also for the qualities of the results the project realizes, including their societal and environmental implications. But how does

this attention for sustainability find its way to the reality of managing projects? How is sustainability taken into account in project management processes, methodologies and competencies? Is it a point of concern there? If organizations practice what they preach on sustainability, it is inevitable that sustainability criteria and indicators will find their way into project management methodologies and practices.

This chapter explores the concept of sustainability and its application to project management. It identifies the questions surrounding the integration of the concepts of sustainability in projects and project management and provides guiding insights. The next section provides a brief introduction into, and an overview of the concepts of sustainability. These concepts are summarized in six principles of sustainability that form the foundation for the analysis in this chapter. The following section provides an overview of existing studies and views on the relationship between sustainability and project management and analyses the implications of the principles of sustainability on projects and project management. It includes specific suggestions for the integration of the facets of sustainability into project management and project management standards. The final section of the chapter will conclude with what's new about the integration of sustainability.

The Concepts of Sustainability

The balance between economic growth and social wellbeing has been around as a political and managerial challenge for over 150 years (Dyllick and Hockerts, 2002). Further, the concern for the wise use of natural resources emerged many decades ago, with Rachel Carson's book *Silent Spring* (1962). In 1972 the Club of Rome, an independent think tank, published its book *The Limits to Growth* (Meadows et al, 1972). In it, the authors concluded that if the world's population and economy were to continue to grow at their current speeds, our planet's natural resources would approach depletion. The book fuelled a public debate, leading to the creation of the UN World Commission on Development and Environment, named the Brundtland Commission after its chair, Gro Harlem Brundtland, the prime minister of Norway. In their report *Our Common Future*, the commission defines sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (1987). By stating that, 'In its broadest sense, sustainable development strategy aims at promoting harmony among human beings and between humanity and nature', the report implies that sustainability also requires a social and an environmental perspective, alongside the economic perspective, on development and performance (Figure 20.1).

The vision that none of the development goals of economic growth, social wellbeing and a wise use of natural resources can be reached without considering and affecting the other two became widely accepted (Keating, 1993).

Many companies have already accepted corporate sustainability as an integrated part of doing business. Strategies for integration involve corporate sustainability officers, publishing sustainability reports and incorporating sustainability into their corporate communication strategies (Dyllick and Hockerts, 2002). Clearly, like all business strategies, a sustainability strategy needs clear objectives and measurability. In 1997, Elkington coined the term 'triple bottom line' (TBL) in his book *Cannibals with Forks* (1997). Elkington suggested that companies should not merely focus on their financial bottom line (net income or profit), but also on their social and environmental achievements.

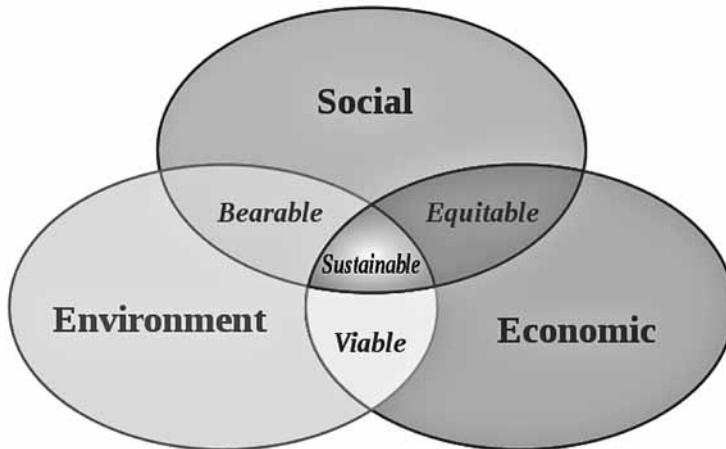


Figure 20.1 The three perspectives of sustainability

A sustainable company should logically measure, monitor, document and report its impact on all three bottom lines. Financial or economic performance indicators may include: sales, return-on-investment, taxes paid, monetary flows and profit. Environmental or ecological indicators may include: air quality, water quality, energy usage and waste produced. Social performance indicators may include: jobs created, labor practices, community impacts, human rights and product responsibility (Savitz and Weber 2006).

STANDARDS

A number of organizations have developed frameworks that help companies develop meaningful indicators for sustainability.

ISO 26000

As a response to the growing interest of businesses and the increasing number of sustainability related institutions and frameworks, the International Organization for Standardization (ISO) launched ISO 26000, comprehensive guidelines for social responsibility, to help companies introduce more sustainable practices. ISO 26000 is designed for all types of organizations, including non-governmental organizations and governments. ISO 26000 defines social responsibility as:

Social responsibility is responsibility of an organization for the impacts of its decisions and activities on society and the environment, through transparent and ethical behaviour that

- contributes to sustainable development, including health and the welfare of society;
- takes into account the expectations of stakeholders;

- is in compliance with applicable law and consistent with international norms of behaviour;
- is integrated throughout the organization and practiced in its relationships.

Activities include products, services and processes, and relationships refer to an organization's activities within its sphere of influence

A company can use ISO 26000 to learn more about social responsibility and as guidance for implementing sustainability principles and practices into their business processes, strategies, procedures, systems and organizational structures. ISO 26000 suggests seven core subjects for social responsibility, which are further broken down into issues, specific themes or activities that a company should work on in order to contribute to sustainable development.

ISO 14000

Another frequently used ISO standard is ISO 14001. This standard describes the core set of processes and practices for designing and implementing an effective environmental management system in an organization, similar to the ISO 9000 series of standards on quality management. ISO 14001 is a normative standard, unlike ISO 26000, which is a guideline. This means that organizations can certify themselves as being compliant with ISO 14001. ISO 14001 and ISO 26000 do not include or imply each other. They can be used independently of, but also complementary to, each other.

Global Reporting Initiative

The Global Reporting Initiative (GRI) is a non-profit organization that pioneered the world's most widely used sustainability reporting framework (Global Reporting Initiative, 2011). Companies can use the framework to indicate to shareholders and consumers their economic, social and environmental performance. The most current version is called the G3.1 Guidelines and is a public free good. GRI's objective is to facilitate sustainability reporting for companies and thereby stimulate them to operate more sustainably. The framework comprises various indicators, from which companies can select the ones they find most suitable for their own operations. Figure 20.2 shows an overview of the GRI criteria.

UN Global Compact

The UN Global Compact (United Nations Global Compact, 2012), is a framework of 10 universally accepted principles (Table 20.1), developed by the United Nations and a number of large corporations.

Economic Sustainability	Direct Economic Performance
	Market Presence
	Indirect Economic Impact
Environmental Sustainability	Materials
	Energy
	Water
	Biodiversity
	Emissions, effluents and waste
	Products and services
	Compliance
	Transport
Overall	
Social Sustainability	Labor Practices and Decent Work
	Human Rights
	Society
	Product Responsibility
	Ethics

Figure 20.2 Overview of indicators in the Sustainability Reporting Guidelines of the Global Reporting Initiative

Table 20.1 Ten principles of the UN Global Compact

Area		Principle
Human rights	Principle 1	Businesses should support and respect the protection of internationally proclaimed human rights.
	Principle 2	Businesses should make sure that they are not complicit in human rights abuses.
Labor	Principle 3	Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining.
	Principle 4	Businesses should uphold the elimination of all forms of forced and compulsory labor.
	Principle 5	Businesses should uphold the effective abolition of child labor.
	Principle 6	Businesses should uphold the elimination of discrimination in respect of employment and occupation.
Environment	Principle 7	Businesses should support a precautionary approach to environmental challenges.
	Principle 8	Businesses should undertake initiatives to promote greater environmental responsibility.
	Principle 9	Businesses should encourage the development and diffusion of environmentally friendly technologies.
Anti-corruption	Principle 10	Businesses should work against corruption in all its forms, including extortion and bribery.

It covers the areas of human rights, labor, environment and anti-corruption. Participating companies agree to comply with these principles. They can use the provided framework as a platform for disclosure. This initiative has been created because the UN realized that businesses are primary drivers for globalization and can help ensure long-term value creation that can bring benefit to economies and societies all over the globe. In the absence of global regulations, this voluntary code of conduct has been developed, hoping to stimulate companies to more sustainable business practices.

FROM LESS BAD TO GOOD

As mentioned earlier, many companies have already accepted some level of responsibility for sustainable development as a part of doing business. Stimulated by government regulations, the voice of pressure groups or perhaps by their own beliefs and values, they are implementing more sustainable business practices in their organizations. The examples are numerous, from more 'fair' production of raw materials, to more efficient use of energy, to tighter travel policies, to recycling of end-of-life products and so forth. However, the level to which organizations integrate sustainable practices into their operations varies widely.

In his book *The Next Sustainability Wave*, Willard (2005) describes five 'sustainability stages' (Figure 20.3).

The stages move from reactive to proactive and describe to what extent a company is committed to sustainability principles. The first stage is when companies fail even to comply with prevailing regulations. They are opportunistic and not engaged with sustainability. When a company complies with all environmental and social regulations it moves to stage 2, 'compliance'. In stage 3 'beyond compliance' a company not only reacts to regulations, but starts introducing sustainability activities. However, these activities are not concerted. Companies that understand the importance of sustainability and the value-added they gain from sustainable activities, for example energy-efficient production or eco-friendly products, and integrate sustainability into their corporate strategy are in stage 4 'integrated strategy'. The highest level, stage 5, 'purpose and passion', is attained when companies are not just driven by profits but also by a sense of responsibility to improve society and the environment and contribute to a better world.

Stage 1 Pre-compliance	Stage 2 Compliance	Stage 3 Beyond compliance	Stage 4 Integrated strategy	Stage 5 Purpose & Passion
Outlaws: disobey social and environmental regulations; only focus on short-term profits	Compliers: take a minimalist approach, reactively do what they legally have to do	Case-makers: move from defence to offence; sustainability initiatives increase but are still marginalized in different departments	Innovators: company transforms and fully integrates sustainability into its corporate strategy; captures value-added from sustainability initiatives	Trailblazers: driven by a passionate, value-based commitment to improve well-being of the company, society and environment

Figure 20.3 The stages of sustainability (Silvius et al, 2012b, adapted from Willard, 'The Next Sustainability Wave', 2005)

This model illustrates how companies move from a reactive approach to a proactive one. The difference between stages 3 and 4 is important. This step distinguishes companies that merely try to be 'less bad', by minimizing the negative effects of their business, from companies that try to 'do good', by integrating sustainability considerations into their core business. This last approach, seeing sustainability as an integrated part of the business, is rapidly gaining momentum. It is the mind-shift from considering sustainability as a 'threat' and a 'cost' to considering it as a (business) opportunity.

Sustainability Principles

A number of sustainability principles have been derived from the concepts, standards and literature on sustainability. Dyllick and Hockerts (2002) identify three 'key elements of corporate sustainability': integrating economic, ecological and social considerations into a firm's strategy; incorporating both a short- and long-term perspective and consuming a company's income and not its capital. Gareis et al (2011) define sustainability according to the following principles:

- Economic;
- Social and ecologic orientation;
- Short-, mid- and long-term orientation;
- Local, regional and global orientation;
- Value orientation.

The ISO 26000 mentions the following principles:

- Accountability;
- Transparency;
- Ethical behavior;
- Respect for stakeholders' interests;
- Respect for rule of law;
- Respect for international norms of behavior;
- Respect for human rights.

On the basis of these definitions, Silviu et al (2012b) derived six 'principles of sustainability' to guide the integration of the concepts of sustainability into projects and project management:

Sustainability is about balancing or harmonizing social, environmental and economic interests: In order to contribute to sustainable development, a company should satisfy all 'three pillars' of sustainability as illustrated in Figure 20.1: Social, Environment and Economic. These dimensions are interrelated in that they influence each other in various ways. From the basis of Willard's (2005) model on the stages of sustainability, organizations can have a reactive approach to this principle and try to 'balance' social, economic and environmental aspects by trading off the negative consequences of doing business for a somewhat lower profit, for example by compensating CO₂ emissions by planting new trees or compensating unhealthy work

pressure by higher salaries. A more proactive approach to sustainability looks at how organizations create 'harmony' in the social, environmental and economic areas of their activities. This approach is not about compensating bad effects, but creating good effects.

Sustainability is about both short-term and long-term orientation: A sustainable company should consider both the short-term and long-term consequences of their actions, and not simply focus on short-term gains. Firms listed on the stock market may be tempted to focus on short-term gains, trying to increase performance from quarter to quarter, thereby losing long-term vision. This principle focuses attention on the full lifespan of the company's activities. In economic theory, an immediate cash flow holds more value than a future cash flow, thereby emphasizing the value of short-term benefits. However, the social impacts or environmental degradation caused by business decisions made for short-term gain may not occur until farther in the future.

Sustainability is about local and global orientation: Many organizations are influenced by international stakeholders, including competitors, suppliers or customers. The behavior and actions of organizations therefore have an economical, social and environmental impact, both locally and globally. 'In order to efficiently address these nested and interlinked processes sustainable development has to be a coordinated effort playing out across several levels, ranging from the global to the regional and the local' (Gareis et al, 2011).

Sustainability is about consuming income, not capital: Sustainability implies that nature's ability to produce or generate resources or energy remains intact. This means the source and sink functions of the environment should not be degraded. Therefore, the extraction of renewable resources should not exceed the rate at which they are renewed, and the absorptive capacity of the environment to assimilate waste, should not be exceeded. (Gilbert et al, 1996). The economic equivalent of this principle is common knowledge in finance and business. Financial managers know that a company which does not use its income to pay for its costs, but instead uses its capital, will soon be insolvent. The principle may also be applied to the social perspectives. Organizations should also not deplete people's ability to produce or generate labor or knowledge by physical or mental exhaustion. To be sustainable, companies have to manage not only their economic capital, but also their social and environmental capital.

Sustainability is about transparency and accountability: The principle of transparency implies that an organization is open about its policies, decisions and actions, including the environmental and social effects of those actions and policies. This implies that organizations provide timely, clear and relevant information to their stakeholders so that these stakeholders can evaluate the organization's actions and can address potential issues with these actions. The principle of accountability is logically connected to this. This principle implies that an organization is responsible for its policies, decisions and actions, and the effect of these on environment and society. The principle also implies that an organization accepts this responsibility and is willing to be held accountable for these policies, decisions and actions.

Sustainability is about personal values and ethics: As discussed earlier, a key element of sustainability is change. Change towards more sustainable (business) practices. As argued by Robinson (2004) and Martens (2006), sustainable development is inevitably a normative concept, reflecting the values and ethical considerations of society. Part of the change needed for more sustainable development will therefore also be the implicit or explicit set of values that we as individuals, business professionals or consumers have and that influence or lead our behavior. GRI Deputy Director Nelmara Arbex puts it simply and clearly: ‘In order to change the way we DO things, we need to change the way we VIEW things.’

These sustainability principles provide guidance for the analysis of the impact of the concepts of sustainability in projects and project management in the following sections.

Sustainability in Projects and Project Management

The concerns about sustainability are based on the concept that the current way of producing, organizing, consuming and living may, or will, have negative effects on the future. Our current way of life is not sustainable. Therefore, things (products, processes, materials, resources, our behavior) and thoughts (beliefs, values) need to change. As we stated earlier, projects can be considered instruments of change. Projects are temporary organizations related to a non-temporary, ‘permanent’ organization, and bring about changes that benefit the strategy or goals of that parent organization.

The permanent organization uses resources and assets in its operational business processes to deliver benefits or value to its customers and ultimately deliver business performance (including profit, market share, return in capital and so on) for its stakeholders. Its activities are based on goals that are developed or set in a strategic management process. The strategic management of the organization is not just about setting goals; it is also about evaluating the business performance of the organization against these goals. If the performance is satisfactory, the operations may continue. But if the performance is unsatisfactory, because of lack of performance or because of changing goals, there may be reason to change something in the organization. In that case, a temporary organization, in the form of a project, is commonly used to create this change. The change may concern the resources, assets or business processes of the permanent organization, but also the products/services rendered or the internal policies and procedures. The selection of the ‘right’ changes for the organization is usually part of a process called ‘portfolio management’. Figure 20.4 illustrates this relationship between projects as temporary organizations and the permanent organization.

Elaborating on the view of projects as instruments of change, it is evident that a (more) sustainable society requires projects to bring about change. This connection between sustainability and projects was already established by the World Commission on Environment and Development (1987). However, Eid (2009) concluded two decades later that the standards for project management ‘fail to seriously address the sustainability agenda’. Given the temporary nature of projects this may not be surprising. Projects and sustainable development are not natural friends. Table 20.2 illustrates some of the differences in the characteristics of the two concepts.

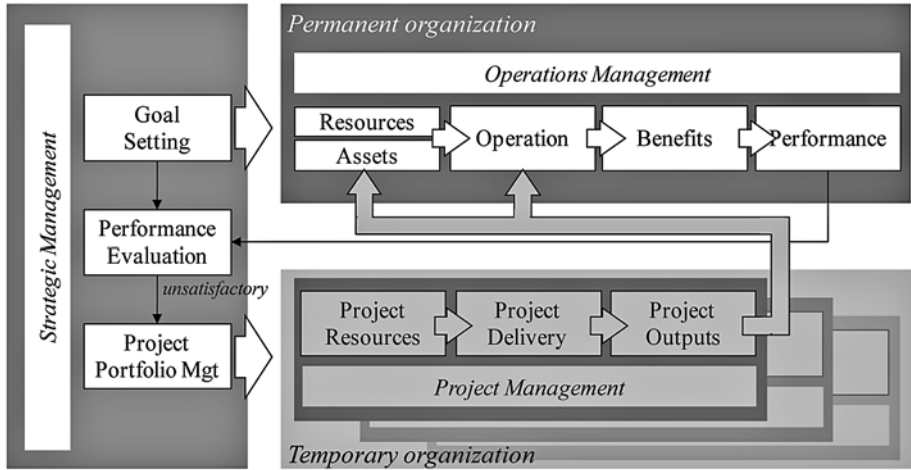


Figure 20.4 Project as temporary organizations that deliver changes to the permanent organization

Table 20.2 The contrast between the concepts of sustainable development and projects (after Silvius et al, 2012b)

Sustainable development	Project management
Long-term + short-term oriented	Short-term oriented
In the interest of this generation and future generations	In the interest of sponsor/ stakeholders
Life-cycle oriented	Deliverable/result oriented
People, planet, profit	Scope, time, budget
Increasing complexity	Reduced complexity

The relationship between sustainability and project management is still an emerging field of study. Some initial studies and ideas have been published in recent years, and although they differ in approach and depth, a few conclusions can be drawn:

Sustainability is relevant to project managers: As stated in the introduction of this chapter APM's president, Tom Taylor, was one of the first to suggest that the project management community should familiarize itself with the issues of sustainability, recognizing that more should be done to contribute to a more sustainable society. This appeal was the output of a small working party in APM that recognized that project managers were not well equipped to make a contribution to sustainable development and decided to investigate this issue. At the 2008 European conference of the Project Management Institute (PMI), Jennifer Russell elaborated on what corporate social responsibility means for project managers. She pointed out that a project manager, being in the frontline of new or changed activities within an organization, is perfectly

positioned to influence the organization's operations towards greater sustainability. She also argued that this position is not without responsibility, both for the organization and the project manager. She concluded that 'Corporate social responsibility is too big an issue to leave to someone else to address'.

Integrating sustainability stretches the system boundaries of project management: In some of the first publications on sustainability and project management, Labuschagne and Brent of the University of Pretoria link the principles of sustainable development to project life-cycle management in the manufacturing industry (Labuschagne and Brent 2006). They suggest that the future orientation of sustainability implies that the full life-cycle of a project, from its conception to its disposal, should be considered. Elaborating on this life-cycle view, they argue that when considering sustainability in project management, you should consider not just the life-cycle of the project, but also the life-cycle of the result the project produces, being a change in products, assets, systems, processes or behavior. This result should be considered over its full life-cycle, being something like design-develop-manufacture-operate-decommission-disposal. In its life-cycle, the asset has a productive phase ('operate'), in which it generates value by producing products or services. Elaborating on the life-cycle view even further, Labuschagne and Brent claim that the life-cycles of the products or services that the project's deliverable produces should be considered. Figure 20.5 visualizes how these three life-cycles, 'project life-cycle', 'asset life-cycle' and 'product life-cycle' interact and relate to each other.

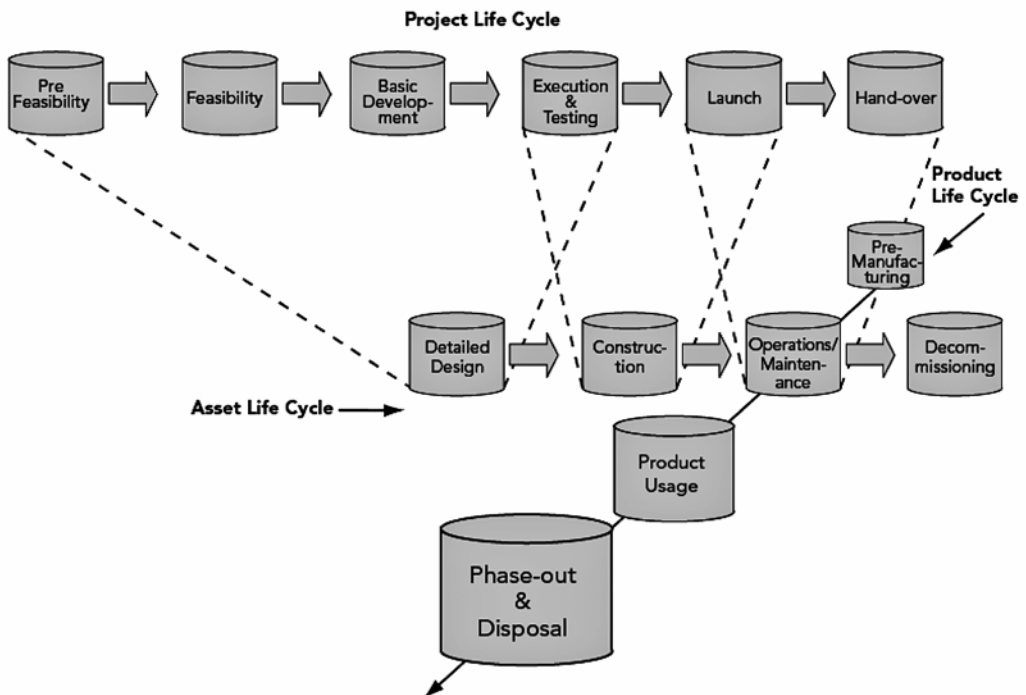


Figure 20.5 Interrelating life-cycles (Silvius et al, 2012a, based on Labuschagne and Brent 2006)

Incorporating the concept of sustainability into projects therefore suggests that all three life-cycles should be considered. Because Labuschagne and Brent include the project's outcome, the asset, in their framework, it is necessarily sensitive to the project's context. Their studies were centered on the manufacturing sector in which projects generally result in assets that produce products. In other sectors, the outcome of a project may not be an asset, but an organizational change or a new policy. The overall insight gained from their work, however, may be that integrating sustainability into projects should not be limited solely to project management processes. A project's supply chain should also be considered, including the life-cycle of the resources used in the project, but also the life-cycle of the project's outcome. Integrating the concept of sustainability into project management may therefore very well stretch the system boundaries of the discipline.

Project management standards fail to address sustainability: This conclusion was most explicitly reached by Eid (2009) in his book 'Sustainable Development & Project Management'. Eid studied the integration of sustainable development in construction project management. Some conclusions from his study include:

- Project management is an efficient vehicle to introduce a more profound change, not only to the construction industry's practice, but more importantly to the industry's culture.
- Project management processes and knowledge fall short of committing to a sustainable approach.
- Mapping sustainable development onto project management processes and knowledge areas identifies opportunities for introducing sustainability guidelines in to all project management processes.

Eid identified a number of 'leverage points' where sustainable development can connect with project management. These points include the contribution to business strategy, the business justification, the procurement strategy, the readiness for service and benefits evaluation of a project. Leverage points cover the whole life-cycle of the project. It should be mentioned that the integration of the concepts of sustainability into project management standards may soon occur. For example the SustPM research project (Gareis et al, 2011) focuses on integrating the concepts of sustainability specifically into project management processes and methods. Silvius et al (2012b) also provide insights, tools and instruments to consider sustainability in project management. Taylor elaborated on his earlier appeal to the project management profession in his book *Sustainability Interventions for Managers of Projects and Programs* (Taylor, 2010). Taylor takes a very practical approach and this publication contains lists of potential considerations and interventions that can be used for understanding the sustainability aspects of projects. Although the checklists lack a systematic approach to the concepts of sustainability, they are meaningful tools for translating the somewhat abstract concepts of sustainability to the daily work of the project manager. Taylor also participated in the 2010 IPMA Expert Seminar 'Survival and Sustainability as Challenges for Projects' (Knoepfel, 2010). This seminar featured several papers and discussions on the integration of sustainability in projects and project management. The seminar's report included a sustainability checklist for a project as developed by the gathered group of international experts and a mapping of these considerations on project management processes, roles and responsibilities of

project members and project management competencies. A more academic study into the operationalization of sustainability in projects was done by Iris Oehlman (2011). She developed the 'Sustainable Footprint Methodology' to analyze and determine the relevant social, environmental and economical impacts of a project. This methodology confronts the life-cycle of a project, consisting of three phases: project pre-phase, project execution and operation of the asset, with the three pillars of 'the triple bottom line': People, Planet and Profit. Each of the nine cells of the resulting framework is detailed in a set of sustainability indicators relevant to the respective sustainability perspective and the phase in the project life-cycle. A somewhat different approach was taken by Maltzman and Shirley (2010) in their book *Green Project Management*. As the title of the book suggests, it focuses on the integration of environmental sustainability in project management. The book provides essential factual knowledge about environmental considerations and includes an extensive description of how these can be integrated into the different phases of a project by project managers and sponsors. Maltzman and Shirley suggest that environmental considerations should be seen as a matter of quality in a project, as captured in their neologism 'greenality' as the merger of 'green' and 'quality'.

The integration of sustainability may change the project management profession: The conclusion of the 2010 IPMA Expert Seminar (Knoepfel, 2010) was that the influence of project managers on the sustainability of their projects is substantial, regardless of whether the project manager actually bears responsibility for these aspects of the project. Project managers have a strong influence because they either are directly responsible for certain aspects or they can influence the persons that are responsible. This conclusion may actually change the nature of the project management profession. From a managerial role aimed at carrying out delegated tasks, it may need to develop into a more advisory position with autonomous professional responsibilities that are aimed at the right organizational changes.

The studies and conclusions summarized above illustrate the current state of knowledge on sustainability in projects and project management. It is mostly interpretive, giving meaning to how the concepts of sustainability can be interpreted in the context of projects, rather than prescriptive, prescribing how sustainability should be integrated into projects. Different authors pose different ideas, containing interesting suggestions about how project management should develop. However, most suggestions are of a conceptual nature and need elaboration to be of more practical value for the profession. The studies provide ingredients and provide questions, rather than answers. Some important questions are:

- Which system boundaries should be taken into account when considering sustainability in projects and project management?
- How can sustainability in projects and in project management be defined?
- How can the concepts of sustainability be made practically applicable to projects and project management?

DEFINING SUSTAINABILITY IN PROJECT MANAGEMENT

The discussion of the different studies and publications on sustainability and project management shows that the question 'what sustainability means for projects and project

management', cannot be answered without discussing the scope or system boundaries of project management. What should be considered in scope and what not?

The positioning of projects as temporary organizations that deliver changes to a permanent organization, as illustrated by Figure 20.4, provides a framework to illustrate possible different approaches. For example, when the concepts of sustainability are considered only on the level of the project management processes, for example labor circumstances of project members or teleconferencing as alternative for travelling to meetings, we talk about 'sustainability in project management processes'. When sustainability is also considered in the actual delivery or 'production' processes of the project, we would call this approach the 'sustainability in project delivery' approach. These project delivery processes can be of an informational nature, for example in software development projects, but also of a physical nature, for example in a project to produce gadgets or giveaways as part of a promotion campaign.

A further expansion of the scope of considering sustainability occurs, when the result or deliverable of the project is also considered. In this 'sustainability in the project' approach, the consideration of sustainability is no longer limited to the temporary organization, but also involves the permanent organization, as this is the user of the deliverables and results of the project. As stated earlier, this result can be any kind of change in organizations, policies, products, services, processes, assets and/or resources. The 'sustainability in the project life cycle' approach adopts the views taken by Labuschagne and Brent (2006) and expands the consideration of sustainability to the project, its outcomes and its (longer term) effects.

Based on the principle that sustainability is about having both a short-term and long-term orientation, it is inevitable to include a project's outcome when considering sustainability. This identifies either the 'sustainability in the project' or the 'sustainability in the project life-cycle' approach as most suitable.

Having discussed the scope boundaries of considering sustainability in project management, we can now elaborate on what the integration of all six principles of sustainability may imply for projects and project management:

Sustainability is about balancing or harmonizing social, environmental and economic interests: Corresponding with the triple bottom line concept of sustainability, integrating sustainability in projects and project management requires the inclusion of 'People' and 'Planet' performance indicators in the management systems, formats and governance of projects. In current project management methodologies, the management of projects is dominated by the 'triple-constraint' of time, cost and quality. Although the success of projects is most often defined in a more holistic perspective (Chapters 2 and 3), this broader set of criteria doesn't reflect on the way projects are managed. The triple-constraint variables clearly put emphasis on the profit 'P'. The social and environmental aspects may be included as aspects of the quality of the result, but they are bound to get less attention.

Sustainability is about both short-term and long-term orientation: As argued above, the inclusion of the long-term orientation stretches the system boundaries of project management beyond what is currently considered as the domain of project management. In the integrated life-cycles view demonstrated by Labuschagne and Brent (2006), one could argue that the boundary between the temporary project organization

and the permanent organization no longer exists. This conclusion, however, confuses managerial responsibility and the scope of consideration. The temporary nature of any project organization implies that the managerial responsibility of the project manager is also temporary. This temporariness, however, does not imply a short-term orientation. Since benefits of the project deliverable most likely occur after the project has been completed, a longer term orientation, longer than the project life-cycle, is also irreversibly included in the scope of consideration of the project.

Sustainability is about local and global orientation: In an increasingly global business world, more and more projects also touch upon the geo-economic challenges we face. Part of the project team may be located in emerging economies like India or China. Suppliers may be all over the world, or customers benefiting from the project's deliverable. It is clear that the globalizing business world also includes globalized projects and project management. The impact of this globalization trend affects how project teams are organized and managed. Topics like virtual organizations and differing cultures get increasing attention in publications and seminars. However, the scope of these publications seems to be limited to the process of performing the project. Within the project management community, discussion about globalization of the project's outcome or deliverables still has to emerge.

Sustainability is about consuming income, not capital: This aspect of sustainability refers to the principle that resources are not exhausted more quickly than they may be regenerated. In projects this principle may apply to the use of materials, energy, water and other resources, both in the process of delivering the project or as included in the deliverable of the project. Since the temporary nature of projects can create an extraordinary pressure for project members, this principle may be explicitly applied to the human resources in the project. Their performance in the projects should not have a negative effect on their future ability to perform.

Sustainability is about transparency and accountability: The principle of accountability is already clearly present in project management. Project managers account for their actions and decisions in regular progress reports. These reports typically include the 'triple-constraint' variables of time, cost and quality. Following the earlier mentioned triple bottom line concept, however, integrating sustainability implies that project managers are also accountable for the ecological and social aspects of their projects. This logically implies that project progress reports also include environmental and social indicators. The principle of transparency is less obvious in project management. The principle of transparency suggests that project managers communicate potentially relevant events, considerations and decisions to (potential) stakeholders. In projects, however, it is common practice that a project manager controls the information flows from the project team to stakeholders, most often with the goal to influence or manipulate the stakeholder's perception of the project. From a stakeholder management perspective, this practice of influencing perceptions is quite logical and rational, but with an expanding set of potential stakeholders, the integration of sustainability would require a more transparent communication with all (potential) stakeholders.

Sustainability is about personal values and ethics: As discussed earlier, our behavior as professionals and consumers reflects the values and ethical considerations of our society and of ourselves. Project managers are no strangers to this. Projects also have specific values, norms and rules, which are heavily influenced by the project context and the project manager. For project managers, professional ethics and values are written in professional ‘codes of conduct’. Members of the PMI receive the PMI Code of Ethics and Professional Conduct and most IPMA member associations also have a code of conduct for their members. The content of these codes often relates to the relationship of the project manager and the project sponsor and the relationship of the project manager and the association to which he or she belongs. Some codes, particularly PMI’s, also mention the project manager’s responsibility towards society in general. Article 2.2.1. of the PMI Code of Ethics and Professional Conduct states that ‘We make decisions and take actions based on the best interest of society, public safety, and the environment’ (Project Management Institute, 2010). The statement clearly connects ethics and professional conduct with the concepts of sustainability.

On the basis of viewing projects as an instrument of change, the holistic nature of the sustainability principles and the conclusion on the appropriate scope to be considered, we developed the following definition of ‘Sustainability in Projects and Project Management’ (Silvius et al, 2012b).

Sustainability in projects and project management is the development, delivery and management of project-organized change in policies, processes, resources, assets or organizations, with consideration of the six principles of sustainability, in the project, its result and its effect.

IMPLICATIONS FOR PROJECT MANAGEMENT

The principles of sustainability should have an impact on the way projects are managed; for example in the identification of stakeholders or benefit areas a logical starting point for the identification of this impact are the processes of project management. Two frequently used standards for project management processes are the Project Management Institute’s project management body of knowledge, the PMBOK Guide (Project Management Institute, 2013), and the Office of Government Commerce’s PRINCE2 (Office of Government Commerce, 2009). The *PMBOK Guide* describes five project management process groups or clusters: Initiating Processes; Planning Processes; Executing Processes; Closing Processes and Monitoring and Controlling Processes. Although these process groups suggest a project life-cycle, they do not necessarily represent the phasing of the project. Projects appear in many variations and ‘there is no single way to define the ideal structure for a project’ (Project Management Institute, 2013). The project management process groups may therefore depict a full project life-cycle or the nature of the project management processes in a certain stage or phase of the project. PRINCE2 bases its identification of project management processes on the project life-cycle and identifies seven project management process groups: Starting Up a Project; Initiating a Project; Directing a Project; Controlling a Stage; Managing Project Delivery; Managing Stage Boundaries and Closing a Project. When comparing these two standards, the early and final process groups (‘initiating’ and ‘closing’) show great similarity. Also the controlling processes (‘directing’ and ‘monitoring and controlling’) show a certain similarity. For the middle stages of the project, the *PMBOK Guide*

shows a more iterative character than the PRINCE2 model. The PRINCE2 processes 'Managing Stage Boundaries' and 'Controlling a Stage', however, also imply iterative steps. Given the similarities between the two standards, we will use a generic project life-cycle model as our baseline for analyzing the impact of sustainability on project management processes. This analysis confronts the six 'principles' of sustainability, with project management processes of a generic project life-cycle. The terminology is based on the *PMBOK Guide*.

Sustainability is about balancing or harmonizing social, environmental and economic interests: This principle provides additional perspectives on the content and process of the project. Hence, it is expected that this principle has a high impact on almost all project management processes. For example, balancing social, environmental and economic interests will influence the project initiating processes in terms of the intended project result and the identification of stakeholders. Also in the project planning stage, providing additional perspectives will logically affect processes like defining the requirements, scope, activities, quality and risks of the project. Taking into account social and environmental criteria will logically also affect the organization of the project and the criteria for materials and supplier selection. All considerations that apply to the project planning stage of the project will also affect the project execution phase. For example, additional perspectives on quality will logically also influence the quality assurance process. Applying social criteria like equal opportunity, also apply in the project execution stage, when organizing and managing the project team. The project monitoring and control processes may be less strongly affected by the inclusion of social and environmental aspects. Of course the project content that is being monitored is influenced by the principal, but the monitoring and controlling processes itself not that much. One exception to this is the reporting process. The project's progress reports will definitely be influenced by the principle, for example by including reporting items that refer to the social and environmental factors. Inclusion of these factors will also influence the process of data gathering and preparing the report. Taking into account social and environmental criteria is not expected to influence the project closing processes.

Sustainability is about both short-term and long-term orientation: This principle also provides an additional perspective on the content and the process of the project. For example including the long-term future as a consideration may influence the selection of materials used in the project, favoring more eco-friendly materials. In this regard, the principle seemingly overlaps with the principle of balancing social, environmental and economic interests, but it adds a time scale to these interests. Adding this time scale logically impacts almost all project management processes in the project initiating and project planning stages, like defining intended result, requirements, scope, stakeholders, activities, quality and risks of the project. In the project execution stage, adding a long-term perspective could include developing team members beyond the needs of the project, but thereby building the organization's strength to perform projects. This would influence the processes of managing and developing the project team. Another consideration that is emphasized by the short-term and long-term process is the acceptance of the change in products, services, systems, processes, resources or procedures that the project includes. It is impossible to narrow this down to one process in the project. The acceptance of the project result is influenced by the way all project

management processes are executed. Following the reasoning stated earlier, the project monitoring and control processes may be less strongly affected by the inclusion of the short-term and long-term perspective. In the project closing stage, the short-term and long-term principle may be expected to emphasize the hand-over of the project result to the permanent organization and the acceptance of the organizational change that the project created.

Sustainability is about local and global orientation: Similar to the first two principles, having a local and global orientation also provides a specific perspective on the content and the process of the project. For example the global aspects of a project may include the labor conditions of organizations in the supply chain that may reside in low-cost countries like India, China or Africa. Local aspects may include engaging with stakeholders in the local community about the effect of the project (for example noise or traffic related to the project) on their living environment. Since considering the local and global perspective can impact again both the content and the process of the project, almost all project management processes in the project initiating, planning and execution stages may be affected by it. The project monitoring and control processes may be less strongly affected by the inclusion of this perspective, as may the closing stage of the project.

Sustainability is about consuming income, not capital: This principle of sustainability provides guidance for the materials and resources in the project, for example by selecting eco-friendly materials to be used in the project. The impact of this principle therefore concerns the content of the project, thereby logically impacting the processes of the project planning stage. But the principle also applies to the processes of the project execution stage, for example by caring for the wellbeing of the project team members or other stakeholders of the project. The result-oriented nature of projects, combined with often limited resources, may create high work pressure for the team members or suppliers involved. If this pressure leads to fall-out of team members, this should also be considered as 'consuming capital', since it affects a person's future ability to perform. The impact of this principle is therefore also relevant for the processes of the project execution stage. The impact of this principle on the project initiating, monitoring and controlling and the project closing phase may be less obvious.

Sustainability is about transparency and accountability: The principle of transparency and accountability does not provide a new or different perspective on the project's content or process, but concerns the openness and pro-activeness in information and communication towards stakeholders and the general public. This principle therefore logically applies to all project management processes. It concerns 'how' processes are done, but also 'what' is done in terms of communicating and engaging with stakeholders.

Sustainability is about personal values and ethics: Following a similar reasoning as the last principle above, the principle of values and ethics also logically applies to all project management processes and stages. It is not that much about 'what' is done, but most of all about 'how' it is done.

Sustainability principles						
Harmonizing social, environmental and economical interests	Both short term and long term	Local and global	Consuming income, not capital	Transparency and accountability	Personal values and ethics	
Project Initiating	High impact	High impact	High impact	Low impact	High impact	High impact
Project Planning	High impact	High impact	High impact	High impact	High impact	High impact
Project Executing	High impact	High impact	High impact	High impact	High impact	High impact
Project Monitoring and Controlling	Moderate impact	Low impact	Low impact	Low impact	High impact	High impact
Project Closing	Low impact	High impact	Low impact	Low impact	Moderate impact	Moderate impact

Figure 20.6 Expected effect of sustainability principles on project management processes

Figure 20.6 summarizes the impact of the sustainability principles analyzed above. The expected impact is indicated as 'High', 'Moderate' and 'Low'.

Based on the analysis above, the following 'areas of impact' can be summarized:

Project context: Project management processes should address questions such as:

- How do the principles and aspects of sustainability influence the societal and organizational context of the project?
- How is this influence relevant or translated to the project?

Stakeholders: The principles of sustainability, more specifically the principles of 'balancing or harmonizing social, environmental and economic interests', 'both short term and long term' and 'both local and global', will likely increase the number of stakeholders of the project. Typical 'sustainability stakeholders' may be environmental protection pressure groups, human rights groups and non-governmental organizations.

Project content: Integrating the principles of sustainability will influence the definition of the result, objective, conditions and success factors of the project, for example the inclusion of environmental or social aspects in the project's objective and intended result.

Business case: The influence of the principles of sustainability on the project content will need to be reflected also in the project justification. The business case of the project may need to be expanded to also include non-financial factors such as social or environmental considerations.

Project success: Related to the project justification in the business case, it should be expected that the principles of sustainability are also reflected in the definition or perception of success of the project.

Materials and procurement: The processes concerned with materials and procurement also provide a logical opportunity to integrate aspects of sustainability, for example non-bribery and ethical behavior in the selection of suppliers.

Project reporting: Since the project progress reports logically follow the definition of scope, objective, critical success factors, business case and so forth from the project initiating and planning processes, the project reporting processes will also be influenced by the inclusion of sustainability aspects.

Risk management: With the inclusion of environmental and social aspects in the project's objective, scope and or conditions, logically the assessment of potential risks will also need to evolve.

Project team: Another area of impact of sustainability is the project organization and management of the project team. Especially the social aspects of sustainability, such as equal opportunity and personal development, can be put to practice in the management of the project team.

Organizational learning: A final area of impact of sustainability is the degree to which the organization learns from the project. Sustainability also suggests minimizing waste. Organizations should therefore learn from their projects in order to not 'waste' energy, resources and materials on their mistakes in projects.

On these logical areas of impact, the standards of project management processes (*PMBOK Guide* and PRINCE2) mainly refer implicitly to sustainability considerations. A more explicit identification is lacking, especially in environmental and social realms. Furthermore, the *PMBOK Guide* and PRINCE2 standards of project management place emphasis on the processes of project management. The content of the project (objective, intended result, deliverable) is mostly considered as given. Integrating the concepts of sustainability, however, suggests that not only is the process of delivering the project taken into consideration, but also the content of the project itself.

Concluding Remarks

In this chapter we demonstrated that projects and sustainability are interrelated. Sustainable development requires that we do things differently, asks for change and needs projects to deliver this change. Project managers are well positioned to influence the sustainable aspects of the projects they are working on – both in terms of the content and the process of the project. Taking responsibility for sustainability may actually be part of the evolution of the project management profession.

However – *What's new?* What does the integration of sustainability into projects and project management really change about project management? This chapter analyzed the impact of the principles of sustainability on projects and project management. From this analysis it became clear that these principles, particularly those such as 'harmonizing social, environmental and economical interests', 'both short-term and long-term orientation' and 'local and global orientation', provide new or additional perspectives on the content and the process of the project. So we may conclude that

integrating sustainability requires a scope shift in the management of projects – from managing time, budget and quality, to managing social, environmental and economic impacts. Integrating sustainability in project management is more than adding a new facet or perspective. It is more than changing some processes and some formats within the current project management standards, adding new perspectives to the way projects are considered also adds complexity. This increased complexity calls for a more holistic and less mechanical project management approach. The traditional project management paradigm of controlling time, budget and quality suggests a level of predictability and control that is just not realistic in complex changes. The integration of sustainability requires a paradigm shift. From an approach to project management that can be characterized by predictability and controllability of both process and deliverables, and is focused on eliminating risks, to an approach that is characterized by flexibility, complexity and opportunity.

The core impact of considering sustainability, however, may be about taking responsibility for a more sustainable development of organizations and business. Taking up this responsibility changes the role of project managers and therefore changes the profession. Integrating sustainability requires that project managers develop themselves as specialists in sustainable development and act as partner of and peer to stakeholders. In this mind shift, the change a project brings about is no longer a given nor exclusively the responsibility of the project sponsor, but also the responsibility of the project manager with ethics and transparency as a basic touchstone. Project management is no longer about ‘managing’ stakeholders, but about engaging with stakeholders in realizing a sustainable development of organization and society. These three shifts resulting from integrating sustainability into project management can be summarized and connected as illustrated in Figure 20.7.

The scope shift resides in the paradigm shift of sustainable project management. This paradigm shift is grounded in the mind shift.

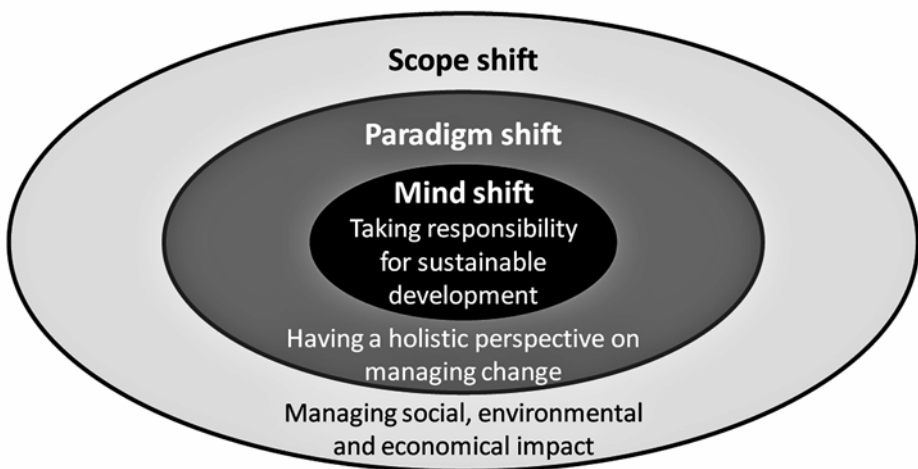


Figure 20.7 The three shifts of sustainable project management (after Silvius et al, 2012b)

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3 *Process*

In Part 3, we consider the management process by which the project's products or results are delivered. We emphasize project management as a process and not as a tool box. It is the process by which our dreams are converted into project realities and as such it is an algorithm by which we solve the project, that is to clarify the end objective and find out how to achieve it. In this part we start by describing the concept of management process, and then describe specific steps in the process, particularly start-up, design, implementation and close-out.

Chapter 21: Managing the Process

In Chapter 21, Martina Huemann and I describe the management process. We try to get away from the idea of life-cycle, because the project doesn't go back to the start. It is a process from start to finish. Management processes exist on several levels. With respect to the project there are two models, the project process, where the project goes through several phases: concept; feasibility; design; execution and close; and the management process, where the management of the project goes through several steps: starting; planning; executing; controlling and closing. The project sits within several possible higher level processes, for: corporate strategy; the product developed by the project; portfolios and programs. Then individual elements of the project plan are also processes. The critical path network is a process, and there are processes to perform individual functions from Part 2 such as risk management.

Chapter 22: Project Start-up

Almost every form of the project process involves some form of start-up. Projects that don't start well cannot end well. In Chapter 22, I describe project start-up. I consider the objectives of start-up, methods used and give an agenda for a project start-up workshop.

Chapter 23: Feasibility, Design and Planning

In Chapter 23, Willie Tan considers project planning in its wider sense. He says we should start with the end in mind, and then describes how to develop project plans, create the project governance structure and create the project control structures.

Chapter 24: Managing Implementation

In Chapter 24, Dennis Lock describes implementation and progress monitoring and control. He introduces an essential framework for implementation and progress measurement, and then discusses the need to communicate the plan. He describes key issues of start-up as they relate to implementation and progress measurement. He then describes how to manage progress in several functions. He also discusses higher level of progress measurement and some special cases. He then describes methods of progress measurement and control.

Chapter 25: Project Close-out

Projects that start well need to end well, and so the process needs to be managed. In Chapter 26, Hemanta Doloi describes project close-out. He describes the essentials of project close-out and how it is managed using his life-cycle project management method.

RODNEY TURNER AND MARTINA HUEMANN

It has been common in the past to talk about the project life-cycle, but we think that is a misnomer. A life-cycle implies that you return to the beginning. An insect goes through a life-cycle: an adult lays an egg; the egg hatches into a larva; the larva turns into a pupa; the pupa hatches into an adult and the adult lays an egg. That is a cycle; you return to the beginning. But that does not happen on projects: one project, and the investment it creates, goes through its life, from its germination to its eventual death, (decommissioning), but it does not necessarily result in a new project. Other projects happen around it, but it is not necessarily the case that the end of one project germinates the beginning of another. Projects, and the investments they create, have a life, but not a cycle – they don't return to the beginning. As a project goes through its life, it follows a number of steps, and so follows a process, and so it is the concept of process we want to emphasize in this chapter.

We will describe a number of different forms of projects and related processes. The concept of process might imply the steps are strictly sequential. That is not the case. The steps can happen in sequence, they can overlap and they can be repeated. Some people say that projects implemented using the agile system don't follow a process. We don't think that is true. They go through design, execution and closure; it is just that design and execution can be repeated many times – in a cycle (but not a life-cycle).

We view the project process very much as an algorithm to help you reach the project's goals, as illustrated in Figure 21.1. (Turner et al, 2010).

When you start the project, there can be some uncertainty about what the project's goal looks like and how to get there. You know roughly what it looks like and where it is and how to get there but there is some uncertainty. The algorithm (process) provides you with a rule to take a step towards the goal of the project. In taking a step towards the goal, you improve your understanding of what the goal looks like, where it is and how to get there. You reduce the uncertainty. The algorithm (process) then provides a rule to take another step, and another step and another step. As you take each step you improve your understanding and reduce the uncertainty until you reach the goal, at which point you know what it looks like, where it is and how you got there.

At any point in the project, there is uncertainty about what the end goal looks like and how to get there. Certainty is the information you have; uncertainty the information you don't have (Figure 21.2).

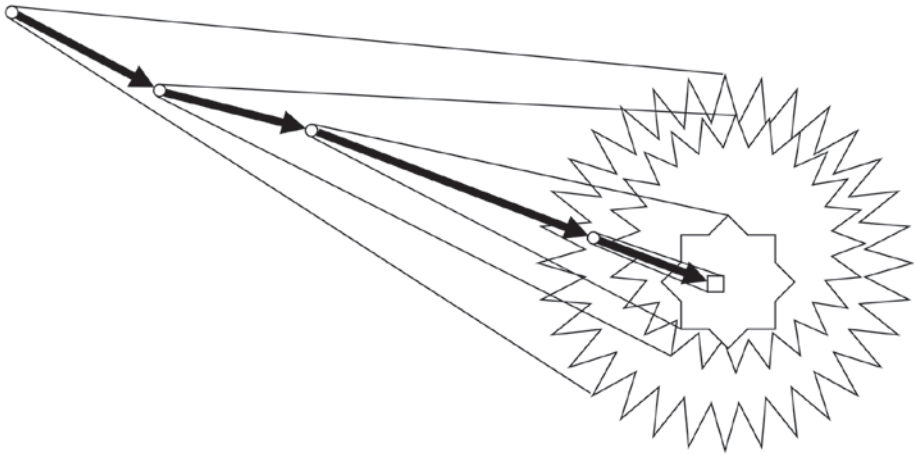


Figure 21.1 The project as an algorithm

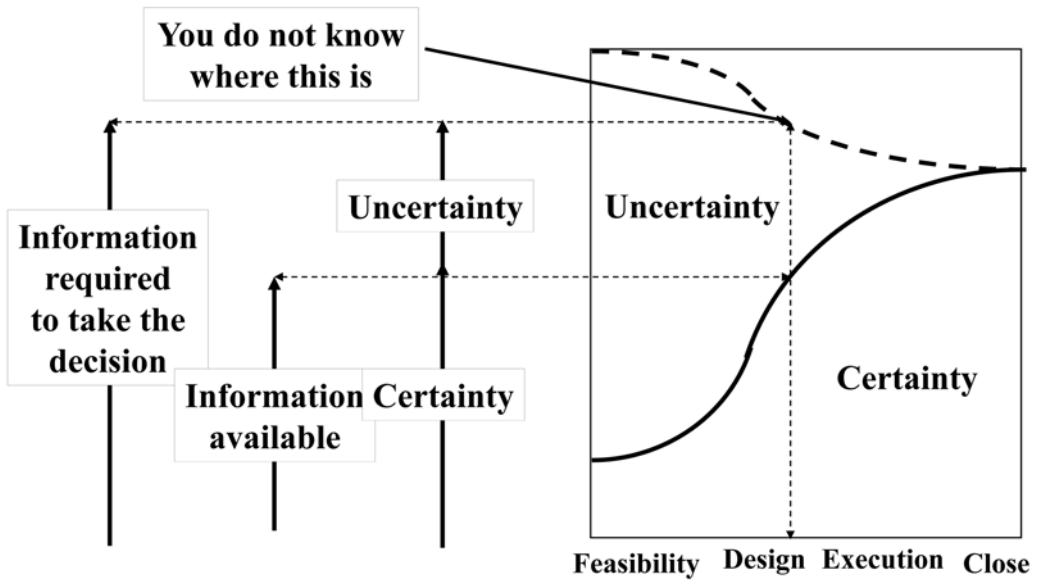


Figure 21.2 Uncertainty is the information you don't have

The only thing is you don't know what information you don't have; you know what the certainty is, but you don't know what the uncertainty is; it might be small, it might be large. You usually think you have an idea – some projects are low risk and others high risk – but you don't know and you might be wrong. As you progress through the process, the algorithm (process) helps you gather information. Winch (2004) describes the project as a computer; it helps you gather and process information to reduce uncertainty. When you reach your goal, the algorithm (process) has helped you gather all the information you need. As you progress through the project, you make decisions about the end goal, and the process to attain it. You assume those decisions are rational. Simon (1955) introduced the concept of bounded rationality, and won the Nobel Prize in Economics for it. As much as you would like to take rational decisions, you can't take completely rational ones. There are three main reasons:

1. You don't have all the information you need; there is uncertainty (Figure 21.2).
2. You don't have the computing power to fully process all the information you do have.
3. You can't foretell the future.

Because of the first two, we have to satisfice; we have to take the best decisions we can and make do. Voltaire said that the perfect is the enemy of the good. If you aim for perfect decisions, you won't make any decisions. You have to make do, satisfice. The third issue just creates risk and there is no way around it other than to manage the risk (Chapter 18). There may be two ways of doing something, A and B, and 80% of the time A will be the right way and 20% B, but before you start you don't know which one it will be. If A is right it will be the better way of doing it and if B is right it will be the better way of doing it. Which do you choose? A probably because it will be right four times out of five, and perhaps you can manage the risk to increase the chance that A is right. If B will be substantially more profitable perhaps you will choose method B and manage the risk to increase the chance of B being right – that is managing opportunities (Chapter 18). If you could foretell the future, all would be fine, but you can't and so you take and manage the risk.

In this chapter we describe different versions of processes on projects. We start by focusing on the project process. Then we describe the project management process, which sets the basis for considering project management as a management process and approach in contrast to considering it as a tool box to optimize project performance. The project usually sits within a higher order entity, an investment, a program or a portfolio. In the second section we consider the higher order processes. Then there may be lower order processes to implement the project plans and the functions of project management (chapters 8 to 20). We consider some of the processes associated with the implementation of the functions.

Project and Project Management Processes

THE PROJECT PROCESS

Figure 21.3 illustrates a fairly standard project process (Turner, 2009). There are five stages:

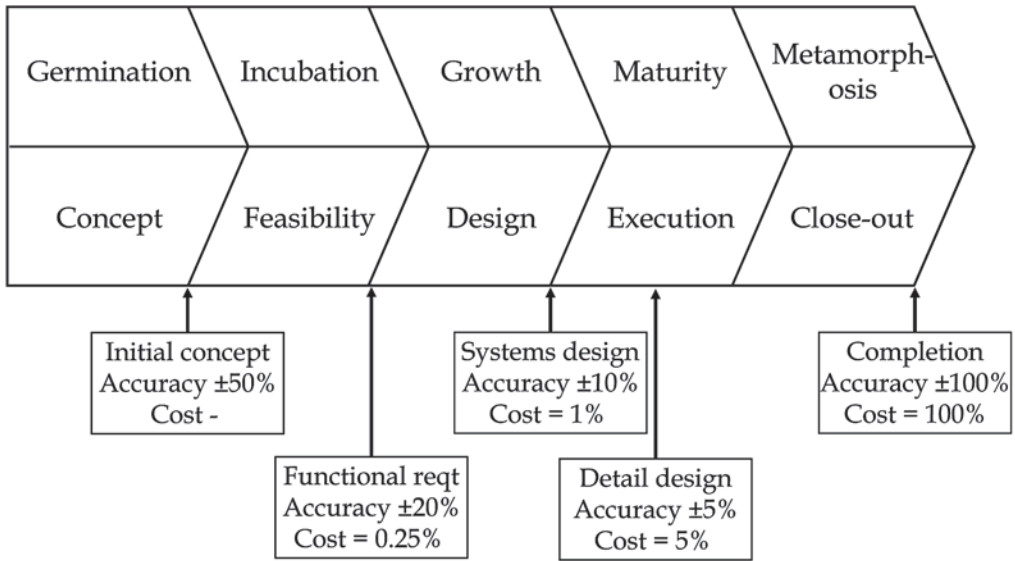


Figure 21.3 A five-stage project process (after Turner, 2009)

Concept: In reality this lasts no time. Somebody in the organization, the project sponsor, has an idea that there is something the organization can do to improve performance. The organization can develop a new asset, the output from a project, Figure 2.1, which will give the organization new competencies, the outcome. The operation of those competencies, outcome, will provide the performance improvement and so give the organization benefit. At this early stage, let's say the cost will be £100 and the benefit £50 per year. That is a two year pay back, which for our industry is excellent. But there is uncertainty, as illustrated by the end of stage review at the bottom. Perhaps it is as high as $\pm 50\%$, which means the cost can be as low as £50 and as high as £150 and the benefit as high as £75 per year and as low as £25 per year. At best and best (cost £50, benefit £75) the pay back is eight months; that is wonderful, what is stopping us? But at worst and worst (cost £150, benefit £25) the pay back is six years; whoa, stop, don't touch it with a barge pole. But at the mid-range value of two year pay back, that is excellent and so we consider it worthwhile committing a very small amount of resource to a feasibility study. People who don't follow a process like this will leap in and do the project based on the two year pay back, and when it turns out to be six ... disaster.

Feasibility: The end of stage review at the end of feasibility suggests that the feasibility study will cost us $\frac{1}{4}\%$ of the cost of the project. That is just suggested as a typical value, but the idea is we should spend a small amount of money to improve our understanding. We gather information about the project to help improve the design and develop the business case. We see whether the project will work from both a technical and economic perspective. The stage gate at the end of the feasibility study suggests we can reduce our uncertainty to say $\pm 20\%$. Let's say the cost is now looking like £120 and the benefit £40. Having improved our understanding the cost has increased a bit and the benefit reduced. With the uncertainty, the cost ranges from £100 to £140 and the benefit from

£30 to £50. At the mid-range position (£120, £40), the pay back is three years. That may still be very good. At best and best (£100, £50), it is still two years, excellent. At worst and worst (£140, £30), it is almost five years, and that may be marginal and even uneconomic. But at the mid-range position it may still be worthwhile and so we commit more resource to a design study. Before we move to the design study we just want to say one more thing. Some people will say that because the cost is now looking like £120, the estimate at the concept stage, £100, was *WRONG*. It wasn't wrong, just not very accurate. It was in fact £50 to £150, and the new range, £100 to £140, is wholly within that old range. The £100 was correct, it just had considerable uncertainty associated with it. There are unfortunately some people, who, when you say £100, assume you mean somewhere between £99.99 and £100.01 regardless of what stage of the project you are at.

Design: The end of stage review at the end of design suggests that the design study will cost a further $\frac{3}{4}\%$ of the cost of the project, giving 1% in total. We gather further information about the project, improve the design and improve the business case. The uncertainty is now typically $\pm 10\%$. Let's say we confirm the £120 and £40. The former is now somewhere between £110 and £130 and the latter between £35 and £45. For best and best (£110, £45), the pay back is about two and a half years and worst and worst (£130, £35), about three and a half years. The latter may be acceptable to our business, so the risk is now acceptable and we sanction the project. We say the estimate for the project is £120, with a tolerance of $\pm 10\%$. We move to execution.

Execution: As a first step of execution we may do a detail design for the project, which forms the basis of control. The detail design may cost a further 4% of the cost of the project, so we have spent 5% in total, and the accuracy of the estimate is $\pm 5\%$; that is the best we can hope for. We may change the tolerance.

Close-out: When we complete the work of the project, we commission the output, transfer it to operation, obtain the outcome and start receiving the benefits. There is now total certainty about what the goal looks like and how much it cost.

As we said above, you cannot leap into the project on the basis of the early estimates. If you rush in based on the estimates you did at concept, you may assume the project will cost £100 with a £50 per year benefit, but find it is £150 and £25 and make a huge loss. You can't make that mistake very many times before you cannot afford to do projects. So you have to progress cautiously. On the basis of the estimates at the concept stage you commit a very small amount of resource to feasibility. Based on the estimates from feasibility, if it still looks worthwhile, you commit more resources to design, and if that looks worthwhile, you commit to doing the project, called sanction.

We talked about end of stage reviews. At the end of each stage you conduct a review, where you review both the technical and economic feasibility of the project to the current level of accuracy. Based on that you either decide to progress to the next stage, abandon the project or go back and do further work at the previous stage. So the reviews are go, no-go or go back.

We call this the project process, but in reality one project will not cover all the stages. Concept will be pre-project. Then feasibility is usually a project on its own. Then design may be a project, and execution and close-out a separate project, or design, execution and close-out can be a single project. There are associated different forms of contract, design, build or design and build.



Figure 21.4 A project process involving procurement for projects done by external contractors

There are many different versions of the process. The Project Management Institute, in their *A Guide to the Project Management Body of Knowledge* (2013), has just four stages. They say the 'life-cycle' starting the project, organizing and preparing, carrying out the project work and closing the project. They go on to suggest that a given project may have one or more phases, corresponding to the phases such as design or design and build as discussed above. Figure 21.4 is a process based on one developed by the Office of Government Commerce for their Gateway Review process, which we will come across again later. This is aimed at large projects being done by external contractors, so needs to include a procurement stage.

THE PROJECT MANAGEMENT PROCESS

Figure 21.3 is a process for the production of the output, and may be made up of two, three or even more projects. But within each project, how do we actually manage the project? This is where we adopt project management processes. Figure 21.5 is a definition of the project management processes Rodney Turner has been using for 25 years.

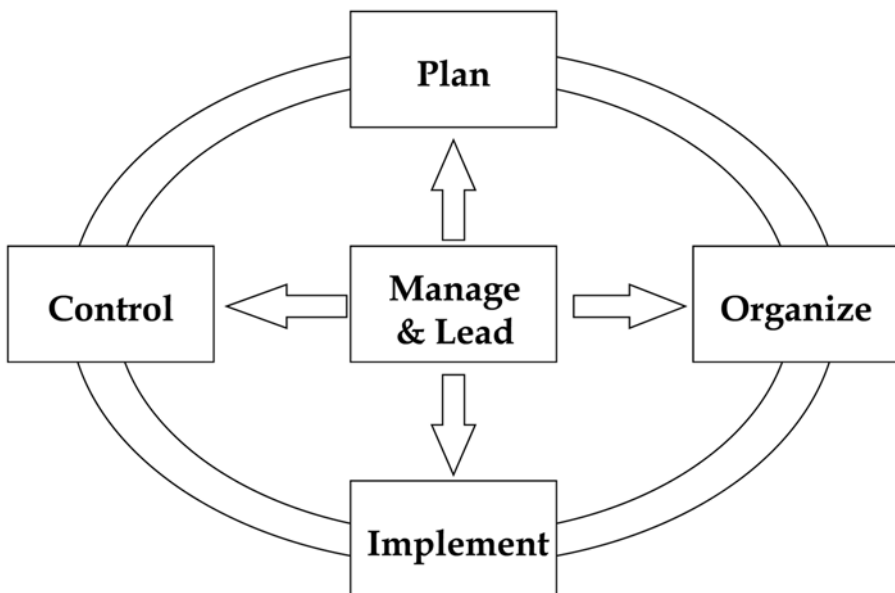


Figure 21.5 The management process (after Turner, 2009)

You have to:

- plan the project;
- organize the resources to do it;
- implement by assigning work to people;
- control progress;
- manage and lead the work.

Figure 21.6 shows the project management processes suggested by PMI in their *PMBOK Guide* (Project Management Institute, 2013). They define five sets of processes:

- Initiating processes;
- Planning processes;
- Executing processes;
- Controlling/monitoring processes;
- Closing processes.

The ISO 21500 standard for project management (International Standards Organization, 2012), uses similar processes.

Figure 21.7 is a model first developed by Gareis (2005). It considers project initiation as not being part of project management and recognizes that there may be discontinuities (Gareis et al, 2013). This model defines an explicit start and end of the project management process; the project management process starts by the project sponsor who assigns the project to the project manager or the project team, and ends with the project approval by the project sponsor.

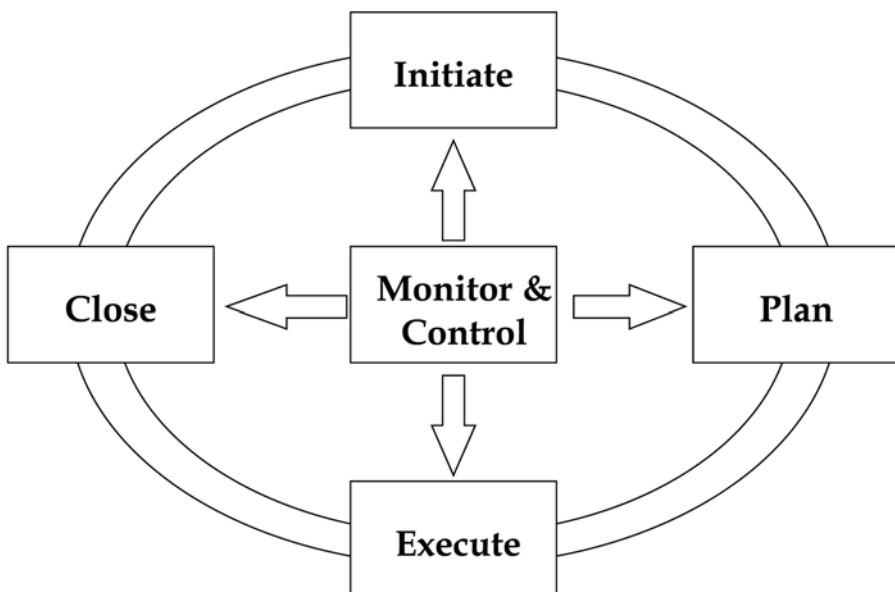


Figure 21.6 The project management process according to PMI (after PMI, 2013)

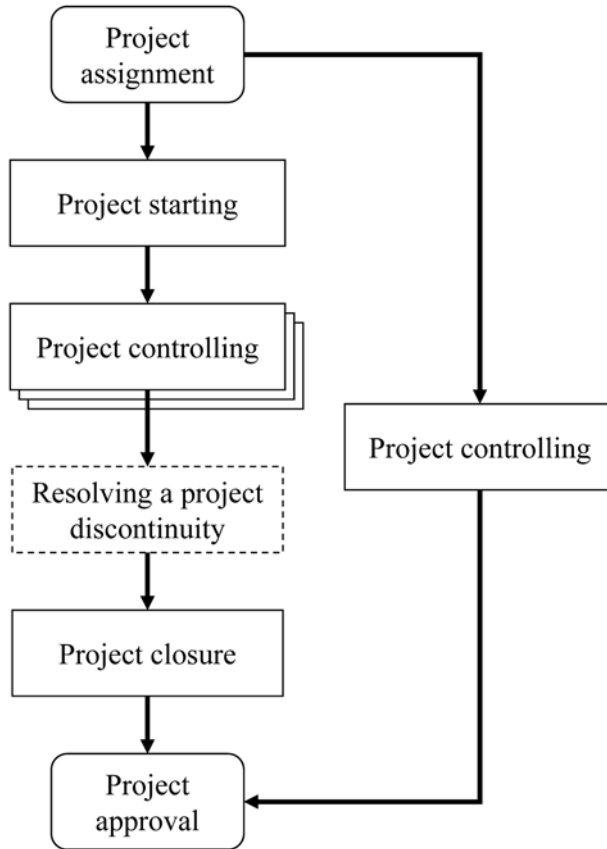


Figure 21.7 The project management process (after Gareis et al, 2013)

Higher Order Processes

It is very seldom that projects take place alone. They are usually part of some larger activity. A project can take place as part of a program or portfolio, or sit within the life of the asset it produces. The project and project management processes sit within higher order processes.

THE LIFE OF THE ASSET

Rodney Turner when he first joined Henley Management College in the late 1980s was listening to an external speaker. The speaker drew a box on the white board and said, 'A project takes air, water and natural gas and produces ammonia'. Rodney thought, 'No, a project takes steel, concrete and wires and produces an ammonia plant. The project's output, the ammonia plant, takes air, water and natural gas to produce ammonia'. But this illustrates a wooliness of thinking, which unfortunately many people are subject to; they mix up the project and the project's output, the new asset it produces.

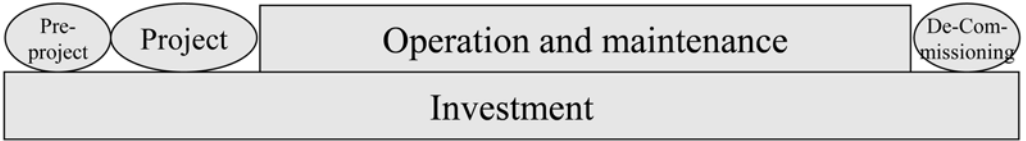


Figure 21.8 The investment and the project (after Gareis et al, 2013)

Gareis (2005) is very specific about this distinction. Figure 21.8 differentiates the project from the investment and relates it to different processes.

A project initiates an investment. In accordance with Figure 21.7, this shows initiation as taking place in the pre-project phase. Gareis (2005) considers the project initiation to be part of portfolio management, as the initiation of a new project adds to an existing project portfolio and therefore needs to be undertaken at the level of the project portfolio and not at the level of the single project. After the project, there might be further projects, and there are the operating processes of the asset and finally its decommissioning.

This distinction between the project process and the investment process is very important. There are many, many different versions of this, many of them based around product development processes, or product life processes; too many to go into here. We include one more, Figure 21.9, one of the original models for project life-cycle due to Wearne (1973).

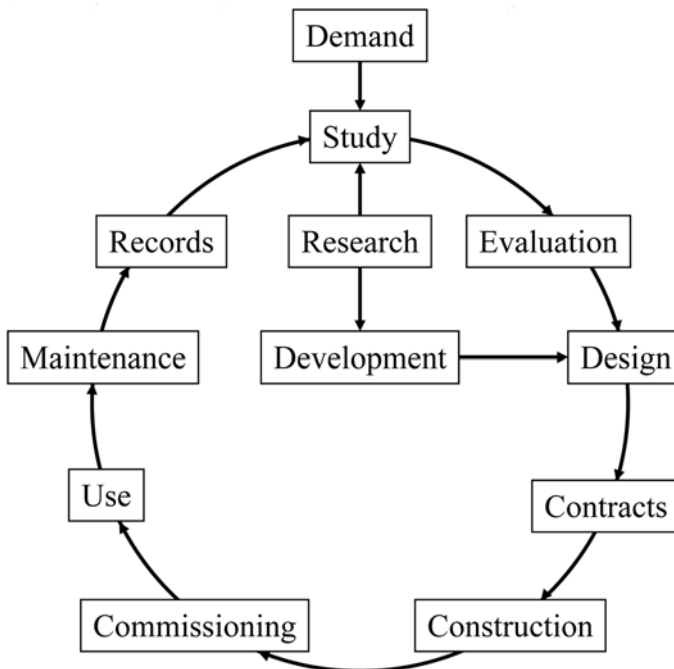


Figure 21.9 The life-cycle of the investment (after Wearne, 1973)

It shows the life of the asset from research, through feasibility, design, construction, operation and maintenance to decommissioning. In reality again it will comprise many projects, with almost every box potentially being a project or operations phase. It is perhaps where we get the idea of *life-cycle* from, because it loops back on itself. But there is no reason for it to loop back on itself. The demise of one asset doesn't stimulate the creation of another, the adult insect doesn't lay an egg.

PROGRAMS AND PORTFOLIOS

Figure 21.10 shows a cascade from corporate strategy, through portfolios and programs down to projects. This is the standard cascade. The organization has an investment portfolio to implement its annual strategic objectives, and the investment portfolio will comprise large projects, large programs and portfolios of smaller projects and programs. But in fact programs can comprise projects, smaller programs and portfolios of much smaller projects and vice versa. But the standard cascade is portfolio-program-project. Figure 21.11 shows a cascade of processes, based on a cascade developed by the Office of Government Commerce (now the Cabinet Office) for its gateway review process.

Portfolios are used to implement corporate strategy, and are made up of programs. Programs are made of projects. This shows the project process from Figure 21.4. The triangles are gateway reviews (end of stage reviews), at the end of each stage. But there are several different versions of process for portfolios and programs.

Portfolio Processes

Processes for portfolios are less well developed than for projects or programs. Turner (2009) suggests a five step process for portfolio management:

1. Maintain an inventory of all the projects and programs in the portfolio.
2. Record progress on the projects and programs against agreed key performance indicators.
3. Prioritize new projects and programs suggested for admission to the portfolio and admit new projects and programs based on the priorities and average availability of resources.
4. Manage the sharing of resources between projects and programs in the portfolios.
5. Conduct a post completion review of completed projects and programs to ensure they delivered their promised business objectives.

In an established portfolio steps 1 to 4 will happen in parallel. But if you are adopting portfolio management for the first time they will happen sequentially. The Technology and Innovation Management Department of the Technical University of Berlin has a four stage process:

- Portfolio structuring;
- Resource management;
- Portfolio steering;
- Portfolio sustainability.

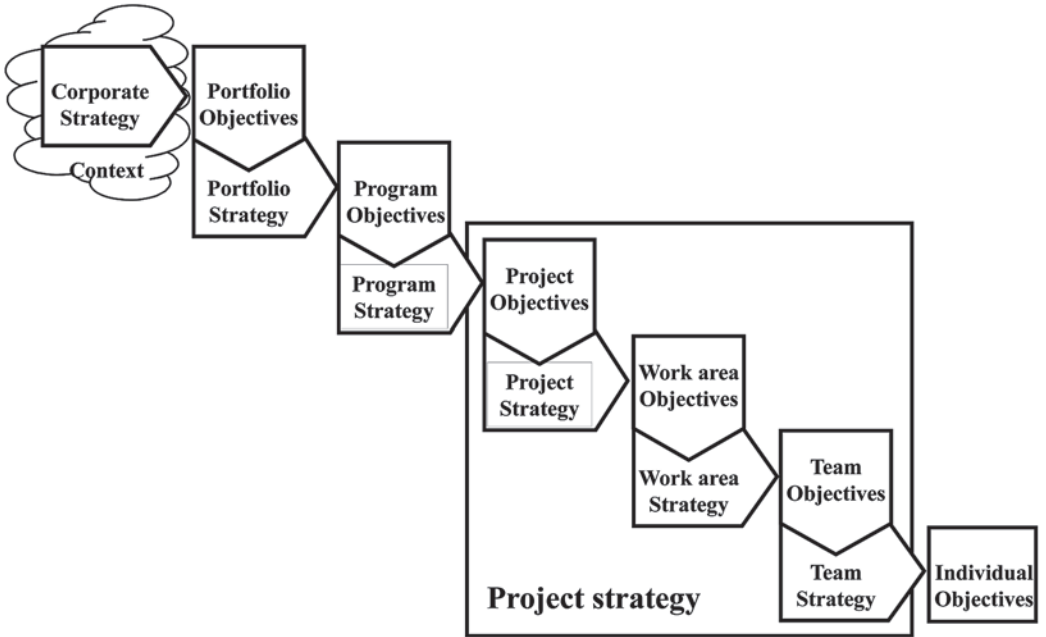


Figure 21.10 A cascade of objectives from corporate strategy to project tasks (after Turner, 2009)

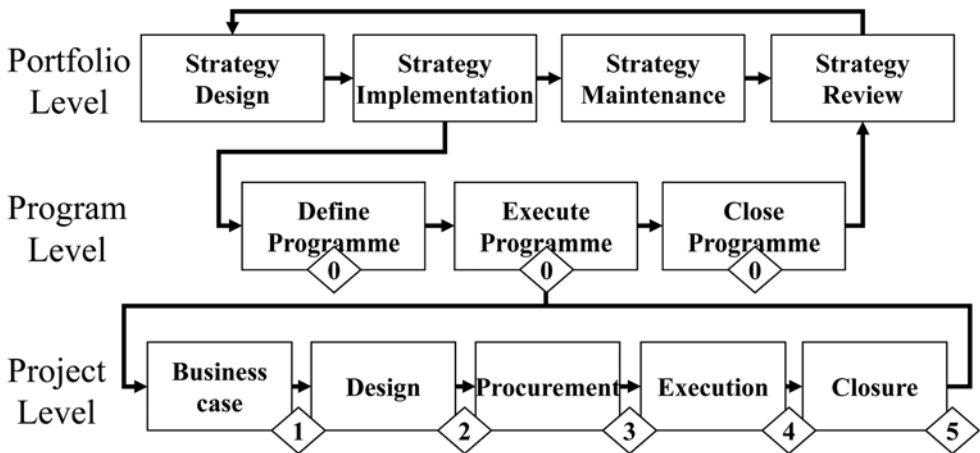


Figure 21.11 Three levels of process

In Chapter 28, Ginger Levin and J. LeRoy Ward suggest the following process:

- Overview;
- Business case;
- Categories;
- Evaluation;
- Balancing;
- Reporting progress.

Programs

Figure 21.12 is the program management process suggested by the Cabinet Office (2011). It is similar to Figure 21.3, and effectively says that programs here have similar features to large projects. In fact for the projects in a program, concept, feasibility and perhaps even design, take place at the program level, and so the projects in a program follow the project management process and not the project process. The triangles again are also gateway reviews at the program level. In Chapter 27 Ginger Levin and J. Leroy Ward don't define a program management process, but concentrate on three key themes: benefits, governance and stakeholders, and say what the competencies of the program manager are.

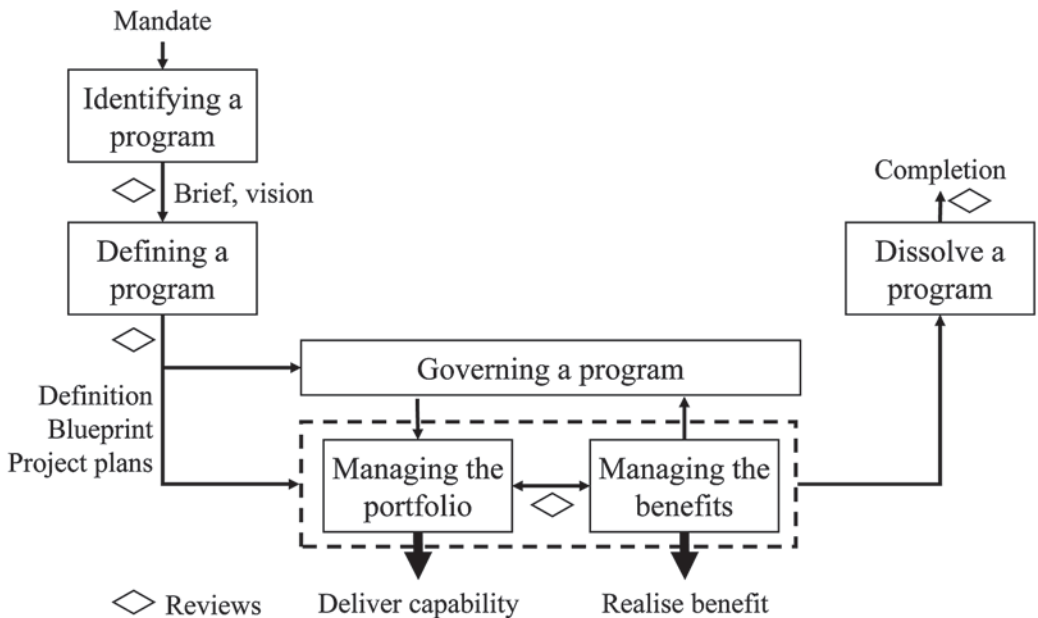


Figure 21.12 A program process

SRHA		MILESTONE PLAN						
Project:		Ockham Razor Day Care and Rehabilitation Centre for Elderly People						
Project Champion:		John Locke						
Project Manager:		David Hobbes						
Date	B	F	P	S	C	Milestone Name	Short Name	End Date
02-Sep-05						When the Joint Planning Committee give approval for project to commence	Joint Planning Committee approval	02-Sep-05
30-Sep-05						When key staff have been reassigned	Reassign key staff	30-Sep-05
31-Oct-05	B1					When the consultant architect has been appointed	Appoint architect/consultant	31-Oct-05
15-Nov-05						When the consultation process with key staff has been completed	Consultation with key staff	15-Nov-05
15-Nov-05		F1				When the services and required facilities have been agreed	Plan services and required facilities	15-Nov-05
15-Nov-05						When an inventory of interfacing computer systems has been drawn up	Inventory of existing computer systems	15-Nov-05
30-Nov-05	B2					When an appropriate building has been identified and the lease signed	Source appropriate building	30-Nov-05
31-Jan-05						When a draft design of the facilities has been agreed	Draft design of facilities	31-Jan-05
31-Jan-05	B3					When the design of the building modifications has been agreed	Design of building modifications	31-Jan-05
31-Jan-05						When the final design of the facilities has been agreed	Final design of facilities	31-Jan-05
31-Jan-05						When key administrative staff have been appointed	Appoint key administrative staff	31-Jan-05
28-Feb-05						When the functional requirements for the computer system have been agreed	Plan computer system - requirements	28-Feb-05
28-Feb-05						When the operating procedures have been written and signed off	Write operating procedures	28-Feb-05
31-Mar-05						When the systems specification of the computer system has been signed off	Design computer system	31-Mar-05
31-May-05						When the job descriptions and person specifications of other staff have been agreed	Write job descriptions and person specifications	31-May-05
31-May-05	B4					When the building work and layout test are complete	Do building work, including layout test	31-May-05
30-Jun-05		F4				When medical, clinical and technical equipment has been procured	Procure medical, clinical and technical equipment	30-Jun-05
30-Jun-05						When medical, clinical and technical equipment has been installed and tested	Install medical, clinical and technical equipment	30-Jun-05
30-Jun-05						When the computer system has been procured and installed	Procure and install computer system	30-Jun-05
15-Jul-05						When all documentation has been written and published	Write documentation	15-Jul-05
31-Jul-05	B5					When the building has been inspected and completion certificates signed	Inspect and take receipt of building	31-Jul-05
31-Jul-05						When the equipment has been tested and acceptance certificates signed	Test and take receipt of equipment	31-Jul-05
30-Jun-05		F7				When transport facilities have been procured	Procure transport facilities	30-Jun-05
30-Jun-05						When the computer system has been tested and acceptance certificates signed	Test and commission computer system	30-Jun-05
30-Jun-05						When non-specialist staff have been recruited	Recruit non-specialist staff	30-Jun-05
15-Jul-05	B6					When the building is ready for occupation	Move in	15-Jul-05
31-Jul-05		F8				When an initial stock of consumables has been procured	Procure consumables	31-Jul-05
31-Jul-05						When team building and training is complete	Team building and staff training	31-Jul-05
30-Sep-05						When the day care centre is commissioned	Commission facility	30-Sep-05

Figure 21.13 The Milestone Plan, a process flow diagram (after Turner, 2009)

Project Plans

Many of the lower levels plans for projects are also processes. A critical path network is a process for project delivery. Turner (2009) suggests the level 1 plan for the project be drawn as a Milestone Plan (Figure 21.13). This is deliberately drawn in the form of a process flow diagram. We also see processes for the delivery of the functions of project management.

FUNCTIONAL PROCESSES

Part 2 of this book describes the functions for managing project performance. We can define a process for managing each of these functions. The Project Management Institute (2013) says what each of the five processes in Figure 21.6 means for each of their nine body of knowledge areas.

Risk management is a function for which many versions of the process exist. Table 21.1 compares four generic processes for risk management from Turner (2009), the Project Management Institute (2012), the Association for Project Management (2004) and Office for Government Commerce (2009).

Table 21.1 Comparing processes for project risk management

Generic Process	PMI (2008)	APM (2004)	OGC (2009)
Focus on risk management		Initiate	
Identify risks	Identify	Identify	Identify
Qualitative assessment	Assess	Assess	Evaluate
Prioritization			
Quantitative assessment	Analyze		
Plan response	Mitigate	Plan	Identify response Select response
Control risks	Manage	Implement	Plan and resource Monitor and report

David Hillson in Chapter 18 has an eight-step process:

1. Getting started;
2. Finding risk;
3. Setting priorities;
4. Deciding what to do;
5. Taking action;
6. Telling others;
7. Keeping up to date;
8. Capturing lessons.

In previous editions of this book, Chris Chapman and Stephen Ward had a nine step process from which Association of Project Managers (2004) is derived.

Concluding Remarks

We have seen that process management is essential to project management. We have shown that there are distinctions between project processes, project management processes and higher level processes like program management and project portfolio management processes. To perceive project management as a process is a relatively new development although some authors have been advocating the process view for more than 20 years (Turner, 2009, first edition 1993). More recently it has received increasing attention and has been adapted in the ISO 21500 standard on project management. This suggests that project management has developed from being a tool box into a management approach for delivering projects.

The remainder of this part covers project and project management processes:

- Start-up;
- Feasibility, design and planning;
- Implementation;
- Measuring performance;
- Close-out.

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RODNEY TURNER

In the previous chapter, we saw that many of the views of the project management processes feature project start or project initiation in some way. The management process model PMI PMBOK (Project Management Institute, 2013), has initiating processes as the first set of project processes, and that is reflected in the new ISO standard for project management, ISO 21500, (International Standards Organization, 2012). The process model developed by Gareis (2005) and adapted by Gareis et al (2013), has initiation as the first step, but they suggest that is pre-project and not part of the project itself. That is similar to the approach taken by PRINCE2 (Office of Government Commerce, 2009), where Project Start is a pre-project phase when the project brief is written and Project Initiations is the first project phase, when the project initiation document is written. Thus project start-up is an essential feature of all projects. If you don't start a project well it has a greatly reduced chance of finishing well. So starting a project properly is something you should put a substantial amount of effort into.

In the last chapter, we also described a project process model which may consist of several phases: feasibility, design, execution and close-out. We did say that one project is unlikely to encompass all four phases; that they are likely to be covered by two or more projects. But PMI clearly makes the point that you need to apply the initiating processes at the start of each phase, feasibility, design, execution and close-out. Thus project start-up is something that is likely to be repeated throughout the project process, and indeed we saw above that PRINCE2 breaks into a two-step process.

Some people feel they do not have time for the project start process; they are too busy getting on with the work of the project. I suggest below that on anything but the smallest project you may spend two to three days in a project start workshop. Such people say a project start workshop is a complete waste of their time. I worked with a project team in British Telecom many years ago. They had seven weeks to complete a critical project. The project sponsor was a great believer in the project start process, and told the project manager that he and the team were to do no work in the first week. They were to spend the first week planning and understanding the project, and they spent three days of that week in a start workshop with me. By the end of the first week they completely understood the project, and at the beginning of the second week they hit the ground running and went on to finish the project in the remaining six weeks. So you just have to ask yourself which is better:

- To completely understand the project, and to complete it efficiently and effectively in six weeks, or
- To mess around for seven weeks, never quite sure what you are doing and making no progress.

In this short chapter I describe project start-up. I describe the objectives of start-up, the methods of start-up and how to conduct a project start workshop.

Objectives of Start-up

A necessary condition for project success is to agree the success criteria with the project stakeholders before the project starts (Turner, 2009). Actually it is wider than that; not only do you want the stakeholders buying into the project success criteria and all focusing on the same end objectives, it is also useful to get agreement on the critical success factors, so that everyone is working on the project in the same way. It is clearly useful to get common agreement among all the key stakeholders, but particularly among the project team, who can make failure a self-fulfilling prophecy if they don't buy into the project objectives and the method of their delivery. The objectives of project start-up are therefore:

1. To agree the business objectives of the project (Figure 2.1):
 - Understand the background and problem faced by the organization
 - Define the strategic need of the parent organization.
 - Define the purpose of the project and its expected benefit.
 - Develop the benefits realization plan (Chapter 8.)
2. To agree the objectives of the project and the strategy for its implementation:
 - Agree the project objectives.
 - Agree the success criteria.
 - Agree the key success factors.
3. To develop and agree the plans for implementation of the current and future stages, and agree people's roles:
 - Develop the level 1 plan (Figure 21.14).
 - Define the project organization, including roles and responsibilities (Chapter 13).
 - Develop the product break-down and lower level plans.
 - Conduct value and functional analysis (Chapter 11).
 - Develop associated time and cost schedules (chapters 15, 16 and 17).
4. To agree the project management method and control process:
 - Will this be PRINCE2, ISO 21500, the PMI PMBOK or some proprietary system?
 - Will a software package be used, and if so which?
 - When and how will progress review meetings be held?
 - Who will attend?
5. To get the project team functioning:
 - How will early milestones be delivered?
 - What will be done tomorrow?

- Get the team marching in the same direction to the same tune, and in step.
6. To brief new team members:
- at any significant change in the project team; or
 - at the start of a new stage or a significant milestone.

There is a shift in emphasis as you move down this list from problem identification and problem solving, to negotiating agreement in the middle, to briefing new members on existing agreements at the end. This represents a shift in emphasis as you move through the project. Table 22.1 illustrates how the objectives of a start-up, definition or launch workshop change as you work through the project phases.

Table 22.1 Start-up through the project phases

Phase	Name of workshop	Objectives
Concept	Initiation	1, 2, 3
Feasibility	Definition	2, 3, 4
Design	Launch	3, 4, 5,
Implementation	Launch	4, 5, 6
Major work package	Briefing	5, 6
Close-out	Task force	3, 5: Mop up what is left

Methods of Start-up

There are three recognized methods of start-up:

1. Workshops
 - Definition
 - Launch
2. Reports
 - Project Definition Report
 - Project Manual
3. Ad-hoc assistance
 - Experts in that type of work
 - Experts in team dynamics

WORKSHOPS

Workshops can be helpful throughout the project, to launch a stage, to brief the team, to gain their commitment, to plan the coming stage of the project. The emphasis of the workshop and its objectives change throughout the project phases as illustrated in Table 22.1. I describe the agenda for a start-up workshop more fully in the next section.

REPORTS

Reports produced in one stage of the project can be used to help launch the next stage. Two specific reports are:

1. *The Project Definition Report*: This is a report of the results of the feasibility study. It will cover the issues outlined in the next chapter. A suggested contents page is contained in Table 22.2. PRINCE2 calls this the project brief.

Table 22.2 Possible contents of a project definition report

Item	Description
i. Preface	Purpose of report
ii. Management summary	One page summary for senior management
1. Background	Strategic need for the project
2. Benefits plan	(Chapter 8)
3. Definition	Purpose, scope and objectives
4. Work scope	Milestone plan, work areas
5. Organization	Roles, responsibility chart
6. Quality plan	(Chapter 12)
7. Risk plan	(Chapter 18)
8. Appraisal	Rough cost and benefit analysis, (to commit resources to design) incorporating the results of the Feasibility Study

2. *The Project Manual*: This will be a complete description of how the project is to be implemented. It will contain the complete design and project plan, and will be backed up by the detail drawings and plan and data held in the computer system at the Project Support Office (Chapter 31). PRINCE2 calls this the project initiation document.

AD-HOC ASSISTANCE

Finally, you may use the assistance of experts to aid the definition of the current project. These experts may be of two types:

1. *Experts in the work*: These will be people who have done similar projects in the past, and can advise the current project team on issues such as
 - Mistakes made previously;
 - Successes;
 - Technology which did or did not work;
 - Project strategies which did or did not work.

2. *Experts in team dynamics*: These will be people who are skilled in managing the working of the team. They will look for disagreements to get the team discussing issues, and agreements to get the team to reach agreement. They will aid the problem solving, ideas generation, and analysis of results. The facilitator and the project manager need to work well together. A good balance is for the facilitator to get the discussions started, around the key issues, and for the project manager to lead the agreement on the objectives. The project manager is then left at the end of the workshop having the full backing of the project team as it is he or she who has seemed to lead the obtaining of consensus.

Project Start Workshop

Table 22.3 gives a possible agenda for a start-up workshop, with timings.

Table 22.3 Agenda for a project start-up workshop

Agenda item	Duration hours	Timetable 1	Timetable 2
Project background	1.0	1:1600	1:1000
Project definition <ul style="list-style-type: none"> • purpose • objectives • scope 	1.0	1:1700	1:1100
Success criteria	1.0	1:1700	1:1200
Milestone plan	3.0	2:0900	1:1400
Project organization	2.0	2:1400	2:0900
Identify stakeholders	2.0	2:1600	2:1100
Calculate durations	1.0	3:0900	2:1400
Schedule milestones	1.0	3:1000	2:1500
Risk plan	1.0	3:1100	2:1600
Activity plans <ul style="list-style-type: none"> • early milestones 	1.0	3:1400	3:0900
Control plan	1.0	3:1500	3:1000

This is a long two days or a comfortable three days. I usually start at 4.00 pm on the first day, and finish with dinner on the third day, or start at 10.00 am on the first day and finish with lunch on the third day. It never works quite as smoothly as the timings given, and I think you will see there is contingency built in, but hopefully you will get the idea. I usually insist on holding the workshop off site, away from the distractions of

the office. Back in the 1980s, that meant we were completely isolated, and people could focus on the task at hand. Now I have to insist that they also leave their mobile phones in their bedrooms, or at least switch them off, and only switch them on during the tea breaks. Holding the workshop off site in a hotel also helps team building. The team can relax together in the evening and get to know each other. I ran a series of workshops with a company where the sponsor was a key snooker player, and each evening we would play snooker, and another company where the project sponsor was a keen cribbage player and each evening we would play cribbage. While playing cribbage or snooker, the team would bond, but would also continue to discuss what they had done during the day and improve their understanding of the project.

The people who may be invited to the workshop are:

1. The owner;
2. The sponsor;
3. The business change manager, or senior user;
4. The senior supplier;
5. The project manager;
6. The project support office manager;
7. Key line managers;
 - resource providers
 - designer managers
 - users
 - marketing
8. Key external contractors.

The process works best with between six and twelve people, with eight or nine the optimum.

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Feasibility, Design and Planning

WILLIE TAN

The project life-cycle comprises some or all of the following stages:

- Inception;
- Briefing;
- Design and documentation;
- Tender;
- Mobilization;
- Build;
- Close-out;
- Occupation, leasing and investment.

The steps differ slightly depending on the procurement method (lump sum or design-build contracts) and the level of detail. The simplest classification is the three-stage cycle of pre-construction, implementation and post-construction activities, compared to the eight-stage cycle above. The stages will also differ depending on the type of project; for instance, not all project outputs are leased or commercially invested. The phases should not be viewed as rigidly compartmentalized or in a linear gated fashion where one phase must be completed before another phase starts. Many activities overlap and can be executed concurrently. Decisions are also only boundedly rational because of imperfect information (Simon, 1957), and may occur incrementally (Lindblom, 1960). In public projects, extensive bargaining among stakeholders often takes place, bringing in additional complexities and sub-stages as well as raising the probability of implementation failure (Pressman and Wildavsky, 1973). However, for conceptual clarity, having distinct process phases is useful. Further, projects should not be naively managed from baseline plans, which tend to be static. What is more important is process, which is the focus of this chapter.

In this chapter we focus on the early stages of the project, pre-construction in the three stage life-cycle above, feasibility, briefing, design documentation, tender, mobilization and planning in a larger cycle. We consider each of those these stages in turn.

Feasibility

A project is initiated because of a need or opportunity. In public projects, this may be top down from an agency or bottom up from the public. Firms may identify a need to expand current facilities or relocate elsewhere. A developer may sense an opportunity to build a shopping mall. These suggestions are first *screened* to reduce them to a manageable number. For promising projects, a commissioning team is appointed to carry out a *preliminary study*.

PRELIMINARY STUDY

The aim of the preliminary study is to determine if the project is feasible before embarking on a more detailed and costly feasibility study. There may be several *options* in solving a problem, such as whether to expand factory capacity at the existing site, increase site density, automate production, subcontract certain processes, acquire the adjacent site, shift storage to a different location or find a new site. Insufficient generation of options, prematurely ruling out certain options, and wasting valuable time on clearly non-feasible ones are common mistakes. In the case of a potential manufacturing plant, the preliminary study may include:

- The rationale (objectives) for the project;
- Its alignment with organizational strategy;
- Sponsors and other stakeholders, their interests, concerns and possible impacts;
- Project scope and major components;
- Market survey of competitors and forecast revenues;
- Study of production processes;
- Availability and costs of fuel, raw materials and labor inputs;
- Availability and costs of infrastructure;
- Potential sites;
- Project scale;
- Capital and operating costs;
- Working capital;
- Ownership and management structure;
- Implementation schedule;
- Regulatory requirements
- Policy issues;
- Project risks and impacts;
- Rates of return;
- Major constraints.

Other types of facilities (such as a shopping mall) follow more or less a similar list of headings. At this point, only rough estimates are used. For example, the initial capital cost may be based on a per unit basis (such as cost per square meter). The implementation schedule contains only simple bar charts with rough timelines. The major components of a project depend on the type of project. For an integrated rural development program (a set of projects), the components may include raising agricultural yields, provision of roads, utilities, schools, and clinics, training programs to improve farmers' productivity

and so on. The project scale depends on factors such as the market's ability to absorb the project's output and technical considerations (for example, one cannot build half a dam). If the scale is too small, the firm loses the opportunity to expand its business. If it is too large, there will be excess capacity. There may also be economies and diseconomies of scale in terms of varying unit cost.

FEASIBILITY STUDY

If the outcome of the preliminary study is promising, a more detailed feasibility study is then commissioned. The same factors are examined in greater detail. The costs of the main components of the project will need to be more accurately estimated by breaking down each into its constituent parts. A *preliminary design* or sketch will also be drawn to facilitate the determination of design concepts and options including *phasing* and provision for future expansion. There are differences in the feasibility study of private and public projects.

Private Projects

In the case of a manufacturing facility, the number of potential sites will now be narrowed to a few sites, and the study should include site visits. If the site is not already owned, there may be a need to purchase a *land option* to conduct *due diligence* to check for title, obtain in-principle approvals and permits and conduct the first stage environmental study. If there are problems (such as site contamination), the land price may be equitably adjusted, but this must be stated in the option agreement. Other terms in the option agreement include the land description, option price, land price, owner's consent for the buyer to apply for permits and zoning and other approvals on his behalf, period of option (for example two months), possibility for renewal (if any), site access to conduct surveys and field investigations, mutual indemnities against injury and property damage, compensation, confidentiality of the buyer and dispute resolution. Instead of outright purchase, other options for securing land include entering a joint venture with the land owner to develop the land, obtaining seller finance, forming a syndicate or partnership, signing a long-term ground lease or obtaining developer designation in the case of state-owned land.

The financial feasibility of a *private* project may be analyzed using the development budget (Table 23.1), and operating pro forma (Table 23.2).

Table 23.1 Development budget (Tan and Tiong, 2011)

Uses of funds	\$m
Land cost	100
Construction cost	300
Design, engineering and other fees	30
Interest during construction	15

Taxes during construction	3
Interior fittings	20
Marketing and leasing	10
Debt service reserve	5
Operating reserve	5
Developer's profit and overhead	20
Subtotal	508
Contingency @5%	25
Total	533
Sources of funds	
Equity	160
Debt	373
Total	533

Table 23.2 Operating pro forma (\$m)

	Year 1	Year 2	...	Year N
Revenue				
Net rent	90	92		120
Other income	10	12		20
Total revenue	100	104		140
Expenses				
Management	8	8		10
Maintenance and repairs	10	12		20
Utilities	3	3		6
Other expenses	10	10		15
Replacement reserve	5	5		5
Operating reserve	2	2		2
Total expenses	38	40		58
Cash flow before debt	62	64		82
Debt service	32	32		32
Cash flow after debt	30	32		50
Corporate tax	3	3		5
Net earnings	27	29		45
Equity IRR	15%			

The land cost includes transaction costs (such as legal fees, stamp duty). Design, engineering, legal and other fees are estimated as a percentage of construction cost. Interest during construction for land and construction loans is rolled over because the project has yet to generate revenue to repay the loan. The land loan is normally given at about 60% loan to value ratio because raw land does not yield rental income until it is developed. The construction loan may be bundled with the land loan or given separately as a permanent mortgage loan, often by a different institutional lender. If there are progress payments from buyers depending on the stage of construction (such as in residential projects), they may be used to pay off the loan to lower the interest burden. The sources of funds may comprise equity, bank loans, bonds, state grants, international aid, export credit loans, carbon credits and so forth. For simplicity, only equity and bank loans are shown.

The *operating pro forma* (Table 23.2) shows how the facility (in this case a shopping mall) will operate each year and identifies the cash flow to service the debt and the financial return (using Net Present Value (NPV) and Internal Rate of Return (IRR)). The operating pro forma underscores the need to cost the entire *life-cycle*, that is, the initial higher capital cost may be offset by lower operating and maintenance costs in subsequent years. However, the developer may wish to sell the facility well before its economic life, in which case costing may not be based on the entire life-cycle. In Public-Private Partnership (PPP) projects, the ultimate transfer of the facility to the government also affects life-cycle considerations because the developer has little incentive to think about maintenance beyond the concession period.

If the decision is to go ahead with the project, the next step is to secure the necessary funding, develop the project organization structure, appoint the project team and issue the *Project Brief* to the team. At this stage, the project organization structure is preliminary and may contain little more than a project team reporting to the sponsor. However, after the procurement route has been decided (see below), the structure is more or less established. If many agencies are involved, it is usual to set up a separate structure with its own funds, either as a temporary or permanent overlay to the existing bureaucracy, to manage the project or program. Such a structure may generally be called a project implementation unit, although in practice it goes by many different names. For instance, in an agricultural project, the Ministry of Agriculture may be the coordinating agency with members drawn from other ministries.

Public projects

For a public project, the feasibility study is more complicated and cost-benefit analysis (CBA), cost-effectiveness analysis (CEA) and impact analysis may be used to complement political considerations in public decision-making. CBA is used when costs and benefits are largely quantifiable and reducible to a monetary unit. CEA is used when benefits are not easily quantifiable, and the focus is on cost minimization. Impact analysis considers the environmental, economic, social and cultural impacts of projects, and complements CBA and CEA. The early literature on CBA from the 1950s to 1980s focused on the relatively large price distortions found in developing countries such as overvalued exchange rates,

tariffs, controlled prices and subsidies (Dasgupta et al, 1972; Squire and van der Tak, 1975). Such distortions have declined under the pressures of globalization and structural adjustment programs. Hence, the traditional concerns with price distortions have been augmented by general equilibrium analysis and valuation of environmental benefits and costs (Dinwiddy and Teal, 1996; Zerbe and Bellas, 2006). While useful in helping to frame the social benefits and costs, CBA has many limitations, such problems in terms as (Tan and Tiong, 2011):

- being a largely top-down approach;
- lack of objectivity;
- too technical or narrow in its technocratic or economic vision (that is treating it as a purely financial or investment decision);
- bureaucrats and consultants may be self-interested;
- the need for a normative (that is value) structure to agree on goals and hence difficulties in dealing with disagreements over goals (for example, whether to build a road through a poor neighborhood or wilderness area);
- political interference in the process or decision;
- inadequate considerations of benefits and costs;
- difficulties in valuing intangible benefits and costs (particularly environmental and cultural goods and services);
- imperfect information;
- distorted prices or missing markets;
- insufficient attention to project risks;
- downplaying factors that are not easily quantifiable;
- the use of many subjective judgments and questionable assumptions or criteria such as the assumption of an equitable income distribution, the value of lives saved, the use of market prices to value benefits and costs and that compensation to losers is not actually paid in the Hicks-Kaldor compensation criterion.

It is useful to note that the political market place is also deficient in reflecting the preferences and opinions of members of society. Problems of short-termism, logrolling and pork-barrel spending are well known. Nonetheless, it is important not to stereotype or be cynical about the motives of bureaucrats and politicians. There are clearly good and bad ones.

VALUATION OF BENEFITS

In CBA, benefits are measured in terms of *willingness to pay* (WTP) for goods and services in *competitive* markets, that is, the area under the demand curve.

In Figure 23.1, if the existing output (such as power supply) is Q_0 and the project output is q , then the social benefit is area $A + B$. If the demand curve is not known, a rough approximation of the social benefit is area B , which is the project's revenue. In this case, the consumer's surplus (area A) is ignored, which is acceptable only if it is relatively small, that is, if the project output is small relative to the existing supply, and the price change is minimal. If markets are non-competitive, distorted monopoly or subsidized prices need to be adjusted to reflect scarcity values, such as using border (world) prices (Little and Mirrlees, 1974). If markets are missing (for example for environmental goods

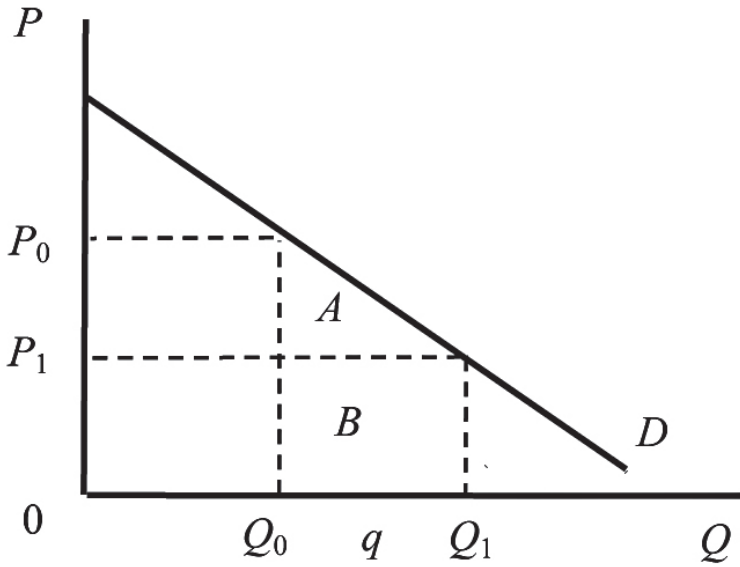


Figure 23.1 Valuation of social benefit

and services such as clean air), then *shadow prices* have to be estimated from surrogate markets. For instance, the value of noise may be estimated from the willingness to pay for noise reduction in housing markets using hedonic price models. Such models postulate that house price is a function of a bundle of house characteristics (including noise) and multiple regression may be used to estimate implicit prices (coefficients) from a large sample of recently transacted house prices. Another method of valuing a good or service in the absence of a market is *contingent valuation*. Respondents are asked for their WTP for a benefit (for example via entry fees, cash or a willingness to pay higher property taxes), or willingness to accept (WTA) compensation of the loss of the environmental good or service. The average value of WTP or WTA is then used to compute the total value by multiplying it by the number of affected households in the sample.

These methods provide at best only rough orders of magnitude. If housing markets are unstable (as they often are nowadays), price fluctuations will be large and there will correspondingly be large errors in estimating the implicit price of noise. Similarly, respondents often find it difficult to value environmental goods and services that are non-tradable. Sometimes, the issue is too technical for the lay person to understand and respond to appropriately, such as the reduction in particulates in air pollution studies. Respondents may also state their preferences strategically, inflating their WTP if they know that the state will be subsidizing the project so that it is more likely to go ahead. Alternatively, they may under-declare their WTP to reduce their share of the contribution if the project goes ahead. It is hardly surprising that although WTP and WTA are theoretically equal, they differ substantially in practice, with $WTA > WTP$. One may be willing to pay \$ x for a certain reduction in air pollution level but is likely to ask for more than \$ x as compensation for the same increase in pollution level. Income distribution is rarely considered in CBA because weights in favor of lower income groups are arbitrary

(Squire and van de Tak, 1975). Thus, CBA focuses on project efficiency involving real resource cost, not income distribution or other social goals.

A project may have *secondary* or indirect benefits, such as when a road creates employment (a direct benefit) and incomes earned by contractors and suppliers are then spent in the local economy. These *multiplier effects* are often ignored for lack of data and, more importantly, because the employment created may merely attract workers and resources from elsewhere, especially when there is full employment. Many public projects require skilled labor, and are unlikely to generate much additional employment.

Transfer payments such as taxes, subsidies and loan repayments are excluded from project benefits as they involve only a redistribution of resources. Unlike private projects, depreciation charges and interest expense are also excluded in CBA to avoid double counting. Finally, *pecuniary* (price) *effects* are excluded, such as when the project's cheaper output reduces the revenue of an existing firm, because these effects are part of the normal workings of the market.

VALUATION OF COSTS

On the cost side, cost should reflect scarcity value. If a project's purchase of a particular input is large enough to raise the market price, the opportunity cost is the area under the supply or marginal cost (MC) curve in competitive markets (area *C* in Figure 23.2).

If the purchase of a particular input does not raise its price, then the input cost is the input price multiplied by quantity. Typically, the initial cost of a project such as a factory comprises the land and construction cost, working capital, labor cost, materials cost and the cost of other inputs (such as energy) valued at competitive prices. Also included in CBA are the operating, maintenance and replacement costs. Finally, *external costs* such as environmental damage are included in CBA. If a market exists, the damage may be valued as the *change in productivity*, such as a fall in agricultural output. The project may impose

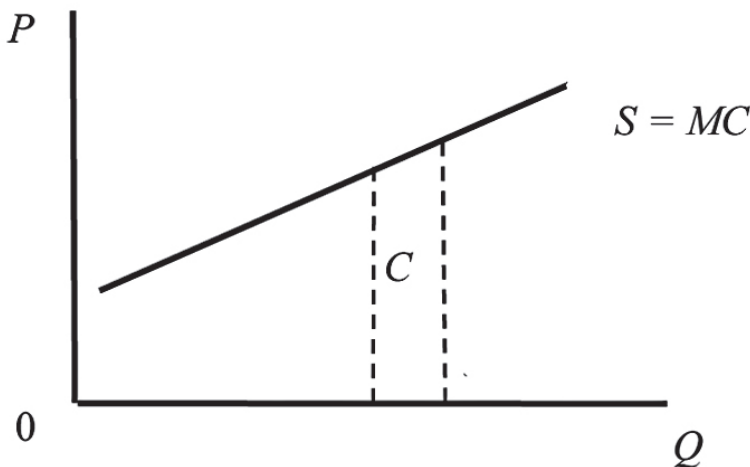


Figure 23.2 Valuation of cost

other costs such as soil erosion that may be estimated separately by the cost of restoring it to the original state if the process is reversible. If the market does not exist, it may be possible to estimate rough implicit prices in surrogate markets.

NET BENEFITS

Benefits and costs are valued for each period for the entire project life (n) and then discounted to present value at an appropriate social discount rate. Benefits are estimated on 'with and without' the project basis, rather than on 'before and after' basis. For instance, if agricultural output is likely to rise by 10% with the project and by 3% without the project, the project 'benefit' in this case if valued by the with and without basis is 7%. The long-term trend of a rise in output by 3% per year is excluded from the benefit. The net benefit is simply the benefit less cost, and this is computed for each year up to the terminal year n . These income streams are then discounted at the social rate of discount to obtain the NPV.

In any project, there are often winners and losers, and money. A new road may benefit motorists and the car industry, but it is too noisy for affected residents (a negative externality). Importantly, CBA is based on the controversial Hicks-Kaldor compensation principle where winners do not actually compensate losers. Thus, a project with positive NPV is deemed to be feasible if winners can *potentially* compensate losers. Actual compensation need not be paid. In practice, losers may be compensated. For instance, landowners are typically compensated, though often below market value so that the project does not over-stretch the local authority's finances and is still financially viable. However, existing residents affected by traffic noise are rarely compensated. New residents are, of course, indirectly compensated by the fall in property values when a new road is announced, before they buy the properties. On the other hand, a new road also offers windfall gains to owners of properties that are not affected by the noise but benefit from better access. From this perspective, one can see that project analysis is inherently political.

CHOICE OF DISCOUNT RATE

Which discount rate should be used for social projects? There are different suggestions, such as using

- the government cost of funds;
- the private sector opportunity cost of capital;
- the social discount rate, the time preference of society between savings and consumption;
- a weighted average of different rates.

Some government agencies use a standard rate across all projects, but the basis of such a rate may be unclear. In such cases, it is also usual to specify the real rather than nominal discount rate because of varying inflation levels. For instance, if a real rate of 3% is used, it is added to the prevailing inflation rate to determine the nominal discount rate

to be used. The use of government cost of funds is not suitable for PPP projects that are privately funded. Using the private sector discount rate ensures that only projects that pass the market test are shortlisted, but it may ignore projects that confer considerable social benefit. A low discount rate should not be used to simply make a project look good. The social rate of time preference (approximated by the savings deposit rate) may not be suitable because consumers tend to be 'myopic' and prefer consumption to saving, or they do not adequately take into consideration the welfare of future generations. Given the differing views, it is common practice to use two different discount rates in computing NPV (such as 6% and 10%) to see if the project passes both tests. If so, then the choice of discount rate in this situation does not really matter.

CRITERIA FOR RANKING PROJECTS

Generally, the NPV (with different discount rates to test its sensitivity) or project IRR is used. Note the project is evaluated on its own strength and not because it enjoys tax benefits, subsidies or cheap loans.

RISK ANALYSIS

Sensitivity analysis or Monte Carlo simulation may be used to check how the NPV or IRR changes when certain variables change. As there are many variables that affect NPV or IRR, only changes in the key variables are used.

MAKE RECOMMENDATIONS

The last step in CBA is to make recommendations in the form of a formal report based on NPV or IRR, and perhaps other qualitative criteria. In the case of a program (set of related projects), the evaluation needs to be carried out for the entire program, rather than on isolated projects. Some projects will inevitably yield higher returns than others, and projects cannot be considered in isolation, although they may be prioritized on political, economic and social considerations. Similarly, a new road is likely to divert traffic from elsewhere and therefore reduces congestion on these roads. Strictly speaking, these general equilibrium (or system) benefits need to be included in CBA. However, it may be difficult to analyze the situation fully, particularly if it is an urban road. There are just too many unknowns in the system.

COST EFFECTIVENESS ANALYSIS

Cost effectiveness analysis (CEA) is a special case of CBA where difficulties in measuring benefits result in their replacement by simple output measures such as the supply of a certain quantity of treated water or power supply. In health services, where CEA is commonly used, the benefit may be the number of lives saved. The objective is to find the least cost or most cost effective solution, such as to expand an existing water treatment plant or to build a new one. The benefit is not evaluated. Thus, if the outcomes are different, that is, if the benefit is not fixed, then CEA cannot be used. The steps in CBA on

the cost side and the use of discounting remain unchanged. However, in practice, unlike CBA, users of CEA tend not to use efficiency prices in valuing costs, presumably because there is a small error. This assumption may not be correct.

IMPACT ANALYSIS

Impact analysis may be used to assess the environmental, economic, social and cultural impacts of a project or program. The three that follow are the three pillars of sustainability (see Chapter 20).

Environmental impact

The environmental impacts of a project include impacts on water quality, flora and fauna and noise and air pollution. Simple indexes are often used, as the water quality index, biodiversity index and air quality index. These indexes are tracked over time on 'with and without' project basis. Impact studies are typically used for individual project appraisal, and less so for the appraisal of programs or development policies. The most common form of impact studies is the Environmental Impact Assessment (EIA), which was formally recognized in the US under the National Environmental Policy Act 1969. The basic steps of an environmental assessment for a large project are as follows:

- Screening to determine if the project warrants an EIA;
- Identification of the project activities (scoping);
- Identification of possible significant environmental impacts;
- Evaluation;
- Management of the adverse impacts;
- Audit of the management process some time after implementation.

In terms of procedure, if an EIA is required after screening, the project owner prepares an Environmental Impact Statement (EIS), which is basically a study report together with a detailed environmental management plan, to the competent authority. The report is used as a basis for consultation among stakeholders and the findings are then presented to the competent authority for a decision. The EIA is not mandatory in all countries. In developing countries, there are obvious difficulties, such as the need to attract much-needed investments and political interference in the process, imperfect environmental information, insufficient public consultation and insufficient skills to evaluate the reports.

Economic impact

Economic impact analysis usually focuses on direct job creation. A more sophisticated method, called input-output analysis, tracks the indirect impacts or multiplier effects of a project or investment.

Social and cultural impacts

The social and cultural impacts of a project include:

- demographic changes such as the displacement of people from a proposed dam site due to expected flooding, changes in the size and composition of population (permanent or seasonal);
- income changes such as changes in income distribution;
- changes in community institutions such as the fall in the participation of voluntary organizations and other interest groups or changes in the patterns of social networking
- gender issues such as opportunities for women to participate or advance;
- cultural changes, such as whether the project has cultural significance, changes the cultural heritage or generates new cultural identities.

The impacts are often taken into consideration qualitatively because they are hard to quantify.

Briefing

If the project is feasible, the project team will be briefed by the owner (or client) on the basic characteristics of the project. These include the background, objectives, site and legal description, project organization structure, preliminary schedule, proposed budget, expected quality, assumptions, major risks and constraints. The project team then prepares a *pre-construction schedule*. The activities may include programming (to gather further user requirements), site visits, visits to similar facilities, obtaining permits and approvals, design stages (conceptual, schematic, and detailed), preparation of tender documents, tendering, pre-bid meetings, negotiation and award of contract. The project team will also advise the owner on the type of *procurement contract* (or delivery method) to be used. The two main types are the traditional lump-sum Design-Bid-Build (DBB) contracts (Figure 23.3) and Design-Build (DB) contracts, which are similar to Engineering, Procurement and Construction (EPC) contracts (Figure 23.4).

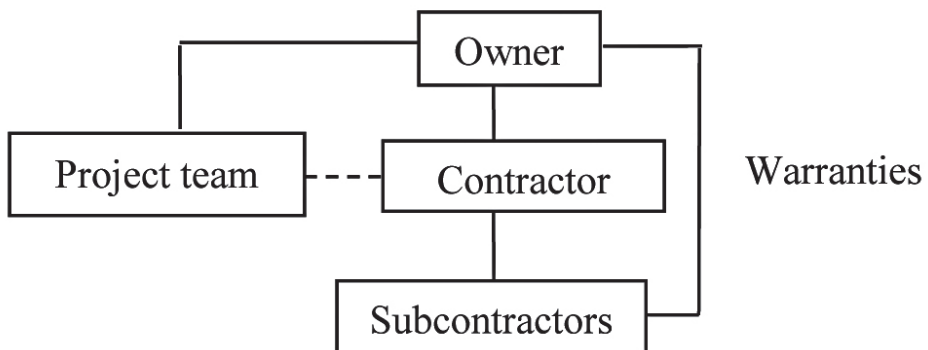


Figure 23.3 Design-bid-build contract

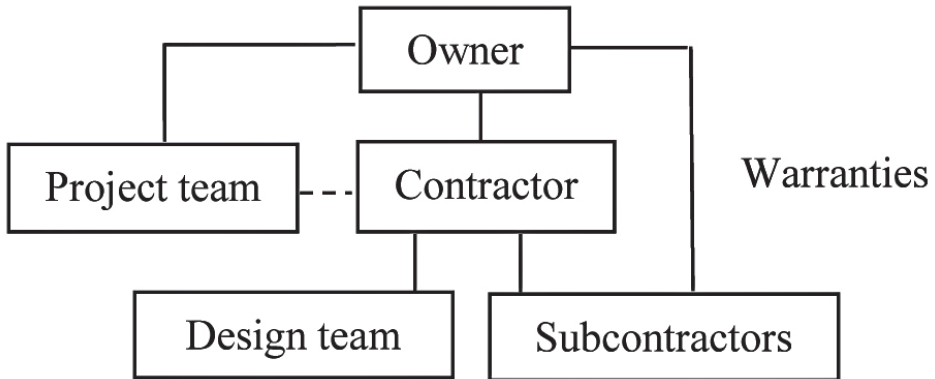


Figure 23.4 Design and build contract

In DBB contracts, the owner may have an in-house project team (if such facilities are built regularly) or they contract with a project management services firm. The project team includes the design team (architect(s) and engineers) who usually contract directly with the owner. Alternatively, the architect may contract with the owner and subcontract with the engineers. Once the design and tender documents are completed, the work is tendered out to contractors who, in turn, subcontract part of the work to subcontractors. There is no contract between the project team and contractor, or between the owner and subcontractors. The latter, however, provide warranties to the owner against defects. The project team supervises the work of the contractor on behalf of the owner (shown as dotted line). This procurement method is slower than other methods because detailed design needs to be completed before tender. The project team and contractor also tend to blame each other for defects (including poor design or shoddy construction), requiring the owner to mediate. There is also little input from the contractor in the design process. On the plus side, the cost of construction is fixed beforehand (but still subject to variation orders and claims) and there is an independent check by the project team on the performance of the contractor.

In DB or EPC contracts, the common dispute between the project team and contractor is resolved by having a single point of responsibility. The design team is separated from the project team and integrated with the contractor. Now, the design team cannot blame the contractor for shoddy work while the latter cannot blame the former for poor design. In many cases, design-build teams respond to the owner's Request for Proposal (RFP). The RFP describes the key features of the project, and shortlisted design-build teams are asked to provide the conceptual (outline) design and bid price at the tender stage.

A variant of this approach is for the owner who wishes to have greater control over the design to initially contract with a design team to develop the conceptual design. This outline design is then sent out to bidders as part of the RFP. Once the tender has been awarded, the design team is then *novated* to the contractor.

Less often used are cost-plus contracts because there is little control over cost and owners find it time-consuming to monitor claims. Hence, such contracts are usually subject to a Guaranteed Maximum Price (GMP).

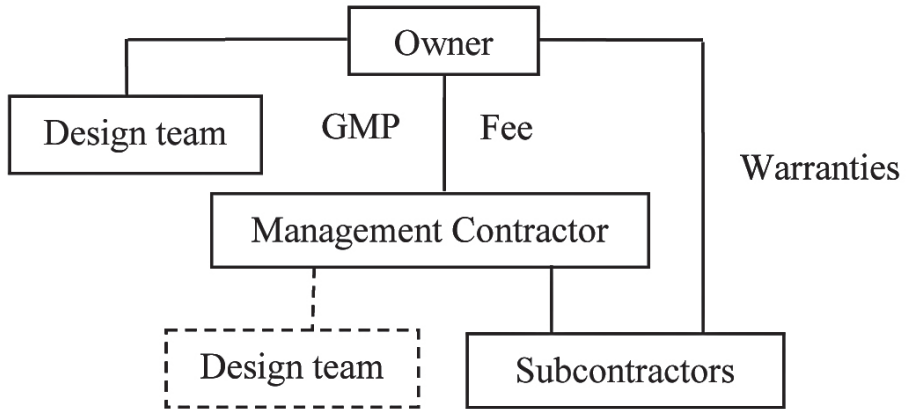


Figure 23.5 Management contracting

In management contracts (Figure 23.5), a construction manager (CM) advises the client for a fee (called Agency CM) and a guaranteed maximum price for the project.

Alternatively, the management contractor contracts with the subcontractors (At-risk CM). The design team may be engaged by the owner or management contractor. Management contracting is seldom used because the legal implications are still unclear.

Finally, in turnkey contracts, the winning bidder (usually a consortium) finances, designs, builds and may even operate and maintain the facility. Such contracts are common in PPP projects.

Design and Documentation

During the design process, design review is carried out at different stages (for example 30%, 60% and 90% completion) to check for conformance to budget and design criteria, errors and omissions, code compliance, integration and to obtain feedback. At each stage, the owner's approval is required before proceeding to the next stage. The most important milestone is to fix the conceptual design, often from three options. *Value engineering* (Chapter 11) is also carried out at the design stage, either at a particular stage (such as the 30% or 60% stage) or continuously as part of design development. The aim is to remove unnecessary cost by simplifying methods, generating alternatives, eliminating redundant items or using alternative acceptable materials or standards. For large projects, a *constructability review* may be carried out by an independent team (internal or external) with fresh eyes to check whether the project can be implemented according to plan. It involves simplifying construction, removing design conflicts, checking for technical completeness and whether there is missing information, and ensuring that the proposed schedule is realistic. There is also a *document review* process to check plans, specifications, and contracts to remove ambiguity, detailing conflicts, inaccuracies, inconsistent information and useless or outdated information. As more details become available during the design process, the cost engineer will provide regular cost and schedule updates. Concurrently, the tender documents will need to be developed.

Tender

For large projects, bidders are often pre-qualified and those who are interested will attend a pre-bid conference that usually includes a tour of the site. In DBB projects, a Bill of Quantities (BQ) may be issued for bidders to insert their rates for each item. For DB projects, a standard form is used to allow the owner to compare the various rates for the work packages. These form the direct cost of the project. The indirect cost of site overhead, company overhead, mark-up, goods and services tax, insurance and bonding is then added to arrive at the tender sum. Thus, the owner's project team also needs to compare the indirect cost submitted by each bidder. A tender deposit or bid bond is also required so that the winning bidder does not walk away from the project, such as because they now realize that the bid is too low. A bid may be high or low for reasons other than trying to win a contract by varying the mark-up. Tender documents may have errors and omissions, a bidder may genuinely misinterpret a particular instruction, or there may be alternates proposed by the bidder. If there is a real difficulty in pricing a particular item, the owner may compare bids based on a provisional sum. Whatever changes that should be made to a bid should be made known to tenderers. It is common to award a contract based on criteria other than price, such as the proposed design, schedule, track record and financial strength of the bidder. Even if the designs are similar, owners may view very low bids as erroneous, or that the contractor intends to recoup the loss through variation orders or claims. If all goes well, two or three bidders may be shortlisted out of the initial six tenderers for an interview to discuss various aspects of the bid. This is followed by 'give and take' negotiation (it is unethical to drive down the price further at this stage) and award of contract.

Mobilization

After the contract has been awarded, the contractor needs to furnish to the owner *certificates of insurance*, typically on worker's compensation, builder's risk (insurance of works, materials and temporary structures, which may alternatively be purchased by the owner) and general liability (to third parties). Design professionals are normally required to furnish professional liability insurance to cover defects, errors and omissions in providing professional services. If a project consists of different parts and each part is awarded to a different contractor (such as in a rail network), the owner may arrange an 'umbrella' insurance to cover the entire project. This arrangement is cheaper, avoids interface problems and ensures that insurance cover does not cease on individual sections. The contractor will also submit a *performance bond* to protect the owner in case of non-performance, a *schedule of values* for the owner's cash flow planning on likely contractor's periodic request for payment and a *construction schedule* for monitoring project performance. Once these documents are received, the owner's project team issues a *notice to proceed* and allows the contractor site access. A *kick-off meeting* will also be convened to introduce the project team, contractor, and subcontractors, brief the parties on the key project parameters, important procedures (for example payment, submittals and variation orders), safety, site security, treatment of hazardous materials and the project communications plan.

Planning

Much of the planning also occurs at this stage. It is the primary responsibility of the contractor to develop the schedule, quality plan, environmental plan, safety plan, project control plan (such as project status and periodic reports), commissioning plan, stakeholder management plan, submittal plan and project documentation. Importantly, many of these plans also include or integrate process so that the key steps are not inadvertently left out in managing the project. These plans are necessary because the project team needs to process submittals of product samples and shop drawings, issue variation orders, process monthly payment, attend to claims, resolve technical conflicts and contractual disputes and manage stakeholders. Because the project team deals with different types of people, leadership and people management skills are important. Proper communications and documentation are critical. The latter include drawings, reports, minutes, project logs, diaries, emails and so on, and serves many purposes such as in coordinating activities (such as updating of design changes) and as evidence in contesting claims and disputes.

Concluding Remarks

This chapter has provided a description of the early stages of a project, preceding the construction stage. It has done it from the perspective of a project, the work of which will be done by external contractors, but many of the ideas can also apply to internal projects.

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Managing Implementation

DENNIS LOCK

This chapter starts with the assumption that progress needs managing. The importance of delivering all project commitments on time should be obvious. Quite apart from inconvenience caused to the customer, late delivery of any project is likely to involve the contractor in excess expenditure through financing work in progress and suffering the fixed costs that accumulate relentlessly with time for as long as a project remains unfinished on the premises. Late completion of a project will have knock-on effects that disrupt the schedules for subsequent projects. Project time is a vital, irreplaceable and expensive resource. All project resources should be managed effectively and time is emphatically no exception.

Essential Framework for Managing Progress

To give a project some chance of being carried out according to the client's wishes, the management methods and organization structure have to be suitable. If any of the following conditions is not met, progress will be difficult or impossible to manage effectively. Some of these conditions may seem very obvious but they are not always fulfilled in practice.

Project definition: The project specification and objectives have to be clearly defined. The project manager must be in no doubt about what he or she is expected to deliver and those deliverables must be feasible given the resources and time available.

Control of changes: Uncontrolled changes can wreak project havoc. They must be properly considered and controlled if delays and overspending are to be avoided.

Organization: The project organization must be led by a competent project manager and should be appropriate to the size and nature of the project, with effective downward, upward and lateral communications.

Supportive management: The project manager does not stand alone. He or she cannot operate in isolation. Backing from higher management is essential, in terms of both material provisions and moral support.

1. Material support includes the authorization of funds necessary for managing and executing the project. The project must not be allowed to fail through lack of essential resources and facilities (such as people, equipment and accommodation).

2. Moral support is at least as important as material support. It can take many forms. Here are some examples:
- Appropriate and generous delegation of authority and responsibility to the project manager;
 - Enforcement of project management procedures and systems;
 - Interceding with managers inside the organization in support of the project manager, for example to resolve arguments over conflicting priorities;
 - Interceding at higher management level outside the project organization;
 - A common example is seen when a project manager has no success in obtaining essential materials from a key supplier; dialogue between the two organizations at higher management level can sometimes produce results.
 - Encouragement of individual development through training and further education;
 - Physical presence – occasional attendance at progress meetings and visits to workplaces or a project site to lend encouragement.

CUSTOMER PARTNERSHIP

The customer must act responsibly and cooperate with the project manager. This means:

- paying valid claims for payment promptly;
- avoiding unnecessary changes;
- giving design approvals without delay;
- generally appreciating the problems that face the contractor.

There should be an atmosphere of partnership rather than confrontation. Concurrent engineering is a good example of such partnership, where customer and contractor work together in a search for mutually beneficial project strategies.

Competence of people in organizations: The success of a large project depends on the competence of many people throughout the organizations of subcontractors, suppliers, service companies, government departments, the customer and the project contractor. Some of these people will be competent. Others might be less so. We have to assume that most are capable of performing their jobs properly if project progress is to be assured. Although the project manager will not have direct control over the people in external organizations, some control can be exercised by the careful choice of those organizations.

Allocation of responsibilities: People must know what is expected of them. One tool that can assist the project manager to allocate responsibilities is the responsibility assignment matrix. This is best suited to deal with task categories rather than listing all the detailed tasks. For example, it can show the person or body responsible for approving new designs in general, but it is not the place in which to list all the drawings that carry those designs.

Workable schedule: The project schedule is key for managing progress. Here are some characteristics of the ideal plan for a project or, a larger project, each subproject or work package, all significant tasks:

- Tasks placed in logical sequence, preferably as a critical path network;
- Estimates of duration as realistic as possible;

- Scheduled to use resources at feasible rates;
- Flexible to authorized changes and progress, so that it can be kept up to date;
- Divided into separate work-to lists for departments or work groups.

IMPOSSIBLE?

With all these conditions perhaps it is a wonder any project ever gets finished. So far, we have not thought about other things which can go wrong, as seen in any insurance company's catalogue of disasters: fire; storm; civil commotion; war (civil or otherwise); strikes; lockouts; objects dropped from aircraft; other natural disasters; unnatural disasters; and so on. What chance does any project ever have of being finished on time? Many do, of course, finish late. Progress management seeks to start and finish every task in accordance with the project plan. It should foresee and forestall possible risks, monitor work in progress, identify current problems and (above all) must take corrective and timely action against significant delays.

Communicating the Work Program

Consider a contracting organization which has received a prized order for a new project. Possibly over 100 of the contractor's staff are going to be working on the new project for a prolonged period. All good news. But how do they know when to start and what to do?

PROJECT AUTHORIZATION

The first official document used in many companies to start a new project is a works order or project authorization. This gives key information about the project in summary form. Apart from giving information about the project, the works order carries the signature of a director or senior manager which authorizes the start of work and other expenditure on the new project. The following items are among those likely to be included:

- Name and address of the customer or client;
- Project site or delivery address (if different);
- Project title;
- Project number (which should provide the root of the code of cost accounts and work breakdown structure);
- Name of the customer's project manager or key contact person;
- Number and date of the customer's purchase order or contract;
- Project description and scope of supply;
- Serial and revision numbers of key documents, such as the project specification;
- Pricing details and agreed terms of payment;
- Key dates in the project life-cycle;
- Departmental budgets;
- Name of the project manager.

WORK-TO LISTS

While the works order or other authorization document gives instructions in broad management outline, it does not carry enough detail from which to issue and control work down to the level of separate jobs in all the separate departments. The most effective and convenient tool for that function is the work-to list, derived from the project network and resource scheduling. This provides each manager with a list of all project tasks for which he or she is responsible together with essential schedule information. Ideally, the computer should filter tasks so that reports can be specific and relevant to each departmental manager.

Giving every activity a departmental code will facilitate departmental filtering. The computer should sort and print the list for each department in ascending order of activities' scheduled start dates. The earliest possible start dates from time analysis will have to suffice if resources have not been scheduled. Other sort sequences may be more appropriate for some departments. The person responsible for expediting purchase orders might, for example, find it more convenient to have all the lead time activities for purchased goods listed in order of their planned completion (delivery) dates. Work-to lists provide managers or their delegates with valuable schedules and checklists from which to issue tasks and manage their progress.

Starting Up

Project start-up is covered in Chapter 22. Key issues for implementation include:

KICK-OFF MEETING

When the contract has been won and work authorized, the kick-off meeting is a good way to get things started. The project manager, having first been thoroughly briefed on all known aspects of the project, must call together the principal participants and brief them in turn. This is the time and place to explain the project's technical and procedural requirements, warn of specific risks, quantify deliverables, obtain everyone's agreement and commitment and generally encourage all concerned to get their forces mobilized and motivated.

STARTING EARLY

One of the biggest risks in managing progress is failure to start a project on time. A project which starts late is likely to finish late. It can be difficult for an organization to activate a new project at the time and rate of working envisaged in the schedule. Delay in signing the project contract can be one reason for delay, perhaps while a few final details are negotiated or for the more mundane reason that one of the authorized signatories is temporarily unavailable. No work should be allowed to start on a commercial or industrial project until a firm contract exists between contractor and client. This is an inviolate rule that should be ground into every self-respecting manager from birth. However, as with most rules, there is an exception.

In most projects, the rate of working and expenditure follows a well-known pattern; the characteristic S-curve results. The rate rises slowly at first, while preparations are made and the resources are mobilized. Expenditure is at its highest rate near the middle of the project. Work and expenditure then tail off towards the end, and the curve converges on the final cost. In an engineering project, for example, the first weeks of the active project life-cycle might be used for planning, investigating standards, resolving queries with the client, establishing procedures and so on. Some companies use checklists for controlling this preliminary work, and put the checklist in the form of a standard preliminary network diagram. All these early activities are likely to need no more than one or two people. This early work is unlikely to account for a significant part of the total expenditure. Yet this work must be done before the main project activities can start and many of these early tasks will lie on the critical path.

If the time available for the project is tight, or the company wants it finished quickly, it might be advantageous to commit commercial heresy and allow some activities to go ahead, and to incur some costs, before the contract with the client has been signed. There are risks. In the event that the contract is not awarded, the preliminary expenditure will have to be written off. There is a danger that the contractor's price bargaining position will be weakened if the client discovers work has already begun. The contractor can limit the risk by issuing a preliminary internal works order that releases only a very restricted budget, specifies the work allowed and names individuals authorized to carry it out. The risk has to be evaluated and weighed against the benefit of bringing the project completion forward by one or more months.

Managing Progress in the Various Project Functions

A simple control cycle can be described for accomplishing each activity. The steps are:

1. Prompted by the work-to list, the manager responsible allocates the work to the appropriate person, group or other resource as near as possible to the scheduled time.
2. The responsible manager ensures that all necessary facilities and information are provided and that the task requirements are fully explained and understood.
3. Work is monitored against schedule so delays are identified as soon as possible.
4. If any potential problem is identified, corrective action is taken immediately. The severity of such action is in inverse proportion to the amount of float remaining for the activity.
5. At set intervals, and on completion of the task, progress information is fed to the project manager and to the computer so that the project schedule can be updated and kept valid.

Progress Chasing

In the ideal modern system, it should be possible for all progress information to be reported and entered into the computer control system by the responsible managers or their delegates, using the local area network. Project managers, being ultimately responsible, may not rely entirely on other managers for progress monitoring and control. Partly for

this reason and to ease the administrative load on all managers, routine progress monitoring can be delegated to one or more specially assigned people, who may have job titles such as progress clerk or progress chaser. These people should cooperate with the various departmental managers to gather information against work-to lists and report as necessary to the project manager and the relevant computer system. (The role of the project office is described in Chapter 31.)

OBTAINING DESIGN INFORMATION FROM EXTERNAL SOURCES

Engineering design activities very often depend on information from outside sources. In the case of a large construction project, for instance, this can include considerable correspondence with the client, suppliers and subcontractors. Engineering and other work can be held up while waiting for information from these external sources, or for the client to approve documents such as key drawings, specifications and purchase documents. The project manager must ensure close monitoring of these information exchanges and see to it that no external organization is allowed to put the success of the project at risk by avoidable delays. On larger projects it will probably be necessary to impose office procedures on all correspondence and document transmissions, whether these are by mail or electronic means. All important communications need to be monitored to make certain that every message needing an answer gets that answer promptly. These transmissions may need to be given serial numbers and subject codes so that they can be filed for future reference.

SUBCONTRACTED ENGINEERING DESIGN SERVICES

Engineering companies sometimes offload work to external design offices, either at times of overload or as a more permanent policy to maintain staffing flexibility. It is not unknown for a company to operate with a small core of permanently employed professional engineers, and to have a substantial amount of detailed design work being performed in several external offices. The two most apparent risks to project deliverables introduced by this practice are:

- dilution of company standards or quality;
- loose control of progress.

The quality aspect can be covered to some extent by ensuring that the external offices are certificated to relevant quality standards. A practical measure is to arrange for one or more supervising engineers from each regularly used external office to be trained in the company's own offices so they absorb the host company's standards and culture. When these engineers return to their own offices they become an effective extension of the company's own engineering management. A useful arrangement for controlling progress in external offices is to appoint a qualified and experienced person as a subcontract liaison engineer. This person can visit each external office at frequent, regular intervals to deliver and collect work, monitor progress and give on-the-spot answers to some technical queries.

PURCHASING

Purchased materials and equipment can take months to obtain and purchasing activities often lie on the critical path. Engineers and designers must be encouraged to release purchasing information for critical items as early as possible, without waiting for the issue of parts lists or bills of materials and purchase schedules. That should enable the purchasing department to place orders as soon as possible for long delivery items, such as castings and bearings. Even in cases where final design details cannot be given with confidence, the release of outline information will allow external manufacturers to reserve capacity. Once a purchase order has been placed, expediting becomes important to keep each supplier reminded of their contractual obligations and give early warning of any difficulty. Items ordered from the supplier's catalogue usually require only one check during the waiting period. For major purchases, especially for bespoke goods, it might be necessary to send expeditors and inspectors to the manufacturer's premises to see progress for themselves and, in some cases, to carry out inspection and witness tests.

MANUFACTURING

The timely movement of machined parts, subassemblies and other production jobs between work stations is particularly important for progress. If a job requires, say, 10 operations from raw material to completely finished component, and if it takes a day to move that job between each work station, then the part will spend two weeks of its time in the factory sitting on racks or trolleys. Delays in work transit (and therefore in work in progress inventory) can be reduced by the use of Kanban or just-in-time methods, although these may not always be appropriate for special project work. All good manufacturing establishments will have their own methods for production control and detailed progress management, and these are outside the scope of this handbook. The principal role of project management in manufacturing should be to provide work-to lists, from the project schedule, that give the required start and finish times of each manufactured assembly or subassembly. The manufacturing managers should be relied upon to work within those limits, but that is not to say that the project manager should be shy of making spot checks on progress. Given the acquisition of the necessary skills, project planners can use resource scheduling to ensure that, in overall terms, work is fed to the manufacturing departments in line with their normal overall capacity.

A project manager with access to the manufacturing facilities employed on the project can spend profitable time walking through the factory regularly (perhaps once a day). Just 10 minutes is often sufficient for the project manager to note whether any job is held up. A stack of steel piled in a corner for a few days might be an indication that the production management have downgraded the priority on this project work to the advantage of some other project manager who is able to shout louder.

CONSTRUCTION

At a construction site (which may be thousands of miles away from the project manager and the home office) it is customary to establish a management team to control work. The size and organization of this team can vary, from two or three individuals on a small project to a substantial management and administration team for a larger job.

Adequate communication facilities must be established between the project site and the contractor's head office. This used to be a serious problem with some international projects and remote sites but is less so with modern communication. Organizational arrangements can have a marked effect on the degree of day-to-day control that the site manager must exercise on the work of various trades. A managing contractor who employs no direct labor but relies on subcontractors would need less day-to-day involvement than one who employed its own direct labor.

It is essential all materials are delivered to site at the right time and in good condition. The purchasing organization has a prime responsibility towards maintaining construction progress. The site manager will report shortages, preferably when they are foreseen rather than waiting for them to happen, and the purchasing organization will be expected to take urgent action to get the goods to site. No less important than the flow of materials and equipment to site is the supply of construction information. This takes the form of drawings, equipment suppliers' installation instructions, take-off lists, engineering standards, specifications and erection instructions. Construction often starts before engineering design is completely finished. Thus there is a danger of construction work outstripping the supply of drawings and other engineering information. Drawings sent to a construction site are usually stamped to show they have passed the necessary checking and approval stages. 'Released for construction' is a typical legend for this purpose. Design engineers are sometimes unable to release drawings fully for construction. They might be awaiting final details of bought-out equipment before power supply requirements and fixings can be added to the drawings. In these circumstances the incomplete drawings may be released provisionally for construction, perhaps with a rubber-stamped legend reading 'Released for construction with holds'. A drawing released with holds can often allow some planning and limited work to take place on site.

The use of network float is another point worthy of mention. It is easy to allow all float to be taken up in the engineering design phase, so that the construction site team are left with no remaining float and therefore find themselves squeezed for time. One way out of this difficulty is to add a special final activity to the project network which does not represent work, but which adds an artificial delay of, perhaps, four weeks to the end of the program. This has the effect of driving float away from the front (engineering) end of the network, and provides a safety buffer for construction activities. This is not unfair to the engineers. Most project difficulties, at least most of the excusable ones, occur on site. Engineers are not likely to be affected by ice, snow, floods, running sand, strikes, fights, thefts or any of the other unforeseen problems faced by the site manager.

SPOT CHECKS AT HIGHER LEVELS

When attempting to manage progress at the level of individual activities it is easy to lose sight of the big picture. An example based on the engineering design function illustrates this point. Consider a project on which the engineering design effort is expected to need 100 people during (say) the tenth week. The project manager should have access to this figure from the resource schedule. Whether the detailed feedback on progress is good or bad, the project manager would be advised to ask, 'How many engineers are actually working on my project this week?' The answer might produce a shock: not 100 engineers, but only 60.

I once carried out a similar check myself. An external, subcontracted, drawing office was supposed to be making numerous detail drawings, based on overall layouts and specifications produced by our in-house engineers. At the time of the check the schedule showed that 30 external staff should be busy on the project. Our check found only six. Yet engineering progress was confidently being reported by our internal managers as being in step with the plan. Urgent investigation found the in-house engineers were reporting their layouts as completely finished, but were not releasing them to the external office for detailing. They were reluctant to let their work go, perhaps through some lack of confidence in their designs or so that they could give a few late tweaks to move their work nearer to absolute perfection. Firm action from the engineering director put this right, but the problem would not have been revealed in time without the independent, overall global check on the rate of working.

SPECIAL PRIORITY CASES

It is generally not good management practice to attempt the allocation of priorities to work outside the normal scheduling sequence. Manufacturing, for example, is a function in which attempts to allocate priorities are fraught with risk of failure. Labeling work as priority A, B or C might seem a good idea, but eventually all work becomes Priority A. However, there are occasions where special action is needed. The cost to a project of a failure which delays the production of one small item can be out of all proportion to the cost of obtaining that item. Particularly disastrous is the case of an assembly, possibly containing complex electronic or electromechanical gadgetry, which fails catastrophically on its final test. Possibly some single component has broken down, causing other components to be lost. Situations such as this are even more difficult to resolve when it transpires that the failures were caused by design errors, so that the whole cycle of design and manufacture has to be repeated.

There is a procedure which can cope well with such problems. It depends on the issue of an immediate action order (IAO). The usual documents seen in the factory or engineering offices are printed on ordinary plain paper, so one document looks much like another. The first thing which strikes one about an IAO is it is anything but an ordinary piece of plain paper. These top priority documents are printed on paper with brilliantly colored diagonal stripes (fluorescent if possible). They cannot fail to be seen on a desk or worktop. Another feature of IAOs is that, because they are so special, they have to be authorized at general manager or managing director level. They are so special that their use has to be restricted. They must not be allowed to proliferate or their impact will be lost. The rule, therefore, is that no more than one IAO may be sanctioned at the same time.

Once authorized, there is no limit placed on the expenditure allowed to get the job done. If the offices or factory must remain open all night, or over Christmas, then so be it. If materials are only available in Sweden and the factory is in Cornwall, then those materials must be obtained by the quickest route regardless of cost. An IAO commits all departments so that, in the case of a design fault, the engineering department must correct the relevant drawings without delay. Normal quality standards must still be respected, but those responsible for carrying out inspection and testing will be bound by the urgency of the order. The IAO is carried from department to department by a progress

chaser, who date- and time-stamps its arrival and departure times at each departmental manager's desk. The progress chaser remains with the IAO until the job is done.

In companies where this system operates, managers learn to fear IAOs. They are a nuisance. They carry risk of criticism or rebuke from higher management if they are not properly obeyed. They command priority over all other work – even to the extent of stopping a machine in mid-cut, removing the workpiece and resetting the machine to take the immediate job. The logic is seen when by spending perhaps £15,000 to finish a job which should only have cost £1,000, a project delay of several weeks is avoided. The cost of the immediate action is likely to be very small in relation to the savings in overall costs and reputation.

IAOs get dramatic results. A tiny prototype 5,000 volt transformer for military equipment burned out on test. It had taken six weeks to manufacture and was difficult to make, being encased in an intricate electroplated copper gauze screen and then encapsulated in epoxy resin. Manufacturing operations were subject to numerous quality checks against a stringent military specification. The successful replacement took three days from the start of redesign to final test.

Progress Meetings

Progress meetings provide a forum in which progress difficulties and risks can be discussed, and actions agreed. Each meeting should be managed efficiently from the chair, with the aid of a sensible agenda, so that it deals effectively with all matters related to keeping the project on schedule but is not side-tracked into technical and other issues that should more properly be dealt with elsewhere. Progress meetings should also be kept as short as possible, given that those attending are probably busy, short of spare time, highly paid and needed back at their own departments for actually doing work rather than simply discussing it. It is not a bad plan to arrange that progress meetings, at least those attended only by in-house staff, are started at a fairly late hour in the working day. Then there is a real incentive to get the business done quickly. Of course, this argument would not apply where the client had travelled thousands of miles to attend the meeting.

FREQUENCY

The frequency of progress meetings depends on the duration and complexity of the project. For a highly intensive project carried out at feverish speed over just a few weeks or months it might be deemed appropriate to hold a short progress meeting every week. Monthly is a more usual interval for most projects. One company in my experience managed its projects well without regular progress meetings. All project departmental managers were issued with work schedules from a multi-project model, and a project coordination group controlled progress against these schedules on a day-by-day basis. As soon as any activity seemed in danger of running late, action was taken to bring the work back on schedule. No specific decision was taken to abolish the traditional progress meetings: they simply became unnecessary. However, a project manager has no alternative but to call progress meetings when the participants come from different departments or organizations and must meet face-to-face to resolve their genuine difficulties and so keep the program on course.

COMMITMENTS

During progress meetings it is common for individuals to be asked to make estimates, or to give promises of fresh dates by which late or additional jobs can be finished. The chairman ensures promises with vague wordings such as 'the end of the week', or 'sometime next month' or (worst of all) 'as soon as possible' are not allowed. He or she must insist on firm, measurable commitments. If any member of the meeting feels the promises being made by others are unrealistic, he or she should (politely) say so, so that all possible consideration is given in advance to likely problems. All promises and commitments must be realistic. How often have we attended progress meetings where, from one meeting to the next, the same item keeps cropping up with the only result being that a new, later, promise is given each time?

MINUTES

Progress meetings are a waste of time when the agreements reached are not followed up to ensure that promises are kept. The control document for this purpose is that containing the minutes of the meeting. The minutes should be:

- concise, giving short statements of actions agreed;
- annotated to show those persons required to perform or manage the agreed actions;
- issued promptly, as soon as possible after the meeting;
- distributed to all those present plus any other person listed as having to take action.

Progress Measurement

Progress measurement is not the same thing as progress management because, by itself, it does not imply the taking of action. Measurement is, however, necessary for several reasons. The most important of these are:

1. To provide an equitable and certifiable basis for interim claims for payment. Thus the work of subcontractors has to be measured to establish when and how much they can bill the main contractor (or the client) for work done. A main contractor's own work should be measured for similar reasons. The inclusion of key events or milestones in the plan is a good way of identifying the timing and amounts of interim payments.
2. To provide data for inclusion in reports to senior management and the client.
3. To allow comparison of actual costs and progress with the current schedule and budgets. Such comparisons give early warning of possible overspending or late completion.

If a computer schedule is used which is updated and reissued at intervals, all new data and progress information must be related to the next 'time-now' date. This is the date (decided by the planner) that the project management software uses as the start date from which to calculate and report the next revised schedule. Most computer programs allow the progress of an activity to be assessed in a number of different ways. Here are some of the possibilities:

1. Report that the activity has started, or will be started, by time-now. This information should prevent the computer from rescheduling activities which are already in progress.
2. An assessment of progress achieved. This might be expressed as one of the following:
 - Estimated duration remaining to completion after time-now;
 - Estimated percentage completion achieved at time-now; or
 - An estimated completion date for the activity.
3. Report that the activity has been completed, or will have been completed at time-now.

ASSESSING PROGRESS ON SOFTWARE TASKS

Estimates of activity durations usually tend to be optimistic. The project manager finds that when the work actually takes place, some activities take longer to finish than the time allowed in the plan. It is common practice to judge progress on software tasks (such as engineering, drawing and computer software design) in terms of percentage completion. Thus, if a particular design job were to be estimated as taking four weeks, the progress might be reported as (say) 75 percent complete, from which the project manager and any other interested person would conclude that one week's work remained. It is, unfortunately, true that most people tend to be optimists when making assessments of their achievements. Thus, the project manager with several years' experience should not be surprised when this particular job is finished not one week later, but after three weeks, and then with questions still to be answered on some finer engineering point or other.

MILESTONE TRACKER DIAGRAMS

Variations between the estimated and actual completion times can be predicted and highlighted for most tasks using a milestone tracker diagram (Figure 24.1). These are sometimes known as milestone slip diagrams, but that title is unsatisfactory because it reflects a negative attitude and assumes that milestones will always slip.

Tracker Diagram: Preparation

The milestone in the example used in Figure 24.1 is for a gearbox design, but the method could be applied to any other software activity, whether for mechanical design or computer software. The estimated duration for this gearbox design activity was first judged to be 20 weeks (the baseline estimate). Preparation of the tracker diagram requires the following steps:

1. Draw two axes at right angles to each other, and scale these axes in weeks. The total period allowed should be at least as long as that which the milestone could take under the worst possible conditions. The axes should be equal in value. Note that the scaling of the y (vertical) axis is in the reverse direction from that expected in a normal graph, with zero at the top instead of at the origin. (The diagram can also be drawn rotated about the diagonal, that is with the planned date along the top, and actual down the vertical axis).

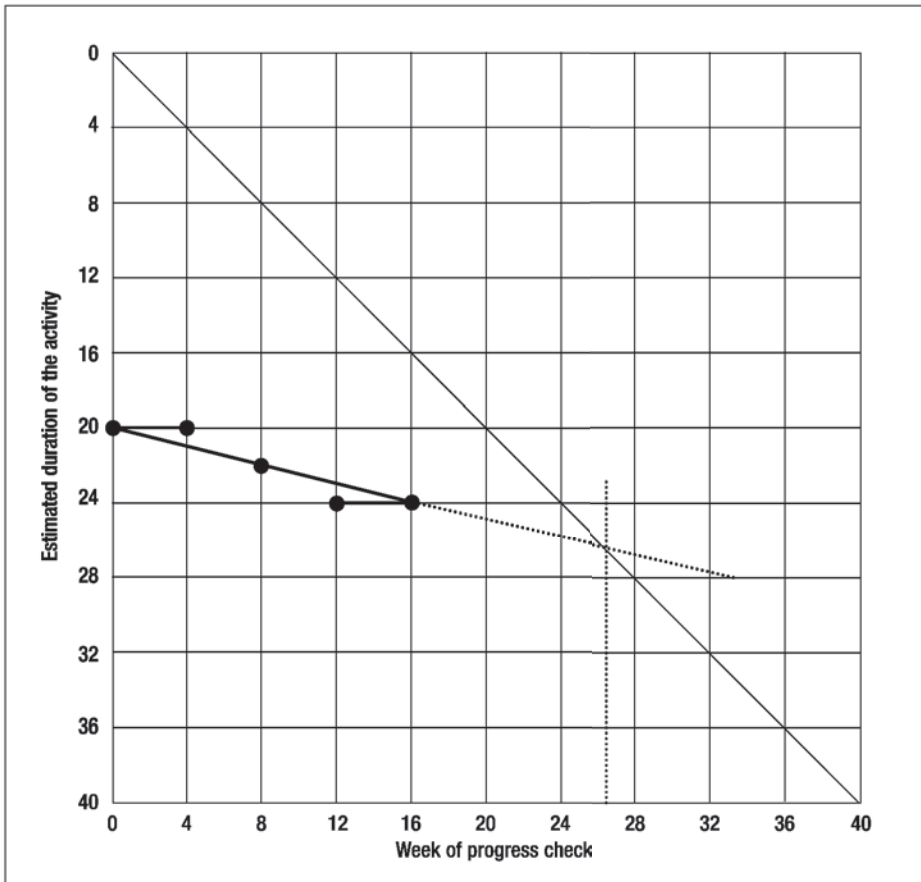


Figure 24.1 Milestone tracker diagram

2. Draw a diagonal line from the zero on the y axis to the maximum possible duration point on the x axis (which is 40 weeks in this example).
3. Plot the estimated delivery date of the milestone (week 20) at week zero on the time-now axis.

Tracker Diagram: Application

After the gearbox designer has been at work for four weeks, her supervisor asks how things are going. She replies that all is going well and she expects to finish in the 20 weeks originally estimated. This is plotted on the diagram, as shown in Figure 24.1. After a further four weeks, at week eight, a new progress check shows the designer to be less confident. She thinks she will need a further 14 weeks before she finishes. This is equivalent to a revised total duration estimate of 22 weeks, and this result is plotted on the diagram at week eight. During further checks at weeks 12 and 16 the designer has revised her estimates again and now expects the total duration to be 24 weeks. Again, these results are plotted on the diagram. At any time during these progress checks the project manager

can draw the best possible straight line to connect these revised estimates. If that straight line is projected to the right, it will intersect the diagonal line at a point which can be taken to predict the delivery date of the milestone.

All project milestones can be put on a single tracker diagram to give an overall view of progress, although earned value analysis, described later in this chapter, is the method generally preferred.

ALMOST FINISHED

A problem facing the manager trying to get a project designed on time is the frequency with which engineers and software designers report work as 90 or 95 percent complete, leaving that last tantalizing 10 or 5 percent just out of reach. The shrewd manager learns to apply a few simple rules to elicit progress. The first requirement is to identify a set of milestones or key events that allow no compromise in interpreting whether or not they have been achieved. These events, which should appear on the project network (and therefore have a scheduled date) must be chosen at close intervals. A good general rule when planning targets is to choose events where jobs pass from person to person, or from department to department. Thus the handover of a manufacturing drawing from designer to checker, or the release of a particular set of fully checked and approved drawings might be real indicators of progress.

CONSTRUCTION INDUSTRY TASKS

Procedures are well established in the construction industry for monitoring and measuring progress by the various trades on construction sites, including the work of subcontractors. Quantity surveyors work with people from the site management team to ensure that work is progressing at the planned rate. Much of the work can be measured in terms of physical quantities, such as tons of earth moved, amount of steelwork erected and so on.

EARNED VALUE ANALYSIS

Earned value analysis (Chapter 16) is a methodology for comparing the achieved value of work in progress against the project schedule and budget. It can be performed at the single activity level but its maximum benefit depends on looking at all activities and rolling the results up through the hierarchy of the work breakdown structure. As with any measurement technique, earned value analysis is not a progress control tool in itself. It can only highlight a need for corrective action by indicating trends. The method does, however, have the advantage of being able to show trends fairly early in the project life-cycle. It depends on the existence of a sound framework of planning and control, including:

- A detailed work breakdown structure;
- A correspondingly detailed cost coding system;
- Hierarchical and complete tabulation of all project tasks with their approved budgets;
- Inclusion of all authorized changes to the project at the appropriate times;
- Timely and accurate collection and reporting of cost data;
- Regular progress reviews;

- A method for quantifying the amount of work done at each review date;
- Inclusion of work in progress in all reviews;
- A competent administrator.

The basic principles can be described using a milestone tracker diagram (Figure 24.1). The original estimate for the task in that example was 20 weeks. Suppose that this work is costing £1,000 per week, so that the corresponding total budget is £20,000. Assume, for simplicity that the expenditure rate is linear. Consider a reporting date of week 16. At this time the activity should be 80 percent complete, for which the budgeted cost would be 80 percent of £20,000. In earned value analysis terms, this would be expressed as follows:

$$\text{BCWS} = \text{£16,000}$$

where BCWS is the budgeted cost of work scheduled to be complete at the reporting date. Here we are looking at just one activity, but BCWS would usually have to include all project work scheduled to be complete at the reporting date. BCWS must include not only all work actually finished, but also the completed portion of all work in progress. Returning to the single package of work in Figure 24.1, we know, that this activity is running late. Suppose the latest estimate from the milestone tracker chart shows a likely total duration of 25 weeks. If the activity expenditure is at the expected level of £1,000 per week, the likely cost will be £25,000 instead of £20,000. It could be said that, at week 16, the percentage of work achieved is not 80 percent, but only 64 percent. The earned value analysis expressions which describe this state of affairs are as follows:

$$\text{ACWP} = \text{£16,000}$$

where ACWP is the actual cost of work performed to date;

$$\text{BCWP} = \text{£12,800}$$

where BCWP is the budgeted cost of work performed (budget cost appropriate to the amount of work actually achieved). These results can be used to produce the following indices:

$$\text{cost performance index, CPI} = \frac{\text{BCWP}}{\text{ACWP}}$$

$$\text{schedule performance index, SPI} = \frac{\text{BCWP}}{\text{BCWS}}$$

For the single task in the tracker diagram in Figure 24.1 the CPI and SPI are both 0.8. Values greater than unity point to performance better than plan. Values less than unity, as here, indicate negative variances and the need for action to correct the trend. When the measurement takes into account all the project's work, the CPI can be used to calculate the estimated costs remaining to completion or the predicted final project cost, as described in Chapter 16 and illustrated in Figure 16.1.

Similarly the SPI can predict the probable completion date, although this factor is not used nearly as often as the CPI.

Changes

Change to an active project can threaten progress and increase costs. It is true that there are companies which welcome their client's requests for changes, since these can provide reasons for levying additional charges and extending the timescale at the client's expense. Once the project is active, any change can be an increase in project scope which the contractor can sell at a price unrestricted by external competition. Project managers, however, usually view all changes as nuisances.

CHANGES WHICH NEED CONTROL PROCEDURES

Changes can obviously occur at any stage in a project. Some are relatively insignificant, because they happen early, cause little wasted effort and do not affect the project as it was originally defined in the sales specification and contract. For example, a designer may have to make several attempts at a difficult design problem before a drawing can be produced that is suitable for release to the production or construction organization. It would not be reasonable or practicable to expect the designer to seek formal approval every time he or she wiped the computer screen and started again. There is a way to decide whether or not an action should be regarded as a change needing formal management approval. This is to ask whether or not the proposed change would alter any information on a document that has already been issued to authorize work. This definition means that a formal procedure should be applied whenever a proposed change would affect:

- the contract document or any of its attachments (in which case the controlling change document would probably be called a project variation order or contract variation);
- an issued purchase order (the change would probably be called a purchase order amendment);
- any drawing or specification which has previously been issued for manufacture, purchasing or construction.

These changes can be interactive, so that a contract variation originated by the client (for instance) might result in a series of engineering changes and purchase order amendments.

CONTROL PROCEDURES FOR ENGINEERING CHANGES

Before a proposed engineering change is allowed to go ahead, it is usual to assess its risks, examining the possible effects carefully in all respects (technical, manufacturing or construction methods, commercial, safety, reliability, timescale and costs). Because no one person can usually be found in the organization who is capable of assessing all these factors, a committee of departmental managers or other experts, which might be

called the change committee or change board, is often formed for the purpose. A change committee might contain a senior representative of key company functions. A typical composition might be:

1. The chief engineer, acting as design authority;
2. The quality manager, acting as the quality authority (or the inspecting authority);
3. The manufacturing manager, as the manufacturing authority;
4. The commercial manager;
5. The purchasing manager.

All requests for engineering changes should be submitted to the change committee in a suitable standard format. The procedure should ensure change requests are dealt with properly, without undue delay, and that actions decided by the committee are followed up. Not least of these actions is the updating and reissue of drawings and other affected documents.

The change control procedure should be centered on a technical clerk or project coordinator, who can serial number and register each request and then use the register to control its progress. The project management office (PMO) is an ideal home for this function (Chapter 31).

Monitoring must continue until each change request is either rejected by the committee or fully implemented. The coordinator must keep those who are likely to be affected (including the request originators) informed of the committee decisions. In a typical arrangement, the change committee will meet at regular intervals (perhaps weekly or every two weeks) to consider change requests in batches. The committee will consider each change on its merits and potential risks.

In one multinational company the view was taken that all changes would initially be classified as either 'essential' or 'desirable'. Essential changes would include those necessary to guarantee safe and reliable operation of plant, or to correct errors. These might be approved without comment, sent back to the originator for more information or an alternative proposal, given approval in a modified or limited form or rejected altogether. Changes requested by the customer would also fall into the essential category, most of these resulting in additional revenue. Changes classed as desirable would always be rejected. The slogan was 'If it's essential we must do it, if it's only desirable we won't'.

DESIGN FREEZE

Sometimes project organizations recognize that there is a point in the design and implementation of a project after which any engineering change would be either particularly inconvenient or unacceptably damaging to costs and progress. This leads the organization to announce a 'design freeze' for the project. In some companies this is called 'stable design'. The idea is to deter anyone from having the temerity to suggest any further change. The change committee will refuse approval for any change request once design has been frozen, unless the originator can show compelling reasons such as safety or a funded customer request. Ideally the customer should also be bound by the design freeze, or at least should be made to pay heavily for the privilege of breaching it.

OTHER PROCEDURES RELATED TO ENGINEERING CHANGES

There are at least three procedural systems that are similar in many respects to engineering change procedures, especially in manufacturing companies. These procedures deal with:

1. engineering queries: requests for advice from manufacturing departments where drawings and specifications are unclear or appear to contain errors;
2. production permits and concessions: requests from the manufacturing departments for permission to depart from design or process instructions in one or more respects;
3. inspection rejection reports, where the degree of rejection is marginal and the design authority must rule whether or not to allow a concession.

Change procedures and their related systems are described more fully in Lock (2013).

Progress Reporting

Progress reporting takes place at many levels, formally and informally, on any project of significant size. At the simplest level reporting is person to person when, for example, a supervisor performs the daily rounds and asks how individual jobs are progressing. There follows an ascending hierarchical structure of reporting, involving other departments, subcontractors, purchasing and shipping organizations, finally reaching the level of regular, comprehensive cost and progress reports to the client. The lowest and most detailed level of reporting is concerned with collecting data from which to keep the schedule up-to-date. This was discussed earlier in this chapter.

EXCEPTION REPORTING

Strictly speaking, the more senior a person in the management structure of the project, the less detail he or she should be given about progress. Those managers responsible for taking action when things look like they are going wrong should not be given a long list of jobs that are on course, so that potential problems are hidden among them. It is necessary to pick out the problem activities and highlight them. Then managers' time can be focused on resolving the problems. Every item in danger of running late or of exceeding its cost constitutes an exception that should be reported. Accountants have known and followed this principle for many years, but they call exceptions variances, a term that has since gone into wider use.

When a computer is used for scheduling, it is possible to edit lists so that only late or critical activities are shown. There are also techniques, such as the allocation of report level codes to activities, for reducing the number of activities in reports to individual managers still further on a need-to-know basis. These methods can be combined to produce effective exception reports and target them to the managers who should get them and take action.

Material shortage lists are a good, if specialized, example of exception reports. They list all items of purchased materials and equipment that are urgently needed to maintain or regain work momentum. The purchasing department is then able to concentrate the efforts of its expediting section on dealing with these exceptions and getting the goods delivered.

PROGRESS REPORTS TO THE CLIENT

If the project is large in terms of time and cost, the client will want to know how the project is progressing at any time. This information is usually presented in the form of a progress report (typically issued monthly). It is usual to combine progress reports to the client with cost reports and statements showing how project funds are being used. The main contractor of a large international project might include the following items in regular reports to the client:

1. A written account of progress achieved to date, with special emphasis on progress achieved since the previous report;
2. Photographs showing physical progress;
3. Some form of quantified evidence to back up the progress claimed. This might include, for example, a table of drawing achievement showing:
 - total number of drawings required for the project;
 - number of drawings issued during this reporting period;
 - total number of drawings issued to date;
 - number of drawings in progress;
 - number of drawings not started;
 - percentage of total engineering design and drawing finished;
4. A statement of the position regarding purchased equipment, possibly with detailed lists in the form of purchase and order schedules;
5. A cost report, showing in tabular and graphical form the expenditure to date on main areas of the project and a summary. The cost report should include the latest predictions of total final project expenditure, and would also give the client up-to-date cash flow forecasts;
6. A short summary of the work planned for the next reporting period;
7. A list of problems caused by the client in holding up the supply of information, approvals or funds. That is a schedule of actions which the contractor requires from the client;
8. A summary of project variations, separated into those which have been approved and those which are undergoing appraisal;
9. A summary of documents and correspondence communicated during the reporting period, highlighting as exceptions those which still have to be satisfactorily answered.

Project managers or their superiors should edit reports for clients carefully to ensure that the contents represent a true picture of the project progress. It is not necessary, obviously, to tell the client of every silly mistake made during design or manufacturing, provided that such mistakes are correctable within the time and cost constraints of the contract. The client must, however, never be misled or intentionally misinformed. If a problem is foreseen which poses a real threat to the timescale, to the budget, or to the technical performance of the finished project, then the client must be told. A client who is left to find out such problems by default will not feel that the project manager has acted to protect his best interests. The client should feel justified in asking how the contractor felt able to ask a fee for managing the project when, at best, there appears to have been no awareness of the problem and, at worst, deception.

References and Further Reading

- Fleming, Q.W. and Koppelman, J.M., 2000, *Earned Value Project Management*, 2nd edition, Upper Darby, PA: Project Management Institute.
- Lock, D., 2013, *Project Management*, 10th edition, Farnham: Gower.

CHAPTER **25** *Project Close-out*

HEMANTA DOLOI

Project closure is the final step in the project life-cycle. All of the stakeholders would like to reach this point as quickly and efficiently as possible. There are some key points in the project closing process such as:

- Time at which the project reaches the closing process;
- Time in which the project is closed formally;
- Activities that should be carried out during the project closing process;
- The main outputs of the closing process.

In order to address these points, a comprehensive process is designed that illustrates the main activities in the project closing process. Project closure has different aspects and different groups should contribute to this process. The major aspects of project closure fall in the following categories:

- Technical;
- Financial;
- Legal;
- Human resources.

In larger, more complicated projects, project managers often seek support from external consultants to help them with these issues. In order to prepare for a smooth project close-out, a project closure committee is recommended which includes different stakeholders with different expertise to manage closing process activities. This committee can be managed by the project board or project manager.

Overview of the Project Closing Process

The project closing process can be divided into three phases:

1. Closing assessment;
2. Closing preparation;
3. Post review project.

This process should be revised according to the size and complexity of projects. The project closing process is started in order to respond to the big underlying question ‘Is the project ready for closing?’ This important question is evaluated and responded to in the closing assessment stage. If the assessment in the first stage reveals that the project is complete and ready for close out, the next stage in the closing process ‘closing preparation’ can start. This stage considers all actions that should be carried out in order to close projects legally. The final stage in the closing process is the post project review. In this stage, when the project owner or project management team ensures that the project is closed technically and legally in its entirety, they will then prepare the project end report and prepare the lessons learned. The project closing process can be represented graphically as shown in Figure 25.1.

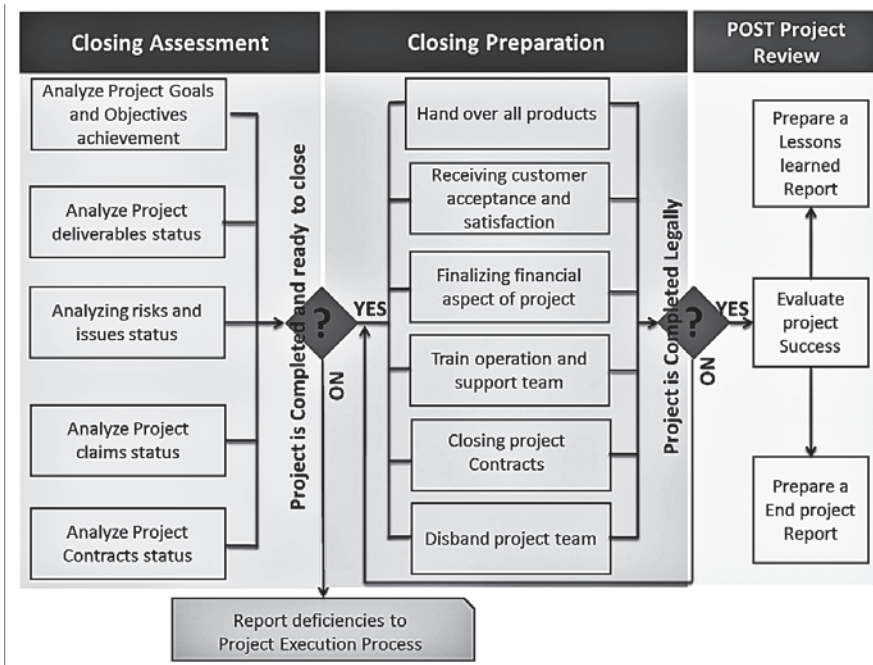


Figure 25.1 Project closing process

CLOSING ASSESSMENT

The first stage in the project closing process is the closing assessment. In this step, the project manager should analyze whether the project is ready to start the closing process or not. Before examining the activities that should be carried out in the closing assessment, it is important to assess different types of project closure. There are two types of project closure namely ‘premature’ and ‘planned’ closure. Planned closure kicks off when a project is completed and all or the majority of project deliverables are delivered according to the contract or other project documents. In premature closure, major project stakeholders, particularly project owners, decide to close the project before completion. Some of the common causes of premature project closure are:

- Outcomes and benefits that the project is expected to deliver are not justified now;
- The main contractor does not have the capability to provide deliverables based on the contract;
- There are some force majeure conditions in the contract and if they occur, it may result in a premature closure of the project.

Some of the key activities associated with the closing assessment stage are discussed below.

Analyze Achievement of Project Goals and Objectives

In the project initiation phase, project goals and objectives are defined and agreed by major stakeholders. Projects are defined to help organizations achieve their business goals. There should be a correspondence between business and project goals and objectives. Once the project is ready for closure, the project manager should review and analyze the project goals and objectives and evaluate whether all project goals and objectives have been achieved or not.

Analyze the Status of Project Deliverables

Project deliverables are identified in the project scope statement. Analyzing the project deliverables status is the easiest approach in evaluating project completion. This activity concentrates more on the technical aspect of project closure. Acceptance criteria are the most important measures in order to analyze the completion of project deliverables. The project manager should consider acceptance criteria during the project life-cycle. The project can be closed when project acceptance criteria, which are specified by the project owner and customer, are achieved. When the project owner, customer and users are satisfied with the project deliverables, it can be said that project is technically completed.

Analyze Open Risks and Issues

During project execution, the project may be exposed to different risks and issues. These risks and issues should be evaluated and responded to before the project closing process. In some situations, it is possible that a risk or issue has not been solved during the project life-cycle. In this case the project manager should explain the issue or risk to the project owner, customer and probably user and convince them that this issue or risk is not important and project goals and objectives will not be affected by them. Regarding the fact that project deliverables are managed by product managers or operational units in the customer's organization, product managers and operational managers are the proper candidates that can make a judgment about open risks and issues. They can decide on how to manage the project deliverables with regard to such open risk and issues. Finally, if there is any open risk or issue which the technical team cannot resolve, this risk or issue must be declared and agreed upon by the major stakeholders.

Analyze the Status of Project Claims

During the project life-cycle, particularly project execution, numerous claims can be raised by different stakeholders. For example, if the project contractor sends drawings or other documents to the superintendent for approval, based on the contract they should evaluate and approve it (or defer it) in 20 working days. But if the superintendent takes 40 working days to respond and this delay causes an extra direct cost for the contractor, the contractor can claim extra money for the delay. Claims of different types require different arrangements for providing adequate responses. The project manager should evaluate all of the project claims and ensure that all of them are documented, evaluated, responded to and closed. Then the project can proceed to the next step which is closing preparation.

Analyze the Status of Project Contracts

Projects can include three types of contracts. The major contracts are usually between the project owner and main contractor, the sub contracts between main contractor and subcontractors and the suppliers and sometimes the complementary contracts between project owner and consultants and the superintendents. Each contract has a technical, legal and financial part. The project closure team or project manager must consider the status of these contracts before initiating project closure. At this stage, the project manager should examine whether or not the project contracts are closed or ready to close financially, legally and technically. Such analysis can be carried out by using the project closure assessment check list. This check list should be customized on a project to project basis as one size does not necessarily fit all. If the assessment shows that there is any defect or omission in any part of the works under contract, these deficiencies should be analyzed and appropriate corrective actions communicated with the responsible persons in the project execution process. After resolving these deficiencies, the closure committee should formally inform all the key stakeholders about the corrective action taken and liaise with the project owner or project manager for their acceptance to start the closure preparation stage.

CLOSING PREPARATION

After assessing the readiness of the project for closure, closing preparation starts. In this stage the project is closed legally and the responsibility of project deliverables are handed on to the operational team (Office of Government Commerce, 2009). The project is legally closed when the following activities are fully accomplished.

Hand Over all Products

As suggested in Chapter 10, the project should deliver specific products. The information about the products can be found in the project scope statement or product work break down structure (Chapter 10). The project products should be handed over during the closing process. This activity should be done formally. The project owner and customer should state that they are ready to accept the products based on the contract after successful commissioning.

Receiving Customer Acceptance and Satisfaction

The project contractor should try to receive the customer acceptance in the first step. There are almost always many stumbling blocks to this. Sometimes the major activities are accomplished but there are many small pieces of work that should be carried out in order to get customer acceptance such as preparing manuals, documentation and implementing minor changes in products. While getting customer acceptance is an obligation for contractors, achieving owner, customer and even user satisfaction is not mandatory. But it can be helpful for the contractor to win projects from this customer in the future. In addition, it can be a good point in the contractor's resumé that they achieve customer satisfaction in their projects. Customer satisfaction can be declared by a formal letter.

Finalizing the Financial Aspect of the Project

As we said earlier, each project can have different types of contracts. During the project life-cycle many financial transactions are created. These transactions can either be based on the plans or sometimes not. The important point here is that the financial health of the project should be carefully evaluated throughout the project life and all of the outstanding bills should be paid to the contractors and suppliers as per the contract terms. On the basis of the project situation, it is possible that the project contractor repays money in the closing process owing to reasons such as decreasing project scope and accepting obvious defects or omissions. Finalizing financial aspects of the project means that there is no further payment and all financial transactions including payable and receivable are completed and the major stakeholders, especially customer and contractor, have agreed upon the payments.

Train the Operation and Support Teams

When the project is closed all products and services that are produced based on the project scope should be passed on to the customer and user organization. Therefore, operational and support teams in their organizations should be able to operate and manage new products and services. Consequently, the responsibility of managing the new services or products is transferred to the operation and support teams. Therefore in the closing process, the project owner or customer should make certain that all necessary knowledge for the operational period is transferred to the operational team and that they are ready for the operational period. In most cases, the project implementation team should hold training courses such as maintenance and operation for the support team. The required training courses should be stated in the contract. It is highly recommended that a readiness assessment is accomplished during project closure to evaluate the readiness of the customer and user organization in order to evaluate their capability in managing the new products or services. The readiness assessment is not limited to human resources knowledge and capabilities. It also includes the organization infrastructure, required new processes and procedures and work instructions.

It should be considered that usually projects create a business transformation in organizations. Therefore organizations should be ready for the business changes.

Projects not only add some new services or products, but also they change the process, structure and behavior of the organizations. These changes can be minor, moderate or major and according to the scale of the change, test for readiness is different.

Closing Project Contracts

In the closing preparation stage, the different contracts of the project particularly the contract between owner and main contractor should be legally and formally closed. The closing procedure should be stated in the contract. In most cases, a meeting is held and the project board analyzes the project documentation showing evidences of hand over products, customer acceptance, finalizing payments and related agreements. According to the received evidences, the project board decides whether the project contract can be closed or not. By closing the project main contract, the project is formally closed and the project team can be disbanded.

Disband the Project Team

A project is temporary and therefore the project team is a temporary organization, which should be disbanded when the project is closed (Turner et al, 2008). Considering the fact that usually the project team is working in the customer's or contractor's organization, they can be assigned to another project or returned to their functional roles and sometimes they quit organizations after the project is closed. However the project manager or sometimes the human resource manager has the responsibility to assign the project team to future projects after closing the current project.

POST PROJECT REVIEW

A post project review is highly recommended in projects but it is not an obligation and in most cases it is not done. A post project review is effective for organizations to learn from their experiences, analyzing their strengths and weaknesses and learning from them for future projects. A post project review may include the following activities.

Evaluate Project Success

It is useful during project closure to assess how successful the project was, and what factors contributed to success. As discussed in Chapters 2 and 3, the limited view of project success is to say it was completed on time, within budget and to the agreed quality specification, the so-called iron triangle (Atkinson, 1999). It is now more commonplace to assess success by also including the project's contribution to business success and including the assessment of a wider set of stakeholders (Chapters 2 and 3; Shenhar and Dvir, 2007; Turner and Zolin, 2012). Shenhar and Dvir suggested five dimensions of project success (Table 25.1):

Table 25.1 Assessment of project success (after Shenhar and Dvir, 2007)

Efficiency	Impact on team	Impact on customer	Business success	Preparation for the future
Meeting schedule	Team satisfaction	Meeting requirements	Sales	New technology
	Team morale		Profits	New market
Meeting cost	Skill	Meeting specification	Market share	New product line
Yield, performance, functionality	Team member growth	Benefit to the customer	ROI, ROE	New core competency
	Team member retention		Cash flow	
Other defined efficiencies	No burnout	Extent of use	Service quality	New organizational capability
		Customer satisfaction	Cycle time	
		Customer loyalty	Organizational measures	
		Brand name recognition	Regulatory approval	

1. Project efficiency;
2. Impact on the team;
3. Impact on the customer;
4. Impact on the business;
5. Preparation for the future.

Different projects need different definitions of project success. Therefore it is important that the project success definition is customized and clearly defined in the initiation phase of each project. The major project stakeholders should agree on the definition of project success. When the project is legally closed, the closing committee can evaluate project success on the basis of the definition of success. Project success is not an absolute concept. However, based on the project success definition, it is reasonable to report the success in quantitative terms such as the project was 80% successful. Anecdotally, quantification of project success is usually linked to cost and time performance. But it should be based on the contribution of the project to the business, based on criteria such as Shenhar and Dvir's (2007), or in the more extreme cases Turner and Zolin's (2012). Furthermore, project oriented organizations can aggregate their project success for all of their projects and calculate their business success according to them.

Prepare Lessons Learned

Project management includes processes, procedures, structures, tools, techniques and other components. Organizations need a clear approach to continually improve these components. Analyzing project progress and evaluation of project issues and problems, strengths and weaknesses in managing different aspects of projects such as time, cost and stakeholders is an effective way to improve project management maturity in the organizations. NATO in their lessons learned handbook say, 'Lessons learned are broadly

used to describe people, things and activities related to the act of learning from experience to achieve improvements'. A lessons learned report and process is shown in Table 25.2 and Figure 25.2. Different questions can be discussed in order to prepare a lessons learned report as follows:

Table 25.2 Part of the lessons learned report for the sample project

Follow up actions	Responsible	Due date
Creating risk register data base and entering identified risks from the previous projects into this data base	Project management office	To be specified
Train risk management team in order to learn quantitative risk analysis	Human resource manager	To be specified
Identifying and buying suitable risk analysis software in order to provide quantitative risk analysis calculations	IT department	To be specified

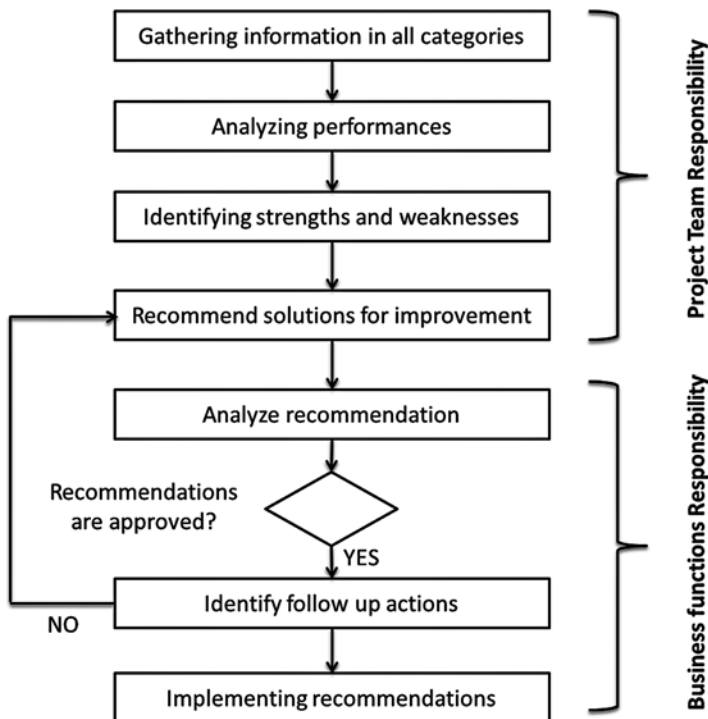


Figure 25.2 Sample lessons learned process

- Did the project management methodology work? If not, why not?
- Was the customer satisfied with the final product? If not, why not?
- Were the risks identified, analyzed and controlled? If not, why not?
- Was the schedule met? If not, why not?
- Was the cost and budget met? If not, why not?
- Were project changes evaluated and implemented without adverse impact on the project objectives? If not, why not?
- Did the project deliverables meet the acceptance criteria? If not, why not?
- Were quality planning, assurance and control accomplished? If not, why not?

To prepare a lessons learned report, project management should be divided into different categories. These categories can be based on various factors such as project scales, contract types and technical areas and the project manager should identify suitable categories such as lessons learned in project time and cost management, quality management, risk management, stakeholder management, procurement management, issue resolution and change management. While there is not any specific structure for the lessons learned report, the following is an example of a sample lessons learned reported under the risk management context.

Project Scenario: Upon completion of a major refurbishment project of an institutional building in one of the Australian universities in Melbourne in early 2012, the lessons learned in the risk management context was reported by the project team as follows:

Performance overview in risk management: Risk identification was not accomplished accurately, so the calculated reserve was not correct. In this project, expert judgment was used for risk identification but it would have been better to use another approach such as the Delphi technique. Risk assessment for individual risks was almost accurate. It will be helpful to calculate project risk in the future. Risk monitoring and control were carried out properly.

Recommendations in risk management: Providing risks databases that include risks for different types of project should be helpful and will increase accuracy of risk identification. In addition using quantitative risk analysis techniques such as Monte Carlo simulation and assessment of Expected Monetary Value should be considered for the future.

Follow up actions in risk management: Some of the follow-up actions should be considered as shown in Table 25.2:

There are two important points that should be considered in order to achieve effective continual improvements out of the lessons learned process. Firstly, although preparing lessons learned is carried out by the project management team, it needs the organization's support. As can be seen in the risk sample, it is recommended that the organization should buy the risk analysis tool. This recommendation needs funds and funds should be confirmed and provided by relevant directors in the organization. Therefore, effective lessons learned usually need close cooperation between the project team, project management office and responsible business functions. Secondly, lessons learned are not only documentation

about project history, they are also created for continuous improvements resulting in more effective and efficient project management in the future. Therefore, preparing lessons learned needs a clear process in organizations. Figure 25.2 shows a sample process for preparing lessons learned based on the NATO lessons learned manual.

Prepare an End of Project Report

An end of project report can be integrated within the lessons learned report. The end of project report should analyze the project performance in different categories, especially in terms of the success criteria as agreed at the project initiation. A typical end project report may include the following information:

- Project summary;
- Project owner, customer and user's view on project progress;
- Project success or failure calculation;
- Review on project products;
- Review on team performance;
- Project budget and actual costs;
- Project schedule and actual out-turn;
- Performance against the business case.

Project Closure Using Life-Cycle Project Management

In high risk and major projects such as implementing a direction system for ground control, power stations, wind farm and so on, projects need rigorous control and verification systems for commissioning. It is not reasonable to roll out a high risk project without final testing of all functionalities. Life-cycle Project Management (LCPM) provides an approach to commissioning high risk projects by using process simulation. On the basis of this approach, project outputs are simulated and run digitally on the computer and the output of the simulation can be compared with the functionalities that are identified in the project initiation phase (Doloi, 2008). Use of simulation can help improve the project rollout safety and reliability. Simulation can help the project owner and customer to evaluate both effectiveness and efficiency of the prepared product or services.

Simulation is an effective tool in mitigating risks in project rollout. After simulating the functionalities, it is possible for the project team to carry out some corrections in their products to create new functions or improve existing ones based on the result. In addition, as the risk and safety teams take proactive roles in commissioning, a simulation of processes for risk free commissioning is possible through simulation. If there are some hazards that cannot be removed from the products or services, the risk and safety teams should prepare a clear risk management plan to control them during the operation period. Applying effective control measures are vitally important. A sample process for applying closing a project by using simulation in order to analyze functionalities in commissioning and operational phases is shown in Figure 25.3.

This approach will be effective in large or high risk projects. By applying this approach, not only are the project delivery processes and underlying functions

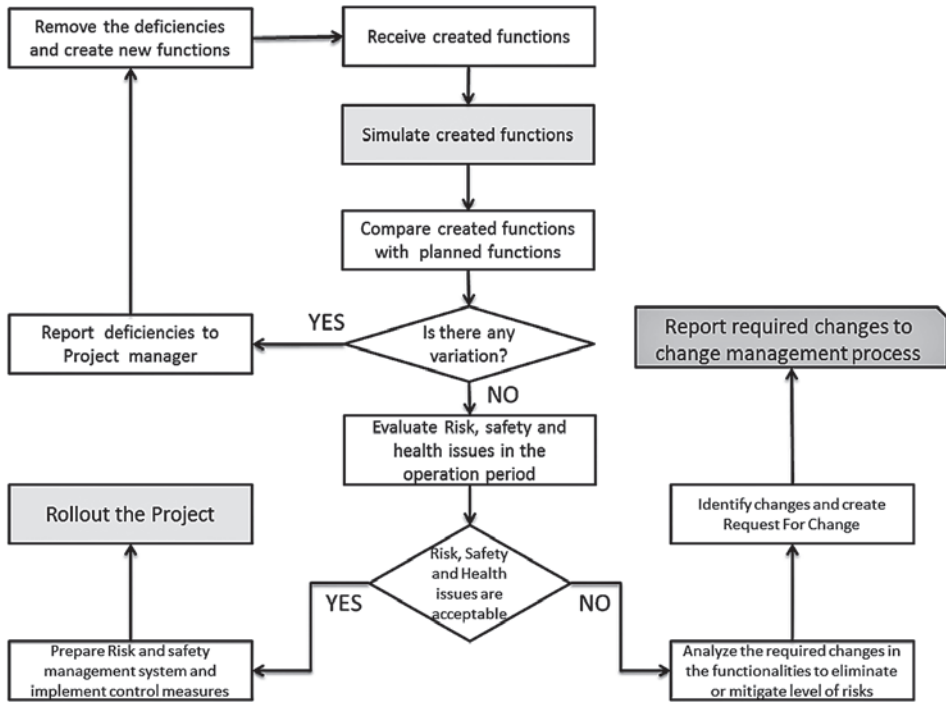


Figure 25.3 Sample function simulation process in LCPM approach

meticulously scrutinized, but the post project issues, including risks, safety and health over commissioning and closing phases, are also effectively addressed.

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4 *Portfolio*

Few projects take place as an isolated, stand-alone project. They are part of a larger portfolio in one form or another. In the fourth edition, I started with corporate strategy, and worked down through the portfolio and program to the project. In this edition I started with the project and worked out. So now I consider the several different forms of portfolio the project can exist in. I have worked out to corporate strategy. We start with complex infrastructure projects which have many of the features of programs. We then consider program management and portfolio management, and how programs and portfolios link projects to corporate strategy. We consider the nature of the project-oriented organization, and the governance of project management. Finally, we consider the PM Office, where P can stand for project, program or portfolio, and its role in the coordination of different constellations of projects.

Chapter 26: Complex Projects

In Chapter 26, Marcel Hertogh and Eddy Westerveld describe the management of complex projects. First they describe the practitioner view of what constitutes complexity, identifying six elements of complexity. Then they describe the academic view, with two dimensions of complexity, the complicatedness of the technology and the complexity of the social system. That leads to four management styles, ranging from the routine management of the simple to the dynamic management of the complex.

Chapter 27: Managing Programs of Projects

Continuing to work out from the project, we come first to programs, collections of projects contributing to a common strategic objective. In Chapter 27, Ginger Levin and J. LeRoy Ward describe program management. They describe the nature of programs, and three key issues of program management. They also describe the competencies of program managers.

Chapter 28: Managing Portfolios of Projects

We next come to portfolios of projects, groups of projects sharing common resources. In Chapter 28, Ginger Levin and J. LeRoy Ward describe the management of a portfolio of projects. They describe how to establish and implement the portfolio management processes.

Chapter 29: Managing the Project-Oriented Organization

Finally we come to the project-oriented organization, an organization undertaking several portfolios or programs of projects. In Chapter 29, Martina Huemann describes the management of the project-oriented organization, including the management of human resources in such an organization.

Chapter 30: The Governance of Projects and Project Management

The organizations at all levels of this cascade, project, program, portfolio and project-oriented organization, whether temporary (project and program), or permanent (portfolio and project-oriented organization), require governance. In Chapter 30, Ralf Müller describes the governance of project management. He describes institutions of the governance of projects and how to link corporate governance to project governance.

Chapter 31: The project management office: building a PMO for performance

A key element of the governance of project management is the project management office. In Chapter 31, Monique Aubry and Brian Hobbs describe the project management office. They describe the role of the single project office and networks of project offices, and how to implement the project office.

MARCEL HERTOIGH AND EDDY WESTERVELD

The successful implementation of Large Infrastructure Projects (LIPs) is regarded as highly important but in general management is failing to meet the high expectations during project delivery. The image of these major undertakings is far from positive: both researchers and practitioners observe delays, cost overruns, benefit shortfalls and a general failure to meet stakeholder expectations. One potential cause for failure is the lack of recognition and success of the project management of LIPs to manage the complexity of these mega projects. In order to investigate this, a study was initiated with the main research question: How to manage complexity in the implementation of LIPs in Europe? The research was carried out on six main cases across Europe.

Outcomes of the study show that complexity is a key theme in the management of LIPs. In general dealing with two types of complexity was found crucial: detail and dynamic complexity. While management of both these types of complexity is important, the management of especially dynamic complexity is currently falling short. A coherent framework is presented with four types of management approaches that can be used to successfully manage complexity in practice.

Problem Statement: Huge Ambitions and Disappointing Results

HUGE AMBITIONS / DISAPPOINTING RESULTS

Transport networks are needed to enable modern economies to create wealth and employment. But the current infrastructure networks are not considered sufficient. To meet the rising and changing demands, an ambitious program of transport networks has been set up in Europe. The European Commission initiated the Trans-European Transport Network (TEN-T), in Essen in 1994, and established a list of 14 priority projects. Mainly because of the extension of the European Union in 2004, these 14 priority projects became 30 in 2005. Mr Barrot, Vice President of the European Commission, with responsibility for Transport, wrote (European Commission, 2005):

In view of growth in traffic between member states the investment required to complete and modernise a true trans-European network in the enlarged EU amounts to some €600 billion.

The ambitions are huge. But what is the performance in realizing these programs? The media frequently report disappointing results in realizing infrastructure projects, often with substantial political consequences. Cost overruns of the Betuweroute and HSL-South projects were the immediate cause in The Netherlands for the parliamentary enquiry executed by the Temporary Committee for Infrastructure (TCI). The TCI carried out a thorough investigation on the decision making process of infrastructure projects in The Netherlands. It asked: How is it possible that despite years of experience, we still are not able to control these projects? (Temporary Committee for Infrastructure projects [Tijdelijke Commissie Infrastructuurprojecten], 2004). The fact that the results are disappointing is supported by international research.

Flyvbjerg has studied 258 transport infrastructure projects worth US\$ 90 billion (Flyvbjerg et al, 2002, 2003, 2007). He studied the reliability of cost estimations and found that:

- cost overruns of 50 to 100% in real terms are common in mega-projects, overruns above 100% are not uncommon;
- inaccuracy in cost forecasts is on average 45% for rail, 34% for bridges and tunnels, 20% for roads;
- for the 70-period time-span for which cost data were used, accuracy in cost forecasts has not improved.

Flyvbjerg and his co-authors concluded that:

The cost estimations used in public debates, media coverage, and decision making for transportation infrastructure development are highly, systematically, and significantly deceptive. So are the cost benefit analyses into which cost estimations are routinely fed to calculate the viability and ranking of projects.

and they advise (Flyvbjerg et al, 2002):

not to trust the cost estimations presented by infrastructure promoters and forecasters.

We saw that in 1994 the European Commission initiated 14 priority projects. What were the results after ten years? Mr. Barrot of the European Commission reported in 2005 (European Commission, 2005):

After 10 years, however, it is clear that the results fall short of the overall ambitions. In 2003, barely one third of the network had been built. And only 3 of the 14 specific projects endorsed by the European Council at Essen in 1994 have been completed.

Since then, delays have been reported (European Commission, 2012). Apart from the disappointing performance in terms of money and time, we notice general dissatisfaction of involved stakeholders with the development and realization of LIPs (Teisman, 1992; Hertogh et al, 2008, Hertogh and Westerveld, 2010). TCI concluded that stakeholders are

often not satisfied with the final results of a project in terms of the added value (benefits) and how the protection of ‘negative interests’ was dealt with (Temporary Committee for Infrastructure, 2004). LIPs often seem to be ‘out of fit’, causing a democratic deficit (Nijssen, 2006). This democratic deficit means that government, and the other involved stakeholders, are not able to sufficiently align project outcomes with stakeholders’ interests.

OUR RESEARCH PROJECT

To overcome this conflict of ambitions and results, management quality in the delivery of LIPs needs to improve. Against this background, we undertook a research project (Hertogh and Westerveld, 2010), in which we investigated how these large projects evolve and to find suitable ways to improve the management of these projects. We describe the results of this research in this chapter. In parallel we also carried out research for the European Commission, in which we investigated 15 European LIPs to find best practices and lessons learnt (Hertogh et al, 2008). We formulated the following main research questions:

- How does the implementation process of LIPs in Europe evolve?
 - How are the characteristics of complexity visible in implementation of LIPs?
 - How is this process managed?
 - What are suitable ways to improve the management of the implementation process?
- We studied six LIPs (Table 26.1).

Table 26.1 Large infrastructure projects studied

Project	Country	Mode	Length	Delivery
Betuweroute	Netherlands	Rail	160 km	2007
HSL-South	Netherlands	Rail	125 km	2009
Highway 73-South	Netherlands	Road	42 km	2008
Gotthard Base Tunnel	Switzerland	Rail	57 km	2017 (expected)
Lötschberg Base Tunnel	Switzerland	Rail	35 km	2007
West Coast Mainline	United Kingdom	Rail	650 km	2008

Within these six projects, we studied 14 critical events in order to study the management of complexity. These events or sub-cases were identified by asking respondents to identify important sub-cases in their projects. For each sub-case we distinguished rounds of decision making and for each round we analyzed the strategies that the actors used and whether these actors were satisfied or not. The goal was to develop a substantive theory, which would be helpful in solving practical dilemmas in the management of complexity in LIPs. We used a holistic approach in which we observed the project delivery organization in the broad context of the stakeholder network. To improve the quality of our research, we discussed our (preliminary) findings with advisory committees with people from the projects.

The main sensitizing concept used in this study was complexity. During our early interviews with key players involved in the implementation of LIPs, this theme emerged quickly. Complexity is a term which is broadly used in practice to describe the management issues associated with LIPs. In addition the term is used in management theory and other fields of study, offering us access to a tremendous number of insights which can be fruitful for managers active in these LIPs. The dominant term we used to judge the quality of this research is 'usefulness'.

We started our research into the six projects by means of storylines in which we distinguished several rounds of decision making. These rounds showed for all projects a non-linear implementation process and a large number of actors. In the projects context factors played an important role, factors that are not under the direct control of the project delivery organizations and therefore implicate uncertain conditions for decision making. From these and other similarities among the projects, as well as general facts and figures, we concluded that the six projects are comparable in the management of complexity. In the next two sections we will discuss complexity from two perspectives:

- Firstly, from a practitioners' view, based on the findings of interviews;
- Secondly, from a scientific perspective, to develop a theoretical framework.

The Nature of Complexity

A PRACTITIONER'S VIEW

We developed the practitioner's view by asking respondents: 'What makes your project complex to you?' Since in our study we are interested in how to manage LIPs from the project manager's point of view, it is of great importance to know what makes the management and organization of LIPs complex for the project managers involved. On the basis of the interviews, our own experience and discussions with practitioners, we distinguished six types of complexity within LIPs (Figure 26.1):

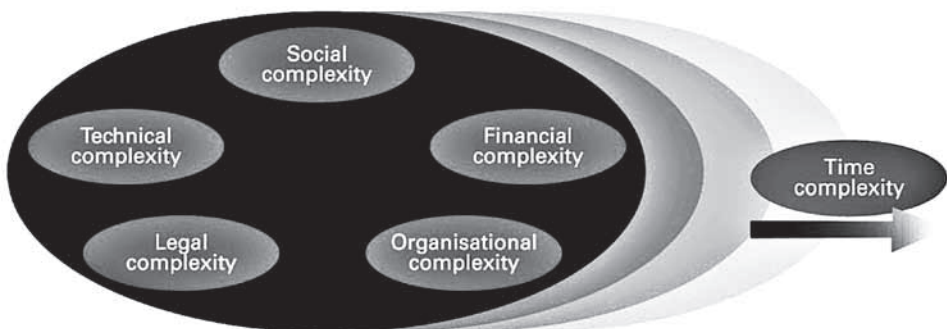


Figure 26.1 Six complexities within LIPs

- *Technical complexity*: was of high importance in all our studied cases. We identified two main issues on technical complexity: unproven technology, including tunnel safety technology and technical uncertainty, such as related to the underground geology.
- *Social complexity*: is related to the interests of stakeholders. Social complexity in LIPs originates from conflicts of interest between the involved stakeholders that lead to different perceptions (opinions) and attitudes, on issues that have a large impact on their business, life or environment.
- *Financial complexity*: is related to value for money (cost-benefit ratio), cost calculations, financial control (management and accountability) and the financing itself.
- *Legal complexity*: arises because legislation makes LIPs complex because of changing, non-existent and conflicting laws. Also the extensive legislation and rules have an important influence on content and processes. Because of this extensive legislation at LIPs, project managers admit that they often try to act flexibly in dealing with legislation, otherwise it would be impossible to carry out the project.
- *Organizational complexity*: was mentioned in many interviews, when we heard of the difficulties people experienced in organizing themselves. The organization itself becomes complex to set up and to manage. At the Betuweroute, the internal management system contained 62 processes (for example for scope management and land acquisition) that needed to be tuned with the client, contractors and other stakeholders.
- *Time complexity*: is related to the long implementation process of LIPs that means that the five complexities discussed before are continuously evolving. In other words: the context changes over time and participants have to deal with it. Think of a new minister, new legislation from Brussels and technological innovations.

What is the Dominant Complexity?

What is the relative importance of these six complexities? Do project managers perceive each as equally important? In order to answer these questions we used two approaches. First we analyzed the answers of respondents to the question: 'What makes this project complex to you?' and clustered these into the six categories to make a complexity scan. For each interview we have divided 10 points over the six complexities and after summation over all the interviews, the total scores were calculated. Second, we used a more indirect approach to complexity, focusing on important themes and events. We analyzed 14 sub-cases in depth for each sub-case and within each decision round we analyzed whether we observed any of the six types of complexity. Then we calculated their relative importance (total 100%). The results of both approaches are shown in Figure 26.2.

In general the analyses of the 14 sub-cases reflect the tendencies reported from interviews. On the basis of this analysis we found that all six types of complexity are relevant on LIPs, but social complexity is the dominant and central complexity. Legal complexity appears less prominently.

When the challenge is enormous, social aspects seem to be the most important to deal with. The core of social complexity lies in the different interests of the involved stakeholders. These different interests are mainly apparent as between NGOs and local stakeholders on the one hand, and the client, users and parent organizations on the other.

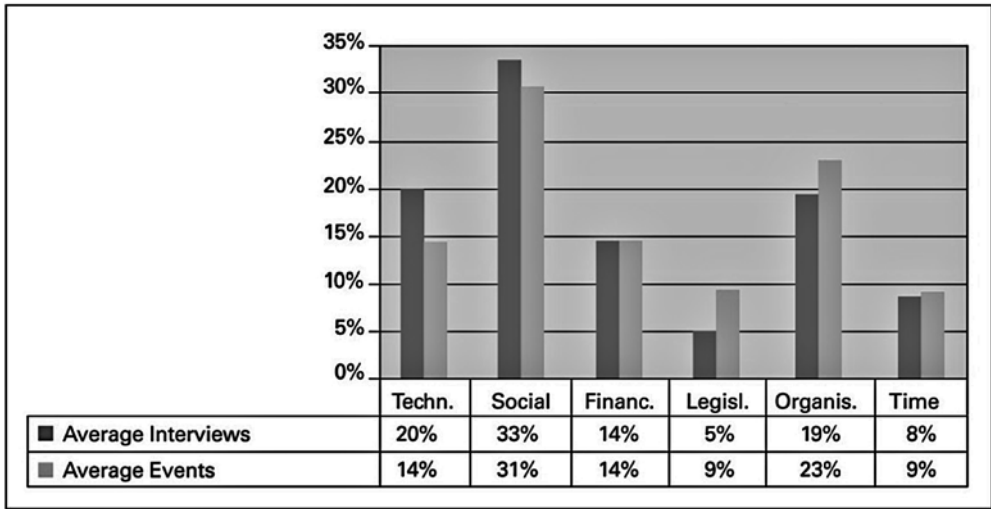


Figure 26.2 Complexity as identified from the interviews and analysis of the 14 sub-cases

Strikingly legal complexity was the complexity least mentioned in the interviews. People apparently do not experience this as a key issue in organizing a LIP. This may surprise jurists, but it seems that, in the end, legislation is not what makes the real difference. This does not mean that legal complexity is unimportant: it can still have a great impact on LIPs. But other factors appear to be more important. This finding conflicts somewhat with the impression that politicians often have that legal complexity causes important delays (WRR, 1994; Elverding Committee, 2008). They ask themselves: is it possible to speed up the delivery of LIPs by optimizing the legal system? Although optimization of the legal system can be beneficial, our research results indicate that the most benefits are expected from dealing with social complexity.

The practitioners' view of complexity demonstrates that complexity, as a sensitizing concept, is recognized broadly by practitioners as a key element in the successful implementation of their projects. The six types of complexity matter to practitioners in the implementation of LIPs. These are the elements they worry about in project implementation, requiring a great deal of management attention and, in this sense, representing key themes to address in the quest for the success. It is interesting to note in this respect that these types and issues deviate from the traditional aspects of project management – time, money, quality, organization, information and risk – seen in much of the literature.

A SCIENTIFIC VIEW

We recognized two perspectives on complexity.

1. Detail complexity

- Many components with a high degree of interrelatedness;

2. Dynamic complexity

- The potential to evolve over time: self-organization and co-evolution;
- Limited understanding and predictability.

We found that the characteristics of detail complexity are broadly mentioned in the literature of complexity (Gell-Mann, 1994; Axelrod and Cohen, 2000). This type of complexity, also known as complicatedness, is clearly present in our cases, as can be witnessed by the overwhelming list of facts and figures of our studies. LIPs mean numerous kilometers of railway and road facilities with intricate relationships which can be found in the substructure, superstructure, communication systems, bridges, tunnels and so on. A manager from the Swiss Federal Office of Transport gave us an example of detail complexity:

The geological demands are complex. And also the technical risks. The logistics of building material for example. But in general we can handle this. This is all manageable.

Dynamic complexity breaks with the traditional view that systems are 'knowable' and 'predictable'. Senge (1994) identifies these two sorts of complexity. Detail complexity refers to systems in which there are many variables. Dynamic complexity refers to situations where cause and effect are subtle, and where the effects over time of interventions are not obvious. Dynamic complexity occurs according to Senge (1994):

- when the same action has dramatically different effects in the short and the long run;
- when an action has one set of consequences locally and a different set of consequences in another part of the system;
- when obvious interventions produce non-obvious consequences.

A civil servant of Canton Uri in Switzerland identified dynamic complexity when he said, speaking about the Gotthard tunnel project:

You have no general overview of what will become reality and what will not, something for which we are also partly responsible.

According to Sargut and McGrath (2011) the main difference between complicated and complex systems is that in a complicated system, one can usually predict outcomes by knowing the starting conditions. In a complex system, the same starting conditions can produce different outcomes, depending on the interactions of the elements in the system (see also Flood 1999).

We can relate dynamic complexity to the social complexity in our practitioners' framework. Social complexity is connected to the concept of ambiguity: the lack of shared meaning. This lack of shared meaning is prominently visible in LIPs when conflicts of interest arise between stakeholders. Within LIPs we see that stakeholders tend to interpret reality in line with their own interests, especially when the stakes are high. This in itself is interesting but key to the dynamic complexity in LIPs is that not only do the interests and preferences of players diverge; they can undergo a major revision over the course of the project.

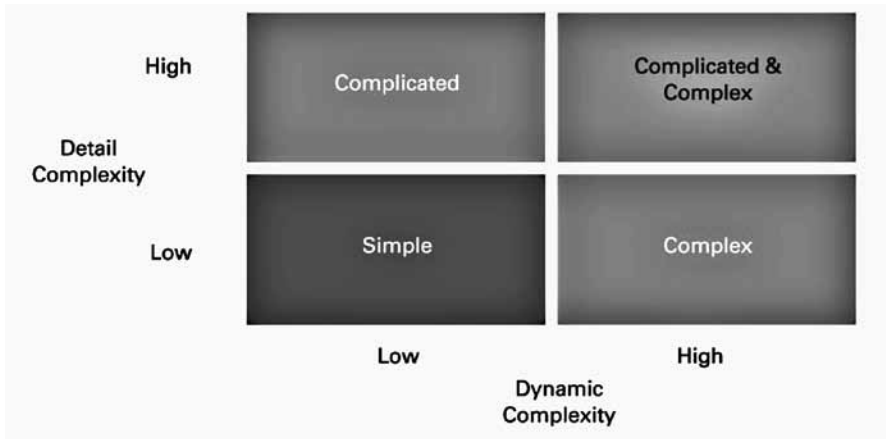


Figure 26.3 Four types of project related to detail and dynamic complexity

Four Types of Project

This classification of detail and dynamic complexity is not the only possible one. The reason we chose it was that it enabled us to link complexity to distinctive management strategies. Figure 26.3 shows four types of project based on detail and dynamic complexity.

We propose this framework as a basis for project managers of LIPs to understand complexity and its management. We will use this basis to distinguish management strategies in the next section.

Management of Complexity

A FRAMEWORK FOR THE MANAGEMENT OF COMPLEXITY

How do the involved stakeholders handle the detail and dynamic complexity within LIPs? On the basis of the characteristics of complexity, we can outline two main demands for management approaches:

Detail complexity – Need for control: The volume of activities and the large number of relationships with stakeholders means that project managers cannot rely solely on their own overview to make arrangements: a more structured approach is needed to coordinate their efforts. In order to manage these large numbers we need to split up tasks and monitor progress closely. For this decomposition will help, such as work break down methods. If this were not done we would quickly lose our grip on the project to be delivered. We refer to this need as the need for *control*.

Dynamic complexity – Need for interaction: Dynamic complexity within LIPs has significant management implications on their management since it highlights the importance of factors outside the control of project managers. Political changes, policy changes, economic changes, incidents and accidents greatly influence the results that an infrastructure project produces. Often project managers are assigned to deliver projects within the constraints of budget, schedule and quality (scope). The application of these

strict constraints in judging project management performance however does not fit well with the conclusion that many factors outside the project manager's control can influence project results. On the basis of this we identified a second need in the management of complexity, especially to deal with the impact of external influences such as stakeholder behavior and uncertainty in decision making. We labeled the need for *interaction*.

Table 26.2 illustrates the needs for control and interaction.

Table 26.2 Strategies of control and interaction

	The need for control	The need for interaction
Fit for:	Detail Complexity	Dynamic Complexity
Management strategies:	Decomposition in terms of: <ul style="list-style-type: none"> - time - end product - organization management processes <ul style="list-style-type: none"> - schedule - costs - quality - risks 	Alignment <ul style="list-style-type: none"> Redefining the problem Using short term predictability - systematic evaluation - selection of successful strategies Variation strategies <ul style="list-style-type: none"> - scenario building - pattern analysis

MANAGEMENT OF COMPLEXITY

So how can managers responsible for the implementation of LIPs manage the complexity in these projects? Based on Figure 26.3, we have introduced a framework of management approaches that can be used to deal with complexity (Figure 26.4).

This framework, based on the need for both control and interaction, identifies four types of management approaches:

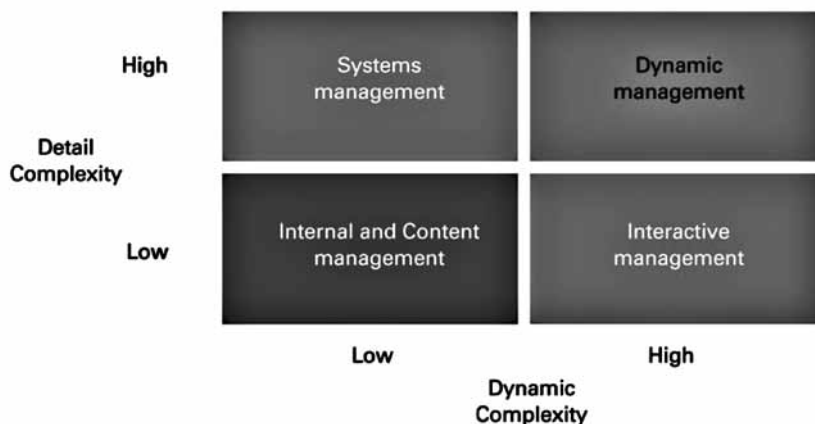


Figure 26.4 Four approaches for the management of complexity

1. Internal and content-focused approach;
2. Systems management: strategies focusing on control;
3. Interactive management: strategies focusing on interaction;
4. Dynamic management: balancing control and interaction.

INTERNAL AND CONTENT-FOCUSED APPROACH

In our case analysis it quickly became clear that there was a frequently used approach which was not a part of our initial theoretical framework. We labeled this 'the internal and content-focused approach' because it involves a lack of clear management strategies and relies on a pure focus in finding a technical (or financial) solution to a perceived problem without paying too much attention to strategies of control and interaction. The approach is highly internal: the satisfaction of involved stakeholders is not regarded a major concern. We observed this content-focused approach in 10 of the 14 sub-cases we analyzed.

- The content focused approach was often used in 70% of the sub-cases.
- In these 10 sub-cases the content-focused approach led to what we call 'premature convergence'. This means that a solution is chosen early in the process, thereby killing off many other options present at that time. The difficulty lies in the fact that the chosen solution might seem logical when selected, but would cause problems later on because of the different preferences of stakeholders.
- The content-focused approach leads to premature convergence of solutions.
- By analyzing the results of the 10 sub-cases, without exception, we found that the stakeholders were dissatisfied. None of these sub-cases showed positive results.
- The content-focused approach does not yield positive results in situations of high detail and dynamic complexity, which is the case in most LIPs. In general it produces dissatisfaction amongst stakeholders.

Because of this dissatisfaction, organizations that use the content-focused approach sooner or later are forced to change their attitude. In addition, the dissatisfaction resulting from the use of this approach will influence the attitude of stakeholders in a negative manner, long after the approach has been abandoned. So the long term effect of the content-focused approach in the management of complexity can be (and normally is) devastating.

From the 10 sub-cases we found some common factors that can be a stimulus for the adoption of the content-focused approach:

- Experts in the role of project manager with an underlying focus on content. This was also the case when management has a lack of attention, so the specialists have freedom to find the best solution.
- Financial tensions (such as cost overruns). These may lead to the reflex of the content-focused approach by making decisions without sufficient interaction with stakeholders.
- Organizations that are unfamiliar with each other's characteristics, causing decisions to be made without sufficient attention being paid to the relatively unknown interests of the other organizations.
- A limited internally focused group is in charge leading to groupthink.

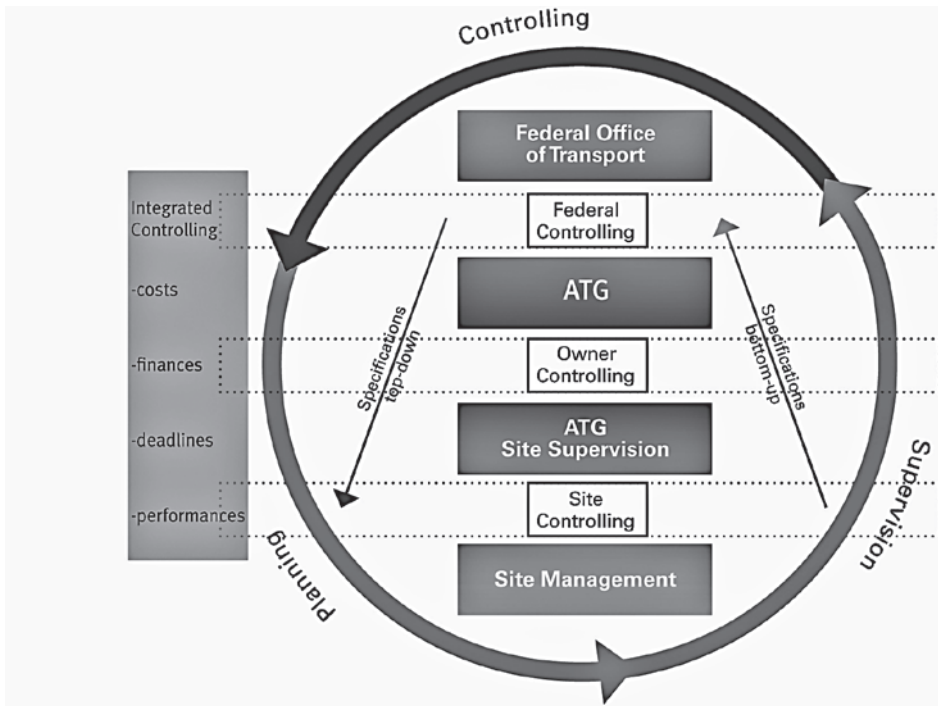


Figure 26.5 NEAT Controlling Regulation for the Gotthard

SYSTEMS MANAGEMENT

The second approach observed is systems management. This is effectively standard project management (Project Management Institute, 2013). Project control is basically tight monitoring and steering of costs, time and scope. This is intended to make sure the project will be delivered according to the set specifications and within the set boundaries of costs and time. Many tools and techniques have been developed to structure the collection of information to minimize the chances of unpleasant surprises.

An example of systems management is the NEAT Controlling Regulation (NCW) (Figure 26.5).

It is generally accepted as one of the biggest strengths within the Gotthard Base Tunnel project. It defines and documents all processes for the supervision, control and reporting of the project. It contains the overall work breakdown structure and defines the responsibilities of the project members on the basis of legal and contractual guidelines. It underlies a continuous improvement process and therefore is revised periodically.

When starting our research we felt that the principles of systems management are broadly known and applied in LIPs. But although systems management is sometimes regarded as a basic instrument in the management of projects, this was often not the case.

Although systems management is often regarded as a hygiene factor in the management of LIPs, its application is certainly not a given. Systems management within LIPs is a time consuming task often supported by sophisticated tools that require continuous attention in the set-up and use of appropriate instruments of project control.

Systems management can be an especially effective way to decrease the detail complexity in the stakeholder network. Two primary examples of benefits are:

1. Increasing transparency by regulating responsibilities between players;
2. Improving accountability by tracking and documenting changes.

On the other hand we also noted that systems management does not seem to be a very flexible approach to the management of complexity. Because of the need for decomposition and control of scope, time and budget constraints we often observed a tendency to stick to outdated solutions. But LIPs are characterized by the occurrence of new developments and new insights, caused by dynamic complexity. So, while the use of systems management can certainly be beneficial, we need something more to address dynamic complexity. This something more is interactive management.

INTERACTIVE MANAGEMENT

Interactive management as an approach was originally developed as an alternative or supplement to systems management. Traditional systems management strategies turned out to be insufficient to deal with the dynamics of (mainly local) stakeholders, often found in LIPs. An example is the Betuweroute in the early years of the 1990s. The needs of many local parties, individuals, interest groups, environmental groups and local governments were not denied, but simply neglected. This led to massive opposition to the Betuweroute. In The Netherlands in the mid 1990s projects like the Betuweroute stimulated a conviction that a new approach was needed that would pay more attention to the needs of local inhabitants, (local) governments, private companies and interest groups (NGOs). This led to the development of the theory of 'interactive management'.

Interactive management focuses on interests of all stakeholders to improve their support. But interactive management goes further than creating support for a decision that already has been made: it also covers joint initiative, co-production and co-financing. Interactive management addresses the social complexity which characterizes the stakeholder network and the dynamic development of stakeholder preferences over time. The traditional literature on interactive management has a heavy focus on 'interaction with stakeholders'. We added an additional element to this theory which we borrowed from the theory of complexity management: a focus on flexibility. This is needed to deal with the many changes that occur within LIPs. For instance it may lead to a redefinition of the problem or changes in scope. This makes interactive management able to address the social complexity which characterizes the stakeholder network and the dynamic development of stakeholder preferences over time.

When we analyzed our sub-cases we find that clients and project delivery organizations have the tendency to use an internal approach more often than external stakeholders (such as NGOs and local governments).

- External stakeholders' behavior tends to be based more on the strategies of interaction than clients and project delivery organizations.

The client generally supports the project and has established a project delivery organization to achieve the project's objectives. We find that these project delivery

organizations are not 'neutral' in the sense that they only execute what they have been ordered to by the client. In fact they tend to safeguard their project against the influence of external stakeholders, maintaining the status quo in terms of scope of the project, planning and budget. This could possibly explain why project delivery organizations tend to use an internal approach towards their external stakeholders.

- Project delivery organizations established to execute the project are not neutral, but become important players in safeguarding the project.

By analyzing our 14 sub-cases, we found that interaction is far more beneficial than the content-focused approach. We clearly found that interaction can improve satisfaction for both the client, project delivery organization and the external stakeholders. In fact we think one of our key findings of the research is that:

- Interaction pays off.

An example is the stakeholder representation in West Coast 250 on the West Coast Mainline. West Coast 250 is a network representing many of the local authorities along the line. The client/sponsor, the project delivery organization within Network Rail and the train operators met this body on a bi-monthly basis. Residents living along the line were also the users of railway services. They provide local intelligence about measures to be taken and they play an important role in communication with the local community. Generic lessons from the West Coast Mainline that illustrates interactive management:

- Alignment of objectives of the different parties involved is crucial to make the project a success, to try to get all the people aligned upfront.
- In communication be absolutely open, honest and talk straightforwardly. Tell stakeholders good news as well as bad news. The easiest thing is to make false promises; but people remember.
- With open communication the chance of surprises diminishes. Stakeholders in general don't like surprises.

In line with our conclusion that interaction pays off, we believe that strategies of interaction have the potential to provide added value in the management of complexity within LIPs. Project managers and other stakeholders can benefit much more from practical application of these strategies than they already have done. But managers also need to be aware of the potential pitfalls of the strategies of interaction. The most important pitfall of which is that pure and unique focus on stakeholder demands may seriously limit project progress, or lead to over expensive solutions emerging. This is because of the risk that difficult decisions are avoided in a desire to satisfy stakeholder demands and are thereby not confronted.

DYNAMIC MANAGEMENT

Our fourth approach is called *dynamic management*. It is our answer to the question: How to manage complexity in LIPs? This approach is based on a synthesis of our findings in the successful management of complexity. A well balanced match of strategies from

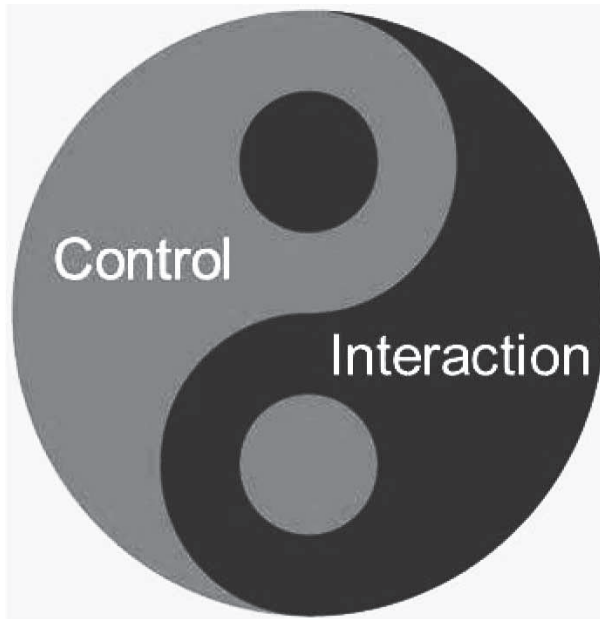


Figure 26.6 Balancing control and interaction

systems management and interactive management was observed in some cases. We have labeled this approach dynamic management: balancing control and interaction. LIPs show both the characteristics of high detail and high dynamic complexity. This means that strategies of control and interaction need to be balanced in order to be successful (Figure 26.6).

It is essential to look for a balance which fits the unique circumstances of the project with the characters in your project delivery organization. Recipe book approaches to the management of complexity will prove impossible because of the high importance of the unique context. Practical applications of the balancing strategy are still relatively scarce compared to applications of content-focused and internal approach and of systems management. But the first analysis shows the balancing strategy can greatly enhance the chance of success in the management of complexity. However, many questions remain both on the theoretical foundations and on its use in practice. Future research will need to address this.

Examples like this from the Betuweroute, but also from the tunnels in Switzerland, the West Coast Mainline and the highway A73-South in the Netherlands showed that the strategies of control and interaction can be combined in practice. But at the same time one can argue that tensions exist between both strategies. Increased interaction can limit the possibilities for control and vice-versa:

- Due to inherent tension between them, strategies of control and interaction cannot be deployed in full harmony but need to co-exist in the successful management of complexity in LIPs.

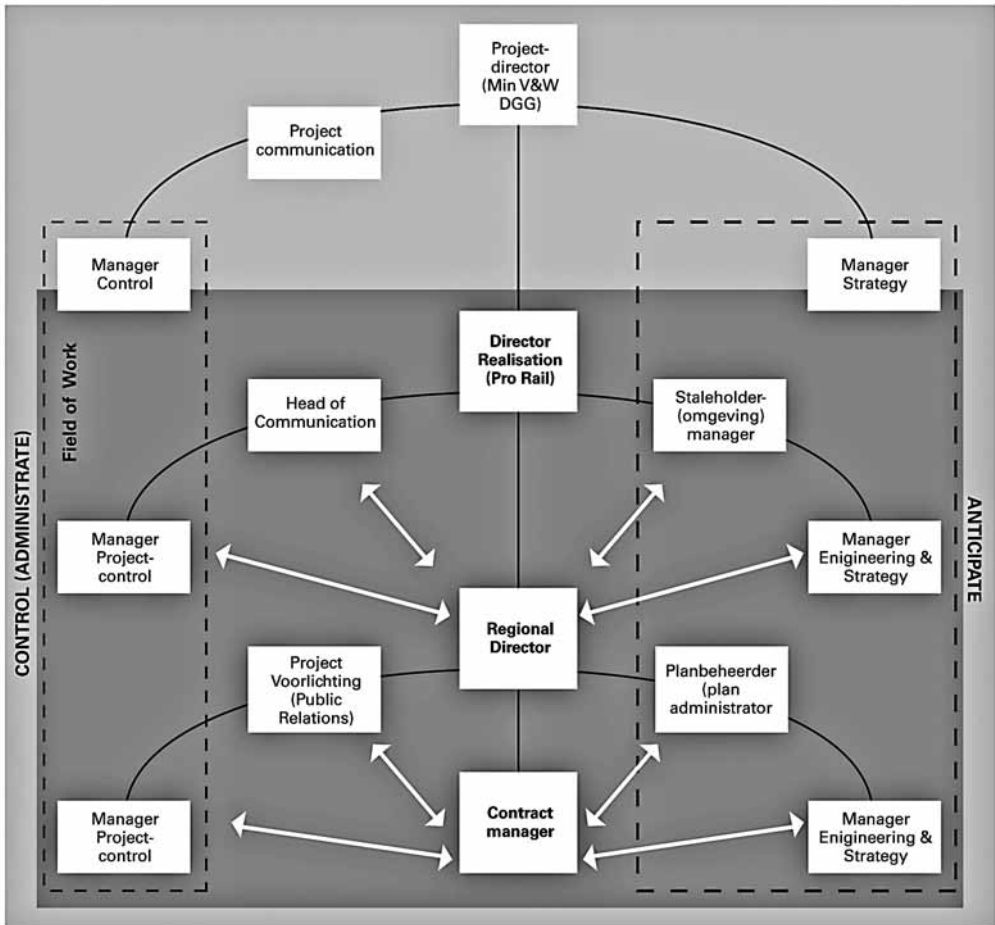


Figure 26.7 Organizing the natural tension between control and interaction (Betuweroute, 2000–2002)

An example of this is the organization of the Betuweroute around the turn of the century. By then, the organization needed to improve control, as well as be more sensitive to signals from the environment. These two needs were incorporated in a model they called 'tension arcs', where control and anticipation (we used 'interaction') formed 'the natural tension'. In the scheme control is on the left side, and anticipation on the right. Tension arcs were drawn at each level in the organization: between client and project delivery organization (Figure 26.7).

Apart from balancing the strategies of control and interaction, in analyzing our empirical material we have investigated those cases in which successful results were achieved in more detail. Here we discovered that something more, something additional, is needed in order to be successful. These additional ingredients that can enable managers to brew their own unique recipe for success in the management of complexity, involve the introduction of extra-ordinary solutions. We feel these extraordinary solutions, or X-factors as we have called them, are key to dealing with complexity in LIPs.

Combined with the balancing of control and interaction, these represent the keys to success in the management of complexity within LIPs. We observed five 'extraordinary' solutions:

1. Stakeholders system: higher order of cooperation;
2. Player level: project champions;
3. Personal level: competent people making the difference;
4. Capability to find unique management solutions;
5. Windows of opportunity.

We give an example of the fourth. Within the cases we saw several examples of deadlock or crisis in which the projects came close to being abandoned. In these times of crises there is a great sense of urgency, a motive to change things. In addition, because the problems faced are often unique and so specific, clients, project delivery organizations and other stakeholders need to come up with unconventional solutions to change things, to ensure project survival. In other words, the dominance of dynamic complexity within LIPs means that creating and dealing with change becomes a subject of vital importance. We saw unique management solutions in several cases that created a breakthrough for participants.

An example is the FinöV fund at the Gotthard and Lötschberg. Around 1994/1995 intense discussions between the Ministers of Transport and Finance took place about the Gotthard and Lötschberg tunnels. The Minister of Finance doubted the financing and profitability and also doubted the need for two axes (Gotthard as well as Lötschberg). This last discussion he lost but, because of his worries, a totally new financial model was developed and adopted: the FinöV fund. With hindsight, the discussions led to a better solution in the end, in which both Ministers were satisfied with the outcome. The FinöV fund is a financing program that ensures financing for 20 years, without burdening the Treasury as was the case with the 1992 proposal. The revenues are from oil tax, value added tax and heavy-vehicle tax. This is also a perfect example of changing the scope in order to make a feasible plan. The FinöV fund enlarged the scope from NEAT to an overall package embracing high speed connection between West and East Switzerland, noise protection measures and Bahn 2000. The solution fits the dynamic complexity within LIPs and stimulates project execution.

Concluding Remarks

Europe has set up an ambitious program of transport network projects. However since the start, studies show that many LIPs face cost overruns, late delivery and a general dissatisfaction from the stakeholders involved. A possibility to overcome the deadlock between an enormous need for mobility, and great difficulties in implementing LIPs, is by increasing the quality of management of LIPs. In order to investigate this, a study was initiated with main research question: 'How to manage complexity in the implementation of Large Infrastructure Projects in Europe?' The research was carried out on six large projects across Europe.

Outcomes of the study show that complexity is a key theme in the management of LIPs. In one of our two perspectives on complexity, the practitioners' view, we

distinguish six types of complexity: technical, social, financial, legal, organizational and time complexity. These types are the elements practitioners worry about in project implementation. One type is the dominant and central complexity: social complexity that is related to the interests of stakeholders. Legal complexity appears less prominently. The second perspective is a scientific view, where were found crucial detail and dynamic complexity. Detail complexity, also known as complicatedness, refers to the fact that there are many components with a high degree of interrelatedness. Dynamic complexity broke with the traditional view that systems are 'knowable' and 'predictable' and it refers to situations where cause and effect are subtle, and where the effects over time of interventions are not obvious.

This classification of detail and dynamic complexity enabled us to link complexity to four distinctive management strategies. The first is the internal and content-focused approach, when both detail and dynamic complexity is low. It has a pure focus in finding a technical (or financial) solution, without paying much attention to the satisfaction of stakeholders. Our research showed that this approach is frequently used and that it does not yield positive results at LIPs. In general it produces dissatisfaction amongst stakeholders.

In dealing with detail complexity, systems management is an appropriate approach. It is traditional project management: tight monitoring and steering of costs, time and scope. We found that systems management is certainly is not a given in LIPs and that it needs more attention. In dealing with dynamic complexity, interactive management focuses on interests of all stakeholders to improve their support for the project. It also covers joint initiative, co-production and co-financing. We find that interaction pays off for the client, project delivery organization and external stakeholders.

In cases of high detail and dynamic complexity, the approach is 'dynamic management'. For this a well-balanced match of strategies between 'systems management' and 'interactive management' is needed. We also discovered additional keys to success in the management of complexity within LIPs: five 'extraordinary' solutions, the X-factors. These X-factors, together with the balancing of systems and interactive management is our answer to the question: 'How to manage large infrastructure projects?' By doing this, our research brought together a theoretical framework, that could serve as guidance for project managers. Nevertheless, areas remain for future exploration and development. Some of these priorities are:

1. To elaborate the principle of Dynamic Management;
2. How to incorporate theory and practices into smaller projects;
3. How to deal with cultural differences;
4. How to incorporate a life-cycle approach and new requirements such as sustainability.

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Managing Programs of Projects

GINGER LEVIN AND J. LeROY WARD

Program management is experiencing a rapid rise in interest in major companies, governments and other public institutions around the world. The question is why? The answer is simple: major transformational initiatives such as the development of the Boeing 787 Dreamliner, the design and construction of Burj Kalifa in Dubai, the development of the International Space Station, the bringing to market of a new drug, or the development, test and launch of a major software system, require a management approach that goes beyond what project management can offer. Organizations are questioning the nature of their initiatives and discovering that what they are really working on are programs not projects. And, they recognize that their project management practices, as good as they are, simply are not adequate to manage the enormous challenge posed by complex programs. So, they are searching for a better, more effective way to manage such initiatives; that way is program management. Yet, very few organizations have the internal capabilities, tools, techniques and approaches to manage programs for the simple reason that they lack the professionals with the necessary program management skills and competencies to do the job right.

In this chapter we describe the relationship between project and program management, and program and portfolio management, explore the program life-cycle and then delve into the three key concepts in program management; namely, benefits realization, governance and stakeholder management. Next, we discuss program complexity and the challenges it offers all program managers. Finally, we will identify the key performance and personal competencies of a program manager based on research conducted by the authors.

The Nature of Programs

Programs are major initiatives undertaken by organizations, following the development of a suitable business case, that generally bring major change to a business unit, operational component or to the whole of the organization. There are many drivers for such major business change including advances in technology, competitive pressures, outsourcing, mergers and acquisitions, regulations or the need to improve delivery of services to citizens, to name but a few. The Cabinet Office (2011) offers an interesting way to categorize programs which may help the reader better understand programs at a high level:

1. *Vision-led program*: one that is intended to deliver a clearly defined vision that has been created and is owned by the top of the organization.
2. *Emergent program*: one that evolves from multiple projects that someone in the organization recognizes as being linked in some way to a broader set of goals and benefits.
3. *Compliance program*: one that is intended to satisfy certain legal or regulatory demands or directives.
4. *Specification-led program*: one that is focused on delivering new facilities based on specifications developed for said purpose.

Regardless of the type of program, their size and complexity require that they be managed differently than the individual projects and activities that comprise them. One key component of managing programs is managing organizational change itself, which is no small task.

PROGRAM AND PROGRAM MANAGEMENT DEFINED

We begin by looking at two definitions of program. The following is that offered by the Cabinet Office (2011):

... a program is defined as a temporary, flexible organisation created to coordinate, direct and oversee the implementation of a set of related projects and activities in order to deliver outcomes and benefits related to the organisation's strategic objectives. A program is likely to have a life-span of several years.

Following is the definition offered by the Project Management Institute (PMI):

A program is a group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually. Programs may include elements of related work outside of the scope of the discrete projects in the program. (Project Management Institute, 2008a, p. 5)

The reader can readily see two different concepts of program proposed by these definitions. The OGC definition talks about a program as an organization, whereas PMI views a program as a group of related projects: two very different perspectives. Additionally, the PMI definition also includes the notion that a program may include activities that are outside the scope of any individual project. In short, programs can include operational activities. This one concept alone further distinguishes a program from a project, which, by definition, does not include operational activities. The authors' professional experience and expertise view the PMI definition as the one closest to that concept used by most organizations most of the time. As such, it is the definition on which we base our subsequent discussion in this chapter. Using the PMI definition of program, we then offer that program management

is the centralized, coordinated management of the programme's projects and other activities to achieve the programme's strategic objectives and benefits. (Project Management Institute, 2008a, p. 6)

Program management tends to focus more on project interdependencies rather than on the individual projects themselves, which is the role of the project manager.

THE RELATIONSHIP BETWEEN PROGRAM MANAGEMENT AND PROJECT MANAGEMENT

Table 27.1 shows the differences between project and program management.

Table 27.1 Differences between project management and program management

Area	Project management	Program management
Focus	Nonstrategic	Strategic
Objectives	Singular	Multiple
Extent of change	Narrow	Broad
Benefits realization	Once	Incremental
Deliverable complexity	Low	High
Deliverable quantity	Few	Many
Overall time scale	Rigid	Loose
Scope change	Exceptional	Desirable
Functional diversity	Minimal	Multidisciplinary

The differences are not 'either/or', but the differences should be read more as two ends of a continuum. This suggests a significant difference between program and project management, yet, programs are made up of individual projects. Accordingly, programs exist in a world where the two must be integrated and aligned to achieve stated benefits. This singular challenge, viewing the work as a program but executing it as a series of projects, is what makes programs unique and challenging.

THE RELATIONSHIP BETWEEN PROGRAM MANAGEMENT AND PORTFOLIO MANAGEMENT

A portfolio is defined as

a collection of projects or programs and other work that are grouped together to facilitate effective management of that work to meet strategic business objectives. (Project Management Institute, 2008b, p. 4)

Portfolios exist at two discrete levels (Figure 27.1).

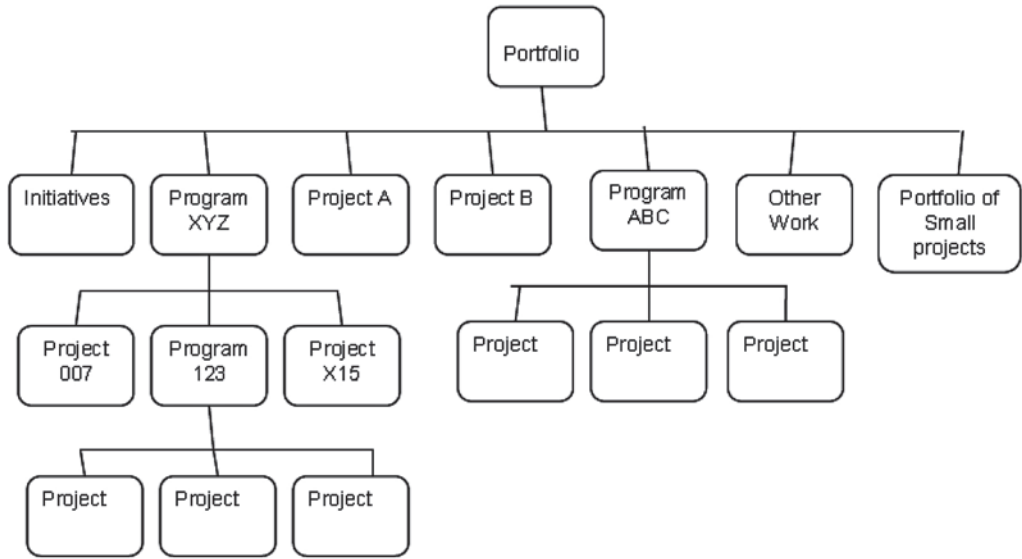


Figure 27.1 An organization's investment portfolio

A portfolio at the organizational level includes all investments made by an organization within a specific time, such as one year. Such investments include programs, projects, initiatives and other work. This collection of specific projects and programs is not necessarily interdependent or even directly related to one another other than the fact it is work to be done in one year. The only relationship between and among the portfolio's component at this level is that this is the work the organization has decided it will do thus representing the strategic intent of the organization. Thus, portfolio management is the process of identifying the organization's priorities, making the required investment decisions as to which work gets done, and allocating resources to the work.

Figure 27.1 shows that in addition to standalone projects (Project A, Project B) and programs (Program XYZ, Program ABC), we have a hierarchy of work such that programs can actually be part of other programs (for example, Program 123 is a part of Program XYZ), and certain projects are a part of a named program (for example, Projects 007, 123 and X15 are a part of Program XYZ). Accordingly, the sublevel programs and component projects are indeed a part of, and directly related to, the overall Program XYZ. Thus, at the program level, portfolio management requires the program manager to engage in a variety of portfolio activities such as identifying the component projects required to achieve stated benefits, allocating resources and initiating, executing and closing projects in a specific chronological sequence as required.

THE PROGRAM LIFE-CYCLE

As in project management, programs are easier to manage if they are divided into phases (Figure 27.2).

While we know these phases are never executed in such a serial fashion, it does help to conceptualize a program as having a five-phase life-cycle (Project Management Institute,

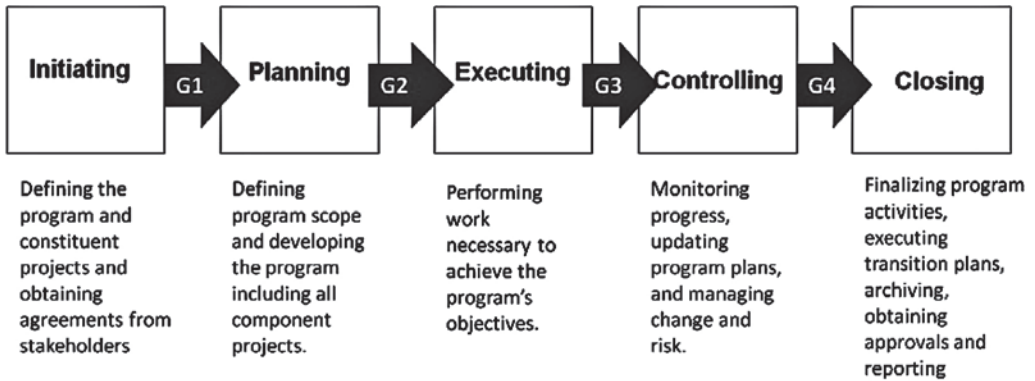


Figure 27.2 The program life-cycle

2011). Also included are major tasks and deliverables that are produced as a result of phase accomplishment. The notations G1, G2 and so on, represent 'Gates' where key stakeholders meet to discuss the work accomplished to date to help decide if the program is ready to proceed to the next phase. Part of the gate review process is to ensure that the business case, usually completed either before, or as part of Initiating, remains viable.

The Three Key Themes of Program Management

Of all the activities to be conducted in program management, three clearly stand out as being so integral to success that we highlight them and discuss each separately. These are benefits realization, governance and stakeholder management.

BENEFITS REALIZATION

A benefit is a positive contribution or improvement to the running of an organization such as increased revenues, reduced costs or improved employee morale (Sanghera, 2008, p32). Programs are initiated to fulfill objectives, but benefits provide a measurable, actionable quality to program execution. After all, objectives, while aspirational, are rarely articulated at a level where one knows exactly what is to be delivered as a result of the program. Accordingly, program managers must (see Chapter 8):

- develop the benefits realization plan;
- identify and capitalize on synergies and update stakeholders on program status;
- monitor and take corrective action to ensure benefits are achieved;
- verify that the component projects are meeting or exceeding the benefits realization criteria to meet the organizational objectives;
- analyze and update the benefits realization plan as required;
- develop a transition plan to operations in order to guarantee attainment of products and benefits delivered by the program;
- appoint a Benefits Realization Manager as required.

One key deliverable is the benefits realization plan, which is developed concurrently with the development of the program plan. It is a comprehensive view of all the benefits, their dependencies and the expected realization timeframe. It is critical that the benefits identified are congruent with and flow from the business case developed and approved to justify the program. Benefits may be identified and categorized in a number of different ways:

- Business area;
- Stakeholder;
- Geography or region;
- Customer;
- Technology;
- Business impact.

Benefits realization in program management is a process and is best understood by viewing it from a life-cycle perspective. PMI has identified such a life-cycle, along with associated activities for each phase. The benefits life-cycle illustrated in Figure 27.3 is juxtaposed to the program life-cycle to allow the reader to understand the association between benefits realization activities and overall program management activities.

A program’s size may require a benefits realization manager be assigned to ensure the component projects will individually and collectively deliver the stated benefits and to assure adherence to the business case. Benefits accrue in programs over the life-cycle as projects are executed and closed (Bartlett, 2000, p. 109). There are many programs for which benefits are not realized until well after the program has closed requiring the performing organization to continue to monitor benefits realization long after the program team has disbanded.

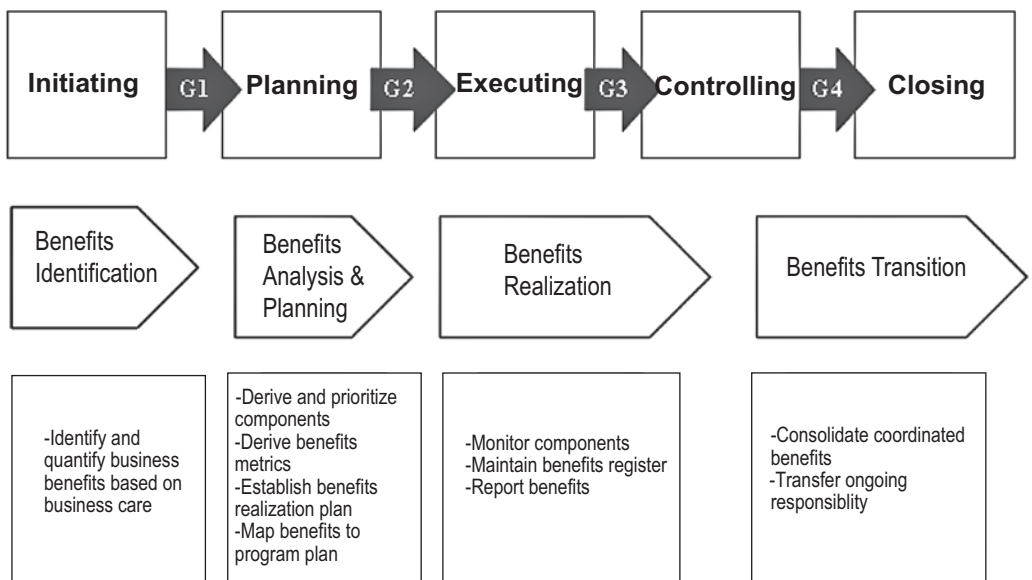


Figure 27.3 The benefits life-cycle

In essence, the delivery of benefits is the delivery of the change the program is bringing to the organization. In many implementations of program management, the core team will have a Business Realization Manager (BRM) assigned who will help identify the organization's readiness for change, design a change process to facilitate the introduction and use of the change being delivered (such as new tools, processes, approaches) and who will offer guidance to the performing organization to ensure change is sustained. During program execution, the BRM (other titles include Benefits Change Manager and Benefits Manger) will also be monitoring the benefits realization plan to ensure that the individual projects are producing the requisite deliverables, which are designed to meet and address the benefits previously identified. This process is typically called a Benefits Review and is a structured, systematic way to trace the benefits being delivered to the original benefits realization plan.

PROGRAM GOVERNANCE

Program governance is:

The process or set of processes used by an organization to define, develop, manage, monitor and close-out a program. It is primarily aimed at ensuring that the programme's objectives are met and benefits delivered, and it includes a process for terminating a program if it appears the program will not meet identified objectives and benefits. (Ward, 2008, p. 338)

Governance includes such activities as:

- establishing governance goals;
- defining the governance structure;
- defining the roles and responsibilities for the governance board and other players;
- ensuring that the program is strategically aligned to the goals of the organization;
- implementing a decision-making process that provides for evidenced-based decision-making in a timely manner.

The program manager, working with key stakeholders, should develop a program governance plan; to describe governance goals, structure, roles and responsibilities, decision-making process and logistics. Program governance is typically carried out by a Program Governance Board as part of an overall governance framework across all phases of the program life-cycle. While governance frameworks can vary widely across industries and organizations the model shown in Figure 27.4 includes common elements found in many implementations.

People have a specific role and attendant responsibilities regarding program governance. Using our model framework above we now define what those roles and responsibilities are.

Executive Body

We use this somewhat generic name because it could be a Business Unit Head, Division Manager, Portfolio Committee, Management Board and so forth. Essentially, the role of

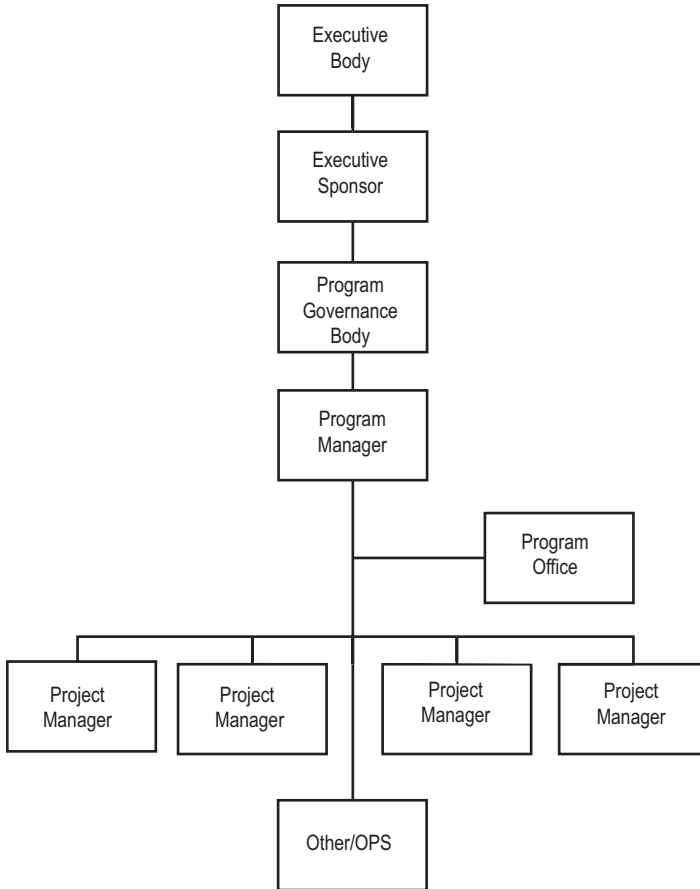


Figure 27.4 Project governance board

this group is to acknowledge the need for and fund the program based on a review of the business case, which has been made to it. The Executive Body establishes the overall strategic direction for the organization and causes, through funding allocations, the necessary program or programs to be executed. From time to time, this body will review the key milestones of the program to ensure it is delivering benefits and the business case remains sound.

Executive Sponsor

As a key representative of the Executive Body, this person (sometimes a committee) has overall accountability and responsibility for:

- corporate controls;
- governance strategies;
- initiation of assurance reviews.

The Executive Sponsor (who may be called Senior Responsible Owner) works closely with the Program Manager to ensure the program is progressing according to plan and that the program is funded appropriately. He or she also provides program and project resources to ensure program success and participates in stage gate reviews and works with the program manager and other stakeholders regarding changes to program scope. In some cases the Program Manager will report directly to this role; in others, the Program Manager reports to a Program Governance Board.

Program Governance Board

This board is a group of key stakeholders who represent management and executive interest in the program by providing oversight, control and guidance to the Program Manager on all aspects of program management and delivery. The Board (other names include Program Board, Program Steering Committee) meets on a regular basis to review program status and performance and to make decisions escalated to it by the Program Manager. The Board provides the necessary and requisite authority to the Program Manager to execute the program and reviews program activities to ensure that benefits are being delivered and the business case remains viable. In some cases, this is called a governance review and is based on the governance plan established at the program's outset which describes how governance occurs.

Program Manager

The Program Manager sets up and manages the program. He or she is responsible for the daily activities of all program staff, for reporting to the Program Governance Board or Executive Sponsor, and for escalating key issues to those bodies should the need arise. The Program Manager is also responsible for communicating with all key stakeholders so they are kept apprised of program results.

Program Office

The Program Office is a function that reports directly to the Program Manager providing assistance in many different activities depending on the size and scope of the program. Personnel may include scheduling, risk, financial and technical experts. It may also include the Benefits Realization Manager, the Business Change Manager and other key roles. The Program Office is responsible for the gathering, analysis and distribution of individual project information and consolidating the same into program level reports. In certain implementations, the contracting function may be housed here as well. The Program Office is not to be confused with a Program Management Office (PMO) or Centre of Excellence whose responsibility tends to be more toward implementing project or program management practices at an enterprise level. The Program Office is part of the program and is responsible for its performance, not for any other program or project in the organization.

Project Managers

These individuals plan, execute, track and deliver their projects in line with program objectives.

Other/OPS

Given that programs can have elements of work that fall outside the scope of its component projects this part of the framework acknowledges that fact. In some cases, this piece may constitute operations of one type or another.

STAKEHOLDER MANAGEMENT

The third important theme is stakeholder management. A stakeholder is any individual or organization whose interests may be affected, either positively or negatively, by the program execution or completion. A stakeholder can also be called party-at-interest (Ward, 2008, p. 415). Stakeholder management is critical to program success because it is integral to implementing successful organization change, the type of change delivered by major programs. As such, program plans should demonstrate a deep understanding of sophisticated change management approaches and techniques. (Stakeholder management is described more fully in Chapter 14.)

The first step in stakeholder management is to identify the key stakeholders. While there are many approaches to doing this, and many checklists and templates available to help, we suggest that the following list of questions will help the Program Manager identify most of the key stakeholders relatively quickly. By answering these seven questions the Program Manager and his or her team will be able not only to identify the key stakeholders but can also start the needed analysis of them. Who

- is paying for the program;
- is making a profit at, or benefiting by, it;
- is using its outputs;
- is for or against it;
- can influence the outcome;
- can help get the job done.

Stakeholders may be grouped for rapid identification. They can be internal or external to an organization. Internal stakeholders come from anywhere in the hierarchy whereas external stakeholders can hail from any organization, or may be influential individuals in the community or industry. Stakeholder analysis includes assessing the position of each stakeholder relative to the program. For example, there will be certain stakeholders who are proponents of the program, some will be neutral or undecided and others will be opponents of the effort. Many believe that the Program Manager and team should try to convert those who are opponents of the program to a position of neutrality or being proponents of the effort. While the authors do not argue with the logic of this approach we believe a Program Manager's valuable time is better spent persuading those stakeholders who are as yet undecided on the program to become program proponents.

In the end, this is probably a better use of one's time and effort. The result of stakeholder identification and analysis is a stakeholder register and stakeholder management strategy (Project Management Institute, 2008a, p. 232).

The key to effective stakeholder management is to engage with them on a continual basis throughout the program by interacting with them, communicating strategic objectives and status, influencing them if possible and resolving the inevitable conflicts that arise when working on initiatives of such complexity. When the program or a component project will negatively affect a stakeholder, the program team should develop strategies for minimizing such impact to try to keep the stakeholders engaged. Certain stakeholders must participate in the various and critical stage gate reviews to review program status and performance and to assess if the program remains viable and should continue based on a continuous review of the business case. Stakeholders may also be influential in providing key resources to the program or for removing obstacles and impediments to program performance.

Program Manager Competencies

PROGRAM COMPLEXITY

Programs tend to be quite complex for a variety of reasons:

- The number of team members and their geographical distribution;
- The introduction of untested or relatively new technology;
- The size, scope and monetary value of the initiative;
- The degree to which they introduce major organizational change.

While there has been research on *project* complexity, and how to manage it, little has been done on *program* complexity and the use of specific management systems to deal with it. The literature clearly shows that management complexity is a far more extensive construct than previously described. Current program management bodies of knowledge or methodologies are incomplete and do not address complexity in a meaningful or practical way. There is a highly Tayloristic, one-best-way approach that most methodologies employ, which is inconsistent with the contextual diversity that managers face (Maylor et al, 2008). Project failures continue to occur in the face of an ever increasing number of bodies of knowledge. The focus on program complexity is critical because the management of such major complex initiatives requires an individual with a particular set of skills. Very little time and attention has been devoted to answering the question: what competencies and skills does a program manager require to be successful in such a complex environment?' The authors set out to answer that question by undertaking a six-month research project in 2010–2011.

THE PROGRAM MANAGER COMPETENCY MODEL

We identified six *performance* competencies and eight *personal* competencies for program managers (Figure 27.5) (Levin and Ward, 2011).

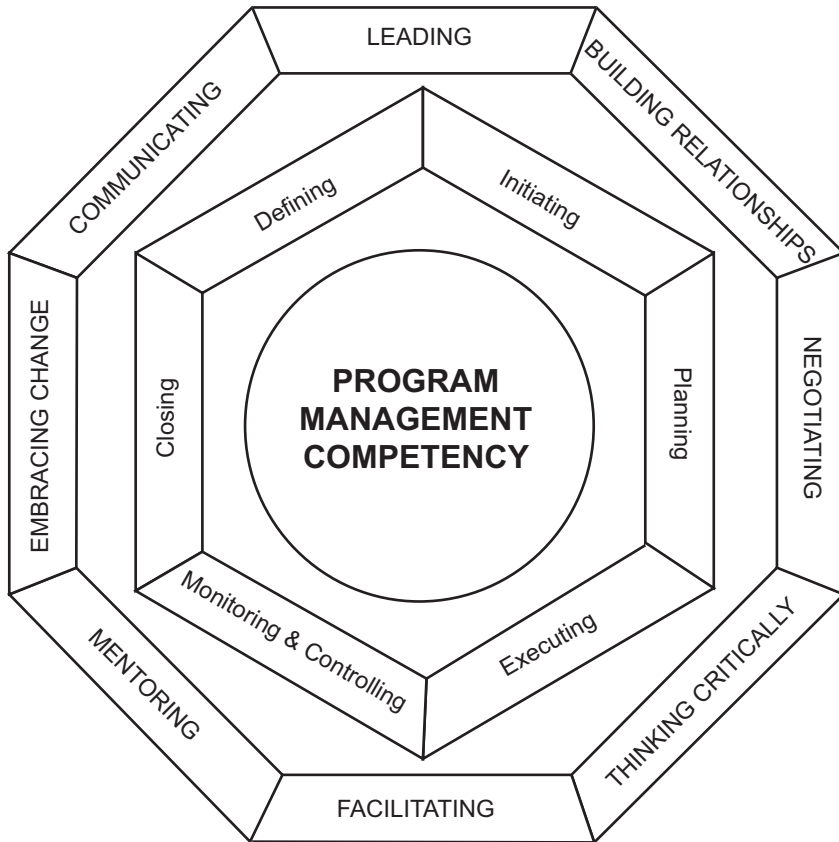


Figure 27.5 The Levin-Ward program manager competency model (after Levin and Ward, 2011)

To begin the development of the model, an informal survey was conducted of members in an online Program Management Professional (PgMP®) group. Following the theme of Cicmil et al (2009), the majority addressed the need to recognize the complex process of interaction. Suggestions included:

- Stakeholder management;
- Communications planning;
- Effective listening;
- Social responsibility;
- Effective written and oral communications at all levels;
- Long-range strategic planning;
- Relationship building and management (both vertical and horizontal);
- Mapping business strategy to program objectives;
- Interpersonal skills;
- Negotiation skills;
- Strategic thinking to set the vision;
- Tactical planning to sell the vision;

- Financial acumen;
- Benefits management;
- Strategic integration management;
- Leadership.

It is interesting to note that those polled did not include technical competency as being needed. Perhaps it is implied, and the ones above are in addition to the technical competence of the program manager. Using this small sample, the conclusions of a US Government Accountability Office report (Government Accountability Office, 2003), the need for hard and soft competencies (Patanakul and Milosevic, 2009), plus our own experience as program managers and PgMPs, we developed the model above. Our goal was to make it generic enough that it could be used, in whole or in part, across organizations in every industry sector.

Performance Competencies

Performance competencies are ones that show what the program manager should do by applying his or her knowledge of program management to deliver the planned benefits of the program. The six performance competencies are:

1. *Defining the program*: includes defining the program objectives and requirements, creating a high-level roadmap, preparing a benefits realization plan, conducting an initial stakeholder analysis and obtaining authorization to proceed.
2. *Initiating the program*: includes articulating the program mission statement, developing the high level WBS and milestone plan, establishing project management standards for the component projects and conducting the program kickoff meeting.
3. *Planning the program*: includes developing a detailed program scope statement and Program Work Breakdown Structure (PWBS), establishing the program management plan and baseline, leveling resources and developing the transition plan.
4. *Executing the program*: includes implementing the program management plan, consolidating project and program data to monitor program performance, motivating team members and capturing program status and disseminating same to key stakeholders.
5. *Monitoring and controlling the program*: includes analyzing cost, schedule and quality variances and making decisions to correct deficiencies, forecasting project and program outcomes, ensuring stated benefits are realized and managing change in accordance with the change management plan.
6. *Closing the program*: includes completing the program performance analysis report, executing the transition plan, conducting stakeholder review meetings and documenting lessons learned.

Personal Competencies

These are interpersonal skills which enhance the manager's abilities to successfully apply the performance competencies. We based these on the GAO report (Government

Accountability Office, 2003), a survey we conducted of PgMPs, and the program manager knowledge and skills discussed in the PMI standard (2008a). The eight personal competencies are:

1. *Communicating*: Project management research has shown that an effective project manager communicates approximately 90% of the time. In program management, communications consumes an even greater amount of time as there are more diverse stakeholders and more stakeholders who are external to the organization. Active listening is included in this category.
2. *Leading*: The program manager is responsible for ensuring that the vision of the program is understood at all levels in the team and organization. Leadership involves setting forth this vision and establishing the program's direction. It also involves being able to galvanize a group of diverse individuals and have them work efficiently together in pursuit of a common goal.
3. *Building relationships*: In program management, stakeholder management is a knowledge area (Project Management Institute, 2008a). The program manager is responsible not only for identifying those stakeholders who may influence or impact his or her program, but also for formulating a stakeholder management strategy to engage them throughout the program's life-cycle. This entire process is one of building relationships across the enterprise in the best interest of the program.
4. *Negotiating*: Programs typically have a large number of stakeholders, many with divergent interests. Accordingly, there is a need for the program manager to have the highest level of negotiation skills and competencies. He or she will be negotiating for a wide variety of things such as resources, money, time, material and for making sure the program remains a top priority in the organization's portfolio by persuading the Program Governance Board to make certain decisions during stage gate reviews.
5. *Thinking critically*: A critical thinker is one who has the ability to identify the important questions to ask and problems to solve in a way that defines them clearly. They also have the ability to think openly, to not be unduly influenced by others' thinking, and to identify the assumptions, constraints and implications and consequences of their decisions. Simply put, better thinking yields better results.
6. *Facilitating*: It's not the program manager's job to do all the work of the program; that is the responsibility of the project managers, operations managers and the team. However, the program manager must set the stage for success by creating an environment in which people can perform their assigned tasks without extensive roadblocks. If there are issues that need to be addressed, resources that need to be acquired, a stakeholder that needs to be assuaged, then the program manager must step in and help make it happen.
7. *Mentoring*: Because programs last several years, the program manager has an interest in ensuring his or her staff become the best they can be in their current and future role. As such, the program manager needs to mentor them in an effort to improve their managerial decision-making and interpersonal skills, among other key competencies. On large programs, it may be desirable for the manager to establish a mentoring program at various levels within the program office. A program manager who is seen as encouraging their staff to grow professionally will develop a loyal and committed team.

8. *Embracing change*: Unlike the project manager who generally strives to keep changes to the project at a minimum, the program manager recognizes that changes are going to occur on the program, and that they can be positive. He or she therefore must keep an open mind to, and embrace, change. A change on one project, while at first may be perceived as negative, may in fact benefit other projects on the program. Given the extended life of most programs, technology changes also may be beneficial.

USING THE LEVIN-WARD COMPETENCY MODEL

By using both sets of competencies, program managers, prospective program managers and their organizations can identify any gaps that may exist and determine how best to fill them. Organizations can use the model, tailoring it as required, to meet their unique needs to best match individuals to positions as new programs are undertaken, existing program managers leave for other assignments or as existing programs are reprioritized. Individuals can use the model to help them further improve their overall effectiveness as a program manager or to determine whether or not program management is a desired career path.

Concluding Remarks

Organizations of all types and sizes have recognized that many of their initiatives fall under the definition of a program, yet they continue to manage these important pieces of work as stand-alone projects. As such, they are missing the big picture, and are probably not gaining efficiencies, economies of scale or optimizing resources as could be the case if they were managing the effort as a coherent whole. One of the authors was told by a partner at a prestigious consulting firm that she was severely criticized by one of her clients for not recognizing the massive re-engineering effort she was leading was a program, and not a 'bunch of individual projects'. Her client recognized she was inefficient in her approach to working with them and essentially wasting the valuable time of the client's staff. When we run programs as individual projects, key interdependencies can be missed, and we can fail to see how seemingly small perturbations in one project can have a major impact on others. When managed as a whole one stands a greater chance of understanding how projects can relate. There is a better, more effective way to manage them; namely program management.

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28 *Managing Portfolios of Projects*

GINGER LEVIN AND J. LeROY WARD

Increasingly, organizations are recognizing the importance of programs and projects as strategic assets. Fewer organizations work on single, isolated projects, and instead, many have embraced an emphasis on program and project management as critical to their overall strategic success. Over the past 20 years, many organizations, especially those in the *Global Fortune 500*, have placed a strong emphasis on ensuring that the key tools and techniques are in place to manage projects and, more recently, programs effectively.

However, portfolio management, given existing resource constraints, is also essential. The emphasis therefore has changed to ensure that only those programs and projects that support the organization's strategic objectives are selected and pursued. Recognizing that strategic objectives can change based on any number of factors, a portfolio management process that is embraced and consistently followed at all levels of the organization is essential. Such a process can be easily developed but takes time to implement as it represents a major culture change for most organizations.

This chapter describes the importance of portfolio management to program and project professionals and includes a review of key literature in the field. It is followed by items for consideration in the development of a portfolio management process for an organization. Next, a discussion is presented on how to best implement portfolio management to increase the chances of it being followed. A summary concludes the chapter.

The Importance of Portfolio Management to Program and Project Professionals

While portfolio management has been an area of emphasis in investment analysis with the introduction of portfolio theory (Markowitz, 1952), the practice of portfolio management in terms of programs and projects began to emerge in Cleland and King's (1983) work in which they stated that the increasing use of project management led to many projects that were not part of the organization's core competencies and were not related to the organization's strategic direction. They noted some projects were ones with funding levels that exceeded the ultimate expected benefits. Their work showed organizations were beginning to question the pursuit of various projects in earlier stages. Then, in 1997, Cooper et al explained that project portfolio management is a dynamic

decision-making process in which a list of projects is regularly updated and revised as required as they noted the importance of stage gates in new product development projects. Their work led to the later and continuing emphasis on the need for governance to ensure that projects that were selected were regularly reviewed to determine whether their objectives were being met and should thus be continued.

Others described how projects are managed as part of a portfolio (Turner and Speiser, 1992; Payne and Turner, 1999; Elonen and Artto, 2003; Engwell, 2003; Söderlund, 2004). Artto and Dietrich (2004) and Morris and Jamieson (2004) described how projects are linked to an organization's strategy and to business interests. These contributions took portfolio management to a new and more important level showing the need to continually link programs and projects to overall strategic objectives.

In the late 1990s, Essex (2005) noted portfolio management increased in popularity, especially for information technology projects, and as vendors released software to facilitate categorizing projects and to share data on each project. Subsequently, other tools were introduced to identify business goals and the contribution of project portfolios to these goals. These tools as well interfaced with traditional project management software to help promote an emphasis on portfolio management.

In 2004, the Association of Project Management (APM) developed standards for programs and portfolios, followed by the Project Management Institute's (PMI) standards issued in 2006 and updated in 2008. PMI defines a portfolio as

a collection of projects or programs or other work that are grouped together to facilitate effective management of that work to meet strategic business objectives ... the components of the portfolio are quantifiable; that is, they can be measured, ranked, and prioritized. (PMI, 2008, p. 4)

PMI further explains that the "portfolio is a true measure of an organization's intent, direction, and progress" (PMI, 2008, p. 5)

PMI emphasizes that the portfolio shows the various components and the organization's strategic goals and reflects the organization's actual and planned investments. Therefore, portfolio management processes involve identifying portfolio priorities, making investment decisions, and allocating resources as the portfolio represents the work *selected* to be done but not necessarily the work that *should* be done (PMI, 2008, p. 5).

These definitions complement those of Turner and Müller (2003, p. 7) as they state a portfolio is

an organization temporary or permanent where projects are managed together to coordinate interfaces, prioritize resources between projects, and thereby reduce uncertainty.

They further note portfolio decisions are not made in a 'vacuum' and are balanced against other organizational performance measures.

No longer are people in some organizations pursuing the projects or programs they feel are interesting based on personal preference and should thus be undertaken; instead, a defined process is used for selection, and once a project or program is included in the portfolio, there is no guarantee that it will remain in the portfolio as new programs and projects are selected, and as organizational strategic objectives change. Termination of programs and projects in the past was rare or did not occur at all. However, in an

organization with a mature portfolio management process that is consistently followed, it often is done based on changing priorities not on whether or not standard processes are being followed. The emphasis therefore shifts to ensuring the selected work is the work that should be done and should continue to consume valuable resources.

Establishing a Portfolio Management Process

OVERVIEW

The starting point for a formalized portfolio management process is to develop a standard process and have official buy-in to it throughout the organization. Often organizations begin with inadequate or non-existent processes, and without an effective process, portfolio management tends to be considered a 'passing fad' and will not be balanced or embraced within the organization. PMI (2008) suggests the following in establishing a portfolio management process as shown in Figure 28.1.

It further notes the importance of identification of portfolio risks, analyzing them and developing responses. Since portfolio management is ongoing, it focuses as well on reviewing and reporting performance, monitoring business strategy changes and communicating portfolio adjustments (p. 37).

BUSINESS CASE

Each component in the portfolio first requires a business case to be developed to describe why it should be considered at all. The program or project sponsor typically prepares this business case, demonstrating why the program or project is important and how it supports the organization's strategic goals and aligns with them on the basis of the program or project's strategic objectives. It also considers the resource requirements, benefits to be realized, scope and components, assumptions and constraints, risks and issues, schedule, stakeholder considerations, governance requirements, attractiveness of the end product if appropriate to the customer, time to market and key financial criteria such as revenue, gross profit or operating profit to be earned. Ideally, a standard template is available for the business case, which each sponsor uses, typically prepared by the Enterprise Program Management Office (EPMO).

CATEGORIES

Because organizations often have different lines of business, specific categories for the component (program, project or other work) are useful to ensure that the organization has what it considers the right mix of components in each category in the portfolio (Crawford et al, 2005). These categories can be classified in different ways such as:

- *Divisional or business unit*: operational or maintenance or breakthrough;
- *Strategic or financial*: competitive edge, time to market, utility, high risk, low cost, high payout;
- *Capability improvement, process improvement or research*.

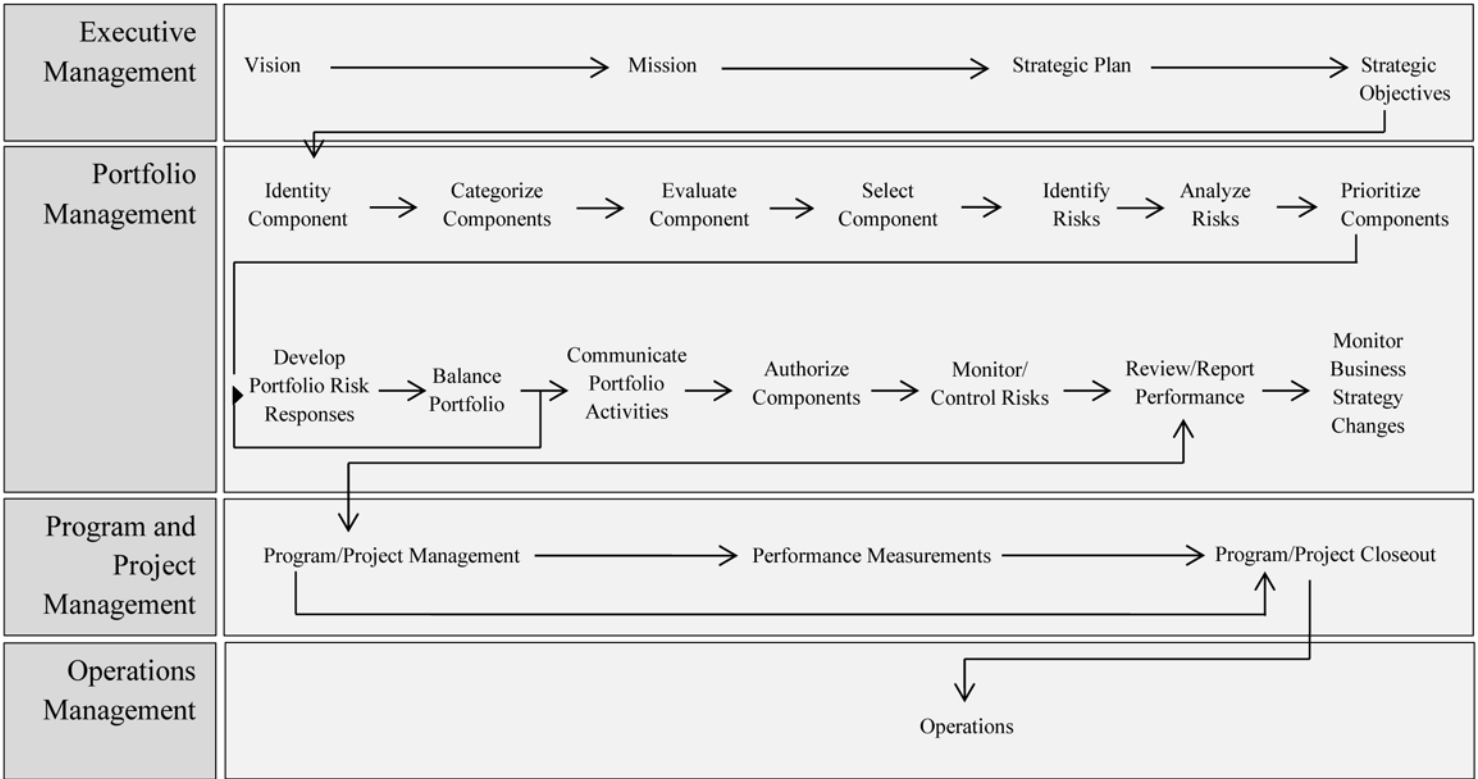


Figure 28.1 Portfolio management process (adapted from *The Standard for Portfolio Management, Second Edition, 2008*)

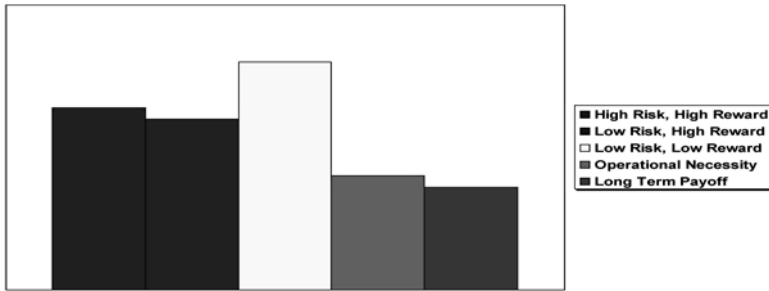


Figure 28.2 Category example (adapted from Rad and Levin, 2006)

Each organization then defines the appropriate category for the proposed program or project as each category tends to have funding limits associated with it. Figure 28.2 gives a representative example.

EVALUATION

Once the business case has been submitted, each new component requires evaluation using a defined process that is followed consistently for every component submitted. If it is noted that the process is not followed, the people in the organization will not consider it to be viable and will continue to do programs or projects that do not have official authorizations. The criteria in the process and model must be used objectively in order that individuals cannot use it for their own biases and set it up to ensure their components are selected over others. There are a variety of potential evaluation approaches ranging from scoring categories in a spreadsheet to detailed methods such as the Analytical Hierarchy Process (AHP) (Saaty, 1980). Most scoring methods include four basic components (Rad and Levin, 2006, p. 32):

1. Categories or criteria to determine the type of model to follow;
2. Range of values for the criteria;
3. Measurement and description for each value within the range;
4. Importance of the weight of each of the criteria.

The AHP focuses on decision making using qualitative and quantitative approaches and can be used in a variety of settings, not only in portfolio management. It reduces complex decisions to a series of one-on-one comparisons and then synthesizes the results. It uses subjective, pair-wise comparisons to enable determination of numeric weights and decision criteria and criteria scores for alternatives. Decision makers then can select the best alternative on the basis of the value measured by a hierarchy of sub-objectives or attributes. It also can help reduce risk through the selection of the best alternative. It is especially helpful in portfolio management as it has a defined process to follow for evaluation of business cases.

Other approaches include that of Cooper et al (2000) in which there is a 'Project Attractiveness Score' based on a number of questions using a 1–5 or 1–10 scale. They note this score must exceed a minimum number and then becomes a proxy for the 'value

of the project' (p. 4) but includes strategic factors as well as financial ones; these values then are used subsequently at stage gate review meetings to consider whether or not to continue the project. This approach emphasizes the use of more than just financial criteria in considering whether or not to consider and approve projects. If strategic and other non-financial criteria are used, it then must be made quantifiable through the use of surveys, for example, for ease of comparison.

Martino (2003) discusses other criteria and such as cost, probability of technical success, probability of market success, payoff, market size, market share, resource availability, the degree of organizational commitment, the strategic position of the project, the level of competition, regulatory constraints and policy considerations. He suggests classifying the criteria into overriding, tradable and operational criteria. The value and importance of the criteria are then determined to evaluate which criteria can be measured objectively and which ones require judgment. Martino notes that these scoring models are a 'one-level' (p. 32) process; one or more of the criteria are comprised of sub-criteria that are combined to obtain the value for a factor. Martino's work therefore further supports that of Cooper et al (2000) noting a variety of criteria that can comprise the evaluation projects. The challenge then becomes which criteria best fit the unique challenges of the organization.

Martino also proposes a Real Options Approach as a method to select projects as he states it is analogous to selecting financial options. This approach helps especially with those projects that are too large to be treated as overhead but are not ready for consideration as a capital investment. This approach is similar to selecting an opportunity to make a further investment if the investment is one that is profitable. Risks must be identified for each project, and methods to offset the risks must be determined. There are options the organization can take to reduce risks, which Martino states are shadow options, focusing project professionals to confront risks. The next step is to determine different methods to structure the project. During the analysis, each method considers different combinations of the shadow options that have been identified. Then, the combination of the options that results in the most favorable one is determined, and the shadow options are converted into real options. Martino explains an advantage of this approach is that it can translate 'real project phenomena into visualizable effects' (p. 62). It also serves to determine when an attractive project is perhaps too risky to pursue. Martino's Real Options Approach supports PMI's (2008) emphasis on consideration of risk management as an integral part of portfolio management.

Meredith and Mantel (2006) suggest the use of a weighted scoring model since it enables multiple objectives of the organization to be reflected in the decisions concerning those projects to support and those to terminate. They explain the models can be adapted on the basis of changes in organizational strategy and do not include a bias toward short-term gains as compared to approaches that focus on profitability. Meredith and Mantel state these models are straightforward, and their use forces decision makers to make difficult choices. The models also can be simulated as the weights and scores are typically estimates. One approach they describe is to use a constrained weighted factor scoring model to add additional criteria as constraints rather than weighted factors. Such an approach can avoid the temptation to include marginal criteria. Constraints then represent project characteristics that must be present or absent for the project to be successful.

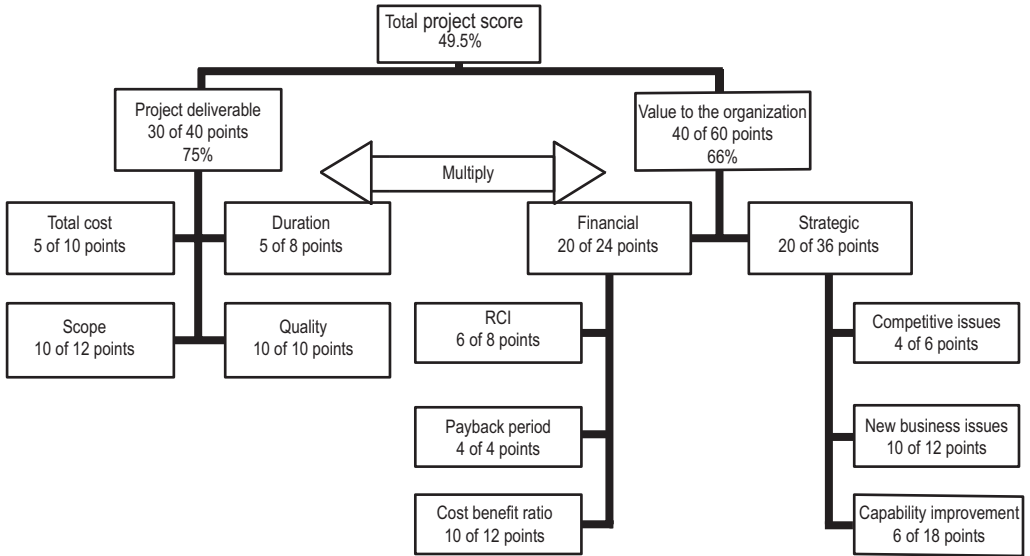


Figure 28.3 Example of a project scoring model (adapted from Rad and Levin, 2006)

Figure 28.3 presents an example of a weighted scoring model based on the work of Rad and Levin (2006) in which a score is determined by specific factors, in this case the value of the project per se as well as the value to the organization.

As noted in the discussion of Martino's Real Options Approach, the risk of each new program and project must be considered as its business case is reviewed including the risk of adding the program or project to the organization's existing portfolio. For example, while the business case may show the program or project is one that is high risk but still should be pursued, when evaluated with the other programs or projects already in the portfolio, the entire portfolio may then turn into one that is considered to be too risky for the entire organization. Each business case evaluation cannot be done in a stand alone way of just one project or one program and must consider all of the initiatives in the portfolio.

Müller et al (2008) in their worldwide study of 133 organizations found that successful organizations have a defined process to select and prioritize projects supporting organizational strategy. They also found there was a standard reporting process from the project level to the portfolio level, and the governance style in place in the organization affected the use of different portfolio control practices. They explained, for example, that a 'hybrid' governance style (combining portfolio and program governance) was characteristic of a more mature portfolio control process especially in terms of selection, reporting and decision making. As PMI (2008) notes, the more mature the portfolio management process is, the more likely it will be embraced and followed throughout the organization.

BALANCING THE PORTFOLIO

Once a program or project is authorized to be part of the portfolio, it then requires the entire portfolio to be rebalanced and reprioritized. Portfolio management is a continuous process, and a program ranked, for example, as the number one program in the organization, may subsequently have its rating change as other programs or projects become part of that same portfolio, or, as the organization's strategic initiatives change. Such change is to be expected, but best practices (PMI, 2008) show the importance of using a standardized process for authorizing new programs and projects to be added to the portfolio, reprioritizing programs and projects as others are added or as changes occur and regularly conducting mid-stream evaluations through stage gate reviews to ensure the programs or projects continue to support the organization's strategic goals and objectives.

Attention is also needed to continuously assess organizational change. APM states this means 'adjustments of the portfolio with regard to the constraints, risks, and returns anticipated and in light of developing circumstances around the portfolio' (2006, p. 8). If the stage gate reviews show the program, project or operational work should be terminated, this work then should be removed from the portfolio. Continual communication with affected stakeholders obviously is required, especially with those who are actively involved in the initiative or affected by it. If the reason for the termination is a change caused by a new emphasis on a different strategic objective, the program or project manager and his or her team should be immediately notified so team morale does not suffer, and they understand the reason for the termination. Comparable notification also must be provided if the program or project is not meeting its intended objectives.

REPORTING PROGRESS OF PROJECTS IN THE PORTFOLIO

A standard reporting format on the status of each program or project in the organization must be established along with a formal cycle for reviewing each program or project periodically. This reporting format should not be one that is cumbersome to prepare and should reflect the interests of the stakeholders and members of the Portfolio Review Board or comparable group in the organization. It should highlight the benefits realized to date, contribution to the organization's strategic goals, progress of deliverables, outstanding issues and risks and planned work for the next reporting period. The report must be easy to prepare and formatted correctly so it will be read immediately by all interested stakeholders.

Similarly a schedule of reviews by the Portfolio Board is required to manage the process. Program and project managers should be required to submit standard information for these reviews. This eliminates multiple and different reports to be reviewed by the Board and makes it infinitely easier for the project and program managers to prepare for the meetings. A best practice is for the program and project managers to establish a stakeholder engagement strategy in which they regularly meet with the Board members or contact them outside of the official Portfolio Review Board meetings to discuss the program or project and recognize any concerns they may have in advance of the meeting.

Once the Portfolio Review Board meeting is held, its emphasis is on decisions. If rebalancing occurs, information about it then is communicated throughout the organization so everyone recognizes the changes that have occurred and any impact these changes have on their specific work. These meetings should be scheduled in advance but

also held as required especially if there are unexpected changes to the organization's overall strategy that in turn affect the portfolio. A pipeline of programs and projects is essential as the focus is on ensuring organizational success and survival based on strategy formulation and enhanced program and project management processes.

Figure 28.4 shows the continuous nature of a management-by-program/project approach as noted in Rad and Levin (2006):

Implementing Portfolio Management

DETERMINING THE LEVEL OF INVOLVEMENT

In an ideal world, portfolio management is driven by the Chief Executive Officer (CEO), to whom the Chief Portfolio Manager (CPM) as well as an EPMO with its director report. Such an approach implies that *all* programs, projects and other work are part of the organization's portfolio, and all programs, projects and other work are subject to and follow the organization's portfolio management process. This concept is recommended by Cooper et al (1999) in which they state all projects, and by extension then programs and other work, require a stage gate approach since resources are limited and are involved in all work that is done. Building on their concepts, resource capacity limitations require full attention to portfolio management to ensure investments in programs and projects are ones that balance the available risks according to the available resources to do the work based on the organization's overall strategic direction. However, we do not live in an ideal world. Nonetheless, the portfolio process should be placed as high in the organization as possible which will clearly demonstrate to all the importance of the activity.

In practice, however, few organizations have a complete understanding of all the work that is under way in the organization, even if an EPMO is in place. While the CEO

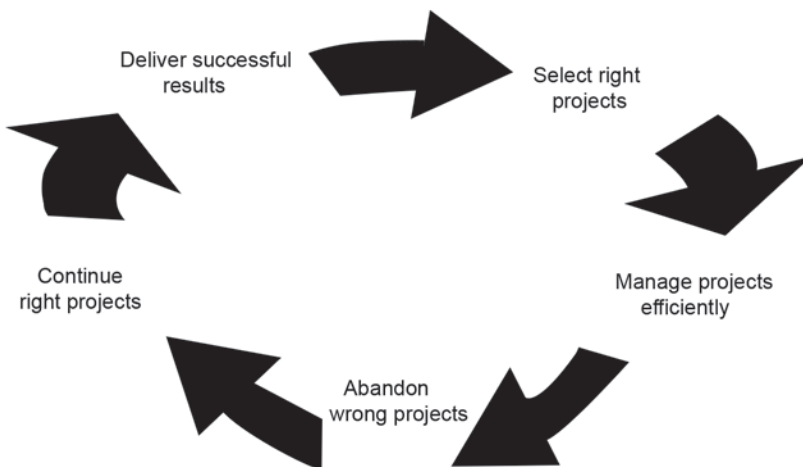


Figure 28.4 Management by projects or programs (adapted from Rad and Levin, 2006)

and CPM focus on the large programs and complex projects, they probably are not aware of much of the smaller projects that are in progress and do not follow the portfolio management process. This conclusion is supported by research by Blichfeldt and Eskerod (2008) in which they studied 30 companies representing diverse industries over a two year period. They found that many of the smaller projects are done outside of the process in place in the company and are not included within the portfolio. They noted in some of the companies in their study it was acceptable not to even seek approval for some small projects or for renewal ones especially those with low dollar values associated with them. Several interviewees echoed this comment in their study: 'We are talking about small projects, projects that never become big enough to make it worthwhile to set the whole machinery in motion ... Most of the time, I just do them without asking anybody' (p. 361).

As Blichfeldt and Eskerod suggest, if portfolio management is *not* to be all encompassing in an organization, one approach to consider is to have a 'pool of loosely-controlled resources' (2008, p. 364). Under this approach, executives could set aside time for people to work on the smaller projects of their choice or consider an 80/20 type approach in which the formalized portfolio management process would cover 80% of the resources for larger programs and projects in the organization, with 20% of the people working on these smaller projects. The emphasis is to ensure that the smaller projects are not consuming so much time that the more significant larger programs and projects are therefore unable to be completed as planned. Under this approach, then, multi-tasking becomes the normal way of operating, reducing overall productivity and adding to stress of individuals at all levels. Extending this concept, it could be part of a career path in program/project management, with one's first exposure as a project manager to one of these smaller projects outside of the portfolio, while perhaps also serving as a team member on a project in the portfolio.

ESTABLISHING A VISION FOR PORTFOLIO MANAGEMENT

The comments noted above show the value of establishing a vision for portfolio management for the organization. Ideally, portfolio management is embraced at the most senior levels and also will transcend to various business units, to departments or divisions, and even to programs, in which the program manager prioritizes the projects in his or program. The vision is the desired end state for portfolio management in the organization unit and will differ since each organization has unique objectives and strategic goals. A vision statement is a recommended approach that reflects cultural values and is meaningful and valid to organizational stakeholders. The key and most affected stakeholders should sign off on this vision statement indicating their commitment to it.

ESTABLISHING DETAILED PORTFOLIO MANAGEMENT GOALS

After the vision statement is prepared, it should be followed by detailed goals for portfolio management. These detailed goals should go beyond assessing the business case for each new program and project and serve as a way to collect data for use during stage gate reviews as to whether or not to continue the program or project. These detailed goals will discuss how the small projects will be handled and managed in light of resource constraints and whether or not portfolio management also will include ongoing activities. The latter is a

key consideration, with outsourcing the norm and not the exception, especially for those activities that may be better served through outsourcing such as information systems, human resources support or accounting.

RECOGNIZING THE ORGANIZATION'S MATURITY LEVEL IN PORTFOLIO MANAGEMENT

The level of maturity of portfolio management in the organization will influence the effort needed for implementation or enhancement. Levin et al (2010) in the 'Portfolio Framework Maturity Model' suggest five levels of maturity:

Level 1 – Ad Hoc: is characterized by using inconsistent performed processes and miscellaneous tools and techniques; the benefits associated with a formal portfolio management process are not recognized.

Level 2 – Consistent: has a formal portfolio management process that is being introduced in the organization. Basic processes and standards are developed as executive support is evident. There is recognition of the need for governance, risk management and component identification.

Level 3 – Integrated: is one in which portfolio management is introduced throughout the organization. Portfolio management is aligned with organizational strategy with key performance indicators in the process. The organization's strategy and its business goals are the inputs to the process to ensure components are aligned with organizational goals.

Level 4 – Comprehensive: in which there is commitment within the organization to a portfolio management culture. People follow the portfolio management process at all levels, and therefore, programs, projects and operational work contribute to the organization's strategic goals and objectives. Members of the Portfolio Review Board are actively engaged in the process, and the Portfolio Manager is respected and reports to the same level as the EPMO Director. Key metrics are collected and regularly reviewed to enhance the process and its value to the organization.

Level – Optimizing: is characterized by continual improvements to the portfolio management process. Communications with stakeholders are emphasized along with introducing new technologies to facilitate the portfolio process as appropriate.

COLLECTING BASELINE DATA ON EXISTING PORTFOLIO COMPONENTS

Next, data on all the programs, projects and other work should be collected regularly. This process on the surface sounds easy, but in practice it is difficult to convince people to inform others of the varied work they are doing. Data should be collected on:

- the number of programs and projects that are under way;
- the people supporting each program and project;
- how the programs and projects were selected;
- how long the programs and projects have been under way and scheduled completion dates;
- the cost of each program and project;
- the benefits to be realized by each program and project;
- the complexity of each program and project;

- the interdependencies between programs and projects;
- the sponsors and key stakeholders;
- the contribution of the program and project to organizational goals.

As Rad and Levin (2006) state, the Portfolio Manager requires a portfolio management information system that he or she or the respective staff design, develop, implement and maintain. Kendall and Rollins (2003) suggest the system contains data that is both strategic and tactical. Tactical processes are ones involving ongoing programs and projects, with strategic processes focusing on selecting new components to be part of the portfolio and others to be terminated. They recommend the system contain policies, processes, techniques, tools, plans and controls for portfolio management.

Expanding on these concepts, the system serves as a repository for all of the work in the portfolio. Data must be reliable, timely and accurate, and a process is required to ensure data are submitted when due and are updated as required. The system should be able to filter information required for status updates for key stakeholders and the Portfolio Review Board.

PREPARING CHARTERS FOR THE PORTFOLIO MANAGER AND THE PORTFOLIO REVIEW BOARD

Charters are useful for programs and projects to detail why they are being pursued, their specific benefits to be realized and deliverables to be completed, roles and responsibilities, level of authority of the program or project manager, key stakeholders, high level risks, a high level schedule and budget and assumptions and constraints. Similarly, charters are useful for the Portfolio Manager and the Portfolio Review Board. Table 28.1 expands on a charter for the Portfolio Manager from that in Rad and Levin, 2006.

Table 28.1 Template for a charter for the portfolio manager

Portfolio Manager name	Phone	Mobile	E-Mail	Address
Goals:	State the goals for this position			
Reporting Level	State the level of reporting for the Portfolio Manager			
Authority and Responsibility	Describe the Portfolio Manager's authority and responsibility in terms of overall management of the portfolio process. This section can consider items such as development of the business case template, the portfolio process and the prioritization process; methods for regular portfolio reporting and communications of the priority of the components in the portfolio			
Team Members	Note the team members supporting the Portfolio Manager			
Process	Describe the organization's portfolio management process			
Assumptions and Constraints	List assumptions and constraints associated with the position			
Risks	List risks identified that may affect portfolio management in the organization			

Schedule	Describe a schedule for portfolio management building on its maturity level in the organization
Budget	Describe the budget allocated to the Portfolio Manager and his or her staff; include a financial framework and financial management plan
Training and Orientation	Describe training for program and project managers in portfolio management, training for executives, and orientation sessions for everyone in the organization
Metrics for Success	Describe how the Portfolio Manager will be evaluated in terms of overall performance
Approvals	Have members of the Portfolio Review Board sign off on this charter

Table 28.2 expands on work of Rad and Levin (2006) in terms of a charter for the Portfolio Review Board.

Table 28.2 Template for a charter for the Portfolio Review Board

Portfolio review board member names	Phone	Cell	E-mail	Address
Goals and objectives	Describe the goals and objectives for Portfolio Management in the Organization			
Roles and responsibilities	State the roles and responsibilities for members of the Portfolio Review Board and its level of authority in the organization; describe the decision-making process and the head of the Board			
Interfaces	Describe how the Board will work with the Portfolio Manager and the Director of the Enterprise Program Management Office			
Meetings	State the frequency of the Portfolio Review Board’s meetings and its authority to call ad hoc meetings when required			
Assumptions and constraints	List any assumptions and constraints relative to the Portfolio Review Board			
Risks and issues	List any known risks and issues involving portfolio management in the organization			
Communications management	Describe how the Portfolio Review Board will communicate its activities with the rest of the organization			
Approvals	Obtain sign-offs indicating commitment to the charter by each Board member			

PORTFOLIO MANAGEMENT PLANS AND DOCUMENTATION

Scope Statement

The Portfolio Manager and his or her team should prepare a scope statement for the portfolio management process that is issued by the Portfolio Review Board. Suggested items for the scope statement include:

- Describe the organization's intent and purpose in portfolio management;
- Describe resources to be dedicated to portfolio management in the organization;
- Define success criteria for portfolio management in the organization.

It should be periodically reviewed and updated as portfolio management continues to mature in the organization.

Work Breakdown Structure

Once the Portfolio Review Board issues the scope statement, a Work Breakdown Structure (WBS) for Portfolio Management is useful. The purpose of the WBS is to show the scope of the portfolio management activities in the organization and to show what it entails. Building on the work of the PMI Standard (2008), it can be divided into three elements:

1. The Aligning Process Group;
2. The Monitoring and Controlling Process Group;
3. Project management showing the project management tasks to be performed.

Portfolio Management Plan

The Portfolio Manager next should prepare a plan that is issued by the Portfolio Review Board. This plan would detail:

- vision, objectives, milestones and completion dates;
- a schedule network diagram, bar chart, roles and responsibilities, interfaces and a cost estimate;
- a communications management plan
- a risk management plan;
- a stakeholder engagement plan.

Implementing portfolio management is a project and in order that stakeholders can see progress in portfolio management, the schedule should be structured to show some milestones that can be met early in the process within the first three months of implementing portfolio management. Early successes can lead to later successes as portfolio management represents a culture change for the organization. A fully functional process with a portfolio management information system in place tends to take about one

year for implementation throughout the organization with regular meetings held by the Portfolio Review Board and communication of the decisions disseminated throughout the organization. Such regular meetings are essential to show commitment to portfolio management by the highest level of the organization.

Concluding Remarks

Meskendahl suggests 'project portfolio success consists of average single project success, project balance, strategic fit, as well as the use of synergies and is positively related to business success consisting of economic success and preparing for the future' (2010, p. 811). He further explains that it is important to focus on strategic orientation in order to moderate relationships with portfolio structuring and portfolio success. Portfolio management is a continual process. As an organization matures in portfolio management, it will make changes to the process and model that is used. As noted by Levin et al (2010), data are collected to evaluate the effectiveness of the process and are analyzed to ensure the process continues to support the organization's business needs and its stated values and objectives.

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Managing the Project-Oriented Organization

MARTINA HUEMANN

The project-oriented organization is a contemporary organization form with increasing importance. In addition to traditional project-oriented industries such as construction and engineering, which traditionally perform large contracting projects, new types of internal projects such as strategic planning, marketing, personnel development and organizational development are increasingly performed in organizations. Thus the demand for projects is spreading into all kinds of industries including service industries and the public sector. In the public sector, for example, projects and programs are applied for organizing reform and change. This is why I explicitly use the term project-oriented organization to include also public and non-profit organizations.

The objective of this chapter is to describe the project-oriented organization and indicate challenges and potentials that projects and programs bring to any organization. This chapter is organized as follows. I start by clarifying the model of the project-oriented organization and describe its specific strategy, structures and culture. After having introduced the project-oriented organization, I describe the tension between temporary projects and the permanent organization which both follow different management logics. This can explain some of the frictions project managers may experience in project-oriented organizations. I then focus on the Human Resource Management (HRM) system as a functional sub system and summarize a viable HRM system for the project-oriented organization to fit its specific context.

Project-Based or Project-Oriented?

Labels vary; organizations that carry out projects may be called project-based, projectified or project-oriented. Often these labels are used synonymously. But there are differences. Traditionally the project-based organization is an organization that carries out contract projects for external customers, which is in line with management theory which says that the production process determines the form of organization (Woodward, 1965). The project-based organization is project-based *perforce* because of the customized nature of the demand from its customers (Turner and Keegan, 2001). On the other hand, the project-oriented organization is such by *strategic choice*, based on the organizational strategy of *Management by Projects* (Gareis, 2005). It carries out projects or programs for performing business processes, whenever adequate. These projects may be external contract projects

or internal projects such as product development, organizational development or change. There is also a difference in the understanding of projects and project management. Table 29.1 summarizes the main differences between the project-based and the project-oriented organization.

Table 29.1 Project-based versus project-oriented (after Huemann, 2013)

	Project-based organization	Project-oriented organization
Reason for projects	Projects are performed per force, because of the customized nature of the project.	Projects are strategic choice Project is one option for the organizational design
Relation	Production process	Business processes
Type of projects	Mainly external projects	External and internal projects
Understanding of project	Project is considered as complex task or system	Project is considered as temporary organization
Understanding of project management	Mainly operational capability	Operational and strategic capability
Paradigm	Different paradigms Prevailing mechanistic planning paradigm	Systemic-constructivist, explicitly farmed as construction

The project-oriented organization is explicitly framed as a construct and therefore also describes how a project-oriented organization may be equipped to be capable to perform projects and programs. This is reflected in the definition of the project-oriented organization (Gareis, 2005), as an organization which:

- defines *Management by Projects* as its organizational strategy;
- applies projects and programs as temporary organizations;
- manages a project portfolio of different internal and external project types;
- project management, program management and portfolio management are specific business processes;
- has specific permanent organizations like a project portfolio group or a project management office to provide integrative functions;
- applies a management paradigm which reflects the ability to deal with uncertainty, contradiction, change, collaboration;
- and views itself as being project-oriented.

To provide a clearer picture on a mature project-oriented organization, Gareis and Stummer (2008) describe the characteristics of an immature project-oriented organization, which are:

- The term project is used to describe many different things, including temporary tasks that are unworthy of a project. There is an inflationary use of the term project. As a consequence as every temporary task is labeled project, there is not enough management attention paid to projects.
- The wheel is repeatedly reinvented. The way a project is performed varies because it depends on the competencies of individuals. There are no organizational standards. Professional project management methods are not applied. As a result, the projects lack transparency and efficient communication. Creativity declines rather than increases.
- The objectives and the tasks are always agreed from one project meeting to the next. There is no 'Big Project Picture', so the project team members lack orientation.
- Projects are defined within division or department boundaries. As a result, there are too many small projects, which lead to sub-optimization. Projects are not holistically defined, thus cooperation across department boundaries is not pursued.
- Nobody knows which projects or how many projects are conducted at any given time. There is no overview on the projects concurrently performed and thus no information about the project portfolio. Thus meaningful decisions on starting new projects and adequate resource allocation are not possible.
- Projects are initiated informally; projects with the same objectives are implemented concurrently and the allocation of project resources cannot be adequately managed.

Strategy, Structure and Culture

The project-oriented organization is perceived as an organization with specific permanent and temporary structures and a specific management culture. The project-oriented company can be described by its strategy, structure and culture (Gareis, 2005), as shown in Figure 29.1.

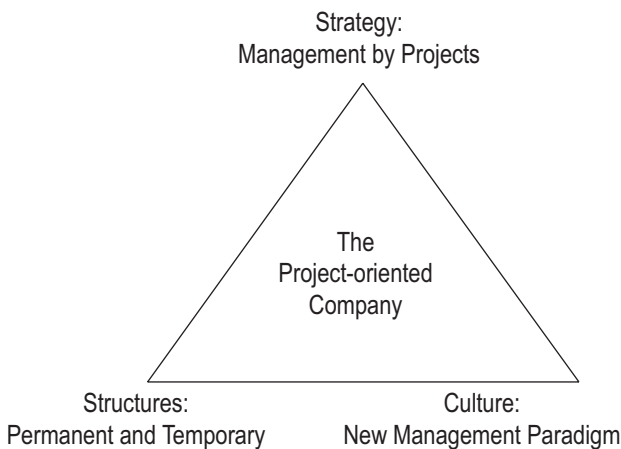


Figure 29.1 Strategy, structure and culture (after Gareis, 2005)

MANAGING BY PROJECTS

Organization theory and management studies have from early on searched for the adequate organizational structures to support the production process of an organization (Woodward, 1965). The project-oriented organization applies the organizational strategy Management by Projects as a strategic choice to organize business processes, not just production processes. Not everything is a project, but the essence of Management by Projects is that the organization applies a project or a program for the performance of a business process, when adequate. As outlined in Figure 29.2, depending on the characteristics of the business process, the type of organization to perform the business process is chosen.

Other organizations only apply projects for their internal processes and not for their primary processes with customer processes because these are routine and a project would not be appropriate. To illustrate with an example: if you go to the bank to open up a bank account, you hope that the organization will not make a project for this repetitive routine process of short duration and small scope. You will expect the bank to have a defined process supported by an adequate IT infrastructure to deliver quickly and effectively. You will get your new bank card within a couple of days in the mail. But if the same bank changes the account management system for all their branch offices and on-line customers you will hope that they take it more seriously strategically and that they organize it as a project and professionally manage it, because if the new account management system fails, the organization will be in trouble. As a consequence organizations require a sound understanding of their business processes to apply the strategy Managing by Projects adequately. Only if the organization understands its business processes, can they explicitly choose which of these are better performed as projects and which should be taken over

Process characteristic	Attribute		
	often	once	once
Frequency	often	once	once
Scope	small-medium	medium-large	large
Importance	low	medium-high	high
Duration	short	short-medium	medium-long
Resources	few	some	many
Costs	low-medium	medium-high	high
Number of organizations	few	several-many	many

Type of organization	Permanent organization	Project	Programme
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Figure 29.2 Adequate organizations for different process types (after Gareis, 2005)

by the routine permanent organization. By that, projects and programs are considered as a strategic option for the organizational design.

Many organizations perform their primary business with clients as projects, but do not consider that they may need professional project management for internal projects. However, these organizations may still be considered to be project-oriented, but they have some development potential. In practice many organizations apply Management by Projects implicitly as they are confronted with the customer demand to carry out contracting projects. But as a consequence these organizations may not be project-oriented enough. They may not have the adequate and correspondent structural and cultural prerequisites to perform projects and manage a project portfolio professionally. In these organizations project management is often only considered from an operational perspective for delivering projects, but the strategic perspective of managing projects and thus the specific organizational structures and a specific culture to support project-orientation is not created. These organizations have the potential to develop further towards the construction of the project-oriented organization with its organizational strategy Managing by Projects.

TEMPORARY AND PERMANENT STRUCTURES

Project-oriented organizations apply permanent and temporary structures in their organizational design. Permanent structures are for example functional departments or expert pools and profit centers. Temporary organizations are projects and programs. Project-oriented organizations perform a number of different internal and external, small and large projects at the same time. The size and number of the temporary part of the organization can change considerably, especially if the organization uses projects for organizing customer contracts. The basic assumption is that this flexible organization form allows for better innovation. Further the projects allow more organizational differentiation, which helps to deal with the increasing complexity of the environment.

However, to cope with this organizational differentiation, integration and specific alignment are required to keep the organization streamlined, ensure synergies and strategic alignment. There is a need for integration between projects and between the projects and the permanent organization. Forms of integration between projects are for example to cluster projects into chains of projects, project portfolios and networks of projects. Specific governance forms are required, like the provision of guidelines and rules for the projects in the form of project and project management standards (Müller 2009). Specific integrative structures include the project management office, project portfolio group or expert pools, as shown in Figure 29.3.

Project Portfolio Group

The Project Portfolio Group (PPG) is a specific, permanent communication structure to steer the project-portfolio. We find a PPG in medium-sized to large project-oriented organizations (Gareis, 2005). Services offered by the PPG include (Gareis, 2005; Huemann, 2013):

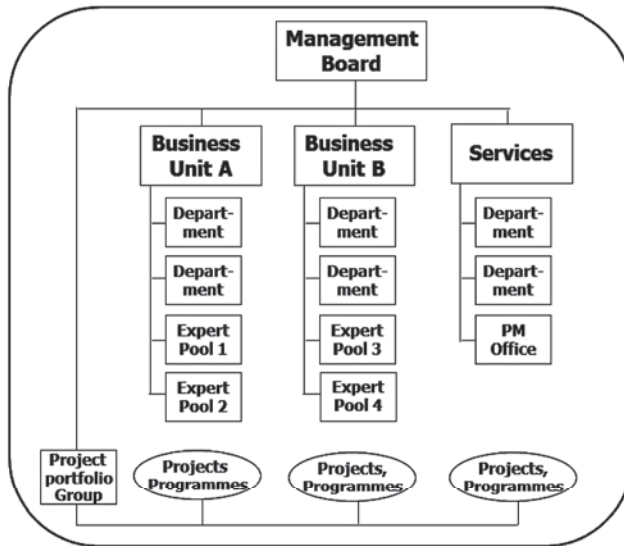


Figure 29.3 Organization chart of the project-oriented organization (after Gareis, 2005)

- Assigning a project or program: aligning project objectives with company strategy; deciding on the organization form for initializing an investment, nominating the project owner;
- Project portfolio coordination such as coordinating (human) resources used in projects; determining project priorities, stopping and interrupting projects and programs, determining strategies for designing relations with relevant project or program stakeholders;
- Networking of projects such as organizing learning of and between projects, using synergies.

Project Management Office – PMO

In contrast to project offices, which are set up to support single large projects, the PMO is set up to be a permanent structure in the project-oriented company. The objective of the PMO is to ensure a professional project, program and project portfolio management in the project-oriented organization. PMOs are a central means of integrating an organization's strategic priorities, permanent structures and temporary projects. Although the PMO has a kind of chameleon function and often needs to take on additional services to justify its existence, core services offered by the PMO include (Aubry et al, 2011; Huemann, 2013; Chapter 31):

- services for project and program management such as providing project management guidelines, standards, forms and so forth; organizing management auditing and consulting to ensure management quality in projects and programs;

- services for project portfolio management such as providing project portfolio guidelines, standards, forms and so forth; maintaining a project portfolio database, developing project portfolio reports; initializing project networking;
- services for project management personnel: organizing training and coaching, exchange of experience for project management personnel, further developing and marketing of the profession project management; support in recruiting, selecting, evaluating and determining salaries for project managers.

Expert Pool

In the project-oriented organization, the project personnel can be organized in expert pools (Table 29.2).

Table 29.2 Traditional department versus expert pool (after Huemann, 2013)

	Traditional department	Expert pool
Empowerment	Employees not necessarily empowered to take on responsibility for quality of their work	Pool members are empowered to take on responsibility for their work in projects and programs
Perception of manager role	Manager is content expert and responsible for the quality of the work of the experts	Pool manager is not necessarily content expert Pool manager has HRM and managerial responsibilities; Pool manager is not responsible for work quality of pool members

Responsibilities of the expert pool comprise competency development of the personnel managed, process management and knowledge management. Depending on the industry and business, different expert pools exist in an organization. In an engineering construction company technical expert pools such as mechanical engineering, electrical engineering and project management can be differentiated (Gareis, 2005).

Different Management Logics

Nevertheless, tension and different management logics exist in temporary structures in comparison to the permanent line structures. Above I have described several specific structures such as the PPG, the PMO and expert pools to allow for integration between projects and between projects and permanent line organization. However, there exist structural tensions between the temporary and permanent line parts of the organization which make it necessary to live with two management logics. Table 29.3 contrasts these two logics.

Table 29.3 Management logics of projects in contrast to permanent organizations (after Huemann, 2013)

	Temporary project	Permanent line organization
Time	Temporary, duration is planned at the beginning of project, end is inherent in the project start Short to medium term orientation Temporality creates urgency, rhythm driven by project end date and milestones	Permanent organization is planned unlimited in time Short, medium and long term orientation Time is cyclic, driven by rhythm of the annual budgeting cycle, and related to quarterly reports
Business process	Relatively unique, short to medium term, strategically important, medium or large scope High result orientation to achieve project objectives, as this is the <i>raison d'être</i> for the existence of the project.	Routine, short term, not strategically important, small scope Result-orientation may vary considerably
Personnel	Personnel are put together on a project-based on a project requirement Personnel may even be integrated from external organizations for example partners, suppliers, customer Contribution to project result (even when intangible as a feasibility study) is visible for the project personnel	Personnel with same competences is organized in functional departments or in expert pools Relation between own contribution and company result may not be so clear for the single employee
Team	Team structures are central to a project Different teams within one project possible Temporary teams	Team structures possible Teams then have the character of permanent teams
Change	Dynamic, as projects organize change. Change object is the project itself and the organization(s) for whom the project is delivered	Often also increasingly dynamic, as change is common in the contemporary organization Change for the permanent organization often organized by projects
Identity	Temporary, needs to be created for the specific project Relatively autonomous but embedded in the context May be influenced by several organizations	Is created and shaped over time, embedded in its context

PROJECT-ORIENTED CULTURE

Classical project management considers a project as a complex technical system. While classical project management is based on a mechanistic and linear planning paradigm, the project-oriented organization understands projects as temporary organizations. Traditional project management methods like scheduling, scope and cost planning remain important but are set into a different context. The project management plans are

not expected to steer reality, but they are considered as means of making sense of reality. Their purpose is to give orientation and allow for agreements in the project and with the project stakeholders.

The project-oriented organization requires a culture which is able to deal with uncertainty, contradictions and change. Values and cultural elements that support project-orientation are empowerment of personnel and projects, team-orientation, stakeholder-orientation, process-orientation, diversity, innovation and change-orientation. Table 29.4 outlines values to support Managing by Projects.

Table 29.4 Culture of the project-oriented organization (after Huemann, 2013)

Empowerment	Increasing the autonomy and responsibility of the personnel. Empowerment comprises project, the project team project team members.
Team-orientation	Projects require team work. Problem solving through teams and projects instead of excessive functional differentiation.
Stakeholder-orientation	Projects meet the customers' expectations. Projects create value for the customer and further project stakeholders.
Process-orientation	Processes as the basis for project work. Project management as a process.
Diversity	Diversity as differences and commonalities. Diversity as a potential for project work.
Innovation	Projects promote learning and innovation. Encouraging co production of knowledge with suppliers and partners.
Change-orientation	Encouraging continuous and discontinuous organizational change. Being able to deal with uncertainty and contradictions.

However, as the organization acts in its industry and national contexts, any organization has its own blend of values deeply depend on their own contexts.

HRM in the Project-Oriented Organization

Because of the specific features of a project-oriented organization all functions in the organization need to adapt when an organization becomes project-oriented. The remainder of this chapter is dedicated to the HRM as one of the functions that needs considerable adaptation to fit and support project-orientation. In many organizations, HRM departments organize for training and education of project managers. Thus they realize that new competences are necessary to perform projects, but often they are too narrow-minded (Turner et al, 2008). The HRM support for project-orientation is often limited to the perspective of developing adequate project managers, without understanding:

Firstly, that it is not only the project manager, who needs project management competences including social competences as a basis for leadership tasks. It is also the project team members as well as the project owner, who need to understand projects and project management to contribute to the project in their roles adequately.

Secondly, there are structural and cultural consequences that projects bring to the organization. Thus the HRM system as such needs adapting and needs to become more decentralized and flexible to better support this rather decentralized type of organization.

ALIGNING PROJECT HRM AND LINE HRM

One of the main issues is the extension of the HRM system from the line organization into projects. Because projects as temporary organizations constitute a secondary organizational layer, the HRM system has to cover the permanent part of the organization and extend into the temporary projects. Not only does this mean that HRM needs to take place on projects, it also questions how HRM on the project is linked to the HRM in the permanent line organization, as project personnel may spend most of their working hours on projects and not in the line structures such as departments and expert pools. The link between on-project HRM and in-line HRM needs to be mutual as shown in Table 29.5.

Table 29.5 Linking project HRM and HRM in the permanent organization (after Huemann, 2013; Huemann and Turner, 2010)

Line HRM	How line HRM needs to support project HRM	How project HRM supports line HRM	Project HRM
Recruiting	<ul style="list-style-type: none"> Recruiting appropriate personnel Recruiting personnel quickly enough to meet the needs of project mobilization Ensure all project team members have the same terms and conditions Ensure project team members adhere to policies Project categorization system to differentiate competences required by the project manager 	<ul style="list-style-type: none"> Forecast future requirements Maintain a resource management system within the project Take account of individual and organizational development needs 	Assigning
Developing	<ul style="list-style-type: none"> Develop personnel competent to work on projects Ensure success planning for future project and program managers Ensure good people are not held in inferior line jobs to the detriment of the organization's needs and the individual's career development Provide adequate careers 	<ul style="list-style-type: none"> Ensure development on project fits with the line career development plans Ensure project assignments meet organizational and individual development needs 	Developing

Appraising	Incorporate project appraisals for the motivation of project personnel	Do appraisals/assessment on the project to provide data for the annual line appraisal	Appraising
Rewarding	Ensure rewards reflect project performance so personnel are motivated to work on projects Ensure people from different departments working on the same project are rewarded in the same way for cohesiveness of the team	Ensure that project rewards and bonuses fit with the organization's policies and the line reward system	Rewarding
Releasing	Capture knowledge from temporary workers leaving the organization Retain a network with temporary workers	Capture knowledge at the end of project, particularly from temporary workers Ensure project personnel are returned promptly to the line so they can be reassigned quickly to other projects Ensure project personnel are moved to projects where their skills are best used	Dispersing

PROJECT-ORIENTED CAREERS AND CAREER PATHS

While HRM on a project primarily serves the project performance, as projects are temporary, there is a distinction to be made between the temporary project HRM and the HRM that takes place in the permanent organization. Difficulties in linking them arise mainly because of the different management logics as described in Table 29.6. For example the time horizons on a project is per definition short term, while the development and career aspirations of the project personnel need long-term consideration. This long-term consideration cannot be handled on a particular project, but must remain in the line organization, which has a more long-term-oriented interest in keeping the project personnel committed to the organization. This has several consequences.

Project Management Career Path

As project management is not only tools and methods, but also a management approach for managing temporary organizations, project managers need to have an understanding of leading a project and its stakeholders. Therefore project-oriented organizations need to develop their project managers by letting them grow into the role and assigning them increasingly complex projects as part of their competency and career development. Thus if managing projects is considered as important in an organization, this organization requires a project management career path. Figure 29.4 shows a project management

Career Progression	Consultant (IT expert)	PM Level 3 Project manager	PM Level 2 Senior project manager	PM Level 1 Project director
Total years	2–5	4–9	6–14	6–14
Training & testing	12 courses	9 courses	3 courses	2 courses
Experience	2–5 years project team experience; lead small teams	2–4 years managing L3 projects; participate in L2 project	2–5 years managing L2 projects; participate in L1 projects	2–3 years managing L1 projects
External certification	-IPMA Level D	-IPMA Level C -PMI PMP	-IPMA Level B	Continuing professional development

Figure 29.4 Project management career path of an international IT company (after Gareis, 2005)

career path of an international IT company, which appreciates project management as a distinct career field.

Success factors identified for designing a project management career path include aligning the competency and qualification of the project manager with the career path level, adequate organizational recognition of the role project manager and the necessity for according salary and promotion policy, a project classification system to be able to assign the adequate project manager to a particular class of project (Hözlze, 2010).

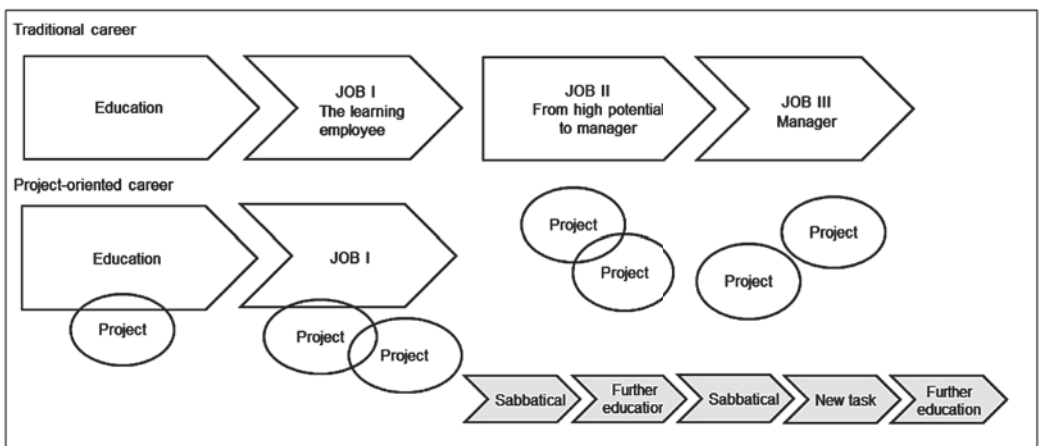


Figure 29.5 Traditional versus project-oriented career (after Lang and Rattay, 2005)

Project-Oriented Careers

Careers working on projects can be fragmented. This includes not just the project managers but also the project team members and other project workers. The project-oriented career is characterized by a series of projects in different contractual arrangements; periods of permanent employment contracts and temporary employment contracts are interleaved (Lang and Rattay, 2005) as shown in Figure 29.5.

Thus the careers of most of the personnel in the project-oriented organization – not only of the project manager – relate more or less to project work. As a consequence also management career path and expert career path in the project-oriented organization need to consider projects.

Concluding Remarks

I introduced the project-oriented organization as a contemporary form of organization and discussed its specific features. Table 29.6 summarizes these specific features of the project-oriented organization, which have consequences for all functions of the organization.

Table 29.6 Specific features of the project-oriented organization (after Huemann, 2013)

	Description	Consequence
Strategy	Managing by projects as making adequate choice of organization to perform business processes	A highly differentiated organization which requires balancing of centralization and decentralization
Structures	Temporary projects in addition to permanent structures	Projects constitute an additional secondary organization consisting of temporary organizations as coupled sub systems of the project-oriented organization Tensions between permanent and temporary structures for example different management logics between temporary and permanent structures Requires specific governance structures for the managing of projects as well as specific integrative structures such as PPG, PMO and expert pool Possibility to build up adequate complexity in the organization to deal with the complexity of the environment and to suit different contexts
Culture	Project-oriented culture	Values that fit project-orientation enables to deal with uncertainty, contradictions, change.

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The Governance of Projects and Project Management

RALF MÜLLER

This chapter considers the ways projects and their management are embedded within the structures of their parent organization and are synchronized with its corporate governance. Projects do not exist in a vacuum. Projects need to be linked to their parent organizations in a way that allows projects to be successful while respecting the practices and limitations set by corporate governance, for example through its policies, processes, roles and responsibilities. Project management starts at the top of the organization, where its business is defined, the need for new projects to develop products, services or organizational structures is created, as well as the need for projects to expand, contract or change the business. It is at the top of the organization where the process or project-orientation of the organization is determined, thus whether or not projects are a building block of an organization's business. It is also here where the *raison d'être* of the organization is decided: what the organization's reason for being is and its role in the market, industry or public sector; how it conducts its business and for whom; how legitimacy and transparency of practices is provided to owners, directors, shareholders or other stakeholders in line with legal and moral requirements. These decisions determine the type of governance for the corporation. It provides a framework for managers to take decisions in day-to-day work, but does not determine these decisions. Through that corporate governance creates the 'conditions for ordered rule and collective action' (Stoker, 1998) (p. 155) and shapes the 'conduct of conduct' in organizations by use of subtle forces in a self-regulating approach (Lemke, 2001).

One of the main factors for self-regulation in governance is a shared understanding about the shareholder or stakeholder orientation of the organization. Decision making in shareholder oriented organizations is governed by the goal to maximize shareholder value. Shareholder oriented organizations in the private sector aim for increasing the wealth of the shareholders or owners by maximizing their return on investment (ROI). The interest of shareholders is prioritized over those of other stakeholders. This governance approach goes back to the Chicago School of Economics and is often found in English speaking countries. Contrarily, stakeholder oriented organizations see themselves as operating within a wider host society, which provides the legal and market infrastructure for the organization's activities. Stakeholder oriented organizations balance the often conflicting interests and claims of their diverse set of stakeholders, which may include managers, shareholders, employees, suppliers and the wider society. Managerial decisions within these organizations are governed by the desire to create value for all stakeholders, which

may include balancing monetary and non-monetary objectives, such as traditional financial objectives as well as social performance measures like reputation or attractiveness as an employer (Clarke, 2004).

Another significant factor for self-regulation in governance is the control structure of the organization. The seminal works by Ouchi, Maguire and Eisenhardt (Brown and Eisenhardt, 1997; Ouchi, 1977, 1979, 1980; Ouchi and Maguire, 1975) showed that organizations use three approaches to control the work of their employees:

1. *Behavior control*: These organizations emphasize conformance with processes for the accomplishment of tasks and projects. Following the process is given priority over achievement of defined goals. The process legitimizes the actions and ethics in day-to-day work.
2. *Outcome control*: These organizations emphasize the fit of outcome and expectations. Priority is given to accomplishing defined goals, and not necessarily following the process. Goal accomplishment legitimizes actions and ethical decisions.
3. *Clan control*: This form of control is more indirect and through more psychological means. A clan is a homogenous group with shared values or objectives and shared beliefs about how to accomplish these objectives. This approach supports either behavior or outcome control by fostering the organization's practices through employees' desire to clan membership.

Overlaying the shareholder to stakeholder governance approach with the behavior and outcome control approach identifies four different ways for organizations to govern their work, including their projects (Figure 30.1).

These four approaches work as project governance paradigms. The clan control structure is executed through particular groups of similar professional orientation within each of the four paradigms. Examples for this include Project Management Offices (PMO), which foster a particular project management culture within the organization and thereby

		Governance orientation	
		<i>Shareholder</i>	<i>Stakeholder</i>
Control focus	<i>Outcome</i>	Flexible economist	Versatile artist
	<i>Behaviour</i>	Conformist	Agile pragmatist

Figure 30.1 Four governance paradigms

execute a psychological control over the Project Management Community of Interest. The four governance paradigms link corporate governance with project governance by setting the framework for decision making and control for projects:

The *Conformist* paradigm with shareholder orientation and behavior control represents organizations that assume highest shareholder return is achieved when employees follow existing processes, rules and policies. These organizations pursue lowest project costs by following existing methods in environments with relatively homogeneous sets of projects. In these organizations project management may be done 'on the side' by following a technology development process. Alternatively a tactical PMO may be in place to implement a particular project management methodology within the organization.

The *Flexible Economist* paradigm with stakeholder orientation and outcome control gives more autonomy to managers, such as project managers. These organizations aim for lowest project costs through a well informed selection of a suitable project management methodology for each project. PMOs may support project management by building a range of skills and a toolbox for project managers to use.

The *Versatile Artist* paradigm with stakeholder orientation and outcome control balances a diverse set of requirements from various stakeholders for the highest possible benefit of all stakeholders. Project managers in these organizations are the most autonomous and experienced of their profession who develop new or tailor existing methodology practices to achieve economies in the balance of the diversity of requirements. They may be supported by a PMO with very experienced or more portfolio management related tasks.

The *Agile Pragmatist* paradigm with stakeholder orientation and behavior control tries to maximize usability and business value of a project's product. Examples include Agile/SCRUM approaches which allow for time-phased product or functionality release over a period of time. Here sponsors prioritize deliverables on behalf of the stakeholder community, often using business value over a given timeframe. PMOs are rarely found in these organizations, but if so they perform tactical process improvement activities.

Within larger corporations all four paradigms may be found in different parts of the organization. For example the R&D department may be governed by a flexible artist paradigm and view their project managers as supermen who can do the impossible, whilst the maintenance department may be governed by a conformist paradigm and project managers are expected to be airline pilots, following a clearly defined process and numerous checklists. The scope of project governance is determined by the corporate governance framework, because it sets the boundaries for the governance of projects and their management.

These paradigms link corporate governance with the project level by corporate governance setting the limitations for governance of projects within each paradigm. Project governance comprises the value system, responsibilities, processes and policies that allow projects to achieve organizational objectives and foster implementation that is in the best interests of all the stakeholders, internal and external, and the corporation itself (Müller, 2009).

The next section describes the institutions and roles involved in the governance of projects and the governance of project management. The governance of projects relates to the governance of the project as a process and a set of activities, while the governance of project management relates to the governance of the project management capabilities

in the organization. Both approaches require different governance institutions. These institutions and their roles are described in the following section.

Institutions for the Governance of Projects and Project Management

The principal tasks in governance are setting of goals, providing the means to achieve these goals and controlling the progress in achieving these goals. This is done by all governance institutions listed below. However, their particular goals may vary by their role and hierarchical level in the organization.

Figure 30.2 shows a generic project governance model.

Governance starts with the board of directors, which provides the strategy and the objectives for project portfolio management. This institution selects the projects and programs to be executed within the organization. Once a project or program is selected the Steering Committee is assembled to govern project execution, and eventually provide the project or program's outcome to the internal or external customer. Middle management provides the required resources, including the project managers. The solid line arrows show the delivery path of the project or program's outcome. The dotted line arrows show the control circle, established through interaction of the project or program with the PMO, which can be in the form of consulting, training or reviews provided by the PMO, as well as collection of performance information provided by the projects and programs, which are accumulated and analyzed by the PMO in oversight reports and forwarded to portfolio management.

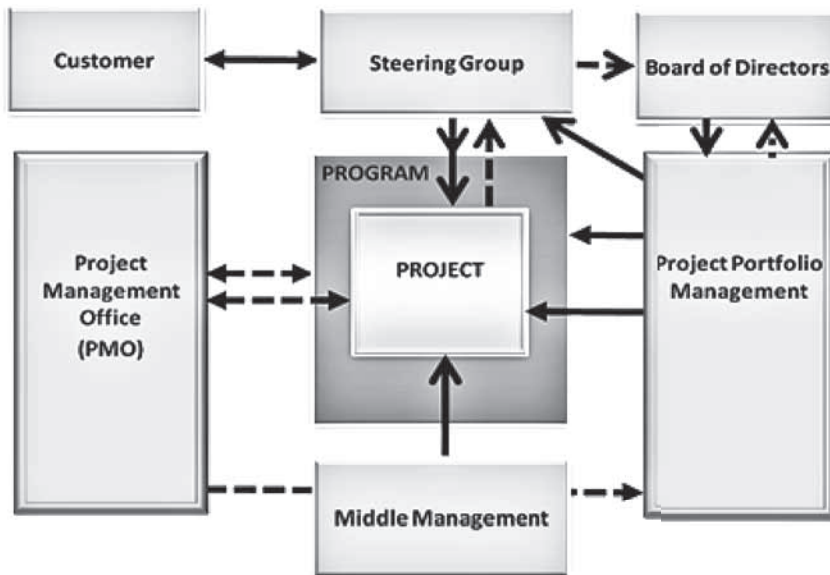


Figure 30.2 Governance model

BOARD OF DIRECTORS

The role of the board of directors in defining the scope of project work was described above. Governance of projects starts at the board of directors which defines the objectives of the business and the role of projects in achieving these objectives, and controlling progress. This sets the strategic value of project management for the organization and impacts decisions on the establishment of Steering Groups and PMOs, or program and portfolio management as organizational measures to manage groups of simultaneously ongoing projects in the organization (Turner, 2009).

PORTFOLIO MANAGEMENT

Project portfolio management groups projects together through their shared resources or skills needs. The projects may be not related to each other in terms of their objectives, but require resources from a common resource pool. To decide for the 'best' projects for the organization the portfolio managers decide on which projects to accept into the portfolio, the priority of individual projects within the portfolio and the allocation of resources to these projects. They further analyze existing or upcoming bottlenecks in resources and skills needs. They also work on remedies and mitigation strategies for risks and issues in projects (Blomquist and Müller, 2006a). Research showed that portfolio success is measured as:

- *Achievement of results* in terms of aggregated delivery of the projects and programs in terms of their time, cost and quality constraints, achievement of user requirements and overall financial results;
- *Achievement of purpose* in terms of aggregated achievements of project and program purpose, that is, the sum of the long term or business objectives of the projects and programs in the portfolio;
- *Balancing priorities* in terms of timely accomplishments of projects and programs as well as stakeholder satisfaction.

These goals are achieved by controlling portfolios through joint decision making by managers for careful selection of projects or programs in the best interest of the organization, and by transparent prioritization of projects and standardized assessment of performance for portfolio reporting (Müller, Martinsuo and Blomquist, 2008).

Once a project is selected by portfolio management the Steering Committee can start with its governance tasks.

SPONSORS AND STEERING COMMITTEES

A project's steering committee is the governance institution that is closest to project execution and ultimately accountable for success. Furthermore it is accountable for the achievement of the project or program's business case, that is, the achievement of goals set in terms of the use of the project or program's outcome. Sponsors are individuals or organizations that order the project or pay for it. In many industry settings, for example in in-house R&D projects, the sponsor holds the chair of the steering committee. In other

cases these might be two very different entities, like in large aid projects, where the World Bank sponsors a project for a country and the local government steers its implementation.

Research by Crawford et al (2008) showed that steering groups execute two main functions:

- *Governance*: by appointing the project manager, setting the project's constraints in terms of budget, time, success criteria and defining the goals to be achieved within these limits. This role also includes provision of resources, controlling the project at its milestones, accepting deliverables and change control, as well as project end.
- *Support*: by preparing the project's parent organization for the use of the project's deliverables, removing obstacles in project execution, helping the project team to obtain required approvals from the parent organization and managing some of the stakeholders in the project.

Steering groups also set up the particular governance infrastructure for a project, which includes the project governance processes, the means of controlling the project and the roles, responsibilities and approval authorities. Projects, or phases of projects, are executed upon provision of resources by the steering group. Control of progress, the third governance function, is done mainly at steering group meetings and end-of-stage (gateway, toll gate) review meetings. At these events the project status, performance, outlook, risk and context is assessed and decisions are made to continue the project, change it, or suspend it.

PROGRAMS

Programs are groups of interrelated projects which share a common objective. A program's objective cannot be reached with just one project, thus a group of interrelated projects is needed. Research has shown that success of programs is multidimensional and measured as the combination of delivery as planned (aggregate meeting of project objectives and stakeholder satisfaction) and building the organization's capabilities for delivery (for example efficiency and structure), establishing marketing capabilities for the program's outcome and the exploitation of technical capabilities through the program (Shao, Müller and Turner, 2012). Program management, as the centralized management of a group of interrelated projects, provides the governance for the individual projects in the program. The program manager acts as the owner or sponsor of these projects. He or she takes on the roles of sponsor and steering committee as described above.

PROJECT/PROGRAM/PORTFOLIO MANAGEMENT OFFICES, PMOS

PMOs vary widely in their charters and levels in the organizational hierarchy. Research by Hobbs, Aubry and Thuillier (2008) showed that the best performing PMOs (about 30% of all PMOs) work on maturing project management and setting the infrastructure for projects to be successful. These PMOs typically oversee many projects and are responsible for the majority of project managers in an organization (Hobbs, Aubry, and Thuillier, 2008). Most PMOs govern through a surveillance role over projects and project managers, for example by deploying methodologies or other practices and providing associated

training and controlling for compliance. These PMOs often collect performance data of projects and feed them back to portfolio management in the form of monthly reports. In addition to that some PMOs provide consulting services by managing other organizations' projects. Some organizations add a third role which is to use PMOs to partner with project managers in a way that allows for knowledge sharing and exploration of new knowledge and ways of working (Müller, Aubry, and Glückler, 2011).

PMOs are not static entities; they change frequently in charter and scope of work. Research showed that changes in PMO charters are triggered by organizational issues and that through these changes PMOs solve the issues by impacting practices in portfolio management and project management methodologies, the collaboration, accountability and skills of resources in the organization, as well as the work climate in general (Aubry, Hobbs, Müller, and Blomquist, 2011). Through the above PMOs execute clan control, which supports the organizations' preference for either behavior or outcome control.

The above shows that the governance roles of PMOs are manifold and dependent on the peculiarities of an organization.

MIDDLE MANAGERS

The role of middle management in the governance of projects is in the improvement of effectiveness, efficiency and in coordination. This can be ex-ante as well as ex-post project start. Effectiveness in project governance is hereby increased by careful business planning for anticipated projects and programs, identification of business opportunities and identification of troubled projects. Efficiency in governance is supported through project and program plan reviews, as well as by conducting reviews and handling of issues, coaching of project managers and general process improvement. Increased coordination is achieved through timely resource planning and procurement, identification of synergies across projects, participation in steering committee meetings and transparency in reporting project status and issues (Blomquist and Müller, 2006b).

The role of middle managers in the governance of project management includes the development and provision of the required quantity and quality of project managers. That includes decisions on the skills levels, experience levels, certification and so forth needed for the successful management of projects, in line with the organization's maturity in project management.

A FRAMEWORK FOR GOVERNANCE OF PROJECT MANAGEMENT

Guidelines on governance of projects and their management have been developed in recent years. They can be grouped in top-down and bottom-up approaches to governance. Top-down approaches address governance from a corporate perspective, for example, from the perspective of SOX compliance. This approach is used by the Association of Project Management (APM) in their Guide to Governance of Project Management (APM, 2004). Bottom-up approaches address governance from a project management perspective by extending existing project management methodologies such as PRINCE2 (Office of Government Commerce, 2009), into the realm of project governance. Both approaches are described below.

The APM Guide to Governance of Project Management

This guideline addresses the directors' tasks and responsibilities without prescribing the application of specific processes and methods. Governance is seen as a flexible and intelligent application of a set of principles, together with delegation of responsibility and use of control systems. Governance is addressed along four different dimensions:

1. *Portfolio direction effectiveness and efficiency*: ensuring that all projects within the portfolio are identified and are consistent with the organization's aims and constraints.
2. *Project sponsorship effectiveness and efficiency*: ensuring the effective link between senior executives and project managers. This is done by empowering sponsors with decision making, directing and representational accountabilities.
3. *Project management effectiveness and efficiency*: ensuring that project teams and their managers are trained, well equipped and sufficiently experienced to achieve project objectives.
4. *Disclosure and reporting*: ensures reliable decision making processes through timely, relevant and reliable information.

This guideline lends itself to projects governed by outcome controlled paradigms.

OGC Guidelines for Managing Successful Projects (MSP)

This approach builds on PRINCE 2 (Office of Government Commerce, 2009). Governance is not explicitly outlined as a function, but implied in the process and control structures. It is a bottom-up approach, as it widens the scope of the existing methodology and introduces governance features into the methodology. Opposite to APM this guideline is prescriptive in its suggestions for governance at different levels, including:

1. *End-of-stage reviews*: including details on when and how to conduct these reviews, questions to ask and decisions to be made.
2. *Benefits management*: process and tools for development of business opportunities, launch of projects and control of their implementation, as well the assessment of the expected benefits from the project's outcome.
3. *Senior manager roles*: their relation and involvement in planning and management of successful projects.

This guideline is best used in projects governed by the behavior control paradigms.

HOW MUCH PROJECT MANAGEMENT IS ENOUGH?

How much investment in better project management practices should organizations make? The economic answer would be until each pound invested in better project management yields less than one pound in improved project results. However, this is of little practical use. Research on the organic growth in project management capabilities showed there are approaches with small, medium and high investments that yield respective results in better project management. One of these approaches is described

Step	1	2	3
What <u>can</u> be done Education	Methodology use and basic training	Certification	Advanced training and Internal Certification
What <u>should</u> be done Management demand	Steering Committees	Project Management Office (PMO / PSO / PO)	Benchmarking
What <u>is</u> done	Audits / reviews	Mentor programs	Maturity Model

Figure 30.3 Migration framework for project governance

as the Governance Framework for Project Management (Müller and Stawicki, 2007). It builds on the balance of three perspectives:

Project manager education and experience: this determines *what can be done* by project managers in terms of good project management. More education and experience increases the chances for good project management.

Demand from managers of project managers: this determines *what should be done* by project managers in order to deliver good project management practices. Managers of project managers who insist on good project management practices increase the chances of good project management delivery.

Organizational pressure: this determines *what is done* by project managers. This is a detrimental force. Too much pressure leads to decision making in projects that may help the project in the short term, but are detrimental for the organization in the long term.

Figure 30.3 shows the framework.

Each step provides a balance of the three perspectives, *what can be done*, *what should be done* and feedback from *what is done*. Therefore it is important to implement all measures of one step and not mix measures from different steps.

Step 1 is appropriate for organizations whose business depends relatively little on good project management, such as process oriented organizations, like manufacturing plants, which use project management mainly for internal projects. This step involves the adoption of simple project management methodologies and the training of project managers in their use. Feedback on the efficient use of the trained practices should be obtained through audits and reviews of projects. Organizations implementing the measures of Step 1 invest relatively little in project management governance, but receive first returns through a more structured way of managing projects.

Step 2 is appropriate for organizations with a medium level of dependency on good project results, such as organizations which deliver parts of their products or services to their customers in the form of projects. Organizations adopting Step 2 measures should have all Step 1 measures already in place, and implement Step 2 measures on top.

These include certification of project managers, like PMI PMP or IPMA Level B certification to raise the education level. Establishing a PMO will allow the handover of maturing of project management to the PMO. The PMO's surveillance will encourage appropriate project management practices from the project managers. Finally mentor programs for younger project managers will allow for knowledge sharing from senior to junior project managers and improve the actual practices in the management of projects. Investing in Step 2 measures requires a stronger financial commitment by the organization. The three measures are costly, especially the establishment of PMOs, but have the potential to yield good returns through improved project results.

Step 3 is appropriate for organizations that want to be the leader in their field. These organizations assume that gradual improvement cannot outperform competition, therefore leapfrog improvements are needed. This is appropriate for organizations whose business is strongly dependent on project results. Step 3 requires the measures from Step 1 and Step 2 to be in place with Step 3 measures implemented on top. Advanced training and internal certification builds on existing certification, but requires in addition an understanding of sector or industry specifics, understanding of the technology used within projects, and evidence of successful application of accepted project management practices. This increases the education of project managers. Benchmarking of the organization's project management capabilities helps identify their strengths and weaknesses relative to competitors and other industries. This sets the bar for the demand for better practice. Project management maturity models, such as PMI's OPM3, allow the assessment of the organization's project management (or even portfolio and program management) practices, and identifies areas for improvement. Investments in Step 3 measures are costly, but have the potential to improve project management practices significantly, and thus yield the highest returns from better project results.

This framework is not a maturity model. Not all organizations should implement Step 3 measures. Instead, organizations should carefully invest, starting with Step 1, and assess their improvements in project results. Building on these results and their particular dependence on good project results they may consider an investment in Step 2. After assessment of the results from Step 2 and in the case of high dependency on good project results, an investment into Step 3 might be considered. Most organizations, however, will best remain at Step 1 or 2, because Step 3 measures are not appropriate for their business.

Linking Corporate Governance, Governance of Projects and Governance of Project Management through the Governance Paradigm

This chapter started by modeling the corporate governance and organizational control approaches into four distinct governance paradigms for projects and project management in organizations. Then the institutions involved in the governance of projects were introduced together with their roles and objectives. A framework for governance of project management was introduced through a three step model for organizations with different dependencies on project results. The remainder of this chapter links together corporate governance, the governance of projects and the governance of project management through the project governance paradigms (Figure 30.4).

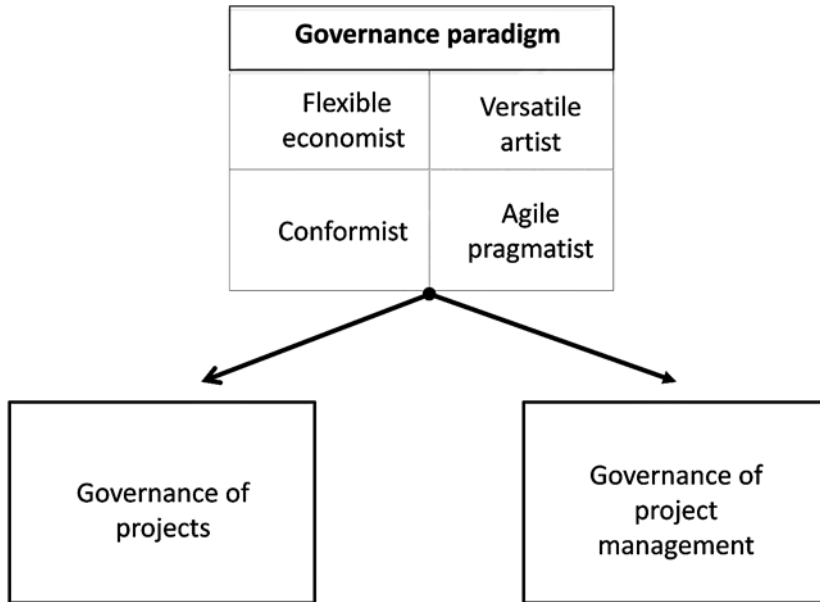


Figure 30.4 Linking governance of projects and project management through governance paradigms

The project governance paradigms represent the combined corporate governance approach and organizational control approach. Each of the four paradigms sets the values, focus and expectations for a particular project governance approach. These can be shareholder or stakeholder orientation in project execution as well as outcome or behavior orientation in the control of project managers.

Each of the four paradigms influences the governance of projects and project management differently. The shareholder to stakeholder orientation influences the decision making in portfolio management, where shareholder oriented organizations will prioritize projects which maximize ROI for shareholders over other projects. Similarly, the corporate governance orientation influences objective setting and control of steering committees and program management and the nature of training and support provided by PMOs and middle managers. The preference for an outcome or behavior approach to organizational control impacts the governance of project management. Behavior controlled organizations will most likely emphasize Step 1 and 2 measures, such as methodology compliance, deployed and supported through a PMO. Outcome controlled organizations still provide methodologies and PMO support, but emphasize Step 3 measures that support the autonomy of projects and their managers, such as benchmarking and maturity models, which do not prescribe specific behaviors but focus on the wider objectives of the organization.

The following describes a possible scenario for each of the four governance paradigms:

The *conformist paradigm organization* is a technology-based firm which emphasizes development processes over management processes. Directors position the company as a technological leader in a niche market. Project management is a by-product of the technology development process, which is strictly enforced and forms the backbone of the

organization's practices. Portfolio management prioritizes repetitive projects due to the cost savings emerging from the application of existing processes. The Steering Committee and PMO focus on process compliance. Middle managers build pools of specialized technical experts, trained in the required development and maintenance processes for the organization's products. Governance of project management comprises Step 1 measures, which emphasize process and methodology compliance. This paradigm is also found in larger organizations, for example in the governance of quality improvement projects that follow a six-sigma approach. Project management is implied in the repetitive use of the six-sigma process.

The *flexible economist paradigm organization* focuses on delivery of projects within cost boundaries. Examples include software development projects based on fixed price contracts. Directors position the company as competitive and specialized in their field. Portfolio management prioritizes projects that leverage existing knowledge and experience in order to minimize cost risks. Steering committees and middle management focus on meeting customer expectations at lowest level of effort, and the PMO trains and consults on a variety of different project management methodologies. Governance of project management includes Step 1 and Step 2 measures, balancing process compliance with process choice.

The *versatile artist paradigm organization* is a project management consulting firm. Directors position the company as a flexible and creative 'problem solver' for non-repetitive projects. Portfolio management prioritizes a heterogeneous set of projects in high technology or high risk environments, where the project teams can use their creativity and experience to balance a diverse set of requirements from a number of different stakeholders. Steering Committees and Middle Management focus on stakeholder satisfaction. Project managers tailor methodologies to the requirements on hand. The PMO shares and distributes knowledge across the boundaries of project teams.

The agile *pragmatist paradigm organization* delivers product functionality over time. Directors position the firm as a flexible development organization which provides business value by delivering required functionality when needed. Portfolio management prioritizes projects that allow for incremental delivery of functionality, such as software applications or release management. Steering Group and Middle Management focus on process compliance, often using Agile/SCRUM or similar methods. PMOs are rarely found in these organizations.

Concluding Remarks

This chapter described the link between corporate governance and project governance through four distinct paradigms. Each of these paradigms sets different boundaries and expectations for the management of projects and project management governed through it. The institutions for governance, their roles and goals were described and a framework for the governance of project management was described. The chapter finished by describing the role of the governance paradigms in linking corporate and project governance, as well as in defining the nature of the tasks and focus areas of the institutions for project governance, and in defining the extent to which project management is done within the organization.

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The Project Management Office: Building a PMO for Performance

MONIQUE AUBRY AND BRIAN HOBBS

Project Management Offices (PMO) do not exist for their own sake; otherwise their existence would be a temporary fad. So why have PMOs emerged recently? To answer this question, we suggest turning to macro-economic issues will provide an initial part of the answer. PMOs have been around since the mid-1950s, but they really started spreading in the 1980s with the expansion of the international market, and more particularly the strong competition from new production capacity in emerging countries. A consequence of this intensive competition on organizations was the pressure to innovate and accelerate the pace for new products. Indeed, to succeed in this macro-economic context, most organizations adopted a strategy of growth, development and innovation. Numerous projects were undertaken in organizations as a means to implement such aggressive strategy. Before the 1980s, projects existed but their number did not justify the use of specific mechanisms to deal with multiple projects. Usual coordination and control mechanisms for individual projects were sufficient to align projects with the strategy and to ensure a correct level of coordination and control over each of them. But these mechanisms are no longer able to support the large number of projects going on, especially given the structural arrangements such as matrix types. New management needs emerge and an organizational way to respond was to implement new activities dealing with multiple projects and provide new coordination mechanisms. Specific activities that deal with multiple projects are program management, portfolio management, project governance and so on. In this context, PMOs can be seen as a locus of coordination emerging from the need of dealing with multiple projects. PMOs are often institutionalized entities when they are part of the organizational chart.

This chapter is built on the results of research undertaken since 2004 at the University of Quebec at Montreal (Hobbs and Aubry, 2010; Aubry et al, 2011). The results are presented in a practical format so they can be useful in answering various questions on PMOs, more specifically in the context of implementing a PMO or reviewing its mandate. We have adopted a very generic approach to PMOs where they could be dedicated to multiple independent projects, programs or portfolios. PMOs dealing with a single project were excluded from our research. The first part of our research on PMOs involved a survey for which we received more than 500 responses (Hobbs and Aubry, 2010). This provided evidence-based results on the diversity of PMOs and the difficulty in finding a typology to classify them. Given the wide variety of PMOs found in reality, we adopted the generic definition from the Project Management Institute (2008):

[A PMO is] an organizational body or entity assigned various responsibilities related to the centralised and coordinated management of those projects under its domain. The responsibilities of the PMO can range from providing project management support functions to actually being responsible for the direct management of a project. (p. 443)

It is not essential that this entity be called a 'PMO'. In our survey, 41% used a different name. The Office of Government Commerce (2008) in its name emphasizes that the offices have project, program and portfolio roles. However, what is essential is that activities that deal with multiple projects in organizations are carried out in a coherent way.

Descriptive Model of a PMO

Facing the wide variety within the population of PMOs and the lack of one 'best PMO', we are proposing to work out the PMO design as a construction process in which a set of distinct components are carefully chosen and joined together in such a way that the overall project management structure is well aligned within a specific context. This construction approach highlights the importance that the PMO designer understands the current context of the organization as well as any past experiences with the PMO in order to set up a PMO that will significantly contribute to the organization's strategic goals. Figure 31.1 illustrates the PMO model that we are suggesting and situates the PMO designer role as being an active player in this process. In this model, the description of a PMO contains two major parts: the PMO context; the description of the PMO entity.

The context is of prime importance when dealing with any organizational challenge. In the particular case of a PMO, the variety is so great that no strict rules exist to determine the *right* PMO. With this approach, the *right* PMO is more likely to be the one that best fits the overall organizational context. There are two groups of components for capturing this context: the organizational context and the type or types of projects undertaken within a particular organization (see Table 31.1).

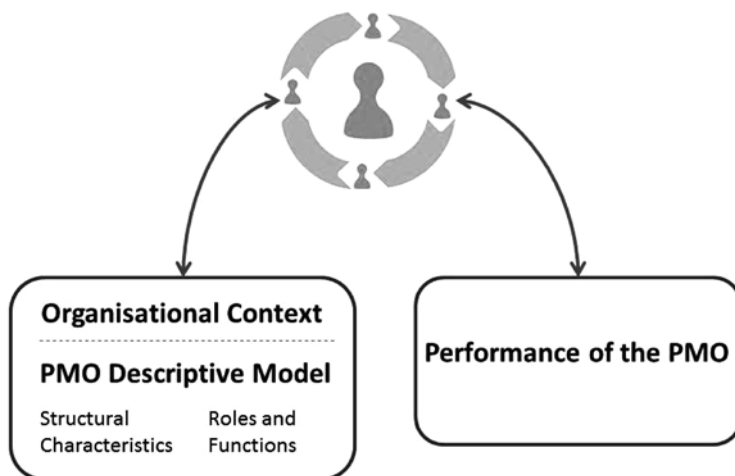


Figure 31.1 Modeling PMO for performance

Table 31.1 Components of the PMO context

PMO Context
<p>A: Organizational context</p> <ul style="list-style-type: none"> • Economic sector • Public or private • Size of the organization • Structure: percentage of resources that report to the same manager as PMO manager or that are matrixed throughout the organization • Internal or external project clients • Single or multiple project clients • Level of organizational project management maturity • Supportiveness of organizational culture
<p>B: Type of projects in the PMO mandate</p> <ul style="list-style-type: none"> • Scope expressed as the average number of people working on projects • Scope in terms of duration • The type of product or service delivered • The primary performance criteria of the PMO's projects • The inclusion of post-delivery activities within project scope • Involvement in outsourcing contracts

Each component should be worked out in order to provide a good understanding of the context in which the new or changed PMO will evolve.

THE PMO CONTEXT

An Organizational Context

The organizational context takes into consideration the internal environment in which the PMO evolves as well as situating the organization in its particular economic context. The size of the organization is more likely to influence the size of the PMO and the number of services it offers. Of particular interest is the case of very large international companies having multi-layered hierarchical organizations, where, the PMO should be positioned within the overall organization and its size should reflect the clientele it serves. Yet, the size of the PMO should be in relation to the size of the regional- or local-level organization. The organizational structure under which projects are mostly carried out is of prime importance for providing coordination mechanisms that fit the need of multidisciplinary contributions to projects and that reflect the internal power system. The matrix structure has a lot to do with political tensions or issues arising between functional and project strategy or priorities. The organizational context relates strongly to the project clients. A major distinction between organizations dealing with projects is based upon delivering projects to internal clients within an organization or to external clients.

Examples of PMOs delivering projects to internal clients can be found in bank business units where final customers are represented as clients of projects by marketing internal services. However, consulting companies (e.g., engineering, information system and technology) are mostly dealing with external clients. In the same vein, whether projects under the PMO mandate are delivered to single or multiple clients may influence the PMO design reflecting the quality of the relationship between PMO and project clients.

The two last elements in the organization context are of special interest since they both may lead to major consequences on PMO performance (see the following section on PMO performance): level of organizational project management maturity; supportiveness of organizational culture. Another item to take into consideration is long-term transformation. A PMO mandate will clearly not be the same during a high level of maturity in the project management context compared with a low level. But, in addition to this ad-hoc observation, the PMO more often is identified as the change agent to sustain a good maturity level or to make it grow. Indeed, when designing a PMO, it does not suffice to measure the maturity in project management at a single point in time; it also requires envisioning the future. The same approach applies to the supportiveness of organizational culture. As mentioned in the introduction, projects are the means to implement the strategy of the organization. A PMO can directly play a role in reaching strategic results depending on its mandate, but also based on the support from the higher organizational level.

Acknowledging the current organizational context is of prime importance when dealing with PMO design. However, this construction process should also include a vision of the direction in which the project management maturity and supportiveness of the organizational culture is to go. As a result, the PMO mandate will then be well embedded in the organization.

Type of Projects in the PMO Mandate

Despite the fact that the overall organization provides the context in which a PMO will evolve, types of projects within its mandate may also provide a good understanding of its internal context. The scope of projects differs greatly and distinguishing PMOs between the ones dealing with numerous small projects from the ones dealing with few large projects might be particularly useful in organizations where both types of PMO exist. This differentiation is often associated with project management granularity. For example, in many organizations, we find PMOs that are responsible for all major strategic projects or projects that are valued at over a certain limit of money. In such cases, rigorous methodologies and governance rules are strictly applied. However, it is not rare to observe PMOs in the IT Department, for example, dealing with hundreds of small projects where they follow a lighter agile-oriented methodology with frequent control mechanisms.

PMOs can also be described by looking at what the final product of the project is under their mandate. This nuance distinguishes between the organization's primary activity (e.g., aerospace, healthcare, telecommunication, video games, financial) and the role of the PMO (e.g., planes, engineering components, software, services, processes). Given the specific projects under the PMO's mandate, what are the primary performance criteria? This element provides an opportunity to discuss and acknowledge what results are expected from the PMO, and particularly from the projects under its mandate.

The PMO is an organizational entity, and, as such, is often considered as an avoidable overhead cost. Searching for value is often at the heart of research on PMOs, and, as of now, no clear answer has been found, certainly not in terms of return on investment (ROI). What remains of prime importance is to create a dialogue with the major PMO stakeholders and to make it clear what is expected from the PMO, and what will be considered as a success. This dynamic approach to PMO performance applies to the overall PMO and to each of the projects under its mandate. Performance criteria on projects may be categorized in two basic areas: project management criteria (e.g., scope, time, costs) and business criteria (benefits).

One main characteristic of projects is their lifecycle. PMOs can provide their services to the overall project life cycle, or they can be specialized in specific stages or phases or projects. Some PMOs include in their mandate the post-delivery activities of projects. This is of particular interest for ensuring a smooth transition from the project to operations, and more specifically to provide a platform for benefits management. Lastly, some PMOs are involved in outsourcing contracts. This is more likely to happen when an organization adopts a procurement strategy of buying project management services. In this particular situation, the PMO manages a collection of contracts by providing a global framework in contract management and control mechanisms with their providers.

DESCRIPTION OF THE PMO

The description of a PMO is based upon two sets of components: its structural characteristics and the functions it performs (Table 31.2).

Table 31.2 Components of the PMO description

PMO Description
A: Structural Characteristics
1. The name used to identify the PMO;
2. Time to implement the PMO;
3. Location within the organizational hierarchy;
4. Relationship(s) with other PMO(s) in the same organization;
5. Size of the PMO: staff other than project/program managers: <ul style="list-style-type: none"> • Experience of the staff; • Professional background of the staff; • Presence of business analysts or business architects among the staff.
6. Size of projects: size expressed as the average number of people working on projects (this characteristic is also use to describe the type of projects within the PMO mandate);
7. Age of the PMO;
8. Percentage of projects within the mandate of the PMO;
9. Percentage of project managers within the PMO;
10. Decision-making authority of the PMO;

11. The status of the project management methodology:
 - Home-grown or brought in from outside;
 - Use is compulsory or discretionary;
 - Degree to which methods are actually followed.
 12. The adequacy of funding of the PMO;
 13. The means of funding including the billing for services.
-

B: Roles or functions

1. To monitor project performance;
 2. To be accountable for project performance;
 3. To develop and implement standards;
 4. To develop the project management competencies on personnel;
 5. To manage multiple projects;
 6. To implement strategic management;
 7. To ensure organizational learning;
 8. To manage customer interfaces;
 9. To recruit, select, evaluate and determine salaries for project managers;
 10. To carry out specialized tasks for project managers.
-

The former aims at describing the PMO entity in more depth while the latter focuses on what is part of its mandate in terms of actions that are really to be undertaken. In other words, the descriptive model of a PMO serves as a detailed definition of what a PMO is (structural characteristics) and what it is doing (roles or functions). Each element must be taken into consideration in the process of constructing or renewing a PMO mandate. The presentation of a model in a book is necessarily linear. But attention should be given to the fact that decisions on the PMO's structural characteristics and functions are part of a very dynamic process, which overall should fit well with the organization.

Structural Characteristics

Globally, there are 13 main structural characteristics that serve to describe a PMO. First of all, an entity dealing with multiple projects does have an identity, and, depending on the internal culture or previous experiences, the name of the PMO might not suit the situation. However the name should translate the mission of this entity and be understood by its stakeholders. The time to implement should be taken into account since it may create impacts on the internal relationships and on the overall power system. A PMO does not work in isolation, and implementing a PMO should be managed as any other organizational project. The decision on the location of a PMO in the organization structure is of prime importance since it influences the coordination and control mechanisms, as well as the knowledge networks. We suggest taking into consideration three dimensions: vertical, horizontal and network. The vertical dimension dictates the place of the PMO within the hierarchy and provides the control line of management. The horizontal dimension usually has to do with the content of the projects to be included

in the PMO mandate. The network dimension provides coordination mechanisms to facilitate the creation and distribution of knowledge within the organization. This last dimension includes the relationships with other PMOs, if multiple PMOs exist in the same organization.

The size of the PMO is defined using two main characteristics: staff and the size of the projects under its mandate. For the purpose of this research, PMO staff excludes project or program managers given they are involved in the direct management of projects and programs. The focus of this research is on other PMO functions. Three sub-characteristics complete the description of the PMO's staff. The quality of the PMO personnel may impact PMO performance, and therefore, attention should be given to the HR dimension in terms of experience in project management and pertinent background. Presence or not of business analyst or architect provide an additional descriptive consideration for a PMO.

It is widely recognized that PMOs change frequently or evolve. Structural characteristics include the age of the PMO and its history. Knowing the PMO history provides the opportunity to learn from previous experiences, both good and bad. This is the only way to turn toward the future with in-depth context knowledge. As mentioned earlier, the PMO should fit with the organizational context. Yet, it is of prime importance to acknowledge changes in the context (internal and external) that may lead to a PMO transformation.

The next two characteristics aim at defining the relative importance of the PMO mandate as related to the entire number of projects and project managers within the organization. These decisions basically serve to categorize the global project portfolio of the organization and to balance project responsibilities throughout the organization. After this is the decision-making authority characteristic, which must be aligned with the matrix structure (within the organizational context) and the distribution of power between functional and project units.

The status of the project management methodology is a PMO structural characteristic. The presence of a PMO usually provides some formalization of project management within an organization. This formalization is often visible within project management methodology. Different strategies can be used to formalize more or less the use of a methodology. This model includes three sub-characteristics to define it. A decision has to be made as to whether the methodology will be home-grown or brought in from outside. The impact of the commitment to this methodology should be taken into consideration. Then, the question is whether the use of it is compulsory or not. If it is compulsory, then what would be the consequences for those who do not use it? An initial reflection on this particular item should include the impact on project management innovation. As in any other field, too much control will result in a reduction in new ideas, creativity and innovation. Secondly, a single 'one-size-fits-all' approach is not likely to support projects of differing scope and size, particularly when using the agile approach.

The last two characteristics deal with PMO funding. These should be taken seriously since the costs of the PMO are often mentioned as a reason for a PMO to change. An operational budget should be established (as in any other unit) based on the functions to be performed and sources of revenue should be identified. One option is to bill for services. Any decision will likely have desirable and non-desirable impacts on the use of PMO services. Trade-offs should be made in light of the specific context in which the PMO is implemented.

Roles or Functions

As we said at the start, a PMO does not exist for its own sake; otherwise, it would quickly become a temporary fad. Management of multiple projects needs specific activities to be undertaken and coordination mechanisms to be put in place. A PMO performs some of these activities and mechanisms. We suggest a list of 10 different functions (Table 31.2). Not all are compulsory in any specific PMO, even though research shows that a PMO performing more functions is more likely to be perceived as performing better. The choice of a set of tasks is dictated by the specific organizational context as well as the objectives to be attained.

Together functions of monitoring and controlling project performance are the most important functions. These functions include:

- Reporting project status to upper management;
- Monitoring and controlling project performance;
- Implementing and operating a project information system;
- Developing and maintaining a project scoreboard.

Almost all PMOs are involved in some level of monitoring, while controlling is more likely reserved for the PMOs that incorporate decision-making authority. While these functions are of great importance for the success of projects, care should be taken to avoid hyper-control over projects. This can be done by taking an overall view at *who* will be monitoring and controlling projects, and *how* projects will be monitored and controlled.

Developing and implementing standards in project management form the third function. This function includes:

- Developing and implementing a standard methodology;
- Promoting project management within the organization;
- Providing a set of tools without standardization efforts.

This function refers to the formalization of a project management methodology, tools, processes and templates. All these components should be scalable in order to be adapted to a variety of projects. Their development and implementation should be considered as a real project, including stakeholders' commitment and change management.

The fourth function includes developing competencies in project management, including:

- Developing competency of personnel, including training;
- Providing mentoring for project managers.

This is done through formal training, but also using more dynamic approaches such as mentoring. Both approaches are complementary. The former provides general knowledge to a group of learners. The latter has the advantage of giving answers to a situation by directly transferring knowledge from an experienced person to a newcomer. This is very much in line with the community of practice approach.

The fifth function relates to multi-project management, including:

- Coordinating between projects;
- Identifying, selecting and prioritizing new projects;
- Managing one or more portfolios;
- Managing one or more programs;
- Allocating resources between projects.

Targeted PMOs in this chapter deal with multiple projects, but not all of them have direct responsibilities in their management. When they do, they are more likely named after these responsibilities, such as Program Management Office or Portfolio Management Office.

The sixth PMO function is strategic management, and includes:

- Providing advice to upper management;
- Participating in strategic planning;
- Managing benefits;
- Carrying out networking and environmental scanning.

Strategic thinking may apply to all organizational activities (such as project strategy). But what we are referring to here is the organization strategy responsible for its global orientation and decisions regarding investments. The strategic process cycle varies from one organization to the other but basically involves an intense process once every three to five years, and then an annual one to revisit and adjust the plan. Projects are the means to implement the strategic plan, and, as such, a PMO dealing with multiple projects may significantly contribute to the strategic planning process, but also to managing the benefits from projects. Projects are temporary, and benefits often materialize after projects have been completed. The PMO is a good choice for keeping track of benefits, as well as strategic objectives.

The seventh function is organizational learning, including:

- Monitoring and controlling the performance of the PMO;
- Managing archives of project documentation;
- Conducting post-project reviews;
- Conducting project audits;
- Implementing and managing a database of lessons learned;
- Implementing and managing a risk database.

Since projects are temporary endeavors, there are many challenges regarding knowledge management for PMOs. The PMO should play an active role in accumulating and disseminating knowledge on project management. This will prevent reinventing the wheel for each project. Included in this function is the management of the PMO performance itself. It emphasizes the importance of identifying clear PMO performance indicators (see the section below on performance). Organizational learning may also build on means other than the ones identified in the list above. Not only should formal and explicit knowledge be encouraged, but informal and implicit types of approaches should also be used, such as community practices.

The management of customer interfaces is the eighth function. It covers the PMO's activities regarding the project customers. These activities could take the form of a steering committee, experimentation and so on. However, whatever the form, the main thing is to ensure a communication link with the project customers.

The ninth function includes operational human relations management (HRM) with project managers: recruiting, selecting, evaluating and determining salaries for project managers (Turner et al, 2008). In most organizations, the HRM Department is involved in this function. The PMO often has to take an active role jointly with the HRM Department (Keegan et al, 2012). The PMO can also go beyond the operational function to be involved in a more strategic one, such as defining project management profiles for the future or developing a career path for project managers.

Lastly, carrying out specialized tasks for project managers is the tenth function. Depending on the need, a PMO can support project managers in a variety of tasks, such as scheduling, estimating and so on.

In conclusion, PMOs represent a wide variety of entities. There are many different characteristics from which a PMO can be built. Our model highlights the importance of the organizational context. But more than this, it also shows the importance of the PMO design process and the role of the designer.

Performance of a PMO

A major challenge facing most PMOs is that they are asked to provide evidence of value, and, quite often, this value should be expressed in terms of ROI. Evaluating the value of the *product* of a project (physical product, process or services) in terms of ROI is usually possible to do. What is very difficult is when these types of calculation apply to management. Thomas and Mullaly (2008) have shown in 65 in-depth international case studies that this ROI approach is almost impossible given the time it would require to implement it with reasonable reliability (Chapter 4). This leads to a quest for other ways of providing evidence of PMO performance.

VARIABLES THAT PLAY A ROLE IN THE PERCEPTION OF PERFORMANCE

In our research, we have explored the contribution of the PMO to project or program performance. Not all individual elements that serve in describing a PMO (as in Table 31.1 and Table 31.2) play a crucial role in determining the performance of the PMO, but some are directly related to it (Table 31.3).

Table 31.3 PMO Design elements to take into consideration for performance

Organizational context	• Project management maturity
PMO characteristics	• Percentage of projects
	• Decision-making authority
Roles or functions	• Total number of functions

Attention should be paid to these specific elements when designing any particular PMO. However, caution should be taken when interpreting these results since, combined, they only explain 27% of PMO performance.

Not surprisingly, a high level of project management maturity is more likely to lead to better performance. In this situation, good project management practices can be repeated to ensure long-term project success. A higher percentage of projects (and also of project managers) within the PMO mandate is related to better performance. Confidence in the positive role of the PMO often translates into more responsibilities given to the PMO in terms of number of projects. The PMO's high level of authority also has a positive impact on PMO performance. Lastly, the more important functions a PMO has in its mandate, the more it will be recognized as showing good performance. To this last point, however, there is a strong limitation depending on the staff of the PMO. Not all functions can be undertaken with limited staff.

EMBEDDING THE PMO IN THE ORGANIZATION

On top of the PMO context, characteristics and roles or functions, there are other elements that have an even more important impact on PMO performance. We have labeled them together as embeddedness of PMO within the organization (Table 31.4).

Table 31.4 Components of embeddedness for PMO performance

The PMO's mission is well understood
Collaboration with other project participants
Recognition of the PMO's expertise
Support from upper management

Embeddedness is used in the managerial literature to describe the close involvement of the PMO in its parent organization. These elements combined are twice as important as the former approach, since they explain 47% of PMO performance. It does not suffice to design the right PMO; this PMO should be embedded in the organization.

There are four components of embeddedness. The first one refers to the establishment of a clear mission when implementing a new PMO or transforming an existing one. This takes time and intense discussion between major stakeholders, basically the functional managers. After this, efforts should be made to communicate the PMO mission to a larger community. Knowing about the PMO mission does not happen by simply writing down a mission statement. It requires actions of communication. Second, collaboration with other project participants highlights the facilitator role of a PMO rather than being in the middle of tensions or conflicts. Third, the recognition of the PMO's expertise is a central point. It too often happens that PMO staff is made up of good people, but they do not have sufficient expertise in project management and applying the related knowledge within a specific domain (e.g., engineering, IT). Lastly, as in any other organizational project, support from upper management impacts PMO performance. This means that continuous efforts should be made to sustain the interest of upper management in the PMO.

Implementing or Transforming a PMO

Implementing or transforming a PMO represents a profound organizational change that may have a significant influence on the perception of its performance. From the survey on the PMO description (Hobbs and Aubry, 2010), almost half of the PMOs had been brought into question during the last year. Legitimacy is the translation of external views of the PMO. Not surprisingly, introducing a PMO has major consequences on the political and power balance within an organization. If this change is not well prepared, it is more likely that some stakeholders may feel as if they were losing some power and may judge the PMO as being very disturbing. That is to say that PMOs in many cases profoundly transform the organization by making project management more visible and more formalized. A lack of legitimacy should not be interpreted as if a PMO were *wrong*. A PMO is a temporary arrangement. Instead more attention should be paid to change management when introducing or changing the PMO. This is a significant organizational change.

REASONS FOR CHANGE

The environment is changing fast, and so do organizations to adapt to these changes. PMOs as dynamic entities move along with the organization. Changes to PMOs happen along the lines of adapting to the external or internal environment (Table 31.5).

Table 31.5 Major PMO change drivers in order of their relative importance

Issues in project management maturity and performance
Issues on project management performance or failures
Issues on portfolio management
Issues on project management standardization
Issues in collaboration and accountability
Change in top management
Issues in the work climate
External events

Other conditions that may lead to changes are the existence of tensions, issues or conflicts. Table 31.5 lists the PMO change drivers in decreasing order of their relative importance. It should be taken into consideration that several of these drivers may occur simultaneously.

IMPLEMENTATION OF PMO TRANSFORMATION

The results of our research suggest that PMO implementation does not receive the level of attention it requires (Aubry, Hobbs, Müller and Blomquist, 2011). Implementing a PMO should be considered as a strategy to deliver benefits from projects, and, as such,

represents an organizational transformation. The following factors are important to consider: change management and time to implement the PMO change. From our survey, 71% of respondents said that the amplitude of PMO change was important, while 50% of PMO transformations were not supported with change management. Not surprisingly, 60% of respondents said that implementation was difficult.

Networks of PMOS

Before concluding this chapter, we want to briefly discuss the multi-PMO environment (Aubry, Müller and Glückler, 2012). When we first initiated the research program on PMOs in the early 2000s, there was a single PMO in large organizations, if it existed. Nowadays, large organizations have formalized their approach to project management by implementing multiple PMOs (or the equivalent) in different units whenever the number of projects or their strategic value justify it (e.g., business, functional).

Thus, the question arises of how can these multiple PMOs work together without reinventing the wheel each time they have to deliver a new process or new tools. We suggest considering PMOs within an organization as a social network adding to the organizational hierarchy. PMOs within this network can act as:

- isolated islands;
- network;
- community of PMOs.

PMOs working as isolated islands develop their deliverables from their own resources without looking at knowledge accumulated somewhere else in the organization and without involving their stakeholders in the development process. In other words, these PMOs re-create the silos that the project management organic approach wanted to break down. Other PMOs form networks together. These networks for the most part replicate the hierarchical structure. For example, the PMO at headquarters is related to PMOs at the regional level, and the regional ones are related to the local level. Relationships are more likely focused on monitoring and controlling projects so the higher-level PMO can gain an overall view of the global situation in the organization project portfolio. Some mechanisms exist between PMOs for interweaving learning, but they are primarily very formal. Other major results are that the central PMO is outside of any network, except for monitoring and controlling projects.

Lastly, PMOs forming communities of PMOs internally aim at involving members in situated learning activities focused on implicit knowledge of *how* to do things and not only on explicit knowledge on the *what*. Using this approach, newcomers to project management learn from more experienced people. The community is opened up to people who have something to do together, whether this person is PMO staff or not. Learning mechanisms in this approach encourage informal relationships, but are based on shared values and commitment.

A 'community-of-PMO' approach requires some slack; in other words, time for resources to build and develop relationships that in turn will serve the organization, create new knowledge in project management, make it available to the rest of the organization and accumulate it in a dynamic way.

Concluding Remarks

In concluding this chapter, the PMO exists for specific tasks. Not only should the technical aspects of PMOs be looked at, but attention should also be given to embeddedness. When examining the community of PMOs, resources should be made available for developing common values and being involved in common situated learning.

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I end with two chapters looking at the history of project management and what we can learn from it.

Chapter 32: The Common Story of Great Projects

In Chapter 32, Dov Dvir and Aaron Shenhar describe research they have done into the management of great projects, projects that were very successful, surpassing all expectations, and having a significant impact on industry and markets. Through their study of these projects, they have identified seven common contributors to their phenomenal success, which they describe.

Chapter 33: Project History: History Meets Projects

In Chapter 33, Sylvain Lenfle and Jonas Söderlund give another view of project history. There are many memes of project management, beliefs about what constitutes good project management which remain untested and unproven. They suggest that by studying the history of where these memes came from, we can begin to challenge them, and understand project management better. They give the example of the Manhattan Project to develop the first nuclear bomb, a successful project, the management of which violated many of the currently held beliefs of project management. A study of the history of project management can help us understand our discipline, how it developed and perhaps challenge some of the deeply held beliefs.

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The Common Story of Great Projects

DOV DVIR AND AARON SHENHAR

Effective project execution is becoming critical to organizational success, yet many projects today are only achieving moderate results and most of them are *not* completed on time and budget, and are not fulfilling their business objectives. From time to time, however, we see a ‘great project’ that stands out, one that surpasses all expectations and has a transforming impact on industry and markets. Out of hundreds of projects we studied, we identified 15 such projects designated as ‘great projects’. In this study we identified seven common managerial elements that seem to have contributed to their outstanding success. While some of these elements have been mentioned before, it appears that the right *combination* of these elements distinguishes between a regular project and a great one. What seems encouraging is that these factors are under management’s control. Our conclusion suggests that organizations may be able to nurture a culture that promotes these elements as part of the company’s way of doing business for better customer satisfaction and project effectiveness.

Introduction

Disarray is a small word for IBM’s position in the important mid-range computer business in 1986. IBM’s market share in the mid-range segment had shrunk to a merely single digit; and its decline was nothing short of shocking. Twenty-eight months later, a relatively small development lab in Rochester, Minnesota was the talk of IBM. A \$1 billion project engaged thousands of engineers around the world in building a 10 million parts machine. The computer, called AS/400, was launched globally in 27 different languages. Within months it became one of IBM’s most successful products ever (Bauer et al, 1992). In retrospect, the AS/400 development effort could be considered a ‘great project’. It was a game changer in the computer industry, and it gave IBM, once again, a competitive edge over its business rivals.

While quite rare, the IBM’s story is not unique. From time to time we witness a project that stands out, often creating unprecedented value to its company and customers, and becoming a legend in its industry. The question is why are these projects so rare or more important, why can’t we make all projects be like them? The motivation for this work emerged during a decade-long research, in which we collected quantitative and qualitative data on hundreds of projects around the world in various industries (Shenhar,

2001; Shenhar and Dvir, 2007). In these studies we looked at projects in their wider sense, namely, as *temporary organizational efforts to introduce change*. This view enabled us to look at a wide range of projects. In addition to new product development, our studies included product and process improvement, construction, IT and other organizational infrastructure, organizational change and reengineering efforts and even marketing campaigns. Such perspective helped us build upon previous conclusions found in various research streams such as, innovation, new product development (NPD), process improvement and the general project management literature. During all this time we were intrigued by a few projects in our database that stood out. We decided to call them 'great projects' and explore further the secrets of their success.

How Great Projects Create Outstanding Impact

Ever since the beginning of civilization, humanity has been involved in large creations that have influenced lives and societies. From the Pyramids of Giza, to the Roman Aqueducts, to the Great Wall of China we have always been fascinated by the ingenuity and creativity of the human mind. But we have also been impressed by the ability to organize, coordinate and execute large collective efforts that involved thousands of people. Today we would call these endeavours projects, and those who left the most enduring impact could be considered 'great projects'.

History behind, we may ask today, when can a modern time project be considered 'great'? To put it simply, a 'great project' is a project that had created an outstanding impact, bringing tremendous benefits to its customers as well as executing organization. In a business context it means that such projects had significantly improved a company's competitive position, changed the basis of competition in the industry and have had a long-term rewarding impact on customers and users. In the public sector great projects substantially enhanced a community's quality of life and significantly contributed to its wellness – whether relating to security, environment, health, aesthetics or culture. To better illustrate the idea of a great project, we present here an example of a recent great project.

In the fall of 2001, Steve Jobs announced that 'listening to music will never be the same again', and for once, the hype was not far short of the mark. He said, 'Apple has invented a whole new category of digital music player that lets you put your entire music collection in your pocket and listen to it wherever you go'. While Apple may not have invented the digital music player or the MP3 standard for digital audio storage, it did turn MP3 players into a new cultural fashion and created a legitimate digital music industry to support it. It also set new standards for product design, ushered in an era of glossy, easy-to-use strokeable technology (Frith, 2007). The iPod was only part of the story: with the simultaneous introduction of its iTunes store, Apple has recreated the way people buy music, influencing the lives and habits of millions. It took Apple only six years to sell more than a billion digital downloads and over 100 million iPods, which made them the fastest-selling music players in history. Apple shipped over 22 million iPods in the first quarter of 2009, making iPod and iTunes responsible for over one-third of the company sales. The iPod's success led later to even greater impact with Apple's introduction of its iPhone in 2007 and iPad in 2010.

As evident from this and similar stories, great projects exist, and while difficult to repeat, they leave an enduring impact on individuals, companies, industries and communities. Such projects sometimes extend the frontiers of science or art, enabling people to adopt new habits, overcome problems impossible to imagine before and create new ways of conducting business. In our study we set the objective of finding out if there are common ingredients to all great projects and what management can do to increase their frequency.

Research Method

In the course of our project management studies we collected data on more than 400 project cases around the world and in various industries. Our case collection included both well-known projects such as Data General's Eagle Computer development or the construction of the World Trade Center in Manhattan and many lesser-known projects, which were not mentioned previously by any public outlet. Out of this collection we searched for projects that stood out in term of their success and impact. Projects would be designated as 'great', only if they fulfilled each one of the following four criteria:

1. The project was a major undertaking of strategic importance to the initiating organization.
2. The project's outcome has contributed substantially, for an extended period of time to the performance of its organization and to the well being of its customers and users.
3. The project was highly innovative from a scientific, technological, design or operational point of view.
4. The project outcome had a major impact on its industry and stimulated others to follow in its footsteps.

We first identified 46 candidate projects that to some extent met all four selection criteria, according to our own judgment. Using a group of five experts who were experienced project managers or executives, we asked them to assess to what extent they agreed with each criterion on a seven-point scale ranging from 'very much disagree' to 'very much agree'. The final list included 15 projects that received a total score of 25 or higher.

For data analysis we used structured content analysis (Jauch et al, 1980). The basic procedure was to develop a coding scheme for systematic conversion of the qualitative descriptions into quantified variables (Bullock and Tubbs, 1987). Each case was analyzed by two or three researchers familiar with project management theory and practice. The researcher was asked to identify the main factors that, in his/her opinion, have contributed mostly to the specific project's success. The factors they identified were also scored by them on a scale of 1 to 5, indicating the level of contribution to the project success as the researcher sees it. Only factors that achieved scores of 4 or higher by all raters were entered into the next phase of analysis. In the second phase a cross-sectional analysis was done by the authors, identifying those factors appearing in at least 12 of the sample projects. Since some of these factors were described in different words, the final step was to give a general common title to each similar group of factors, capturing their essence and uniqueness in a representative sentence statement (Table 32.1).

Table 32.1 Common factors of great projects

F-1 – Creating a unique competitive advantage and/or exceptional value for stakeholders
F-2 – A long period of project definition dedicated to the creation of a powerful vision, a clearly identified need, building a strong commitment by all parties and selecting the best execution approach
F-3 – Creating a revolutionary project culture
F-4 – A highly qualified project leader, who is unconditionally supported by top management
F-5 – Maximum use of existing knowledge, often in cooperation with outside organizations, suppliers and customers
F-6 – Integrated development teams with fast problem solving capability and adaptability to business, market and technology changes
F-7 – A strong sense of partnership and pride

Table 32.2 lists the great projects studied.

Table 32.2 The great projects studied

<i>BMW Z3</i> : stylish, new roadster, developed by BMW in the early 1990s to maintain its leadership in producing superior and exciting vehicles. It was the first BMW produced in the US, and it has surpassed the company's sales expectation by over 50%.
<i>Boeing 777</i> : A twin-engine, wide-body aircraft developed in the 1990s to compete with Airbus A-330 and A-340 aircraft. The project introduced revolutionary practices in airplane design, making B-777 one of the best-selling planes in Boeing's history.
<i>Philips Compact Disk</i> : Developed in the early 1980s in collaboration with Sony. The next generation of music storage devices and players that quickly replaced vinyl records and became the new industry standard.
<i>Apple's Macintosh Computer</i> : Following the success of Apple II computer, the original Macintosh design of the 1980s, has created a new category of easy-to-use computers, which continues to evolve to this day.
<i>Chrysler Neon</i> : A sub-compact inexpensive American car, compatible with foreign manufactured quality, style and price. The car, called the 'ultimate engineering challenge', turned out to be an outstanding commercial success in the 1990s.
<i>Microsoft Word for Windows</i> : A word-processor, which quickly eliminated all competitor products and became the new market standard.
<i>Sydney Opera House</i> : The construction of one of the most famous and spectacular buildings in the world. Millions visit the every year, making it a leading tourist attraction.
<i>Data General's Eagle Computer</i> : The development of the first Eclipse MV/8000 super-minicomputer. It immediately became a great commercial success and prompted a family of industry followers.
<i>IBM 'Silver-Lake'</i> : A new mid-range computer called AS/400, which restored the company's leadership and became one of IBM's most successful products ever.
<i>Apple iPod/iTunes</i> : The development of the first iPod (introduced in 2001) and Apple's iTunes on-line music store, which changed the way people listen and buy music.

<i>The Mall of America:</i> Construction in the early 1990s of the largest retail center in the United States. The new concept of an in-door mall/entertainment complex attracted over 40 million visitors in its first year and has stayed an extremely attractive site to this day.
<i>Atlantic Crossing:</i> The transoceanic optical cable, laid by Tyco Submarine Systems between the US, Germany and the UK. The new cable, launched in the early 2000s had proved to be an outstanding business success.
<i>The WTC:</i> The construction of the World Trade Center in the 1960s, which set the stage for New York City's financial district and transformed lower Manhattan from a manufacturing to a service-based economy.
<i>Kepler:</i> NASA's project, designed to fulfill a long-awaited dream – searching for potential life beyond the solar system. Launched in 2009, the spacecraft is destined to travel for years deep into the Milky Way, looking for Earth-like planets.
<i>MSE (Mobile Subscriber Equipment):</i> An area-switched integrated communication system, designed to replace legacy systems in the US Army division and corps levels. The system built by GTE proved vastly superior to previous generations and provided the base for modernizing army communications.

How Great Projects Look Alike

The great projects in our list (Table 32.2) often pioneered new designs or new applications, built new businesses, and frequently led to future generations and to the creation of enormous economic value. We asked, however, what made them so great, and more importantly, did the management styles of these projects have anything in common?

As we found, there is a common story to great projects. Although different in goals, industries, technologies and uses, the 15 projects in our study were distinguished by a set of seven similar managerial characteristics, summarized in Table 32.1. Table 32.3 shows how each project illustrated each of the factors.

F-1 – Creating a unique competitive advantage and/or an exceptional value for stakeholders: As it turned out, a clear project mission is insufficient. Many projects today, even when they are well defined, are focused on meeting a set of requirements and specifications. What distinguishes a great project from the rest is that its mission is focused on achieving a distinct competitive advantage and exceptional value for its stakeholders. For example, IBM AS/400's advantage was creating a new modular standard in the mini-computer segment; the value of the Sydney Opera House was a unique architectural wonder and that of the Mall of America was its unprecedented size with an attractive theme park in a Midwest cold state.

F-2 – A long period of project definition dedicated to the creation of a powerful vision, a clearly identified need, building a strong commitment by all parties and selecting the best execution approach: Many projects today are being 'rushed' to execution before they are well defined. It seems that such shortcuts may not always be a good idea. As we have seen, it took a long time for each great project to crystallize the product definition and the project's vision in such a way that reflects 'real' customer needs. The extended time is needed to obtain complete buy-in from all stakeholders – partners, suppliers and customers, and finally to select the right project management style. The Atlantic Crossing project, for example had to fill in an immediate gap in circuit demand to Europe; yet, its planning phase consisted of 17 distinct steps; some of them performed long before contract award. The clear definition

of its expected outcome was a major factor in meeting the project's aggressive schedule. Another example was the time it took to create the strategic alliance with eight leading customer airlines for shaping the configuration and defining the requirements of the 777, and for getting organized to manage this project in the more effective way.

F-3 – Creating a revolutionary project culture: The execution of great projects often requires a different culture, which later revolutionizes the entire organization. Working with its partner carriers and a network of suppliers, Boeing created the most user friendly plane ever made. That, along with a new CAD/CAM system, changed the way Boeing designs and manufactures commercial aircraft. The Z3 changed the way BMW builds cars and enabled the company to start manufacturing outside of Germany, and similarly, the AS/400 transformed IBM into a market driven service focused enterprise.

F-4 – A highly qualified project leader, who is unconditionally supported by top management: Not surprising, highly qualified leaders make a difference. A successful leader should have high personal skills, excellent communication qualifications and connections to upper management. In some of our cases the project manager was even a member of the top management team. For example, Tom Furey, the Director of IBM's Rochester Development Laboratory served also as the Silver-Lake project manager. Yet having a great leader is not enough. Almost all projects are often plagued by problems, conflicts and crises. While the importance of top management support was mentioned before as an ingredient for project success, such support must be *unconditional*, even in times of crisis or conflict. In all projects we studied, management's support reflected a strategic decision to continue with the project 'no matter what' until its successful end. A typical example was the Army's MSE project. The Secretary of Defense labelled MSE as one of his high priority '*Defense Enterprise Programs*'. This entrusted in the project team a sense of importance and allowed the Army to implement new streamlined acquisition processes. Bill Gates strongly supported the Word for Windows project until its successful end, in spite of significant problems, frequent redesigns and painful delays.

F-5 – Maximum use of existing knowledge, often in cooperation with outside organizations, suppliers and customers: All successful projects in our sample adopted everything they could, rather than trying to re-invent what was already known. The existing technology was either adopted from previous projects or brought in from the outside. For example, Word for Windows used the existing Word for Macintosh design; Boeing 777 used the CAD/CAM software, purchased from Dassault and the World Trade Center project adopted an Italian technology to cope with reaching bedrock water levels in the Hudson River. Although outsourcing and strategic alliances have become common practices, as Teece (2000) predicted, companies that treated such alliances as long-term strategic investments fared better. For example, Philips, joined forces with Sony to develop the first compact disk and Apple, for its iPod design, had adopted Tony Fadell's technology, developed previously by his company, Fuse Networks and had closely cooperated with PortalPlayer that was working at that time on several 'reference designs' for different digital players.

F-6 – Integrated development teams with fast problem-solving capability and adaptability to business, market and technology changes: As we found, the multidisciplinary structure of development teams and their ability to solve problems just as they were revealed was a key factor in the success. All great projects in our study had the blend of truly diverse teams with representatives from around the company and beyond. When Tom Furey reorganized the AS/400 lab in Rochester, he selected people, not only from engineering and programming, but also from planning, finance, marketing, customer support and

manufacturing. That structure allowed an open, adaptable and fast problem solving capability. Apple has also long learned to engage people from design, manufacturing, software and packaging in an on-going process of product and technology quick adaptation and changes. Its revolutionary scroll wheel technology in its early iPod models was quickly replaced by the newer touch-screen user interface technology in later models, as well as in its iPhone.

F-7 – A strong sense of partnership and pride: A dedicated team working days and nights to overcome obstacles often distinguishes a great project from a regular one. Today, more than 25 years later, the story of Mac's development spirited team still creates interest (Hertzfeld, 2004). More recently, Kepler's team spirit was informal, inspirational, energizing and exciting, and team members were highly empowered to quickly solve complex problems, without too much direction from management (as the next detailed story illustrates).

Table 32.3 Representative citations and quotes from our case database

Project name	Representative role of factors in each project
BMW Z-3	The roadster concept allowed BMW to maintain its advantage as a producer of superior and exciting vehicles (F-1). Apart from the body, the car did not require the development of any new technology (F-5). However from management, marketing and manufacturing perspectives everything about this car was completely new to BMW (F-3). This project was also used to transfer the company's structure from a traditional, individual oriented functional approach to a team-oriented matrix management approach (F-6).
Boeing 777	It took Boeing two years to figure out what customers really wanted an airplane that would fill in the gap between the 767 and 747 and have a unique advantage of efficient longest possible non-stop flights (F-1, F-2). 'Working Together' referred to the new management style that Boeing, its customers and suppliers had agreed to. Under this approach, Boeing established an open relationship with suppliers, customers, in-house teams and the FAA/JAA to foster communication resulting in a commitment to build a quality product (F-3, F-5, F-6, F-7).
Philips Compact Disk	After initially focusing on video reproduction, it took the project seven years until it began to focus on audio (F-2). When Philips searched for an inexpensive laser that would be suitable for its design, Sharp Corporation unexpectedly came out in 1981 with a long life, low-cost laser and was ready to manufacture it to Philip's specifications (F-5). Sony and Philips soon discovered that the two companies had numerous complementary strengths (F-5).
Macintosh	'The purpose of this design was to create a low-cost, portable computer, so useful that its owner misses it when it is not around ... even if the owner is not a computer freak' (F-1). Jobs, along with several early team members truly believed that the concepts of their previous less successful 'Lisa' project could result in a new personal computer that would change the way the world used computers (F-1, F-5). Jobs enthusiastically began leading the Macintosh team (F-4), in early 1981, when the team consisted already of 20 people; the machine was still being defined (F-2).

- Neon The design of a first-rate, compact, inexpensive car, compatible with foreign models, and suitable for foreign markets would be the “ultimate engineering challenge” (F-1). Chrysler borrowed many Japanese techniques when designing the Neon. Engineers drove competitor models and dismantled them. Each part was scrutinized to justify its function and form (F-5). Chrysler adopted a concurrent engineering structure that embraced multi-disciplinary teams from project initiation to completion. This allowed discrepancies in product specifications to be negotiated without the associated costs of engineering changes (F-6). “We had everybody in one place, including engineering, manufacturing, and purchasing.... And communication was excellent” (F-7).
- Word for Windows In September of 1984, Bill Gates ordered the development of a completely new, high-end word processor with the intention that it would become the new standard for the market (F-1). John Hunt, who had single handedly written the code for PC Word, was the project manager (F-4). Word for Macintosh was already a popular product at this time; so it seemed logical to use that as a base for the development of Word for Windows (F-5).
- Sydney Opera House “Nevertheless, as we [the design selection committee] have returned again and again to the study of these drawings, we are convinced that they present a concept of an Opera House which is capable of becoming one of the great buildings of the world. We consider this scheme to be the most original and most creative submission” (F-1). Utzon (the chief architect) desired to use newer building techniques used widely in industrial buildings, such as prefabricating as much of the building as possible, and leaving little work to be done by on-site tradesmen (F-5). The Labor government, standing behind the project, had vetoed all public statements about the construction of the Opera House from being made by anyone except the Minister (F-4).
- Eagle De Castro (Data General CEO and founder) set the flavor for Data General management; he favored competition amongst his engineering teams, fostered initiative, and provided direction while allowing creative people to run with their ideas (F-3; F-4). Down in the Westborough basement, team members would work with limited resources but no distractions. Formal and informal communication was facilitated and encouraged between the Eagle sub-teams, and among managers (F-6; F-7).
- IBM Silver Lake The vision the project manager put forth was that IBM Rochester could become “the undisputed leader of the global mid-range market” (F-1). This was all made possible due to an important transformation to a customer- and market-driven approach from the previous product-driven approach (F-3). For the Silver Lake project, IBM Rochester did something unheard of at IBM; they opened up their doors and welcomed customers and suppliers in house to work side by side with them (F-3; F-5). From the ashes of Fort Knox (a code name for a project meant to enable compatibility between the two existing computer series), arose Silver Lake, which led to the highly successful development of AS/400 (F-5).
- iPOD “Apple has invented a whole new category of digital music player that lets you put your entire music collection in your pocket and listen to it wherever you go” (F-1). Apple wanted Faddel because of his expertise in the burgeoning world of handheld components (F-4). The company had been focusing on the possible elements in a new MP3 player, particularly the brand-new 1.8 inch hard drive made by Toshiba (F-5).

Mall of America	Perhaps the single most unique and effective tool utilized was the common field office, particularly the inclusion of the City of Bloomington's Building and Inspection staff (F-5; F-6; F-7). By placing the major design disciplines and their assigned staff, exclusively dedicated to the project in one location, there would be no need or potential excuse that design team members could not attend an important meeting or that critical drawings could not be received until the next day in the overnight mail (F-6).
Atlantic Crossing	Because of its worldwide visibility, technical leadership, and financial impact, the company has defined Atlantic Crossing to be a project critical to its future success (F-1). Four vice presidents were appointed as the Atlantic Crossing Executive Team. The VPs come from the commercial/legal, marine operations, development, and project management functions (F-4, F-6). Team morale is high largely due to the fact that the team is working on the highest priority project for the organization with the best people. It became one of the highest performing teams in the organization. This is largely due to the handpicked nature of the group (F-7).
WTC	World Trade Department Director Guy Tozzoli was a visionary leader who knew how to manage an enormous project. He let his team make their decisions while guarding the construction project from outside legal and political obstacles (F-4). Vendors were managed using the group of 20 engineers and architects working directly for Malcolm Levy, the Deputy of Design and Construction. These experts worked closely with the contractors to ensure that vendor decisions were most appropriate for this project from the technical and business sides (F-5; F-6).
Kepler	It took more than a decade before the project was finally defined and approved by NASA's top management (F-2). NASA put the entire Kepler team under the direction of Kepler's JPL project manager Leslie Livesay, a seasoned engineer who worked on Mars Pathfinder and was the flight system manager for Deep Space 1 (F-4). Team members have been delegated the authority and allowed to take ownership, which energized them and made them highly committed (F-6; F-7).
MSE	The design and responsiveness of a MSE communications system leads to a "whole new way of doing business" (F-1). It took six years to convince all parties to proceed and to obtain "buy-in" (F-2). The program emphasized reliance on the GTE project management tools (F-5). Top management support was determined to be the most critical factor that led to the overall success of the program (F-4).

A Great Project Story: Looking for Extraterrestrial Planets

Kepler is one of the most technically complex spacecraft NASA has ever built, and the first spacecraft designed to leave the solar system. Named after Johannes Kepler, the great seventeenth-century astronomer who first described the laws of planetary motion, its mission is to search for Earth-like planets that may orbit 100,000 Sun-like stars deep into the Milky Way. Kepler was launched successfully on March 6, 2009 from Cape Canaveral on a Delta II rocket (NASA, 2009). When studying the project during its development phase, we found many of the factors mentioned in this research.

The project started with an idea championed 25 years ago by the principal investigator who was still part of the project team during this study (F-4). It took more than a decade before the project was finally defined and approved by NASA's top management (F-2). The goals and expected value of discovering Earth-like planets

were documented and shared with team members upfront in the project plan (F-1, F-7), and the exciting and inspirational vision was: *'Exploring if there are others like us in the universe?'* (F-2, F-7). The project was organized as a joint effort of three main organizations: Ames Research Center, Jet Propulsion Labs (JPL) and Ball Aerospace & Technologies Corp, who created a unique, 'Keplerian' culture (F-3, F-6). As one of the interviewees said, *'Had we not added JPL to the team, Ames alone would not have done successfully this project'* (F-5). Team members have been delegated the authority and allowed to take ownership, which made them highly energized and fully committed to the project (F-7). Kepler greatly benefited from past projects through a formal process of studying previous projects' lessons learned (F-5). Finally, the Kepler team with its unique partnership culture, when faced some budget increase requirements was able to find innovative ways to solve these problems within the originally approved budget by scaling back some spacecraft testing, reducing schedule buffer and making many other management changes (F-3, F-6, F-7).

Concluding Remarks

This research provides new insights and practical ideas that can be implemented in almost any major project. First, few former studies have looked at what creates an outstanding project success, or what are the common ingredients of greatness in the projects. Second, our view of projects in their wider context enabled us to combine lessons from different scholarly streams. For example, the concept of open innovation (mentioned in the innovation and new product development literature), proved applicable just as well in other contexts, such as construction. Third, several of the factors are completely new: items such as *creating a unique competitive advantage, a long period of project definition, dedicated to the creation of a powerful vision and strong commitment, or creating a revolutionary project culture* have not been mentioned in previous project success factors studies. Additionally, some factors in our study provide a unique angle. For example, what makes a project's vision into a real success factor is the long period of project definition, which is dedicated to securing a strong commitment by all partners. Or as mentioned, a clear mission is not enough; the mission must identify a distinct competitive advantage with the potential of changing the rules of the game.

What makes the list in this study useful is the specific *combination* of factors. For example, managers of great projects understand that their project's mission is *not* just to deliver a product; rather, it is to make a difference and create value for customers. Similarly, having a good project leader is not enough; he or she must have unconditional top management support, and just building a cross-functional team is not sufficient; such teams must learn to work together, communicate well, have a sense of pride and, above all, develop the ability to solve problems quickly.

One of the major benefits of this study may be its contribution to the on-going debate about the right approach to project management. Traditionally, project management was perceived as an operational undertaking, where project activity should first of all be focused on creating a good plan and then making every effort to stick to the plan throughout the project. Deviations to the plan are undesirable and should be avoided as much as possible, and when they occur, the project team must make every effort to bring the project back on track (Williams, 2005). The project's goal is to meet time, budget and

requirement goals and its success is measured by how well the team could achieve that goal. According to this approach, a project's budget is seen as cost, and just like any cost, it should be reduced while overruns are seen as a negative signs and often a good reason for project termination.

The classical approach to project management is being challenged in recent years by suggestions to adopt a more adaptive and strategic approach (Cleland, 1989; Shenhar, 2004, Shenhar and Dvir, 2007; Arto et al, 2008). According to this proposition, projects should be seen as major drivers of change and vehicles for preparing future businesses. The project's goal (and the project manager's responsibility) is to achieve business results by exploiting new market and technological opportunities, and by creating competitive advantage and added value. While good planning is desirable and excessive spending should be minimized, the reality is that sometimes they are unavoidable due to high uncertainty or unexpected changes. In such circumstances, management must understand that it is sometimes better to continue its resolve and keep supporting the project to the end.

The great projects in this study had clearly adopted the strategic approach as can be seen from several of the factors on the list. Not only were these projects focused on creating the right competitive advantage and value, and on building a clear vision and support of all parties, top management has seen these projects as important, long-term strategic investments. Management understood that short-term results of time and budget are less critical than meeting the long-term strategic goals of market penetration and building a new future. Management also understood that project overruns are not always due to lack of planning. It is sometimes the result of too many uncertainties at the time of project initiation or unavoidable changes that need to be added to the original plan. That understanding was reflected by an unconditional management's support and willingness to keep supporting the project even in face of difficulty and sometimes-excessive overruns. While many of the projects in our study were planned well and met their original budgets and schedules; that was not always the case. The Sydney Opera House in spite of extreme cost and time overruns, turned out to be a great success story for the city of Sydney; the World Trade Center, in spite of a big budget overrun, became a national symbol of financial success and although Microsoft Word's project kept missing its delivery dates, it received continuous support from the top, leading to one of the best selling products of the company.

In conclusion, Leo Tolstoy once wrote: 'Happy families all look alike; each unhappy family is unhappy in its own way'. Perhaps a paraphrase can be made for projects: 'All successful projects look alike; failed projects fail in their own way'. Thus if successful projects look alike, maybe we could do something about it. Virtually, most of the elements we observed in great projects are under management's control and can be clearly planned for. That means, going beyond traditional approaches to project management, which are focused on schedule and budget planning. It also means taking the time to articulate the vision and competitive advantage, as well as complete buy-in from all parties. And it requires instituting the right culture, creating a truly cross-functional team, making sure the team can tackle and solve problems quickly and effectively, while using as much of the existing knowledge, and creating the alliances with organizations inside and outside of the project's firms. Above all it means that if the project is important, top management must be involved and unconditionally committed to support the project against unexpected difficulties. Maybe it is time to add such lists into the toolbox of every executive and project manager.

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Project History: History Meets Project

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History and Project Management

There is a growing concern in the project management community about the lack of historical understanding of the emergence of project management and the importance of landmark projects. Both researchers in project management (Garel, 2003) and business historians (Scranton, 2008) are calling for the development of a history of projects and project management. Indeed with the notable exception of Morris (1997) and the in-depth studies of Hughes (1998) and Johnson (2002), we actually do not know of any history of project management.

The lack of a history of project management should be no surprise. Most of management research and teaching is, unfortunately, a-historical (Chandler et al, 1984; Kieser, 1994; Cummings and Bridgman, 2011). As for the subject of project management, most textbooks in project management begin with a short historical section and then turn to the classical description of project management, its organization and techniques, most of which is notoriously disembodied, almost without taking context into account. The tendency is to produce a very shallow view on the history of project management. More sobering for the discipline of project management, the rare famous case studies comes from political scientists (Sapolsky, 1972), historians of technology (Hughes, 1998; Johnson, 2002a and 2002b), historians (Hewlett and Anderson, 1962; Brooks et al, 1979) or journalists (Kidder, 1981; Rhodes, 1986). The problem for scholars in project management is that these contributions, even if they provide valuable empirical data, are not oriented toward the specific analysis of project management and project organizing as such, and thus rarely reflect on the process of project organizing or the act of project management. Accordingly, there is still room for more historical studies of projects and project management – describing and analyzing them from a project management point of view.

This lack of historical knowledge on project management raises at least two principal problems:

1. First, the existing literature on project history is biased toward large, US military and space projects. Hence, we need to broaden the perspective to other industrial sectors and national contexts. The history of projects and project management is accordingly a global phenomenon and variations exist across the globe. Still, we

know very little, for example, about the most influential projects in Scandinavian history, in English history, in South-American history and in Asian history, and their impact on management capabilities, management practice and subsequent projects. In addition, we know very little about the landmark projects in the former Soviet Union even though there is evidence that some of their management tools were more advanced and sophisticated than the tools used in the Western world (Söderlund, 2005).

2. Second, history can help us to better understand the roots of project management and the evolution of current managerial practices. This could lead us to recognize innovative managerial solutions from the past that are still relevant today and contradict the dominant model of project management. The problem is thus one, so common in management, of making simplifications of the past to present new findings. As Janik (2006) points out:

the idea that we are smarter, simply because we come later, is a scholarly form of hubris and no less self-destructive with respect to our cultural heritage. (p. 297)

Accordingly, a better understanding of history might create an improved understanding of the difficulties in creating, shaping and managing projects, and thus add to the empirical wealth of the management and organization of projects. Therefore we believe that Chandler should not remain an exception. As pointed out by Kieser (1994):

historical analyses can serve to reflect on existing organizational designs and to criticize existing organization theories. Historical analyses do not replace existing organization theory; they enrich our understanding of present-day organizations by reconstructing the human acts which created them in the course of history and by urging organization theories to stand the test of a confrontation with historical developments. (p. 619)

This should also be true for project management research (Morris, 1997; Söderlund and Lenfle, 2013). We are convinced, in the vein of Cummings and Bridgman (2011), that the history of management is critical for our future in order to improve both theory and management practice, most notably to make project management a more 'reflective' discipline (Schön, 1983). However this raises important questions regarding the type of historical method we should rely on. A history of project management is on its own not enough. In that respect, we should be clear on the type of history we want to promote.

The challenge we face is to avoid two classical pitfalls in historical analysis (Dreyfus and Rabinow, 1983, p118): (1) presentism and (2) finalism. In presentism, the risk would be to look for traces of the present (for example PMI's PMBOK) in past projects. The second pitfall, finalism, is an approach which tries to find the foundations of the present in some distant times, and analyze history as a finalized process that necessarily leads from that point to the present. Therefore, as pointed out by Engwall (2012):

there is a frequent tendency to interpret and understand historical endeavors and situations [e.g. building of the pyramids, Viking raids, etc] in the contemporary norms and conceptual frameworks, or in other words, to take present day ontology of project management and force it upon the historical actors. Consequently, this kind of historical narratives tell us more about our present thinking than about the conceptual frameworks of its actors and actions. (p. 596)

This is where the work of the French philosopher Michel Foucault could help (Lenfle, 2012). In his works, building on Nietzsche's concept of genealogy, Foucault uses history as a method to question and deconstruct existing concepts and truths. Through historical investigation he demonstrates how concepts, theories and practices that are now considered as evident are, in fact, socially and historically situated and constructed. He insists on making explicit the conditions that lead to the emergence of objects, knowledge, concepts and their insertion in society through detailed instrumentation. By carefully analyzing discourse, institution, tool and socio-economical evolutions, Foucault shows how knowledge and the associated 'technologies of power' are produced and re-produced. In so doing:

genealogy demonstrates how a field's foundations are actually formed in a piecemeal fashion but then solidify to produce a sense of the development of knowledge while at the same time marginalizing other possibilities. (Cummings and Bridgman, 2011, p. 81)

Foucault's genealogy proposes to build a 'counter memory' (1971) that aims at reviving forgotten knowledge and reinterpreting shared concepts. His landmark contributions on madness (1961) and the birth of prisons (1975) demonstrate the fruitfulness of the genealogical approach. We believe, following the work of Hatchuel et al (2005) that Foucault's genealogy could be greatly profitable to project management research. It can help us reflect on and criticize existing theories of project management and, to uncover the actual practices of project managers (Cicmil et al, 2006). This may constitute an important step in building a relevant theory of project management (Blomquist et al., 2010). More specifically two different uses of genealogy may prove fruitful, see below.

The first one could focus on a genealogy of the PMI model (Duncan, 2004). The goal would be to analyze how, when and why this body of knowledge emerged and became dominant. This would entail questions such as: what were the actors, knowledge, institutions behind it? The work of Morris (1997) and, more recently, Lenfle and Loch (2010), are first steps in this direction. The authors show that the PMI's Body of Knowledge is the outcome of a long process starting after World War II with the US military-industrial complex. The remarkable work by Johnson (1997; 2002a; 2002b) demonstrates that the development of large weapons systems like the ballistic missile led to the development of technical and management tools that help to manage the new complexity of these systems. So-called modern project management comes directly from these projects. It led to the formalization, during the 1960s, of a body of knowledge mainly composed of project management tools like PERT, earned value and so on. This reflected the faith in rationalistic decision making and the desire of the government (first and foremost McNamara) to gain better control of military spending. Indeed, this question deserves additional research to understand the micro mechanisms that progressively led to the formalization of this kind of model, to analyze its impact on project management practices, to unveil its link with decision theory and organizations like the RAND Corporation (see Hughes and Hughes, 2000 for an introduction).

A second strategy leads to forgotten paths, practices, models and organization lost in this process. In this perspective, the purpose is to build a counter-memory; perhaps we should better say 'a memory' since there is almost no history of project management to question the dominant, albeit weak, discourses on its history. This chapter follows this second line of inquiry by reanalyzing the famous Manhattan Project. Indeed post-war

US military projects are worth revisiting because they represent a turning point in the history of project management. Between 1945 and the joint publication by the Department of Defense and NASA of the *PERT/Cost System Design* in June 1962, project management moved from a mainly empirical field to a structured discipline governed by a rationalistic view. However the story is more complex than the usual presentation. The political scientist Sapolsky (1972) was the first to question this dominant and simplistic view. His landmark contribution on the Polaris project (1972) demonstrates the fallacy of the ‘myth of managerial effectiveness’ behind the PERT system. As we will see in the next section, the same is true for the Manhattan Project.

The Manhattan Project Case

The Manhattan Project case is worth revisiting for several reasons. First, the making of the atomic bomb unquestionably represents a major breakthrough in the history of technology. It exemplifies the power of ‘Big Science’, the large-scale mobilization of human, financial and industrial resources to overcome major scientific and technical problems. As noted by Hoddeson et al (1993), the managerial practices developed at the Los Alamos Laboratory were widely taken up in the American scientific and industrial community after World War II. Studying how the breakthrough happened may provide insights into innovation management. Second, it constitutes an important historical reference in the literature on project management. Thus, for Morris (1997), the Manhattan Project ‘certainly displayed the principles of organization, planning and direction that typify the modern management of projects’ (p. 18), and, more recently, Shenhar and Dvir (2007) asserted that it ‘exhibited the principles of organization, planning, and direction that influenced the development of standard practices for managing projects’ (p. 8).

Fortunately, the Manhattan Project has been extensively studied, mainly by historians. We may therefore draw on a large amount of historical material that has so far not been used to study project management (see the references at the end). And the analysis of this history shows that an important discrepancy exists between current descriptions of historical projects and their realities. Indeed, even a brief review of the history of the Manhattan Project reveals the extent to which it violated the dominant control-oriented model of project management (Project Management Institute, 2013). Scientists had been aware since the 1930s that a nuclear fission chain reaction might offer a much greater source of energy than chemical reactions:

A chain reaction had not been obtained but its possibility – at least in principle – was clear, and several paths that might lead to it had been identified. But the available knowledge was theoretical and very incomplete. (...) The theory was full of unverified assumptions, and calculations were hard to make. Predictions made in 1940 by different physicists of equally high ability were often at variance. The subject was in all too many respects an art, rather than a science. (Smyth, 1945, pp. 364–5)

Scientists and engineers faced two major problems: the production of fissionable materials and the design of the bomb itself. Two fissionable materials could be identified: enriched uranium and the recently (in 1941) discovered plutonium. For bomb design,

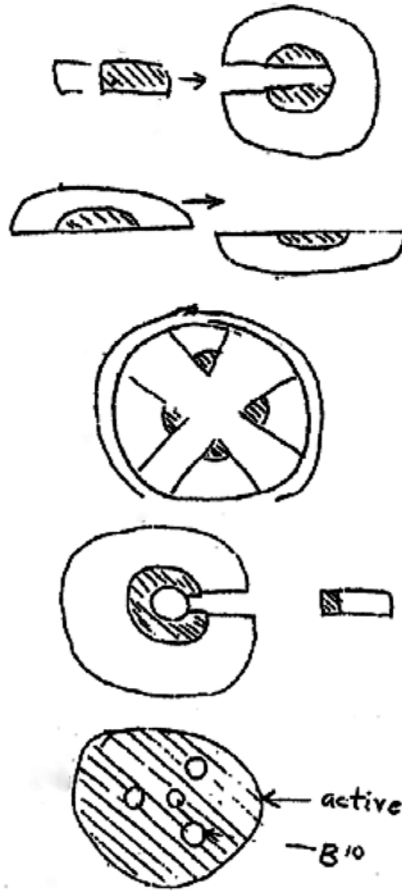


Figure 33.1 Alternative bomb designs drawn during 1942 Berkeley seminar (from Serber, 1992)

multiple ways could be imagined of bringing nuclear fission material together to obtain a critical mass for a self-sustained chain reaction (to create an explosion). For example, scientists drew five different designs in a seminar organized by Robert Oppenheimer in July 1942, as shown in Figure 33.1 (from top to bottom):

- Gun-shot;
- Half-sphere;
- Implosion;
- Modified gun-shot;
- Diffusion.

But which one would work and with which material (uranium or plutonium) was entirely unclear. As project manager General Leslie Groves stated:

The whole endeavor was founded on possibilities rather than probabilities. Of theory there was a great deal, of proven knowledge, not much. Basic research had not progressed to the point where work on even the most general design criteria could be started. (Groves, 1962, p. 15)

Their largely inexistent knowledge is illustrated by the following description of a meeting with scientists at the University of Chicago on October, 5, 1942, soon after Groves’s nomination as project manager:

As the meeting was drawing to a close, I asked the question that is always of uppermost importance in the mind of an engineer: With respect to the amount of fissionable material needed for each bomb, how accurate did they think their estimate was? I expected a reply of ‘within 25% or 50%’ and would not have been surprised at an even greater percentage, but I was horrified when they quite blandly replied that they thought it was correct within a factor of ten. This meant, for example, that if they estimated that we would need one hundred pounds of plutonium for a bomb, the correct amount could be anywhere from ten to one thousand pounds. Most important of all, it completely destroyed any thought of reasonable planning for the production plants of fissionable materials. My position could well be compared with that of a caterer who is told he must be prepared to serve anywhere between ten and a thousand guests. But after extensive discussion of this point, I concluded that it simply was not possible then to arrive at a more precise answer. While I had known that we were proceeding in the dark, this conversation brought it home to me with the impact of a pile driver. There was simply no ready solution to the problem we faced. (Groves, 1962, p. 40)

Groves and his steering committee decided to explore and implement different solutions in parallel, both for the production of fissionable materials and for the design of the bomb itself. These principles were put into action as follows (see Figure 33.2):

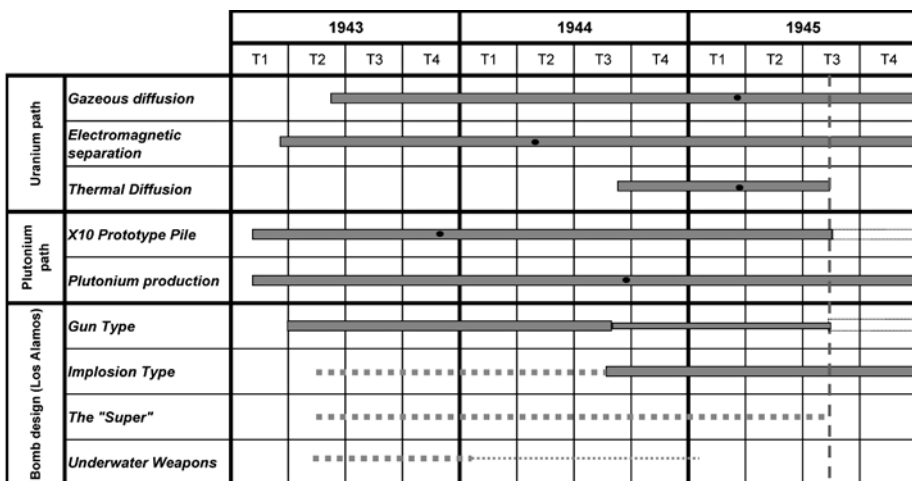


Figure 33.2 Gantt Chart of the main activities of the Manhattan Project (from Lenfle 2008)

- Uranium separation, plutonium production and bomb design proceed concurrently.
- For uranium separation, two different methods were used in parallel. A third method, thermal diffusion, was added later in the project, in September 1944.
- The Los Alamos laboratory explored several different bomb designs at the same time. The 'gun' design (using uranium) was the 'lead' first, but in July 1944 they had to switch to the 'implosion' design for plutonium.
- Moreover, they performed the phases of research (to establish working principles) and development of the production plants (to obtain working materials) simultaneously.

Ten years later, Bernard Schriever called this approach 'concurrency': the simultaneous (or overlapping) performance of logically sequential tasks. Groves had already used it in previous projects, but this was the first time it was extended to fundamental research.

In the face of high technical and scientific uncertainties, the willingness to modify and add solutions mid-course enabled the project to respond to emerging, unforeseen events. In addition, the parallel pursuit of several alternatives increased the likelihood of success as well as the speed of obtaining a workable solution in the face of a rival effort by Nazi Germany. Unforeseen events did arise, as illustrated by the crisis in the spring of 1944. By this date, none of the methods for producing enriched uranium had achieved sufficient accretion rates, and the 'gun' design for the bomb was unsuitable for plutonium, which exhibited a much higher 'spontaneous fission' rate than anticipated. The project had maneuvered itself into a dead end, with a fissionable material (plutonium) without a bomb design, and a bomb design (the 'gun') without a workable fissionable material (uranium 235). The flexible but redundant managerial project strategy now offered the means to overcome the crisis:

- For the production of fissionable materials, a breakthrough came when it was discovered that a new process, thermal diffusion, could provide slightly enriched uranium, which would then feed the gaseous diffusion and electromagnetic processes for further enrichment. The parallel processes were unexpectedly combined into a composite process that finally achieved the desired performance (Lenfle, 2011).
- For bomb design, a second group of scientists had worked on an implosion design as a back up. When it became clear in the spring of 1944 that the gun approach did not work for plutonium, the implosion design became first priority. Still, unprecedented challenges had to be overcome because the implosion had to be perfectly symmetrical in order to achieve a chain reaction. This demanded mastery of a new uncharted field: hydrodynamics of implosions.

The implosion design using plutonium was frozen in February 1945 and tested in the famous Trinity test, on July 16, 1945. On August 6 and August 9, 1945, the two first nuclear bombs exploded with terrifying impact over Nagasaki and Hiroshima.

In summary, the Manhattan Project case exemplifies a few points in relation to current project management. First, the project demonstrates a willingness to pursue multiple approaches in parallel. This is indeed very different from the traditional project management approaches as they have been presented in project management text books and best practice collections. Second, the project relied on a trial-and-error approach. The latter was illustrated foremost by Groves's initiative to try, very late in the project, a new and unproven gaseous diffusion process. In many respects, these approaches and

the Manhattan Project case show practices and approaches that have gained popularity in recent years, including fast-track project management, agile project management and rapid prototyping (Loch et al, 2006).

The Future and Promise of Project History

What then is the relevance of Project History – for the practicing manager doing his or her career in the world of projects – for the young scholar entering the field of project management? We argue that there are several lessons learned and we certainly believe that there is a future for Project History.

Considering the Manhattan Project, we note that there is quite a large difference between the principles applied then and the principles that for many years have been taught and considered to be the general best practices of project management. The technical performance of the Manhattan Project was indeed outstanding, achieved in less than three years, albeit at the cost of a large budget overrun – the budget was the lowest priority. What is sobering for the discipline is that this managerial strategy (parallel approach, rapid experimentation) disappeared from the project management textbooks but was rediscovered a decade ago to manage innovative projects (Loch et al, 2006; Lenfle and Loch, 2010). This research demonstrates that other approaches of project management have existed and that originally project management was grounded in a reflective tradition in terms of the conduct of management – adaptive project management was considered to be critical then, and contingency theory seems to have been important at least for the practicing manager. Recently, scholars have reclaimed the significance of the adaptive approach in project management, which then also opens the way for a better grounding of project management in organization theory research (Shenhar and Dvir, 2007; Pich and al, 2002). So far, our discussion has principally revolved around the study of landmark projects; however, the entire field of Project History (Söderlund and Lenfle, 2013) is more than the study of single projects. According to Söderlund and Lenfle (2013), Project History covers at least five different areas:

1. History of project management practice;
2. Landmark projects and project narratives;
3. Corporate project history;
4. History of project-based production;
5. History of project managers.

The first category entails research into the evolution of project management at various levels. It could for instance revolve around the emergence and diffusion of PERT and particular kinds of planning techniques. It might also involve research into various approaches of project management, the relationships between project management and other management domains, such as systems engineering and systems integration. Examples of research focusing on these issues are Morris (1994), Johnson (2002a) and Lenfle and Loch (2010).

The second category centers on single projects, not on following a particular concept or technique with time. In this area we find a range of studies, such as Hewlett and Anderson (Manhattan Project, 1962), Sapolsky (Polaris Project, 1972), Morris and Hough

(Concorde, Channel link, etc; 1987), Brooks et al (Apollo Project, 1979), Hughes (1998 on Atlas, SAGE and so on) or more recently Midler (1996) and Jullien et al (2013). The interest is primarily to document a project in-depth, describe its background, what happened during project implementation and the effects that the project had. In this area we would investigate all kinds of decision-making, governance, leadership and organizational issues of importance for explaining the shaping and execution of projects. We believe that many cases, that could also constitute a rich base for teaching, remain to be discovered and analyzed.

The third category is directed more towards the firm level. It overlaps with much research in business history, such as studies within the Chandlerian tradition. One example of work in this area is Söderlund and Tell (2009) and their study of Asea Brown Boveri between 1950 and 2000. The authors analyze the evolution of project management and the nature of project organization from the first large-scale projects in collaboration with national clients to increasingly international projects around the world. The authors thus try to depict the change in the nature and character of projects carried out, the change in the ways these projects were shaped and the new forms of management and organization that emerged in response to growing project complexity. The point the authors make is that project-based forms of collaboration emerged relatively early in growing multinational companies and that the so-called P-form corporation (project-form) played an important role for the growth and internationalization of large corporations. Accordingly, the authors add to the image of the large corporation as merely guided by M-form logics (multi-divisional), which Chandler (1962) focused upon. The authors identify a series of 'project epochs' in the evolution of Asea Brown Boveri and identify a number of epoch shifts where the company moved into a new logic of project-based production. This led to the investment in a range of methods and systems to sustain and further develop the project competence of the firm – that is the ability generate and execute projects. In particular, various kinds of organizational mechanisms, shared leadership models, follow-up and review techniques along with collaborative agreements already played a very important role in the 1960s when the company began assuming the overall responsibility for large-scale projects within the power systems sector. In the same perspective Midler (1995) analyzes the evolution of project management methods at Renault and how the firm becomes more and more 'projectified'.

A fourth category could perhaps be labeled the history of project-based production. These studies take an interest in industrial development that particularly focuses on project-intensive sectors and describe the nature of the implemented projects. Indeed, such studies are primarily within the domain of business or economic history, but they still touch upon what we would like to frame as project history. One example, we believe, could be the work by Scranton (1997) and his study of specialty production and American industrialization in the late nineteenth and early twentieth centuries. In a study of custom and one-off production logics, he showed the importance of the 'other side' of the second industrial revolution. In 1900, a third of the 50 largest manufacturing plants in the United States made custom and specialty goods, not throughput commodities following the logic of mass production. Scranton demonstrates that the custom production fostered capabilities to continuously shift outputs, which in turned required skilled specialists, flexibility, ingenuity and resourcefulness. This diversity of work in process forced managers to devise systems for tracking the progress of orders and particularizing costs, to track, coordinate and plan the work of each unit/project.

Selling nonstandard goods routinely involved the creation of plans and estimates, which were often made in close collaboration with clients; clients supplied critical information which later on minimized errors. These custom producers utilized extensive contracting networks, rather than investing in integrated production. Many managerial innovations focused on means to 'systematize', rather than to 'standardize', production, coordination, information processing, recruitment and marketing. As Scranton shows – 'system' became the custom producers' buzzword, whereas 'standardize' permeated the discourse of routine production. The custom producers' need for pools of skilled labor, often led to a co-location of firms with similar needs, thus creating urban industrial districts, which also boosted the sharing of knowledge and experience across firm boundaries. Scranton also shows that many of the firms that moved into mass production still relied heavily on one-off production and typically were able to house both modes of production within the same overarching corporate structure.

The final category we suggest is focusing on influential people. Similar to other historical works about influential entrepreneurs and business leaders, this area of research also focuses on the important individuals; however the focus here for obvious reasons is on people who influenced project management. We believe there is evidence that, compared to famous entrepreneurs and executives, project managers have received little attention. Some studies have been done on engineering geniuses, and many of them are of course also influential project managers; but studies on project managers remain very rare (exceptions that we know are Johnson, 2001 on Sam Philips, Apollo project director, and Norris (2002) on Leslie Groves, Manhattan Project director). However, this area would benefit from focusing not merely more strongly on them as individuals, but primarily on their philosophy of project management, what projects they did and why. Examples of such influential project managers might include William Raborn who played such an important role in the Polaris project, Nils Ericsson who was the project management star in early industrialization in Scandinavia, Thomas Telford – the engineering genius who thanks to his ability to integrate technology with management helped build the infrastructures that had such a huge impact on the British economy for years and years – and Johann Augustus Röbling (John Roebling) who built so many landmark bridges at the cutting edge of technology in the United States and who literally died when working on his Brooklyn Bridge masterpiece. There are certainly more individuals whom we could mention and there are certainly many about whom we know a great deal, but there are still many whom have been nearly overlooked and other important project managers about whom we know a little, but not necessarily as project managers.

We believe, following Engwall (2003), that it is necessary to link a particular project to its context and history. By doing so, managers and scholars should be better able to analyze where projects come from – what are the various traditions, the background of the project. Historical insights might then also be of relevance to the practicing project manager. One of the central ideas with Project History however, we believe, is to cover, in Hughes's words, the 'collective creative endeavors that have produced the communications, information, transportation, and defense systems that structure our world and shape the way we live our lives' (Hughes, 1998, p4). As mentioned earlier, the take here is not to treat industrial projects narrowly. Instead, we welcome contributions with a different focus and broader perception of industrial projects.

There is a natural tendency among management scholars to study the extremes. This means basically two types – the good organizations, the good projects, the most successful

leaders and the best practices on the one hand, and, on the other hand, the failures, the planning disasters (Hall, 1992) and the poor performers. This is also apparent within the domain of project management. The question is how to deal with this problem when doing historical research – should we only study the extremes; are these outliers the only ones possible to study because the mundane, normal, projects, which actually may have concerned the most people, are not accessible because no one bothered to save records about them. Are we thereby creating a history of the bad and the best, but no history about normal projects? Is there a risk associated with such a research strategy?

Additionally, looking at the good and the bad – the extremes in the historical landscape of projects – we might have quite a lot to offer also to other knowledge domains and scientific fields. For instance, as Gaddis (2002) points out:

High modernism can manifest itself in architecture with faceless buildings that efface their own inhabitants, or in the urban planning that produces people-unfriendly places like Brasilia or Chandigarh, or in transportation schemes like those in Tanzania and Ethiopia in the 1970s, or in such massive rearrangements of landscapes as the New Deal's Tennessee Valley Authority or Khrushchev's Virgin Lands Project, or China's impending inundation of the Yangtze's great gorges. And, most devastatingly, high modernism can involve the attempted reconstruction of an entire people. Hitler's purely Aryan Third Reich, for example, or Stalin's forced proletarianization of the Russian peasantry, or the most devastating single atrocity of the twentieth century in terms of deaths it produces – some thirty million Mao Zedong's Great Leap Forward. (p. 144)

The point here is not of course that project management scholars can answer all these problems, but merely that there might be something that project management scholars can learn from these massive projects – be they good or bad – and, which is still to be seen, that project management scholars perhaps could contribute to a better understanding of these collective endeavors by highlighting their organizational and managerial practices and issues. We believe that Project History can offer new ideas and sharpen our thinking on how to best maneuver our projects and the discipline of project management in the future.

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