PROJECT MANAGEMENT FOR TELECOMMUNICATIONS MANAGERS

Celia L. Desmond

Kluwer Academic Publishers

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Celia L. Desmond
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Dedication

This book is dedicated to my husband, John and my three children Andrew, Stephanie and Christopher

Preface

This book on Project Management is intended as a quick reference covering important aspects of project management that should be understood by managers in the telecommunications environment.

This book is organized with an introduction, which introduces the value chain in telecommunications and illustrates the type of project, which one might encounter in a telecommunications company.

Part I: Planning a Project covers the processes to be used in the initiation and planning of projects.

Part II: Running a Project covers the processes that fall into place once the planning stage is completed. All project areas are covered, including Initiating, Planning, Executing, Controlling and Closing.

In Part III we look at the contributions to projects by the different departments in a telco, including Sales and Marketing, Senior Management, Project Management, Engineering, Operations and Purchasing.

The book refers frequently to *A Guide to the Project Management Body of Knowledge* (PMBOK® Guide), 2000 Edition, published by the Project Management Institute, and all processes included are those recommended in the PMBOK® Guide.

The use of gender and the handling of it in this text were weighed carefully. Being a woman makes me especially sensitive to this issue.

However to make the reading of this text flow most easily, I have consciously chosen to use the terms “he” and “his”. This is meant to be all-inclusive and used in lieu of “he/she” and “his/her” at each occurrence.

I had assistance from many people in the preparation of this book. These people are mentioned in the acknowledgements at the back of the book. But I want to especially thank three people here as well. Thanks to Kim Bell for many late hours pulling the material together, to Keith Farndale for reviewing the entire manuscript, and for John Desmond for many edits and rewrites of some portions.

Introduction

Introduction to Project Management in Telecommunications

This introductory chapter describes the telecommunications industry value chain in order to look at the types of companies in which telecommunications professionals work. A number of typical projects that might be encountered in telecommunications are described. These projects will be subsequently used to illustrate project management concepts throughout the book, although the illustrations will not be limited to these projects.

This chapter also introduces the general concepts of Project Management, with an overview of each area, as a basis for the more detailed discussion in the chapters to follow.

The telecommunications industry spans many types of companies, with very different products, objectives, and modes of operation. People in these companies work in many different functional areas, in various organization structures, within environments that range from highly stable, to, more often today, very precarious. Some telecom operating companies are traditional wireline telephone service providers, some provide long distance, and others offer wireless services or data communications or video. Many offer combinations of services. Regulatory environments vary from heavily regulated to completely open competitive markets. In addition, the customers they have vary from single line residential telephone subscribers to world wide corporate customers with complex voice/data/video networks on which their whole business livelihood depends. Some operators are

small; others are among the largest companies in the world. In all of these telecom companies, people work on projects. And these projects are all expected to produce the desired results, within the assigned budgets, and by the required dates. Many projects will have a similarity as they tend to be concerned with similar things, such as creating and offering new products and services, installing or expanding their network infrastructure, changing processes and procedures (billing or customer care, for example) or implementing services for their individual customers. But each project will be unique because of size, location, complexity, environment, etc. Yet, all of these are telecommunications projects, and there are techniques and processes that apply in all of these situations.

Let us consider the high level view of the telecom environment. First, let us look at the value chain of the industry. The value chain consists of companies in many different businesses, all of which contribute to the industry. Figure 1 shows the types of businesses that make up this chain.

Figure 1

Working backwards from the right hand side, we first encounter the end user. Even here, we have quite a variety of profiles, and hence a variety of projects. The end user can be a residential consumer, using telephone service in his or her home. Or it can be a huge multinational business using voice, data, video and multimedia services in a business environment which needs to be secure and consistent in multiple countries around the world. And of course there is a wide range in between. Obviously, from both a telecommunications and also a project management perspective, the projects and the needs of these users are very different.

In fact, the services and the equipment that these users buy or lease vary in size, in complexity and also in the nature of the services. A service can be specifically within one technology area, such as a wireless service, or a network of automatic bank machines, or it can involve many technology areas that may or may not need to interact with each other.

What are some examples of telecommunications projects that might be undertaken by an end user? Obviously these are as varied as the user applications, so it would be totally impossible to list even all of the generic types. Following are some examples to aid in understanding the different types of telecommunications-related end user projects:

- upgrading a company's computer systems to allow better data communication with their customers or easier access to their corporate information databases;
- installing a new LAN with high speed wireless capability;
- moving a department to a new building (with the focus here on the communications portion of the move)
- setting up a "hotelling" office concept that has no assigned cubicles for workers, who will now simply pick up a cart when they arrive, and plug in the cart in any free cubicle, with the network able to locate them as if they were in a permanent location;
- developing a disaster recovery plan and selecting vendors to provide the required services;
- implementing a new communications system, thereby moving from an environment which provides customer services on site to one in which a set of services is provided electronically via kiosks, handsets and computers;
- implementing an e-commerce system to allow the company to sell existing and future products over the web, including the capability to advertise, accept order and payment, keep confidential information secure, provision the products and provide follow-up support for orders as required.

Thus, the product that any given project must produce, even for the end users, can be one of a very large number of types, sizes and complexities. If we are going to talk about Project Management for Telecommunications Managers, we need to cover the tools, techniques, processes and knowledge that can be applied successfully in any of these varied areas. These four areas are what this book will cover.

Moving one step up the chain we come to the Telecom Service Providers. Perhaps telecom is a misnomer today. This industry includes the traditional telecommunications, which has typically been voice service, with the addition many years ago of data service as well. The data service was initially provided as a separate service from voice, mainly because the technologies that supported and carried one service type were not the most efficient and effective technologies for another service type. This also

happened because the companies that provided one of these services did not always provide both – either for business reasons or for regulatory reasons. Some projects involve voice services and networks, while others involve data, and still others involve a combination of the two. In addition to voice and data, there are many other services, such as video, or forms of multimedia services. But we cannot even stop here. Many telecom service providers do not provide the carriage of voice, or data etc at all. Many provide other specialized functions that enable the service providers and/or the end users to define their own business. These functions can be related to the network (e.g. network management), related to the user's business, (e.g. call centers), can involve providing a specific function of the overall service, (e.g. billing), or can include management of customer interactions in an electronic commerce type of service such as E-Bay.

The telecom services involved can consist of typical voice services, or Internet services, or software products that are added to the user's or provider's network to improve performance or provide functionality. Or they can consist of equipment integrated into the network to provide service or enhance service, such as a LAN that allows the small business to integrate all data services, or the messaging system that allows business users to pick up voice messages on email.

Again, there are many types of projects, with differing requirements on the project managers and their teams. Yet despite the specific product related needs, there are also many project management related requirements in common for all of these projects.

So, what type of projects might the service provider undertake?

- Developing a new service
- Developing new features for an existing service
- Analyzing the introduction of another company's competing new high-speed access service, enabling the service provider to determine the best competitive response.
- Work with a major national customer to implement his network in a way that gives him significant savings, while at the same time improving his service by moving him onto a new broadband network with better management capabilities.
- Design, implement and manage a network within a conference complex for a group of UN leaders who will be attending a meeting in your city. The communications includes incoming and outgoing voice and data calls to and from the complex, internal communications amongst the

politicians and their support staff while in the complex, plus a secure LAN within the meeting room itself which allows each politician to communicate and share files with his or her own 'Sherpa, or knowledgeable assistant' during the meeting.

- Managing a serious cable cut in a remote area, in which the cable was carrying over 40 percent of the national backbone traffic, and the redundant backup facility is currently being upgraded, and therefore cannot reliably carry its full traffic capacity
- Implement a new IPV6 capability in a separate network for customers willing to move to the leading edge protocol
- Equip the current network with a new billing system which is more flexible that the current one, allowing new rating models to be adopted when desired
- Move all customer service for medium business clients to one common national call center
- Introduce a new culture to the employees that is more conducive to determining customer requirements clearly before initiating design of a new service, and provides them with the tools to be able to do this.

Somewhere in this continuum we would also find companies who do the research into potential new technologies and products, and who also provide assistance in the technical and management aspects of integrating these upcoming products into the current networks and environments. We can include these under the equipment vendor heading, although not all such companies fall into place in the overall model.

Obviously, if we continue to move back to the equipment vendor, we again see differences. There will, of course, be different products for different vendors. Some vendors sell products in a single area, such as billing software, while many sell products in multiple areas of telecom, maybe having business lines with wireless, broadband and optical products. Some vendors are local or regional, while many offer products nationally or internationally. Projects can be related to purchasing, to planning corporate marketing or strategic direction strategies, to building and maintaining customer relations etc. Obviously these are also quite varied, and yet there are projects in all of these areas. In fact, service providers will also have projects in some of these areas, and there will be some similarity in the nature of the projects, even though the end products are not at all alike.

Many equipment vendors also assemble, and even design and build products, most of which are extremely complex technically. They need to work through the product design cycle from beginning to end, including user

needs and market assessment, requirements definition, product design and definition, product development, product testing, market plan development, marketing information preparation and dissemination, customer relations building, the sales process, and follow-up support. Any given project might span some or many of these areas. It will be important that the exact scope be clear.

Projects for the equipment vendors might include:

- Introduction of a new feature set for an existing CATV cable modem product line, enabling voice services on the IP data connection
- Preparing a proposal for a major client who has issued an RFP for a solution to his problems serving clients in a town which is remote from the main other serving areas, but which has significant traffic to other major cities in the country
- Working with a hotel chain to convince them to implement a high speed internet service offering for their guests in all hotels across the country initially, and then later the world. This service not only uses your LAN technology, but you could provide the ongoing technical support for the guests

For the component manufacturer, many of these same issues exist. These companies will have projects of the nature described for the vendor who also does development. In both cases there will be a variety of projects specifically related to the development and manufacturing processes, where many interwoven factors need to be assessed and managed as part of the production process. Projects can be related to the production itself. There will also be many projects in place to produce process improvements, or corporate efficiencies. These latter projects can, of course, also be present in any of the companies mentioned above as well.

A couple of examples of component manufacturer projects:

- introducing a new automatic reflow solder line, enabling the use of different materials for flux cleaning. This enables the company to both reduce costs and increase the range of products the line can handle
- introducing radical new designs for planar antenna arrays. A project of this kind may result in a final antenna product that is smaller,

lighter, and with increased performance. This can open whole new markets for the manufacturer.

While the primary resource industry is beginning to get rather far afield from the telecommunications focus of this book, and the products themselves tend to be regarded as commodities, things are not so simple as they seem. Drawing fibre or rolling steel plate are perfect examples of process-oriented, rather than project oriented activities, but production lines have to be designed and built, mines have to be explored and dug: these are classic examples of large scale projects driven by extremely detailed project management.

A project is simply defined as an activity that has a distinct beginning and end, has a defined desired outcome, and involves a sequence of activities that is different from those in other projects. The telecommunications industry has always been a dynamic environment, in recent years, "dynamic" has become a great understatement. In an industry which no longer has a "business as usual", innovative project management is crucial.

This book is focused on Project Management. We will not discuss the processes behind many of the functions within the products that the projects are delivering. For example, we will not discuss the techniques for successful marketing, or specific manufacturing techniques, or how to design customer networks. Those are all processes or functions related to the product, rather than the project. So they are not relevant in a discussion of project management, even though they are very relevant in completing those projects encompassing them. In other words, the focus is on the project, not on the product or service that the project is producing.

The accepted base of Project Management processes and process areas is defined by an organization called the Project Management Institute. PMI is an internationally recognized body in Project Management. Along with providing information on project management through publications, conferences and local meetings, PMI certifies project managers as Project Management Professionals (PMP). The PMP requirements include education, considerable experience working on projects, and extensive knowledge in the Project Management field, tested via a rigorous exam. This organization defines 39 project management process categorized into 9 different knowledge areas. All of these processes, in all of the knowledge areas, can be applied to projects in all of the companies described above. We will work through some examples, and suggest some case studies as part of

the material in this book. Beyond that, it will be up to the reader to take the concepts, tools and techniques, and apply them in his or her own focus area.

This book describes most of the processes in the nine knowledge areas, showing the benefit of using each of these. The recommendations are illustrated by examples from different aspects in the telecommunications environment. In particular, the operating company environment will often be used to illustrate which departments are most concerned with different aspects of project management. Manufacturing and equipment vendor projects will also receive attention.

The process areas to be covered are:

- Integration
- Project Scope Management
- Time Management
- Cost Management
- Procurement
- Risk Management
- Communications Management
- Human Resources Management, and
- Quality Management.

Although most project managers are selected from the engineering ranks, project teams are composed of people from many different departments. The Project Manager relies on the skills and knowledge of all of the team members, so project aspects will be considered from various perspectives. Any mathematical concepts presented will assume an understanding of mathematics equivalent to, in fact much less than, that attained by engineers. Many concepts will be presented in a manner that will allow them to be more easily understood and used by engineers.

It is my hope that this book will be useful to engineers working in any area of telecommunications, and it will be understandable and meaningful to anyone working in the telecommunications field.

PART I PLANNING A PROJECT

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Chapter 1

PROJECT PLANNING & INTEGRATION

We present here, a detailed discussion of Project Planning, showing all the desired contents of the project plan, and discussing the value of the information included in the suggested sections.

Before we start discussing the details of a project plan, or requirements for projects, it is necessary to understand what we are dealing with. Perhaps the best definition of a project is given in A Guide to the Project Management Body of Knowledge, commonly known as the PMBOK®.Guide -- a publication of the Project Management Institute (PMI). The PMBOK® Guide is a book which describes the processes and process areas involved in Project Management, and defines most project related terms.

1. Definition of a project

The definition of a project which is given in the PMBOK® Guide is "A Project is a temporary endeavour undertaken to create a unique product or service." Let's think about this definition.

A project is a temporary endeavour. This means that there should be a start, and a finish to every project. And it should be evident when these two events occur. Many times in the telecommunications environment I have seen projects that never seemed to end. Often the reason for this is that people kept adding features or capabilities to something that was under development. Generally the project team started out in good faith to build something that was defined in the initial project scope. Let's say that it was a new service to give customers voice/data integration capabilities. Work progressed well, but before the full set of features and capabilities could be

developed, new market information appeared, which made it advisable to include additional capabilities. Management and the project teams evaluated this market information and agreed that although it would be more costly in terms of time and/or money to include these additions, the end product would be more viable and hence more profitable if they were included. In some cases, the projects suffer only from increased cost and delayed service releases. In other cases, particularly when the people who will eventually support the service are also part of the development team, development has continued for years after the official release. This practice is exactly the sort of practice that good project management aims to quash. All projects should have a start date, which at some point in time is clearly defined. When that date arrives, the project work should begin. And all projects must have a clearly defined end date. The plans must then be drawn up so that a conscientious project manager, with the right team, can meet that end date with a product satisfying the project specifications and requirements. When the end date arrives, the work needs to have been completed, the product or service handed over to the customer or the support team, and the project team reassigned to other work. When this happens we can say that the project was a temporary endeavour, with a start and end date.

Let's think about what determines the end date? Who sets it? The project end date should be set for whenever the client wants the completion. This is almost always earlier than the optimal date for the team to do the work. But the constraint is placed by the client. What good is it to deliver network software after the business opens and people start using the network? It has to work at cut-over; and cut-over has to occur before the customer's business needs the capabilities. In order to meet these constrained due dates, project managers need to develop careful, detailed plans which specify when each of the project milestones must be met, and when each of the project activities needs to be completed. In addition, a project generally has a time line. Now, occasionally projects don't really have a solid end date to them. That's pretty occasional. Perhaps a library wants to introduce a service that allows users to download papers from their suppliers, rather than just obtaining them from the periodicals on the shelves. Perhaps the library cannot afford to pay for the transition quickly, and they do not see enough direct value from the service to justify having it available quickly, even though they know that they will have to provide publications this way as time goes on. So they might not be as concerned about the timing as they are about keeping their costs in check. I have met people who have said "almost all our projects are like that - we just do as much as we can when we get funding, and whenever we get more money we move things a bit further forward". But I have not experienced many real cases of this personally. Most projects have a clearly

defined end date and it's usually pretty solid. Sometimes it's extremely solid and there's no way the date can be moved. For example, consider installing a communications network for the Olympics. No one is going to change the dates of the Olympics because the communications network will not be ready. Sometimes there is a bit more flexibility, either with the end date, or with some of the milestone dates within the project.

In some cases we don't know ahead of time when the start date will be. This might be determined when the funding becomes available, or when the approval is signed, or the enabling equipment arrives. The Project Manager needs to fully understand the start and end requirements, and any interim time requirements, in order to successfully manage a project.

The project has an output that is unique. The output can be a service or a product. That service or product should be something that can be clearly scoped and differentiated from other products or services. Ongoing work, on the other hand, does not have a unique output. So, handling a customer trouble report, or a call in a Call Center, would be classified as ongoing work, not as a project. However designing a base station to be used in a wireless service might be considered a project. The product or service that the project produces must be unique. The fact that it is unique does not mean that there is nothing else that is similar. In fact, many projects are repetitions of previous similar products or services. However, each product is still unique. Thus, installing a LAN for company A can be a project. Installing a similar LAN for company B is another project. There are obvious similarities between these two projects, so it is likely that much of the planning can be reused. But it is also clear that the products are different. The LANs are installed in different locations, probably at different times, for different users, using different equipment. Probably the project teams will be composed of different people. So while similar, we can see that these are different projects. One advantage of repetitive projects is that portions of the project planning and management can be reused. This is a welcome timesaver, as long as the team does a proper assessment of the similarities and differences between the two projects, and accounts properly for all the differences.

Here's an example of repetitive projects which might be undertaken by people in the telecommunications field, although the end result is not a telecom service or product per se. IEEE Communications Society runs approximately fifty conferences per year. Amongst these are two flagship conferences each year, which are fairly similar to each other. In the second

quarter of the year ICC (International Communication Conference) occurs, and in the fourth quarter Globecom happens. Each of ICC and Globecom generally hold 48 technical sessions, 8 business application sessions, a conference banquet, and an awards luncheon. Attendees must either pre-register, or register at the conference, and certain data is stored about each registrant. Upon arrival attendees are given a bag, which contains material such as the conference proceedings, a conference program, tickets that the attendee purchased to conference events, etc. So, in one sense, one ICC is the same as another ICC, one Globecom is the same as another Globecom, and some people might even argue that as a project, an ICC is the same as a Globecom. There are definite, clear similarities. Someone who has organized one of these conferences has a wealth of information that can be directly applied to the organization of another. But organizing Globecom 2003 is a project and organizing ICC 2004 is a project because Globecom 2003 and ICC 2004 very different from each other even though the structure of the conference, and even the projects are very similar, and we can learn and carry over ideas, techniques and plans from one to the other. They differ because the team of people working on the two conferences is different, they're in held in different locations, the technical papers submitted are different, the themes of the sessions and the overall conference are different, among many other things, even though the structure of the two conferences is largely the same. Both are temporary in the sense that there is a unique timeline that starts and ends in a certain point in time, one ending in late 2003, the other in mid 2004.

One similarity in both of these cases, which is also the case for all projects, is that **the planning and *the work are performed by people***. In fact, this is probably the biggest problem we encounter in all of our projects. If the people were all automatons that responded to the instructions of the PM, many project managers think that things would run much more smoothly.

Another characteristic of projects is that they are ***constrained by some limited resources*** and therefore we have to plan and manage very carefully to meet the project objectives. No matter whether the project is the development of a new service and product, a website development, or fixing some processes that don't work well, these characteristics apply.

2. Reasons for establishing projects

Projects are generally established for one of two reasons.

In one case, there is an **opportunity** for the company. It could be an opportunity to get into a new market, to offer a better service to customers, to introduce a new capability, etc. This could be an enhancement, or something brand-new. But an opportunity exists to do something better or to do something different. We can establish a project to take advantage of this opportunity.

Or, a project might be established to **solve a problem**. Possibly some equipment is not meeting service requirements, or some process is not as efficient as desired, or does not produce the customer satisfaction it should. Maybe someone just cut a major backbone fibre, which now has to be repaired. Or the data collected by the billing system is not consistent with the billing in the network-provisioning database. Or the process used to assess the results of trouble reports is not providing information quickly enough to allow proactive solutions. Something is wrong and a project is established to find and implement a solution to the problem.

The Three Dimensions of any project

Time. We talked about start dates, end dates and timelines. These are obviously requirements of projects. Meeting these presents one of the biggest challenges for project managers.

Cost. Most projects are allocated some level of budget, from the beginning, and the Project Manager takes on the project knowing that he or she cannot exceed that budget. Companies don't usually mind if you come in under the budget, but you generally can't go over the budget. So we've got to be very careful that we structure the plan and the implementation in such a way that we can produce the required results within that budget. Part of Project Management is the determination of the funding required to complete the project properly. At some point, the PM needs to decide whether or not the project can be completed within the budget. If this cannot be done, the earlier the company assesses this, the better.

Then the PM must take appropriate action based on the assessment. Sometimes the project was underestimated for cost and/or time, sometimes unexpected difficulties cause the project to trend over or under budget or

schedule. The project manager will discover this if he records the actual cost and schedule performance, recalculates the cost and schedule to completion, and reports any problems. . When there is bad news, the PM must take action. He might even have to go to the lengths of re-justifying the project with a new forecast, letting people know about the overruns, re-planning a smaller scope, or cancelling the project.

Scope. The project has to produce the product or service that it was set up to produce. And these must include all the required capabilities and features, meeting the level of quality that was defined for each. This is called the project scope. We need to complete the full scope of the project.

Meeting scope, time and budget then are the three main requirements of almost every project. The goal of this book is to give the reader the tools and techniques to allow these requirements to be met as consistently and painlessly as possible. We'll cover most of the PMI recommendations and relate these to the type of projects with which telecom managers are involved.

How are the main requirements of any project linked to each other?

Obviously time, cost and scope are completely interlinked. If we start running behind the schedule, there are many ways to get back on track, but most of them involve spending more money than planned, or cutting back on the project scope. We can add resources or ask people to work overtime, but either of these would cost money. We could outsource some of the work, again at a cost. If we start to go over budget, we could drop some of the deliverables, which impacts the scope. If we increase the scope to meet some new customer requests, this will probably increase both the time and the budget. Therefore it is always advisable for the project manager to insist that not all of these three factors be set in the initial project stages.

Of course, it is often not easy to allow flexibility in any of these objectives, so convincing management to allow one or more of these to be set later will often require some excellent negotiation skills. But the truth is that until much of the initial planning has been completed it is not possible to determine whether these objectives can be met. Companies, which are mature in project management, understand this and will give the PM as much flexibility as possible in the early stages. Usually at least one of the project dimensions will be non-negotiable. In a customer network installation, the due date might be controlled by their move date. Of course the customer will also have a budget figure in mind, and some real limitation

on the amount that can be spent. But, if a crunch does hit, often more money can be found if it is really necessary in order to meet the date. In a research project, the budget might be limited by the level of corporate profit, or the size of a grant, and perhaps also government restrictions. In this case, perhaps the scope can be reduced to fit within the allowable budget.

There is another dimension that people sometimes build into this equation. That is quality. Quality and scope are usually considered to be linked. Why? Suppose that a project team, after much honest effort, cannot reduce the time and the cost of a project to fit the allowable limits. The only way they can save must then be related to the scope. If the company's management or the customer will not reduce the scope requirements, and the team truly wants to meet the objectives, the only recourse is to reduce the quality of some of the deliverables. Quality is very closely linked to the scope. In order to fully meet the scope, quality requirements have to be met. At some quality level an evaluator would declare that the deliverable is unsatisfactory, so in fact the scope has not been fully delivered. However, the techniques for managing quality differ from those for managing scope. These will be discussed in Chapter 5.

From the PMBOK® Guide, we can see the processes involved in project planning and integrations, as shown in Figure 1.

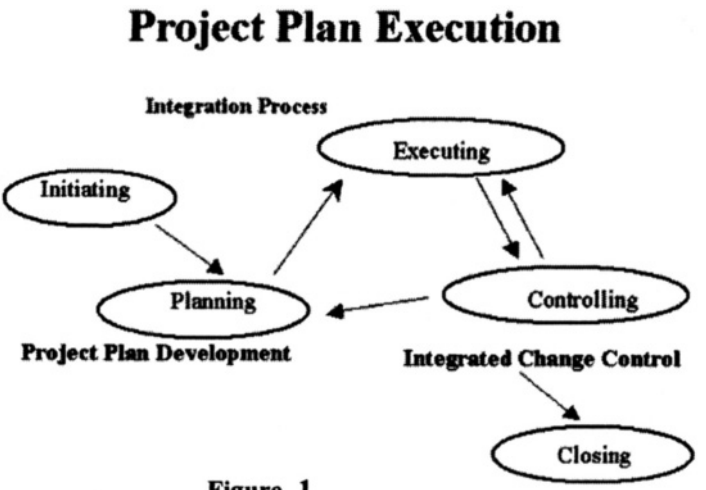


Figure 1

As we progress through this book, we will look at each of the process areas that the PMBOK® Guide describes, and notice how they relate to the application area of telecommunications.

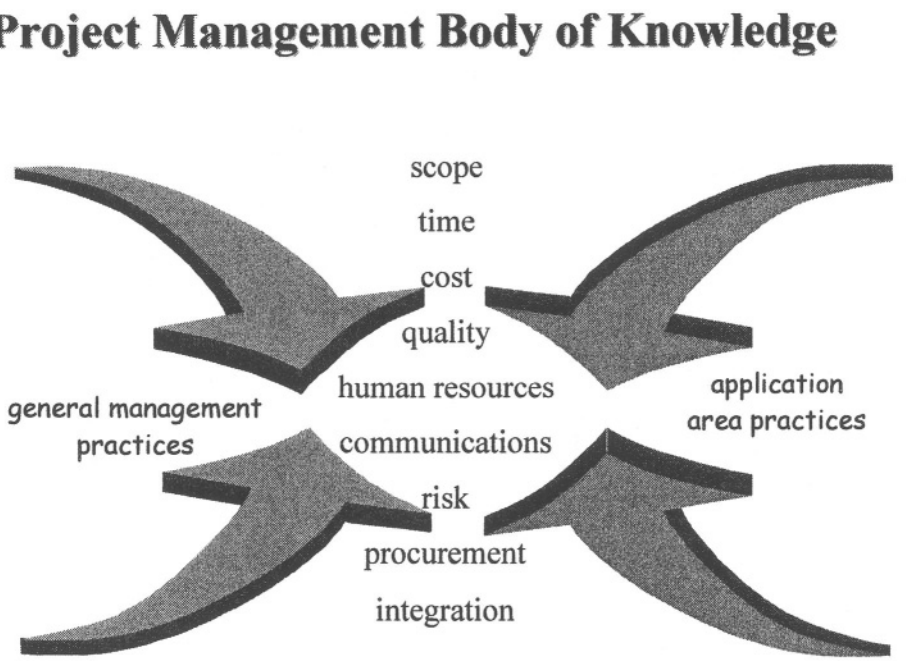


Figure 2

What defines success?

Project managers are generally very ambitious and driven individuals, who live for success. No one takes on a project hoping for failure. Complacency regarding the project success is also not normal. So, to succeed, we need to be aware of the factors that will cause people to rate a project as successful. What is it that makes a project successful?

- ✓ Complete on time.
- ✓ Complete within budget.
- ✓ Meet the defined project scope goals.

Will that do it?

We will need to have criteria to define what we mean by each of these, and to use to determine whether the criteria are met? So, for example we're

going to develop a product and we want it to meet certain performance specs. Maybe we are producing LAN cards, and we need to design and build them such that they meet the specifications defined in such standards as 802.x. We might check this measure by designing a prototype, and running a beta test of our design. Tests should be designed to stress every specification, and required levels of performance defined for meeting spec. This could be one measure of the product, a measure of the project scope.

But in addition to time, cost and scope, there will be other factors that will define project success.

Let's start with resources. Having the right resources, and the right number of resources, is a significant factor in making a project successful. Resources might be money, which we have already mentioned. But they could also be specific skills, or the right number of people. In projects, generally the skill requirements are quite different from those of day-to-day ongoing work? Projects usually require a set of skills that spans a number of disciplines, so the PM might employ a group of people from multiple discipline areas. This is generally not the case in day-to-day work. The people selected for the team may not all report to the same boss, and they might even come from groups spanning many different departments. Later in the book we'll discuss organizational structures and how projects fit in to them. The skills and techniques required to manage a project are different when projects are implemented in different organizational structures. In some structures some things are easier to do than they are in other structures.

One of these could be an efficient working environment. If people are wasting time early in the project and later having to work overtime to catch up, the project will probably not be successful – even if we meet the three objectives of time, cost and scope. In such an environment, people are going to be frustrated. If the situation is bad enough, this could cause major disturbance amongst the team members, or management. In itself this is not good. But there could also be side effects, which compromise the scope or quality as well.

Another could be having the work occur according to plan. The PM should always aim to minimize chaos. People don't like to have to work in an environment where things never seem to go right, or for someone who is constantly changing the way they're doing things, or the overall requirements. Working on such a project can be extremely frustrating for all involved. So it is critical that the team prepare a plan that is as close as

possible to reality, with the capability of reacting effectively to any required changes, without overly impacting the team. This will require first of all a solid plan, but also an understanding of what might go wrong, with backup plans for those things that would really need to be carefully managed.

Responsibility and accountability can be factors that determine success. It is important to clearly define the responsibility and accountability for all activities. We have probably all been involved in something that was derailed because some basic but critical component was missed. Nobody did something that needed to be done. In fact, maybe the team didn't even know who was supposed to do it, so nobody did it. Often these are things that could easily have been done, had they been assigned to someone. But somehow no one noticed that they had not been assigned.

Having clear project objectives is critical to success. People on the team, or the project stakeholders might have different interests, and hence different objectives for the project. Unless someone clearly defines, and gets buy-in for a single set of clearly defined objectives, how can these be met?

Let me use a conference example again to illustrate a problem. This example, while not per se a true one, is based on real factors that did occur in projects. They were found in a project audit. This conference was a relatively new conference in that it had been held only a few times before. The local organizing committee was made up of people who worked on research and development of products using a specific technology. They needed someone to approach industry to get sponsorship dollars, so they asked a young engineer two years out of school, offering him the opportunity to talk to some of the top people in local industry. The engineer agreed, and committed to obtain a certain dollar level for the conference. In actual fact, he obtained four times this amount, which looked as though he had been very successful. Therefore we were very surprised in the audit to find a number of accusations levelled at a young man, claiming that he had been unethical in his dealings.

The audit was instituted six months prior to the conference because there had been a number of complaints about the conference and the team. The small audit team worked for the six months before the conference, and almost a year afterwards. They found that there were fingers pointing all over the place on this project. In fact, they heard many horrendous accusations back and forth from one part of the team to another.

One team member had written a letter to that young engineer's vice president – he worked at a big international company with over fifty thousand employees. The letter accused the young engineer of inappropriately using corporate letterhead. Is that the way a star employee would want his vice president to learn that he exists? In fact, what he had done was to use their corporate letterhead to write a letter asking companies to sponsor this conference. But before doing this he has asked his boss for permission, since the conference did not yet have any letterhead. The boss had agreed that corporate letterhead could be used, as long as the wording indicated that the company was a conference sponsor – not the conference owner. The boss had also checked the wording with his manager, to ensure that there was a consensus on the use. So the young man was actually covered. But of course when that letter came to the Vice President, he didn't know these details, so his first impression of the young star was probably negative.

Someone else was accusing a conference team member of publishing a book containing papers from the conference, but not attributing the ownership of the book or the papers to the conference. Now when an author submits a technical paper into a conference, the right to that paper belongs to the author. The right to publish it in the conference proceedings belongs to the conference. Nobody else can use that paper. But the person was being accused of doing just this. The team looked for this book for quite some time. If he did publish such a book, it was certainly well hidden. It is not clear, how he would have planned to sell this book because the audit team could not find it anywhere.

In fact for every accusation that they investigated, they could not find anything anywhere that anybody had actually done that was in any way legally wrong. And yet, what an environment that was for the people to work in, especially when they were giving their time as volunteers to organize a conference.

As you can see there were problems. As it turned out, that the conference leader was maybe not a good leader. He hadn't pulled the team together and he hadn't stated the objectives very well. Their stated objectives were to run a good conference and put on a good show to get credit for the local team. Some people thought that meant making lots of money. Some people thought that meant making a good technical quality conference. But these two views were often not mutually supportive When it came to questions such as "do we give free wine at the banquet?" there the team seemed to

spilt into two factions, depending on the overall objectives to which they subscribed. No matter what question was asked, there were two views on the best answer. The problem was conflicting objectives. We finally realized that the group didn't understand their objectives at all. And that poisoned the whole environment. That conference never came back to that city. That group of people never again worked together as a group for another conference. It's really too bad because they were all top-notch people. I don't even think that the conference chair ever chaired another conference.

So here we have an example of a project that met all of its objectives, at the high level. It made money. Everything was done on time, and what the attendees saw was an excellent technical conference that ran very smoothly. On some scales, it was a very successful project. As far as I was concerned, it was a failure as a conference. The team was fragmented. The working environment was not pleasant.

Pleasant environment? If the project team was not successful but the product was, could it be considered a successful project? Probably not, going by this example.

This list covers quite a span of the things that define project success. The project manager must ensure that the success measures are clearly defined for the project. He must also be comfortable with these as legitimate things by which to measure the team performance. In addition, many of the stakeholders will also have their own objectives, and these should be made known. Measures can be defined, and included in the project documentation for each of these.

Causes of failure

However, many projects are not successful. In order to understand how to best manage projects, we need to understand not only what makes a project successful but also what causes projects to fail.

Failure to define scope. Often people accept projects without taking the time to fully understand the complete scope requirements. In some cases, say on a software development project, or a research project, it might not even be possible to fully define the scope in the initial project stages. But until this has been done, how can anyone determine whether or not the required scope can be delivered, particularly within the budget and time restrictions?

Scope creep On every project, people encounter some suggestions for additions or changes to the project. If these occur before the planning is finished, they can be built into the design. However, these suggestions and requests continue to arrive throughout the project. In some cases, the request is for something that is necessary in order to properly complete the project. Sometimes the request is for an addition or change which will enhance or improve the product, and which can be completed in a very short timeframe for very little cost. Once the budget and schedule are set even small additions cannot be properly accommodated. Perhaps one or two of these can be included, but generally the number of these requests is so large that there would be an impact on the results if they were all implemented. Even those additions, which are necessary, need to be properly accommodated.

Unreasonable or unrealistic expectations Many projects are undertaken before the team has any opportunity to analyze the possibilities. In some cases the project is the result of a competitive bid, and the bid is prepared by well meaning people who have objectives for furthering the corporate business, but not necessarily a solid understanding of the implications of some of the promises. Perhaps market or customer requirements are create creating stretch objectives for the company, but and in order to be successful in business the company needs to aim to meet them. Think about projects you have seen in which the expectations were unrealistic. Who had those expectations? The customer. Many times we think our customer has unrealistic expectations. The customer doesn't usually think so, however. So there is a need for some honest discussion to determine how the provider help can assist the customer to meet his requirements. Senior management of the company undertaking the project may also have unrealistic expectations, based on needs of the company, which are often different from those of the project team. Who else might have those unrealistic expectations? Upper management. In fact, for some projects both of these different sets of unrealistic expectations exist. When such expectations exist, the PM and the team need to include time and work in the project to deal with them.

Insufficient funding. When this happens project managers expend a lot of effort addressing the funding issues when they would prefer to be working directly on the project. But frequently projects are under-funded – either from the beginning, or because things happen: SARS, earthquakes, national economy, etc. We all have hundreds of examples of things that have caused our projects to be under-funded. In the real world we're working in, we often cannot predict many of the things that can impact our projects. How many people predicted that–WorldCom would be accused of unethical behaviour,

and that subsequently MCI would be forbidden from taking on government projects? Some things we can predict: probably ninety eight percent of these things that go wrong could be anticipated ahead of time. For those at least, we could be prepared.

Failure to accept full accountability. This can be a major problem. The project is destined for trouble all the way if not everyone understands what their responsibilities are, and what they are accountable for. In addition to understanding, the PM needs to ensure that he or she has their commitment to these as well.

Insufficient resources. Resources could be people, space, money, equipment, skills, etc. The team may lack some expertise or knowledge. If so, the quality is liable to suffer, and working with less than optimal people generally increases the time durations as well.

Not learning from past failures. Learning from past mistakes can save huge amounts of time and money – if people just take the trouble to do so. In a mature organization, there is a recognition that failure will occur from time to time. If people are expected to take risks, then sometimes they will fail. And risk taking is inherent to some degree is every project. So having a failure, while not pleasant or desirable, is not completely unexpected, or negative. If nothing else, failures provide learning opportunities. But we must ensure that people learn from them. Why don't we learn from past failures? Many times teams are so pressed to complete the 'real work' of the project that they neglect to take the time to document the failure. Or, if the management does not recognize the value of making the failure public, perhaps it is kept quiet, ensuring that people cannot learn from it unless they were directly involved. Or, even when this information is documented, there is no process in place to ensure that new project teams can and will find the information. For Project Management to work, companies need to put processes in place to allow and encourage learning from past failures and mistakes. Since the cost is being incurred, some value might as well be forthcoming.

Time pressures pushing people too hard. People often start doing their work too fast, not leaving enough time to do things properly. Of course, this will impact the quality, and probably also increase the overall time requirements, as additional work will be required to correct the inevitable mistakes, or forgotten activities.

Lack of proper planning. PMI identifies 39 different processes that should be in place for good Project Management. Most of these are related to planning. So there are many different aspects of the project that require planning. It's not necessary to cover all of these for every project. But it's very clear that if there is not enough planning, **focused** planning, a project cannot be run as efficiently as it should be.

Not identifying decision makers. This is a mistake that can easily happen. Most project teams do identify their key players. But, what do we mean by key players? We need to include not only the team, and the extended team, but also the stakeholders, including anyone who needs to be informed, consulted, etc. These are all stakeholders in the project, and some, such as those whose approval is required, can have a major impact on the project. If we identify who those people are ahead of time, then we can establish the plans and the schedules to ensure that we have those approvals when they are needed.

To kill projects, don't communicate. If we want to keep the project vibrant, we need to decide what communications need to happen, and when, and then ensure that they do happen. Creating and distributing the appropriate documentation is mission critical. If people don't have time to be bothered communicating because, they are "too busy" getting the 'real' work done, problems are inevitable. But we've can all identify with the person who says "It's already eleven o'clock tonight, and I have to be back in the morning at six. I'm just not going to write this up". But it's also clear that if the documentation is not done reasonably close to the actual work time, something will be lost if and when it is ever produced.

Lack of professional environment or lack of professionalism on the team. If nothing else, this can make the working environment unpleasant for many people. And in the worst case, people will be distracted from the tasks at hand while they use precious time and energy dealing with issues that should not exist. Who sets the standards and the tone for the project environment? Project managers have the responsibility to ensure that there is an objective, professional atmosphere. As soon as the project manager hears talk that is not professional, he needs to take action to create a better atmosphere. When he becomes aware of such behaviour as finger pointing, either within the group or towards others outside the group, he needs to immediately set a more professional tone. It's up tot the project manager to turn around the behaviour, and this includes not doing these things themselves, which a lot of project managers do! Even if the PM sympathizes

with the motives for this behaviour, he has to encourage more professional ways of dealing with the problems. This is not always easy, especially if the culture in the company is not totally professional.

Losing resources. Even if the lost resources are replaced, there is usually an initial slowdown, followed by a learning curve to get everything back on track again. If we know that this might happen we need to build enough time into the schedule to allow for the retraining.

Project Management

Many people learn project management on the job. Often people are offered project management responsibilities because they have demonstrated some excellent skills. Many telecom projects are highly technical. Sometimes management will decide to ask the strongest technical resource to manage a project, feeling that this person has the best capacity to understand all the inputs and to make solid decisions. In other cases people who have demonstrated strong management skills are asked to take on projects, because management wants to take advantage of the skills. Telecom companies have many projects underway at any given time, so project management skills are always in demand. If you learned this on the job and you never had formal training, you have probably learned quite a bit about project management. The problem is that you don't know whether what you have learned is the right methodology. Probably some of what you have learned is valid, but other areas require some tweaking or changes.

When I ask people whether Project Management is more of an art or a science, the answer is generally "More art". As more businesses use the project management techniques described in this book and more academics start to study the value of the techniques it is becoming more of a science. There is now an accepted list of 37 processes. That's fairly new. People managed projects for thousands of years without this list. The PMBOK® Guide didn't exist and people managed many extremely complex projects quite well. They used art, but they used more than art; they had good skills and they developed some of the processes for themselves; they just didn't have the same system for categorizing all those processes. The information available about project management today allows us to use a system of categorization, and to build appropriate processes for each category. In the past many project teams used to feel like they were fighting fires, because as the inevitable problems happened; they were constantly having to divert effort from the mainstream activities to fight the fires. On top of this, because the proper planning had not been done, the risk assessment was

often not completed. This meant that fighting one fire often caused additional problems that required another diversion to remedy these. Proper project management includes careful risk assessment with the development of the associated contingency plans.

PMI does have a formal definition of project management. *Project Management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements.*

Once project managers learn the best techniques, they can use these to plan and manage their projects more consistently. An added benefit of knowing and using the processes is the background they provide for convincing clients that you're using the right project management tools.

Project Charter

The Project Charter is a high-level description of the project, which is used to recruit the Project Manager, and subsequently to communicate the project information to those who need to know it. The Charter is discussed in detail in Chapter 2.

Project and Product

Before discussing more details, we need to make the distinction between the project and the product. The project is in place to deliver a product. The 'product' might actually be a service or a process, but we can call it a product for purposes of this discussion. The product will have a description. This product description will be one of the project information documents. It may or may not exist at the very beginning of the project. The Project also needs to have a description. The project consists of all the work that needs to be done to produce the product. The Charter is the first project document. It describes the product, but at a very high level. It gives objectives, and some scope information - what's included and what's not included. Some of these are related to the product, but some can also be related to the project, or the work to be done. The team will do all the project work in order to produce the product deliverables. So some deliverables must also be included which are specifically project deliverables.

Stakeholders

Stakeholders include anyone who has a stake in the project. This will include all the people or groups who will work on the project, those who will

benefit from the existence of the project or the product, and also those who stand to lose something because the project and/or the product exists. Another way of looking at it would be to say that stakeholders include anyone with an interest in the project.

Since these people do have something to gain, or to lose, from the success and direction of the project, it is possible, and even likely, that they will take some actions to try to influence the project or the outcome. Because of this, the stakeholders pose a potential risk (either negatively or positively) to the project. Thus, any wise project manager would be smart to be aware of who the stakeholders are, and what their interests are as regards the project. In fact, the project team would be wise to build the project plan, including the product plans, in such a way that they meet the stated and anticipated needs of at least the primary stakeholders. In this way they can minimize the risk to the project. One of the earliest activities that should be undertaken is to compile a list of all of the project stakeholders and determine their interest in the project. The list should be documented in the project plans, with an assessment of the how critical it is to meet the needs of each individual included. Plans should then be designed which incorporate solutions which meet these needs.

What type of people might be stakeholders? Stakeholders will vary from project to project. Certainly the PM and the team members are all project stakeholders. As is management, and any customers who are directly involved. There will usually be suppliers who have a direct interest, including those providing technical components and products, as well as those providing general items such as Friday lunches, or project t-shirts for the team. Of course, some of these stakeholders have a very strong interest in the project, while others will not be as close to the primary action. And, in some cases, stakeholders who are not central to the project objectives might actually have stronger interest in the project than anticipated, simply because the impact of project on their interests might be very significant. Therefore the team should consider all stakeholders, even those that appear to be minor players, evaluating their interest and potential behaviour. In addition, some stakeholders are not easily identified. It is important that the team try to pinpoint even these illusive stakeholders, as they could pose many risks.

Here is one example of a stakeholder that one PM ran into who caused the PM to spend considerable time managing expectations, and who almost killed what was, in the end, a very successful project. The PM was a manager in an operating company who was struggling with some tough decisions regarding the direction to take with some of the services under

development. She had four different technical areas under development which required tough decisions, and the internal team members had many conflicting views on which direction would be best. In one case there was a new billing system that would be introduced in conjunction with a new service. There were problems with introducing a new system. Not the least of these was that a separate billing system would cause customers using the new service to receive separate bills for the new service. A separate bill would be required because the billing data could not initially be combined with that in the existing databases. However, the new system was very flexible, and it would allow for presentation of the data in many formats which had been requested from customers, and would even allow for customization of the data and formats across customers. This was seen as such a strong advantage that it would outweigh the problems. However, the telco mode of operation had never been strong enough in identifying customer needs. In this case, no one could decide how to best implement the customization. The only way to get really good input on this would be to go directly to many of the customers, and ask for their preferences. However, since the customers would not be aware of the system capabilities, it was decided that it would be best to show the customers the possibilities, and get their reactions. A second team was working on new technical capabilities, which would add modular software to telco switches, programmable databases with real-time customer location and service information to the network, and a number of other enhancements that could be used to build some dynamite new customer services. In this case the number, type and design of the potential services was so extensive that it was difficult to even list the possibilities, let alone describe them. Again, it was felt that customers should provide the input to help decide which services to build, and how to design them. But again, the complexities necessitated the customers being exposed to the possibilities.

At the time, the telco had a very strong policy that no services were unveiled to customers until the full development had been completed. This policy precluded the strategy that the technical teams wanted to use to get the customer inputs. So the PM decided that it would be worth pushing to get an exception to this policy, given the circumstances. She made a proposal to her own management proposing that she organize a Super Seminar, to show these four complex technologies to the executives of a few hundred of the largest customers, asking them to provide feedback on designs that would work well for them. The seminar was to be held one day after a large trade show which the executives were likely to attend, so the chances of attracting them to the extra day were good. And to obtain even

further feedback, she proposed that they obtain a small booth space off the beaten track at the trade show where they could set up demos of some of the technologies in order to get feedback from the show attendees – straying even further outside the standard policy. The proposal was well received by her management, and went all the way to the company president, where it was approved.

The manager then drew up the project plan, shared it with all the stakeholders who were involved with the service development, started to design the seminar, and book the booth space. She worked with the sales departments to invite hundreds of executives from the largest customers, announcing both the booth and the seminar. Plans and development were proceeding extremely well until one Friday evening she received a phone call. The voice on the other end asked if she had booked a booth (yes), was running a seminar (yes) and had invited customers (yes). He then informed her that she was to cancel all the plans immediately, because she could not proceed with either of these activities. Needless to say, That discussion lasted for over an hour, and continued with many interactions over the next few weeks. Even the presidential approval appeared not to matter to the caller. This was not someone who had been identified as a stakeholder in this project, and in fact, not someone who was even interested in how the services and technologies would be designed. But it was someone who had the right to state that this team could not proceed, and enough clout that there was a good possibility everything would be cancelled.

The caller was the Director of Public Relations. The responsibility for deciding what trade shows would be attended, what would be shown there, and how the material would be designed belonged to PR. This PM, in focusing on her own department and her own needs, had neglected to include people who should have been included in the communications and decision making for the project. As it turned out, this mistake was probably a fortunate one, because the PR department was firmly convinced that showing technology that was still under design would confuse the customers, that having a small booth not in the major show location was bad for the company's image, that expecting people to sit in a booth for 15 minutes to give feedback would never work, and that the number of leads that could be generated this way would fall far short of a useful number. The PM meanwhile was totally convinced that this was the only way to allow the customers to understand the possibilities, that a small booth would meet the objectives of taking the material to the show, and that the number of leads required was in fact fairly low, as long as the leads were people who would work with her. In the end, it was only the pre-existing presidential approval

that enabled the show and the seminar to go ahead. The PR department clearly proved that the booth strategy would fall far short of the usual number of leads – while the PM was very pleased to have 150 leads to work with. Over 300 customer executives attended the seminar, and they gave a standing ovation at the end. Development in all four services was enhanced by the feedback.

But the PM (yes, it was me) will never again forget to coordinate with Public Relations on an external project. They are key stakeholders.

As the example illustrates, stakeholders have the potential to help or to destroy a project. Every project team should take the time as early as possible to identify all stakeholders. The interests of each stakeholder need to be examined, and the project design needs to be such that the stakeholders will support and assist the team, rather than working against them. In addition, all the key stakeholders should be kept informed of all project developments which affect them, to keep them on the right side of the project. As in the example above, it might be politically wise to obtain certain approvals, or proceed to certain points before involving some of the stakeholders directly. But it is not wise not to fail to identify them as stakeholders. The PM must identify their interests and concerns and look for solutions that benefit them as much as possible. If additional stakeholders are identified during the project, this information should be added to the plans, so that future teams on similar projects will not forget them.

Consider the project mentioned in the Introduction, under the equipment vendors, to convince a hotel chain to use LAN technology to provide high speed internet to their guests, and to also provide the ongoing support for the service. Who are the stakeholders for this project? Let's list some of them.

- We can start with the PM, and the people on the team. They need a well-defined project, with a scope that can be accomplished within the required timeframes, and the assigned budget. They need to know who all of their primary contacts are.
- There will also be the support group that will provide ongoing support. They will need to ensure that the technology is correctly set up, and also that the trouble reporting procedures are workable, to allow them to provide high quality technical support.
- The corporate marketing department will want to ensure that the technologies the hotels use are ones they want to support for the future, and that the selected services are provided at the right price.

- The sales department wants to ensure that nothing jeopardizes the sale and that no-one interferes with their client relationship.
- The purchasers for the hotel chain want to ensure that they obtain enough equipment, of the right type, and for the best price.
- The hotel management at the individual hotels wants to be involved in determining what the guests will see in the room, and what the cost is, as this will impact the rates they charge to the guests, how the charges will be applied (directly, or through the hotel bill), how the guests will obtain support, and what the standards are for the technical support.
- The hotel guests are concerned about the availability of the service, the operability of the service, and what functionality is provided (eg. Web browsing, or high-speed email, etc.)
- The manufacturing department will be concerned about the number of units that will have to be supplied, during specific timeframes, and the shipping department will be concerned with the number of units that need to be shipped to different national locations.
- Hotel security might be concerned about having to send hotel staff into guest rooms in which the physical equipment might have connection problems. Even housekeeping might be involved if they might be saddled with answering questions, and ensuring that each room has the required cables, etc.
- There will probably be other vendors who are bidding for this opportunity. They will be stakeholders who would really prefer that we fail on this project. And they will come up with many creative ways to ensure that this might happen. We might want to ensure that we have the right sales, marketing and technical support to enable us to anticipate their moves, and be prepared to out manoeuvre them.
- The shareholders in the vendor company might even get involved, if there are some large shareholders who support, or do not support, this project. But this is usually a more remote possibility.

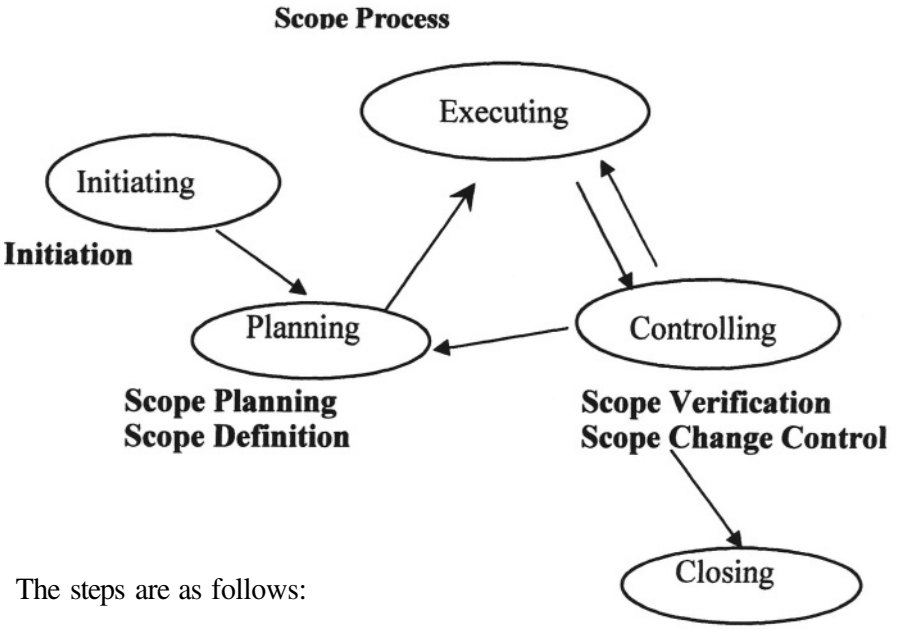
There are many more that could be listed, but this list should give a good idea of how varied the stakeholder list can be, and their scope of the interests.

The items discussed so far, including the project charter, the stakeholders, measures of success, and project requirements are all things that should be identified and clarified in the project plan. As we work through the remaining chapters, we will identify many more areas that need to be included in the overall project plan.

Chapter 2

PROJECT SCOPE

Project scope is the description of what the project will produce. Starting at the beginning with project initiation, the project team builds the project information step by step. According to the PMBOK®.Guide, the processes related to Scope Management are:



The steps are as follows:

1. Great Idea
2. Project Charter
3. Scope Description
4. Scope Management Plan
5. Work Breakdown Structure

Once all of these steps have been completed, the team will have a solid description of the scope. This can then be used to determine the project budget, project resource requirements, and the timelines. In this chapter, we will work through steps 1 to 4, with the Work Breakdown Structure discussion following in Chapter 4.

1. GREAT IDEA

Initially someone has a great idea. The idea is either a wonderful new opportunity, or a solution for a problem. The company should have a process for assessing this idea, to determine how far it is worth taking it. This is done in the initiation phase of the project. Someone, often sales or marketing, might have identified a customer requirement

in meeting with a long-term client. Or marketing could have identified a new product that could fill a gap in the corporate portfolio, preventing loss of some major customers to competitors, and opening the possibility for attracting new customers. Or perhaps customers have identified that corporately your company is not responding well to customer requests, so sales has convinced management to implement a change in corporate culture to become more customer needs focused. Or perhaps an RFQ has been received, and sales have responded with a detailed bid, which has just been accepted. Any of these creates the need for a project to produce the desired results.

In every case, the company must assess the proposed project and make a decision on whether to proceed or not. This decision, if positive, is often to proceed as far as the next gate, which would occur at the end of the planning and definition phase. At that point the project would return for further assessment,

and a decision can be made regarding implementation. Because no details are known at the idea stage, it is difficult to make a go/no go decision on implementation. Hence the second gate requirement.

This assessment might be informal in some cases, but it is best if the company has a defined process for project acceptance. Then, those who might propose projects can be made aware of the criteria for successfully passing the gates, and they can provide the information to demonstrate the proper project value in the first presentation. Having such a process puts projects on equal footing, and also reduces the need for recycling of proposals for evaluation.

Keep in mind that every company has many more proposals than there are resources to implement them. No matter how important your project is to you, unless you can show very solid justification for proceeding, it will not. So the team preparing the "idea" documentation should build as solid a business rationale as possible to maximize the acceptance probability. And this is best done by first understanding the criteria for passing, and secondly, by having some background on the types of arguments that usually generate positive responses. Then any such information applicable to the particular project can be included and highlighted.

One output of this phase is a Project Charter, which is an excellent communications tool for the project.

2. PROJECT CHARTER

The Charter is a very high level description of the project. It should be only 1-3 pages, and it should contain a description of the project and the product to be produced, the project objectives, some business rationale, the budget expectations, what's included in the project, what's not included, the assumptions, and information known about project risks, and maybe some info about the team or required skills. Since so many topics must be covered within only a few pages, the Charter has to be high level.

In theory the Charter is written by the Project Sponsor (management) and used to recruit the Project Manager. In actual fact, it is often written by the Project Manager or the project initiator. If marketing generate the project, they might also prepare the Charter, and present a full Charter to management for discussion and acceptance. The sponsor can then use the document to recruit a Project Manager. Alternatively, the sponsor might discuss an idea with the Project Manager, and leave the documentation with

the PM to complete. When this happens the PM has some freedom to prepare the document in such a way that the project can be delivered in a manner that is best for the PM. No matter who prepares the Charter, the sponsor must fully approve it, and normally, the customer must also approve. Once the approvals are gained, it can be used first to authorize the Project Manager to expend resources and recruit a team, and then as a communications tools for sharing information with all the stakeholders.

The signing off on the Charter is the authorization for the PM to proceed to gather the people for the project, and for management to expect that these people will produce whatever is promised in the Charter. So the Charter essentially kicks off the project.

The budget, we hope, is NOT available at this point. The later we can firm up the budget numbers, the better off we are from a PM perspective, because we can get the true information from the requirements, then cost these in detail. However, management has to allocate money for the project, so you almost always see a number for the total budget in the Charter, and sometimes there is a bit of financial breakdown as well. But this is not the real budget. This is just a preliminary indicator. The Project Manager will develop the detailed and accurate budget with the project team after the Work Breakdown Structure has been completed. Prior to this, it is not possible to be fully accurate in the budget requirements. In fact, as we will see, even with the work breakdown structure, we are still estimating the actual budget. But the budget has to be limited, so the project team must be charged with producing the best possible determination of the requirements, and then the team should be held to meeting their numbers.

If a proposal has been issued, perhaps in response to an RFP, and it is subsequently accepted, this proposal then becomes the Charter, even though it is generally much more detailed than the standard Charter described above. The same holds true when there is a bid. It has to be used, because it is legally binding. This is also true when the project is defined within an already signed contract. In these cases, the team will be tied to many more limitations in terms of deliverables, time and budget, so it becomes more difficult to engineer the project for success.

Direction for new projects generally comes from marketing, sales and/or senior management. In any company many ideas are generated, each of which could become a project. The company has to have some way in which these ideas can be investigated, and evaluated, in order to decide whether resources should be allocated to them. In some companies such processes are

formalized. In others, they are informal. In either case, more ideas and requests are generated than the company has resources to handle. Therefore companies have project selection processes, and these will be discussed in Chapter 4. The process usually starts with someone doing a high level preliminary analysis to get a feel for the relative value of proceeding. After this is complete, most ideas are rejected. But some will be put forward for further investigation and possible implementation. By this point it is necessary to develop a short high-level description of the project. This will be used to communicate the available information, and to recruit resources for the project. It is often at this point that a PM is assigned. The high-level project description is the first of a series of documents that should be created for every project. It is only a few pages in length and it is called the Project Charter.

The Charter is a high level description used between the PM and the sponsor to give an overview - or a vision if you want - of what the project is to deliver. After this is agreed, people start to work out the details of what the deliverables will include, and how they can be produced.

The Charter is one of the main communication tools for the project. It should contain a brief overview of the information that is needed by everyone to understand the project. In theory it is prepared by the project sponsor, who is in senior management (or at least more senior than the project manager). Once the PM is recruited, it is signed off by the PM.

The Charter describes the project. It gives the objective, the high level deliverables, the assumptions, maybe some info on the team, usually at least the date by which the product is needed. Any relevant information that people feel should be mentioned can be included in the Charter. But this is done only at an overview level. It is in the scope statement that more project details will be specified. The purpose of the Charter is to allow management to share information about the project and its direction in order to obtain the buy-in of the key participants. Therefore, it should be kept as streamlined as possible.

In essence, the project idea goes through a series of gate reviews, starting with a concept gate. This is the when the Charter is produced. As mentioned, in theory it is written by senior management, and used first to recruit the project manager, who then uses it to obtain other resources for the project. However, in many cases, management is already presented with a Charter by the originator of the idea. In other cases, management simply discusses the idea with the potential project manager, and the PM has the

opportunity to create his own Charter. This has the advantage that the PM can then develop the Charter to reflect his or her own biases and preferences for the project, giving him a better opportunity to include those things that he has the best chance of producing. Of course this description still has to have the approval of the all the key stakeholders, so it may later be changed by others. But at least the starting point can be presented in the best light for the project, as the PM sees it.

The Charter per se is a document between corporate management and a project manager in the same organization. There is no need to introduce any concept of legality, although the intent is that once there is agreement on the Charter, all future work will be consistent with the Charter, and the Charter will not change during the duration of the project. Once it has been drafted, the discussion process starts, to obtain the approval of all the key stakeholders. Many people may be involved in defining the contents, in some situations. In others, only the PM and his boss are involved. But the concept of the Charter applies in all projects.

The Charter is a document that shares commitment and understanding within one organization, a document of agreement between the project sponsor (management) and the PM. It can be based on any relevant information. That information may have been defined internally, or amongst many parties. Legal or formal documents may form the basis, or part of the basis of the project. But internally, between the PM and the sponsor, there is a need for a high level understanding of what is to be done, and by when. This is described in the Charter.

While the general concept of a Charter is that it is a short, high-level description of the project, in some cases there are legal documents in place that define the project, and these can be extremely detailed. If this is the case, then these documents actually become the Charter – although the PM should probably also create the high-level version, as it will be more effective as a communications tool. The legal documents, which exist in some cases, include bids and contracts. We will discuss these in much more detail in Chapter 9. But when a project is created because the company has bid for some work, such as the proposal to a customer for some custom equipment, that bid clearly describes what will be provided, and it is legally binding, so it must be adhered to. Therefore it becomes the project Charter, because all conditions and specifications included there must be met.

In cases such as the bid situation, promises have been made, often before the project manager and the team have been involved. As the team evaluates

these commitments, they find that creativity will be required in order to meet the commitments, especially if all three of the major constraints of scope, time and cost have already been determined. It is always best to maintain as much flexibility as possible at the beginning, to allow the project plan to be built to optimize the product to be delivered. It falls to the PM to continually work on the processes within their organization to build in as much flexibility as possible at this stage so as not to jeopardize the project.

Initially, then, the project sponsor creates the Charter, and uses it to recruit the project manager. The two firm up the contents, and sign an agreement with each other to allocate resources to the project, in order to produce the deliverables defined. Next the PM uses the Charter to talk to potential team members, and their managers, to secure the required resources to move forward. This process creates the initial buy-in for the project. The buy-in is essential to position the project for maximum success.

The Charter contains the general information about the project. There is no set format for a Charter. Formats vary from company to company. There will always be some administrative information that should be collected, such as the name of the PM, sponsor, possible team members, and possibly other critical players in the corporate chain related to the project. The description of the product to be produced must be included, generally with the project objectives. A preliminary indication of the budget should be included, along with the major time indicators. Any dates that are already known should be included, such as the completion date and perhaps some timing for major project milestones. The major deliverables should be identified.

Other appropriate information, which might be part of a project Charter, is the list of items that are included and those that are not included. Assumptions and risks, which are known, should be specified. Any known constraints can also be specified.

The Charter is final once the PM and the sponsor sign off. But this does not mean that the scope will not change. The project scope is described in the scope statement. The scope statement is much more detailed than the Charter, and it will be developed later. The scope statement is generally narrative, and it can be many pages long. It is also necessary to have a process for handling request for changes to the scope - because once we finalize the budget, the timelines and the people, we can incorporate changes only if we get the additional flexibility and resources. People who do not typically work on project teams do not often recognize this. Environments

have a tendency to change during the course of most projects, so change requests continue to pour in on many projects. Of course, most of the requests for changes are excellent suggestions, and the project outcome might be much better if they were incorporated. However, once the timelines and the budget are set, the resources assigned, and the work begun, any change impacts the possibility of meeting the project objectives. So change requests have to be carefully assessed and handled. Not managing these leads to scope creep. We discuss the change request process in this chapter.

Building the Charter

In order to create a project Charter, it is advisable to learn as much about the requirements as possible. How much money can we possibly spend? Even if there is already a committed sponsor, the project will not have an unlimited budget. In fact, it will be necessary to justify every dollar to be spent with some significant return, either financial or some other form. It is best to work with an understanding of the potential limit.

What constraints exist? These could be physical constraints, or logical. They might be budgetary constraints, if there is a hard limit on the dollars that can be spent. The budget per se is not a constraint. It is actually an objective, albeit an objective that it is advisable to meet. But in the case in which there is a hard limit to the amount that can be spent, this should be listed as a constraint.

Who will be impacted by the product under development? What is that impact? How could the project be designed to ensure that the desired results can be achieved?

Consider the overall project objectives. Chances are that these are related to something beyond the project scope. For instance, in the development of a new product, the objectives could be to produce a certain level of revenue within a specified future timeframe. This is probably not something that can be measured as part of the project itself. But the information can be very critical to the design of the product, or to the problems the team might face in trying to hand over the product to a manufacturing or a sales department. So it is important to give some thought to such objectives and their impact on the project. How much revenue does the company expect to make during the year in question?

Suppose that, in order to understand this, the PM goes to the Marketing Director and asks for the basis of the revenue objectives. If the question is not asked properly, the Marketing Director could interpret the question as an

implication that he does not understand his business. He might ask why the PM wants to know. "That's marketing information. What does it have to do with the project?" The PM needs to position the conversation so that the Marketing Director can understand that the PM would like to be able to make a judgment about whether he can produce the required value. Or, when asking management about their reasons for requesting the project, the PM needs to ensure that he is not misunderstood as believing that there is not good value in taking on the project. Perhaps some introduction such as "I need to understand some things, because I have to build the product and I have to know what to build, and I also have to convince other people to do the right things. I would appreciate any information you can share, to allow me to do my job better.

It is definitely important to ask as many questions as needed to fully understand the project, in order to do the best project possible. Our goals are to meet the project goals, or, if we cannot do so, to make this known as early as possible.

Perhaps some other departments should be involved. Have any of them already been approached, and if so, what was their reaction?

What about the customer? What has been promised, and what specifically has been requested. Are we aware of any additional requirements that might surface?

What is already available that could be used to produce components of the project? Do we have access to this? At what cost? Or under what conditions?

When does management want to see the project plan? What about the key customers? Is there specific information that they need to have included?

What exactly has to be provided for management to consider that the project is complete? What about the customer? The maintenance and support groups? Other departments such as manufacturing?

How does this product relate to other products in this product line? In other product lines? In the corporate plans?

Are there specific people already lined up to work on this project?

We need to ask all of these questions, and others that will help to give a full grasp of the requirements. Once we have the answers, we will be in a better position to plan our project much more easily.

If the PM develops the Charter for the sponsor, he then needs to discuss the details with the sponsor. The sponsor might have a different understanding altogether, but they can discuss this from the PM's point of view, and as the discussion proceeds, the PM will know what points need resolution. This discussion helps to clarify what the project scope is and helps to define what needs to be done. Once the goals and deliverables are known, the PM can start to think about who is going to play what role.

PROJECT CHARTER

Project Overview

Project Title: IP Voice for *Superspeedy* cable modem
Prepared by: P.M. Goodfellow Contact info:PMG@superspeedy.com
Project Sponsor: D. Warbucks Contact info: DW@plutocrat.com
Client contact: A. N. Other Contact info: any1@public.com

Project Objective:

What will be accomplished by completing this project? Please specify the reasons for undertaking the project, the benefits that will be obtained, and the timeframes within which the benefits will be realized.

- Provides a new product opportunity for cable providers to offer voice service on their cable plant.
- Increased sales of Superspeedy cable modem, estimate $150M in first three years
- Product market launch by Q4, 2004

Project Scope:

Provide a brief description of the product or service to be produced. Give information about the methodology to be used.

- New packaging including 2 RJ-11 ports
- Integral ATA function for analog phones
- Voice packet prioritization S/W, support of MGCP, SIP network protocols

Project Deliverables:

List all of the major project deliverables.

- Design specification
- Project plan
- Packaging design

- Manufacturing tooling
- G.729 Modem functionality
- S/W load on NV RAM, downloadable update capability
- Prototype batch evaluation
- Product marketing collaterals
- Beta Market trial with Escargot Cable Co

Inclusions/Exclusions:
Specify key items to be included in the project, and those items which will not be included in the project or the end product.

Inclusions	Exclusions
CPE H/W and S/W	Consumer market research
SIP/MGCP interfaces	Network capacity and loading studies
	Network gateway equipment
	H323 support

Assumptions/Risks:
1. Product will be merged with 2004 corporate marketing campaign
2. Product will share Superspeedy brandlining
3. Potential downside from lack of H323 support

Budget:
In 2003 R&D budget: $2.7M
In 2004 R&D budget: $6.6M
In 2004 Capital budget: $350K

Constraints:
List any known project or activity constraints related to the scope, timing, cost, or quality of the project.
- Availability of mechanical design group in conflict with 2 concurrent projects

Additional Customer Requirements:
None noted

Success Measures:
Specify the success indicators for the project, and with potential requirements for each.

- Unit cost< $46
- No increase to standard Superspeedy cable modem package
- Maximum voice latency @ 1.5 aggregate data throughput <15 mS.
- Availablity to Superspeedy distributor network for 2004 Christmas season

Date project required by: Sept 1,2004

Department approval: Dilbert Grinder Dept: Engineering Tel. #:3.141592
O. Kenobee Dept: Marketing Tel. #:1234567
I Gaapp Dept: Finance Tel. #:2345678

Prepared by: P.M. Goodfellow Contact info: PMG@superspeedy.com

Client Signature _____
Project Manager _____
Project Sponsor _____
_____
_____

3. SCOPE DESCRIPTION

Once the Charter has been accepted, the next step is to flush out the information in the Charter to produce a Project Scope Statement. The Scope Statement is a narrative description of the project. Working from the basis of the information in the Charter, the scope statement builds on the basis, and elaborates on the information to clarify the product and the project.

The process for determining the scope includes viewing the project from a number of perspectives. This process is undertaken by the Project Manager with assistance from as much of the project team as possible. The initial step is to review the Charter, ensuring that there is a full and common understanding of the contents. Next, the team should consider the context within which the project is being undertaken. The best way to do this is to identify the project stakeholders. This takes some thought, but will not take a large amount of time if there are team members familiar with the different aspects of the project environment. Once there is a list of the stakeholders, it is important to identify the potential needs of these stakeholders. This will give the team the opportunity to look at the project from the perspective of

these stakeholders. They will all have needs, and they will be looking to the project to help meet these needs. If the project does not do so, they may not accept or support the project. The more the project can help them, the more they are likely to support it. This analysis will give the team the opportunity to consider ways of designing the project to be positive to the stakeholders. Since each stakeholder will have a different perspective, and different needs, sometimes these will conflict. For this reason, and other project related reasons, it will not always be possible to meet all the needs of all the stakeholders. When this occurs, this early analysis will allow the team to prioritize the needs, and also to be alert for better ways to meet them as the project progresses.

Also, before proceeding too far, the project manager should ensure the project has the appropriate approvals. Sometimes even internal approvals are not in place, and if these do not come through, work will have been expended for nothing. External approvals can be even more difficult. In addition to getting the approvals, the team might need to start working on building buy-in from some of the stakeholders, preferably before the work goes too far.

On one project, sales had sold a large customer on a new offering, which would use telecommunications to change the way they offered their services to their clients. The client was extremely supportive of the change at the upper management level, because management could see the possibilities for much greater client acceptance. However, this was a large organization, with a number of unions to deal with, and a huge line organization dealing with their customers. Since the solution being built for the client was integrated with his internal systems, operations and processes, there was a strong need for the project team to work closely with the client middle management in the definition of the project and product scope. However, when the project team approached their customer contacts, they were always held at a distance, and no real communication of the required details occurred. Without the ability to obtain client details, the team was not able to clearly define the project scope. The cause of the problem was a perception on the part of the client at the working level that their jobs would be impacted by the project. They were not willing to support the definition of something that was potentially a threat to them. Eventually this project was cancelled, because the client management and the project team were unable to convince the client working level of the benefits to them of this project. This sort of issue should be resolved as early as possible.

After stakeholder analysis, the team can flesh out a narrative scope statement. According to the PMBOK® Guide, creating this scope statement

is part of Scope Planning. The statement will include a full description of the project. While doing this, the team should also identify any risks that the project is likely to encounter, so that risk management may begin. We discuss risk management in the next chapter. With the Scope Statement in place, the team should then build the scope management plan, and from there produce the work breakdown structure.

The Scope Statement will contain at least the sections that are present in the Charter, with any appropriate additions or clarifications. Referring to standards, which provide further clarification and definition is a good idea. The scope statement might well contain diagrams, and perhaps in some cases, such as description of logos to be used, some other dimension such as colour may be helpful. The length of these statements varies. The statement should be as long as required to convey the required information.

The project Scope Statement should contain at least the following information:

Business Need:

This description is based on the information in the Charter, but further details can be included if available. The business need should be expressed as a goal or as a problem. Since projects are initiated either to take advantage of an opportunity or to solve a problem, this driver should be described here. A goal should be expressed in terms of a measurable outcome that is desired. A problem should be defined in terms of the gap between "the desired state" and "the current state."

Project Justification:

State the reason that this project should be undertaken. A business need has been described. Given that there is a need, why should the company expend resources to meet this need? The project justification provides rational to justify the expenditure, and to justify the undertaking of this project rather than other projects, which would meet other business needs. The rational could be an increase in revenue, an improvement in customer service, which will help in specified ways to maintain customers, an improved visibility, etc. There should be enough information provided to allow management to understand the benefits of this project, and to compare these benefits to those of other projects competing for the same resources. The rational should be directly related to the corporate goals and mandate.

Product Description:

A project is undertaken to provide some macro deliverable, or product. The 'product' might not be a product per se, but a new service, or a process implementation. However, from a project management perspective, there must be something that is to be produced. It is this 'something' that is the 'product' that the project is in place to produce. The product description provides a brief narrative description of the 'product' (which is the solution to the business need identified above). If the product scope has already been defined elsewhere, then an appropriate reference to supporting details such as the operational definition and/or contract should also be indicated. Unless this reference documentation is generally available to the project stakeholders, it is also wise to include an appendix with the backup material. In other sections of this statement the project and project management parameters will also be more fully defined.

Project Deliverables:

Every project can be decomposed into a small number of high-level deliverables. The Scope Statement must list the major tangible components of the solution (the major outputs) that must be provided in order for the project to be considered complete. These are the components that make up the 'product' described above. In addition, there must be at least one deliverable related to project management. At the highest level this can be just "Project Plan", or "Project Management". But since Project Management is going to be part of doing the project, it must be included at some point, and the scope statement is a good place to introduce it. If it is not introduced at this point, it must be included in the next step, the work breakdown structure. The deliverables should be first expressed as large, high level deliverables. They describe the 'what' of the project. Listing these allows people to comprehend the components of what the project is producing. These should be listed first as bullet points to indicate each discrete deliverable, possibly with a very brief description of each. Then each of these can be more fully defined. In the Charter, only the bullet points need to be included. In the scope statement, more description is required. Enough description should be provided to allow the stakeholders to fully grasp the project to be undertaken.

Included/Not Included

The Scope Statement should clearly describe the items that will be included in the product, and the project. At a minimum, this should be an itemized list, but if needed, further description should also appear. More importantly the statement should also specify what will *not* be included in the project. This will give further clarification to the product and the project,

and likely raise discussion items with stakeholders. This is advantageous because it is generally easier to resolve issues early in the process, before much time and effort has been expended and players are entrenched.

Project Cost Objectives:

Every project has a cost. Generally the cost is expressed in the number of dollars that must be spent to complete the project, and hence obtain the desired benefits. But sometimes costs are expressed in other ways as well, or instead. Costs can be expressed as resources or opportunities foregone to obtain a set of benefits. So the cost might be expressed in some comparative way, such as the cost of doing this project is forgoing something else.

An example of this would occur when a start-up has designs for 3 new unique products, but has funding and resources for only two. The cost of producing the first two products is not serving the third market, and thus potentially not being positioned to capture the market for another generation of the technology, which is expected in a few years.

Cost objectives for the project should be consistent with project selection criteria for profitability and/or growth. In the scope statement these objectives should be specified.

Every objective specified – not just cost objectives - should be **S.M.A.R.T.**

- ✓ **Specific**
- ✓ **Measurable**
- ✓ **Attainable**
- ✓ **Realistic**
- ✓ **Time bound**

When you set an objective, you need to ensure that it has these properties to enable people to determine when or if the objective has been met.

Each should be specific so that people can have a common understanding of what exactly is included, or not included in the objective or the activity. Next, we have to be able to measure the achievement. So, a goal to increase sales is measurable, but a goal to increase sales by 10% by November 15 is specific and measurable. The first can be subjective – if I

sell one more handset than the 800,516 sold last quarter, have I increased sales or not?

Attainable is also important, because people tend not to work hard when they think success is not possible. But when attainable objectives are set, even when these are stretch objectives – something that can probably be achieved if everyone works hard, and outside factors are favourable – people will work hard to achieve them.

Realistic is in some ways similar to attainable, but some things can be attainable, yet not realistic. I could maybe save enough money to personally buy a baseball team, but how realistic is this if I cannot afford to keep it going, and in fact, hate baseball to boot.

We also need to define a start time and a completion time for each objective. If my objective is to improve the service portfolio to fill gaps in the area of IT based services, what timeframes are we considering? Will it be ok if we have some competitive services ready to offer in 3 years time?

It is important to keep these parameters in mind when establishing any objectives. In the description, these criteria should be laid out clearly for each objective. For example, specify how the progress will be measured, and what the team must produce to be considered to have been successful. The team can more easily meet the objectives, knowing clearly what they are.

Project Schedule Objectives:

When the Scope Statement is prepared we do not yet know exactly what work will be done in implementing the project. This will not be known until after the full Work Breakdown Structure has been prepared. Even then, we do not know how much time will be required to produce the deliverables. Therefore it is not possible to provide a precise schedule at this time. At this stage though, it is important to start thinking about the project timing. In many cases, there will be some timing constraints that must be met, and these will have to be specified as soon as they are known, to ensure that the project is designed in such a way that they will not be missed. In the Scope Statement the team should list the major milestones that will be used to measure the success of the project. For each of these, a timeframe should be specified. If this is also a project constraint, it should be mentioned again under constraints. Schedule Objectives then, would include a completion date for the project as a whole and time frames for each of the major milestones. Schedule Objectives should be consistent with the relevant project selection criteria. Moreover, Schedule Objectives should be

consistent with the assumptions and the constraints contained in the Scope Statement itself.

Project Quality Objectives:

Some companies are very focused on quality, and in these companies most people are generally fairly sensitized to the need to define Quality Objectives for projects, although even in these companies, this habit does not always extend to all project areas. In good project management, Quality Objectives are set for the project, and for the major deliverables at least. In fact, it is advisable to set these objectives for all activities during the detailed planning stages. In the scope statement the initial Quality Objectives should be specified, for the project itself and for the high level deliverables. The team should specify the performance expectations that must be satisfied in order for the project to be considered successful. These objectives must be consistent with any quality program in place within the company, and at times they must be consistent with customer quality programs as well. Quality Objectives should be consistent with the project selection criteria and with the project justification.

Project Constraints:

A constraint is a significant limitation to the alternatives that can be considered by the project manager and the team in providing the solution to the business need. All projects have constraints, and it is important to identify these early, and to make everyone aware of them. Therefore, those that are known should be clearly identified in the Scope Statement. This statement should identify the high-level limits (boundaries) that cannot be crossed by the project team when providing the project's solution. It is important to make a distinction between a constraint and an objective. A constraint is a criteria which must be met. An objective is one that it is desirable to meet. We could look at the project budget, and define an objective. We might say that we are allocating $2.3 million dollars to building a network to support the 200x Olympics. As the project progresses, we might find that despite all the good intentions and efforts of all involved, the cost to provide the network will be $2.6 million. If we can go back to the customer, or back to management, and get the additional money, then $2.3 million is an objective, but it is not a constraint. However, if the provider and the customer sign a contract that states that the amount paid will not exceed $2.3 million, no matter what the cost to the provider, and the corporate management make it clear that there is nothing left in management reserves due to the world economic situation, the $2.3 million might be a constraint.

The team must hold to this budget, no matter what. The management and decisions made will be different in the two situations, even though in both cases no one wants the cost to exceed $2.3 million.

Project Assumptions and Risks:

The assumptions should identify significant factors that for planning purposes have been assumed to be real and/or true. If one of these assumptions turns out to be false, then the business need might no longer be relevant, and/or the product description might no longer provide a feasible solution to the business need, or some of the techniques or technologies selected might not produce the expected results, so other solutions will need to be employed. In the scope statement it is important to identify the high-level assumptions that will initially be useful in making future decisions about the work that is being performed by the project

Any known project risks should also be listed in the scope statement, so that the project can be designed to handle them. The list of risks will be extended later in the project, as described in Chapter 4.

Success Measures:

How will project success be measured? The criteria to be used to determine and measure project success should be described. Also included is information on when the measures will be taken, and possibly how, or by whom.

The scope statement should be prepared by the project team, to the extent possible. At this stage, many of the team members are not yet assigned, so it might be necessary to prepare the scope statement with only a partial team. If the full team is not available, it is useful to at least include someone from each of the departments or companies involved, to ensure that their interests are covered. It is not unusual for the preparation of the scope statement to consume considerable time. For example, in the development of a new long distance service, which was one project in a portfolio of related projects, the team of 35 people spent a full day developing the scope statement for the project. After the statement was developed, they moved forward on the development of the Work Breakdown Structure, and subsequently decided that they could not complete this analysis because the scope statement had not been fully developed. The team spent the better part of a second day rewriting the scope plan. This enabled the project planning to proceed smoothly from that point. It might appear that the time spent was excessive, but further thought should lead to the conclusion that the savings

in wasted work prevented greatly exceeded the time used to firm up the scope statement.

Once the scope statement is complete, it is necessary to have it approved. The scope- planning document *must* be approved by the Project manager, and *should* be approved by the key stakeholders. The information should be shared with all the key stakeholders to ensure that there is common understanding of the project and the product to be produced. If any stakeholders need clarification of the project, then it is the responsibility of the Project Manager to ensure that they get it. If the PM is not proactive in informing stakeholders, they are not likely to understand, and thus not likely to make good decisions. Most stakeholders do not need all the details, but there are times when appropriate information needs to be provided to them. The scope definition is one critical piece of information that should generally be shared with all key stakeholders, in full.

Suppose that we are planning a project for an end user, to add an e-commerce capability for the provision of their retail products. Let's consider some of the information that would need to be included in the Scope Statement. We will not create the full scope statement for this project, because it would be many pages of information. But we can get an idea of the type of information that would need to be included by considering some examples. The initial two sections include the same information that was provided in the Charter, with new information appearing in all subsequent sections.

Project Scope Statement
E-boxes: Products On-line

- **Business Need**:

  Recent competitive market analysis shows that our current major competitors are now offering all of their product lines electronically as well as through their retail outlets. Two new competitors who offer strictly on-line products are eroding our market share. We need to introduce a web based sales capability within the next 6 months in order to stop the erosion, and to capture a share of the international market.

- **Project Justification**:

  Market share has dropped from 78% to 71% over the past 6 months. Analysis attributes this change to the advent of electronic commerce offerings by existing and new competitors. With our

strong presence and high quality products, we can stem the erosion, and grow in new markets, by introducing an e-commerce offering. Given that others are already in this business, we need to introduce the offering within 6 months, with an announcement in at least 3 months. This would allow the regain of 4% of lost market share over the first year, and a growth of an additional 2% in new customers in a global market.

- **Product Description**:

  E-boxes will produce an electronic ordering and fulfillment capability to offer all our consumer product lines via the web. Customers will be able to check our catalogue, and order any products, which are attractive. In addition to the ordering information, backup detail which is currently included in our paper catalogue will be available on-line. The site will also allow customers to submit questions, and receive answers via email within 24 hours. All credit checking and process capabilities will be developed. A follow-up contact capability will also be included for customers who require technical support after purchase, and an on line order tracking capability will be created so that customers can track their own orders. All of this capability will be integrated with the current ordering system, but billing will be done via the site.

  Note: Additional details would be included in the actual statement, but this information provides the reader with enough information to follow the rest of the material.

- **Project Deliverables**:

  Product catalogue

  Product Inquiry System

  Order capability

  Credit processing capability

  Customer technical support capability

  Order tracking capability and display

  Return processing capability

- **Included/Not Included**

Included:

All system development for each the deliverables

Negotiation of agreements with credit card vendors

Testing and verification of each deliverable

Definition of procedures for cutover, and for ongoing operation

Not Included:

Preparation of the catalogue content detailed descriptions

Establishment of pricing information

Provision of after market product support

Providing staff for on-line ordering and support functions

Sales of products

- **Project Cost Objectives**:

Here the team would specify the budgeted cost for each major deliverable, and for the project.

- **Project Schedule Objectives**:

Here a timeframe for the completion of each deliverable would be specified. Since the full development, testing and launch is to be completed within 6 months, deliverable completions will probably have dates in the 3-6 month timeframe – very challenging, since the modules will all have to work independently, as well as smoothly interact with each other.

- **Project Quality Objectives**:

Here the team would specify some criteria for the performance of each module. This would possibly include things such as required system response time, average and 90 percent response windows to be developed for pre and post market customer support, etc.
Also, some sample objectives could be:

Must ensure no more than 0.5% of fulfilled orders yield bad debt

- **Project Constraints**:

Must support at least the latest 3 versions of Netscape and Internet Explorer

Must establish contracts with at least 3 major credit vendors

- **Project Assumptions and Risks**:

Product fulfillment costs for international orders will exceed estimates

No further competitors will launch such sites within 4 months of our launch

- **Success Measures**:

Customers attest that access to catalogue information is simple to use, and products are easy to locate

Order information and credit information are accurate. No more than 0.1 percent of orders are contested by the customer.

Credit checking yields accurate assessments during the shopping time of the customer, as attested by customers in on-line surveys

4. SCOPE MANAGEMENT PLAN

Along with the actual scope statement, we also need a Scope Management policy. In this statement we describe how the scope will be managed and controlled. We will ensure that the full project and product scope are defined and managed by creating the Work Breakdown Structure, which we describe next, and by monitoring and controlling the activities. However, there is more to scope management than this.

There is also a problem known as scope creep. As anyone who has ever worked on a project can attest, there are multiple sources of ideas for changes and inclusions in every defined project. In most cases these ideas are actually wonderful ideas, which would produce a better product, or project, if they were implemented. But the problem with this is that once the project has been fully defined, the definition is used to create a project budget, a project schedule, and a full schedule. These fix the parameters of the project. Any changes or additions to the scope will cause corresponding changes or additions to the budget, the work and the time required. If these are minimal the project goals can probably still be met. But at some point every project will hit a break point beyond which the project team can no longer be successful because of the new requirements. Therefore a change management process is required.

In some cases the proposed changes are large, and they will change the entire direction of the project. It is clear in these cases that the impact must be evaluated, and that it may no longer be possible to meet project objectives and goals. In some cases the change does not change the project direction, but nevertheless the proposed change is significant, with large impacts on the budget and/or schedule. Again, it is fairly clear that a management process is needed if the team is to have a chance to meet objectives. But in some cases, the impact appears to be minimal. Implementing one change might take only an additional 2 hours, or cost only an additional $100. A small number of such changes can probably be accepted and worked into the project in some way, possibly by working overtime, or restricting some minor aspect of the project. The problem is, though, that generally there are not only a few such requests. Generally there are many such requests. In some projects these requests number in the hundreds, or even thousands. Even with only 100, we are adding at a minimum, 200 hours (that's more than 5 man weeks) or $10,000 to the project. This starts to look significant. At some point the number of even these small requests will exceed the opportunity for effective absorption. Therefore the professional way to proceed is to define a process for dealing with change requests, inform everyone of the process, and then enforce it. This does not mean that the team is not receptive to the new requirements. It simply means that in order for a new requirement to be incorporated, a process must be followed. And the process will ensure that any accepted changes are important enough that they should be included, and that the project goals can still be met even with these inclusions.

Change requests are generally legitimate requests. They can be initiated by stakeholders, or from the team internally. These internal requests are also called design changes. They have various causes. They:

- May result from error or omission in project definition or planning
- May result from perceived opportunity
- May result from unavailability of deliverables from another department. E.g. our trouble handling process plan could be delayed if it relies on a new trouble database being developed in operations - if the database development is delayed Should follow an approval process parallel to that of change request

The change management process should specify a number of items, such as:

- Who is entitled to submit change requests (anyone, only stakeholders, etc)
- What information is to be submitted?
- Are there dates beyond which change requests will not be considered?
- To whom does the request go?
- What will this contact do with the request?
- How long does the team want to have to respond to a request?
- What will the team require from the submitter, or from others involved in processing the evaluation
- If a positive decision is made (ie. the change request is granted) what will the team require, and from whom?

If these questions can be answered before the fact, even in part, and the information shared, this will facilitate the processing of the requests when they occur.

Policies should be set which make it clear that any change that required additional resources of any kind cannot be accepted, no matter how critical, unless additional resources are provided to the team. The PM should obtain agreement from the key stakeholders up front to this policy so that when an actual request does arrive, the resource request will not be a surprise. Also, it is usually easier to get people to agree to a policy, as a matter of principle, than it is to get them to agree to a specific request for more resources. Such a preliminary agreement makes the project flow much more smoothly when the pressure is on.

In fact, most of the changes that will be proposed are changes that are actually necessary, or at least advisable, as opposed to just nice to have. This makes everyone involved much more likely to want to include them. But, the problem of meeting the project objectives still exists. It is true that many of these changes have to be accepted. The danger is in accepting them before we know where the resources will come from to cover this. The team motto for change requests should be “Show me the money”. Maybe it’s not money, but time, or skills that are needed to implement the change. But the principle still stands. Without the additional required resources, the team really cannot implement any additional requests.

In some cases, the project manager will be advised to use resources already on the team. This is fine, as long as it is clear that those resources

were already allocated to some other aspect of the project. Sometimes in order to get one piece of functionality the client is willing to give up another. If the PM removes resources from elsewhere in the project, then he or she MUST also get the approval to drop the other part of the project. Otherwise the team will still not succeed.

Another answer that PM's are sometimes given is that they can use the project contingency for scope changes. This is definitely not acceptable. We will address the contingency later, discussing what it is, how to determine how much contingency is required, and where to build it into the budget and the schedule. Contingency is included to cover the risks – and it will be needed for this purpose. It is not designed to cover scope changes. If it is used for scope changes, there will be nothing to cover risks that materialize. So never use contingency for anything other than it's purpose – to cover the known unknowns. For scope changes the PM needs to obtain additional resources.

Another question to be considered is who makes the go/no go decision on implementing a change request. This should be defined in the Change Management Plan. Perhaps the client is included in the decision. Or senior management. The PM certainly needs to be party to this process. And probably some of the affected team members should be involved in the decision. Anyone who might need to provide money or other resources to allow the implementation has to be part of the process at some point, either in the analysis or the approval stage.

Another consideration to take into account is that assessing such requests will take time. In practice, any change in the product normally involves many functional groups and getting a change order approved would take a lot of time. So included in the time for the project the team needs to allocate some amount of time just to assess change requests. There will be an additional requirement to negotiate for the additional resources for any of the accepted changes. This must also be recognized, and included in the project. These activities must then show up in the Work Breakdown Structure, to ensure that the time is included in the overall project time. This is a real part of the project, so it needs to be considered as such.

Another consideration is the form of approval that is acceptable. In order to protect the PM and the team in their performance evaluations, and also to provide records for use in planning future such projects, it is important that the approval be in written form, and that is come from the client or senior management – or maybe both.

In fact, the team should document every change request, the results of the analysis and the final decision, including the source of the resources if it is decided to accept the request. The PM also needs to ensure that all the right people see and buy in to this as well.

Such an intensive process is overkill for a small project, but some level of documentation should be prepared to assist in the overall Project Management learning within the organization.

How much time is appropriate to allocate for change management? The answer to this question depends upon the stability of the project. A more stable project will not face as many change requests, so less time needs to be allocated. The time determination should be determined using experience, if there are experienced resources available, and also is records of past projects –this is, in fact, one of the reasons to keep the documentation. If these are not available, it's an educated guess until a corporate information base can be built to help the PMs make good decisions.

So, to reiterate this very important concept, one place that should NOT be considered for resources for scope changes is the project contingency - anything that was already planned in the project allocation is NEVER to be used for changes. We do build contingency into the project budget. It is for risks, or known unknowns. And we don't include enough to totally cover all of these potential risks that might occur. But this is different from scope changes, which are unknown unknowns. Management reserves are one source for covering unknown unknowns. Additional customer funding is another - but never contingency.

When a project is one in a multiple project portfolio, preparing such statements becomes even more critical, to ensure that all components are provided, that all project teams understand what they are to produce (as opposed to deliverables from other projects in the portfolio), and that there are no overlaps in the budgeting or resource allocation. The planning can be done for each project individually, but there should also be a statement for the overall portfolio or program, and the project managers need to work through the bigger picture to ensure that collectively the program plan is solid and coherent.

At this point the Scope and the Scope Management Plans have been defined. It is still necessary to build a structure for the project, to be even clearer about the deliverables, and to build the basis for the project schedule

and budget. This will be done by creating a Work Breakdown Structure, or WBS. Creating the WBS is the next step in defining the scope. This is the creation of a structure, which identifies all project deliverables and activities. This step is discussed in Chapter 4, because the Project Manager and the team must be involved in this activity.

Chapter 3

RISK PLANNING

A risk is a known unknown. This means that it is something that we can predict might happen, but we are not sure whether or not it really will happen. We may also not know when it might occur. We know about it, but it is unknown whether or not it will occur. Although people think of risks as having a negative impact, a risk could in fact have a positive impact. If something were to happen in a project which would make the project come in far ahead of schedule, but we do not know whether or not it would happen, it is a risk. If it occurs, we need to manage the project in one way. If it does not, we manage differently. Even though the overall impact of this risk is positive (finishing early) it may well cause some major headaches for the PM, because many resources will likely have to be rescheduled, as work will now be occurring earlier than expected. The PMBOK® Guide gives the Risk Management Processes as follows:

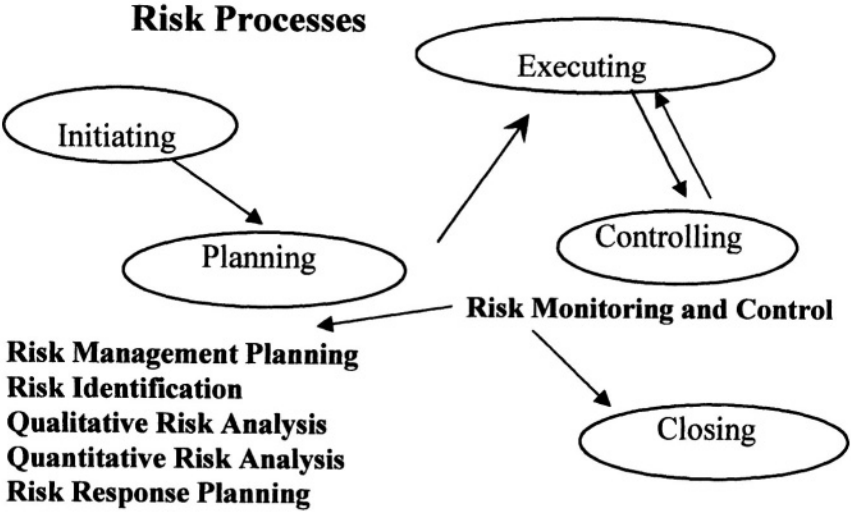


Figure 1

The risk management process is actually fairly complex, requiring a number of steps, including:

1. Risk identification
2. Establishing risk management strategy
3. Assessing risk attitude
4. Risk quantification and assessment
5. Risk Response
6. Inclusion of contingency

Many factors enter into these steps, and the process requires the involvement of many people. There are some tools, which can be used to tighten the process, but some of the risk management process relies on the intuition and experience of the people involved.

1. Risk Identification

Identifying the project risks is the responsibility of the Project Manager, but everyone associated with the project should assist with this. The PM should spend some focused time on this, with the team, early in the life of the project. However, throughout the project people will continue to identify risks, and the team should always be prepared to assess these, and to put plans in place for dealing with potential problems.

There are many ways to identify project risks. One of the most effective is to work collectively as a team to list potential problems. Even those risks, which appear to be small should be listed, at least initially, so that everyone can be aware of them, and all risks can be assessed. Team members should be allowed to brainstorm risk elements. In brainstorming, no idea is a bad idea. All suggestions are considered. In the final analysis most of the items might be removed from the list as not realistic or significant. But in the brainstorming stage, all suggestions are accepted, and subsequently they are analyzed. In this way the team can consider the full gamut of potential risks.

Another source of risks is the documentation from previous projects. In our causes of failure we listed ‘not learning from previous projects’. One way to benefit from previous projects is to extract from their documentation, or from the experience of the team members, information about the things that went wrong. The team can then consider whether or not the same problem is likely to occur on the current project.

In preparing the risk list, it is wise to follow some systematic approach to ensure that all potential risk areas are considered. Initially the team might start with free form brainstorming. But later a systematic approach might be followed. In this approach the team, or the company should establish a list of categories in which risks might appear. For example, one set of categories might be market risks, technology, personnel risks, funding risks, organizational risks, process risks, competition risks, regulatory or standards risks. Within each category the company might have a standard set of initial questions to help the team analyze the area, but there should also be room for the team to include additional questions and even additional categories for investigation.

Team members should interview team members from previous similar projects if possible, or people who have worked in similar situations, or with similar technologies. Experts in the market or technology areas can be consulted for suggestions.

Project managers are advised to accept all suggestions of potential risks, regardless of the source. It is also advisable to meet individually with team members and stakeholders to collect any additional suggestions. All of these suggestions should be analyzed, and included if they are reasonable. Many risks have political overtones, and people may not be willing to suggest them in a public forum. For example, risks due to incompetent personnel may not be mentioned in public, particularly if the person in question, or supporters of that person are present in the group. In some cases it is considered politically to suggest that something is risky, but if there is a true risk, this should be included.

Just a few sources of risk could be:

- project nature
- project environment
- extended team members
- project stakeholders
- unclear requirements
- unknown or obsolete technologies
- new processes

In cases such as the example above, it might be necessary for the PM to find an acceptable way to express the risk when it is included in the

documentation. But all of the quantification should still be as accurate as possible.

Although this process sounds as if it is complicated, in fact most teams can determine the vast majority of the risks within a few hours at the most, and this is time well spent early in the project planning.

2. Establishing risk management strategy

The project team should establish a strategy, preferably beforehand, to define how risks will be handled in each category. This strategy can be made public so that stakeholders will understand it. If stakeholders are not comfortable with the process, they could provide comments prior to the risk quantification and analysis, and if necessary the strategy can be revised. The degree to which the team must prepare for risks is dependent on the risk tolerance of all primary stakeholders

Therefore one of the first tasks the team should undertake is an assessment of the risk attitude of those key stakeholders. First, the team needs to decide which stakeholders they need to consider. This would be any stakeholder likely to be so concerned about any of the risks that they might take action to help or hinder the project because of this. Next the team members should each be aware of their own risk tolerance. This may be something that some individuals have never considered before so it may take a bit of time and encouragement to work through this. People will need to consider what their real reactions and concerns might be to different situations, to determine whether they are risk seekers, risk neutral, or risk averse. Once individuals are aware of their own reaction, the team can work as a group to determine the team characteristics. Then they can analyze the nature of the key stakeholders. Knowing this, they can determine whether or not they should take a conservative approach to project solutions, or push the envelope. If the team is risk seeking, but major stakeholders are risk averse, it will save time for the team to recognize this, and to plan the project on a more conservative way that they would naturally build the plan. If this is not done, the team needs to be prepared for considerable interference, or at least serious concern about their activity, from the stakeholders. They will have to build in time to manage the impressions of the stakeholders if they ignore their risk attitudes.

A few things to consider would be:

What impact does the risk attitude of the customer (or other specific stakeholder, such as management, or department which will take over ongoing support) have on the project? What about the attitude of the team? Which risks would you develop a contingency plan for? What sort of risks could be safely ignored?

When the risks are known, they need to be quantified. The usual way to quantify risks is to determine the probability that the risk might occur, and also to determine what the impact will be on the project if the risk actually does occur. If an event has a low probability of occurring and a low impact if it does occur, then it can be considered to be a low risk item. There is not much point in the team expending a great deal of energy preparing for such events, as the cost of preparation would probably exceed any potential cost of occurrence. On the other hand, if an event has a reasonably high probability of occurring, and the impact is fairly high if it does occur, we have a high-risk item, and the team must prepare for this possible event. In fact, if the probability of an event is high enough, it is probably best for the team to treat it as a given event, and include a risk as the case in which it would not occur. The decision to do this, and the setting of the level at which it might be done are part of the risk strategy.

The team needs to determine the classifications they wish to use for risk events, criteria they will use to classify events, and how they wish to handle each of the categories. It is best to do this before doing any actual risk analysis. It is also wise to get approval of the strategy from the key stakeholders before the analysis is done. This gives a framework for the discussion of any specific risks, and makes the process more objective.

The team might decide that for low risk items, they would simply list the risks, and possibly give a one-word direction on how they would handle these. For medium risks they might decide to have a brief contingency plan, and for high risks, they would want to have detailed contingency plans, which are shared with anyone who might need to take action if the event occurs. In all cases they will build contingency into the project time and project budget to assist in dealing with the risks that do actually materialize. We will discuss this further shortly.

The team should document the risk strategy, to ensure that everyone is aware, everyone can live with this strategy and everyone works within it.

3. Assessing Risk Attitude

Different stakeholders might have different tolerance levels, and this can create problems. However if they can agree on a strategy, then the main differences will be in opinions on how a specific risk should be classified. The classification may take some negotiation, but this is better than arguing over the method for handling the risk event if it happens. The idea is to be prepared for anything that might be significant.

Lets take a look at the different risk attitudes in an actual scenario in a small project that took place about 20 years ago.

At that time, telcos provided modems for users who subscribed to data services because they were not yet allowed to connect customer-provided modems. This meant, of course, that telcos purchased huge volumes of modems. Often these boxes were imported. They were classified as accessories to computers, which set the import duty at 17%. The duty for accessories to communications was 3%, giving a young engineer the idea to challenge the classification of the modems in order to save money. His boss was very receptive to this idea, since there was a 50/50 chance technically that an expert would say that modems fit into either category. However, this would have to be challenged in a government hearing – with the same government that received the duty payments.

Should the telco approach the government to have the classification changed?

- Whose risk tolerance should be considered?
- What is the probability of failure?
- What are the risks?
- How could these risks be minimized?

Of course, there would be a cost for the trial – probably 3 people from engineering for 6 weeks, plus the lawyer, any court fees, and the cost of an expert witness. If the appeal was refused, this cost was incurred for nothing; if accepted the company would save many millions.

The supervisor took the proposal up the line, where it met with some resistance. Unlike the engineer and the supervisor, the director and his boss were risk averse. However, they could not ignore the huge potential savings. They decided to go ahead, but to pin any failures on the supervisor. Since the supervisor was not concerned with the risk, she agreed.

The case proceeded, and the company was successful. Afterwards, the lawyer mentioned that legally the odds of winning had been 60/40 against them. Had the senior managers been aware of this, the case would probably have been stopped – much to the frustration of the engineer and the supervisor.

Clearly the risk tolerance of the individuals involved plays a big part in the outcome of many decisions.

Once a risk strategy is in place, based on knowledge of the risk attitudes of the stakeholders, it will be easier to decide whether or not to approach the government, and with what arguments, as well as would likely to be needed to succeed in such an application, if it is decided to move forward.

4. Risk quantification and assessment

In order to proceed with the analysis, each risk must be quantified. The risk definition process is invaluable in gaining an understanding of the project. The quantification will give the team a basis to build a project least likely to fail, by initially choosing the best options for the environment in which they are working, and then by ensuring that the project is designed in such a way that they can successfully react to the risks that do occur. The quantification is the first step in building this back-up.

Each risk must be quantified, and two parameters are used to do this. The first is the probability that the risk will occur. The second is the measure of the consequence of the risk. This consequence might be a cost in dollars, or a cost in time, or both. Or it might be something along the lines of a loss of reputation for the company or the project team, which could subsequently be translated into a cost in dollars.

For either measure, it is obvious that in most cases the quantification cannot be exact. Later in the chapter we will take a look at some techniques that can be used to tighten these numbers to ensure reasonability as much as possible. How likely is it that an event will occur? There are some events for which the probability can be predicted accurately. There are others for which a probability can be estimated based on past statistics. Even this is a statistical measure, and hence not accurate for a single occurrence, which is what we are dealing with. And for others the probability estimates are totally subjective. Therefore there is room for disagreement amongst the stakeholders about the numbers chosen. For those probabilities that are subjective estimates, one good technique is to first estimate the probability as High, Medium or Low, and then to assign probabilities to these

categories, say 70% for high, 40% for medium, 10% for low. The PM can then discuss this reasoning with the stakeholders for any specific risks for which the probabilities appear to be out of line. Those stakeholders who are risk averse will usually estimate the probability of occurrence to be higher than those who are risk neutral or who are comfortable with a high level of risk. It should be possible to negotiate probabilities that everyone can agree to work with. Then the process starts again, estimating the cost of the consequences. Here again, in a few cases, the cost will be clear. But in the majority of cases, the cost will have to be estimated. When the cost is the replacement of some material, or rebuilding of a component, it might be possible to create an estimate that is fairly sure to be accurate. However, in the case of loss of reputation, the conversion to cost is not at all clear. Again, the team must work with the stakeholders to determine values that all can agree to work with.

Let's discuss a few techniques that are used for risk quantification:

- expert judgment

We discussed coming up with numbers through discussion amongst stakeholders. Some of these stakeholders will be experts in the project areas, so their estimates should be fairly good, within the tolerance window for their own risk attitudes. If there is a wide range of numbers suggested, the team can use the numbers to approximate the distribution under which all the potential values would fall. From this a number can be selected, such as the mean, or the number that is 90% sure to be within the right range.

- statistical sums such as PERT

The team can assume that the numbers fall under a certain distribution curve, such as a Beta distribution. Then values can be calculated using standard formulae for the distribution. For example, average cost, and standard deviation of the cost can be calculated. Obviously the results are only as good as the selection of the appropriate distribution.

- simulation

Using a standard simulation technique, such a Monte Carlo (which implies using a computer program to avoid the need for intense manual calculations), the risk of certain costs, overall project cost, final completion dates, and interim dates can be calculated. The team needs to decide on some parameters to input to the program, since the results will be only as good as

the inputs. The idea here is the instead of using a single number for each activity cost or duration, and running a project program such as MS Project to calculate the project completion date or budget, the program is run many times, and each time it selects a value for each activity parameter. The values are selected by selecting values for the parameter from a given distribution. The program can be told, for each activity cost, or for each activity time, or for some of these, what distribution applies to that parameter for that activity. The user also inputs other relevant values such as the mean for that activity and the standard deviation. This allows the program to construct the curve for each parameter. The program then runs, selecting values for each parameter on each run, in such a way that the large set of values for any activity falls under the provided curve. In other words, the program does a 'what if' analysis. It asks, for every variable parameter, what if it were this value, or that value, selecting the values from the distribution expected for that item.

For each run the program will calculate the overall cost, and the project completion date. The multiple runs (the number of runs must be high enough to guarantee statistical stability) provide a distribution of completion dates or costs. These distributions show the probabilities that the project will complete within timeframes or budget windows. Hence the risk is quantified. This technique can also calculate the probability that a given activity is on the critical path, which gives information to the PM about the criticality of monitoring that item.

- decision trees

Decision trees can be used to show the paths resulting from project risk events. Decision points can also be included. Probabilities and impacts are followed through each path.

Consider an example:

We want to upgrade local facilities and to purchase racks of DSL data sets to offer service in a new town – our competitor will offer high speed internet via cable. The local facilities are old, so until each is upgraded, performance will be poor. Our cost to upgrade and purchase the DSL data sets would be $5M

Consider a decision tree, with 2 risk events:

1) Our competitor announces before us - 20% probability

2) Their new cable modem technology performs better than our DSL offering - 40% probability

When there are multiple events in a path, the second event on a path has certain probabilities these occur *given that* we get to that point in the path. The same applies for subsequent events.

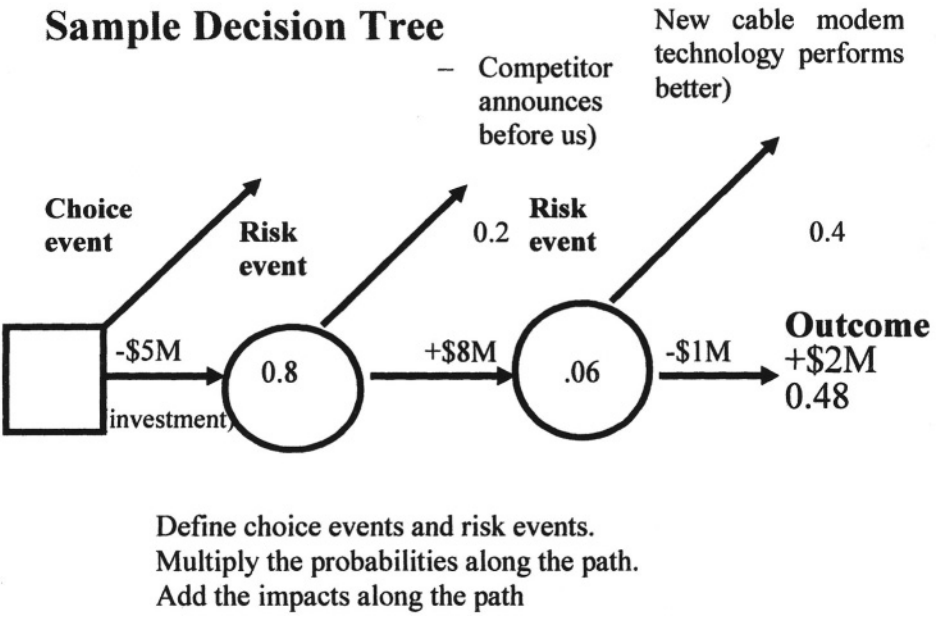


Figure 2

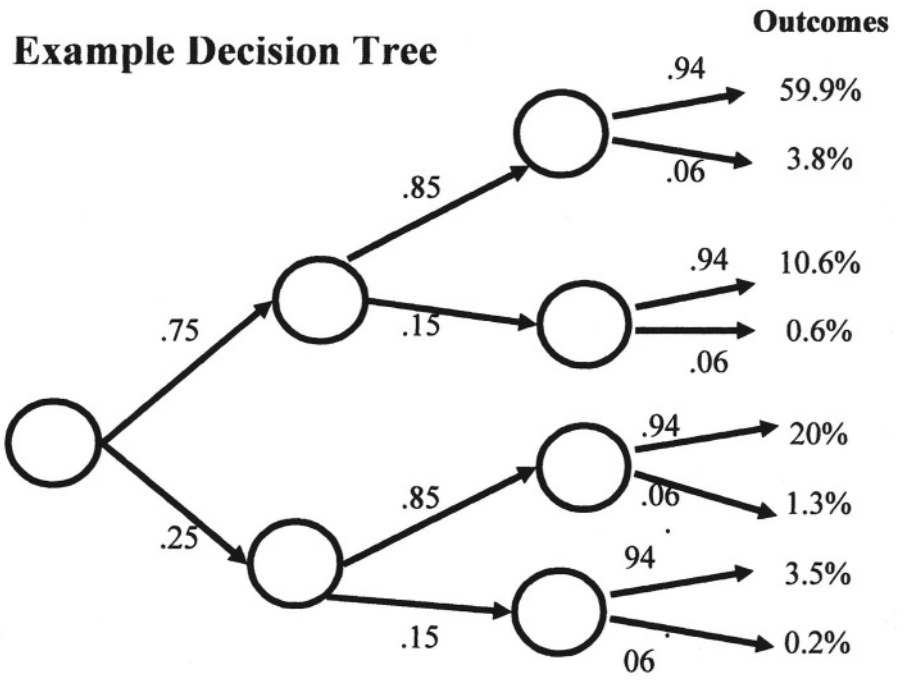


Figure 3

Thus, in this case using our revenue predictions of $8M and $2M, we have a 48%change of making $5M if we offer this service. Of course, most environments are more complex than this, so there will be multiple branches on the decision tree, each showing one possible outcome. Using this tree the analysts can decide whether to go ahead or not. The project team would help to determine the probabilities and impacts for this analysis.

- expected monetary value

The product of an event's probability of occurrence and the gain or loss that will result if it occurs is the Expected Monetary Value (EMV) of that event. EMV can be used to compare alternatives.

Consider the following example, in which the PM faces a choice, and he wants to know what is the least risky or most advisable path to follow:

Choice A: accept an FFP contract to design and install new network in an office floor area for $315,000 with a liquidated damages clause because the buyer needs the network running for his opening event

Or

Choice B: accept the same FFP for $250,000 without the clause. The "penalty" will be $150,000 if schedule not met with acceptable product

There is a 60% chance your cost will be $190,000 and a 40% chance your cost will be $160,000. There is a 98% chance of meeting the schedule

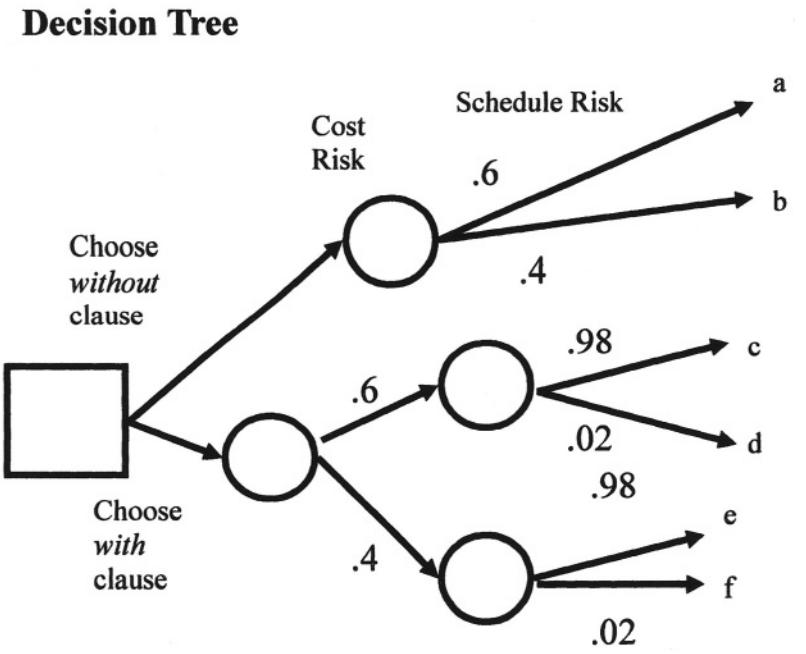


Figure 4

Decision Tree Continued:

Outcome Probability		**Outcome Value**	**Expected Monetary** Value
a) 60%	x	$60,000	$ 3,600
b) 40%	x	$90,000	$ 3,600
100%			$ 7,200
c) 58.8%	x	$125,000	$ 73,500
d) 1.2%	x	-$25,000	-$ 300
e) 39.2%	x	$155,000	$ 60,760
f) 0.8%	x	$25,000	$ 200
100%			**$134,160**

Once the numbers have been determined for a specific risk, we can calculate the overall impact of that risk. This impact is calculated by multiplying the probability of occurrence by the cost of the consequence.

IMPACT = probability of risk x consequence of risk

We can calculate two such numbers for each risk, one being a measure of the time impact and the other a measure of the monetary impact. These numbers are a measure of the severity of the risk, but otherwise, in themselves, they are meaningless. However, if there are a large number of risks on the project – and this is the case with pretty well every project – then these numbers taken collectively are statistically useful. We will take advantage of this fact in building some additional resources into the project to use in dealing with risks.

The objective of the risk exercise is to design and manage the project in such a way that the risks will not cause the team to fail in any of the major project measures – time, cost and scope. So we need to use the risk information to build the project plan to allow for this.

- Dealing With Risks

How will the team deal with risks?

There are a number of different things that will be done. First, they will build contingency into the budget and into the schedule, in order to allow

flexibility to handle those risks that will occur. We will discuss how these are integrated into the schedule and budget in other chapters; in this chapter we will discuss how to calculate the amount that should be included.

Second, they will identify a method of response for each risk. This is initially done at a high level, specifying only the way in which the risk will be handled if it does occur. We will discuss this further shortly.

And third, where the risk strategy calls for stronger action, they will build contingency plans, at the level of detail required by the risk strategy, for each risk. These plans are specific to the individual risks, and to the project environment, so we will not discuss details of these plans.

5. Risk response

Risk response techniques generally fall into one of four categories:

a. Avoidance
b. Mitigation
c. Transfer
d. Acceptance

Let's look at each.

Avoidance

In avoidance, we eliminate the threat from the project. If there is a risk because new unproven technology might not perform as expected, the new technology will not be used. This is avoiding the risk.

Mitigation

Mitigation is reducing the risk. This could mean reducing the probability that the risk will occur. Or, it could mean reducing the cost of the consequences. It could even mean reducing both of these factors. In any of these cases, we are mitigating the risk.

Contingency plans generally aim to reduce the cost of the consequences. Teams often include additional activities in projects in hopes that these will prevent some risks from occurring. For example, sending the programmer on a course in a new language before expecting her to use it is reducing the

probability of bugs in the program. Project managers often place tighter controls on aspects of the project with a high risk of failure.

Transfer

Here the team transfers the responsibility for dealing with the risk and the impact to another party. This can be done in different ways. The two most common are:

- by insurance
  - The project pays a premium to a company so that if a risk does materialize, the project can be compensated for the cost.
- by contracting
  - The project team decides to contract work to a supplier, either because the supplier has skills in that area that the team does not have, or because the team does not have the manpower for the items the contractor will provide. Usually this in itself reduces the risk, because having work done by people with the right skills in itself is less risky that giving the work to someone who does not have the skills. If the risk remains high, the contracting party will be asked to pay a risk premium to contractor – the fee charged by the contractor will include the contingency.

Acceptance

- Probability of risk event
- Impact ($$)
- Visibility of consequences, such as publicity
- Amount of information available
- Manageability of risk
- Importance or benefit of the project or deliverable
- Risk tolerance of the various stakeholders

The full project list of risks is longest at the start due to all of the uncertainties. Of course, this is reduced if you have a team that has worked together before, are subject matter experts in their field, and you have a well-defined scope, etc.

6. Inclusion of Contingency

What is contingency? Contingency is the amount of money, or the amount of time, that the PM includes in the project budget, or the project schedule, to cover for the known unknowns, or risks. This is not an amount that is included due to a specific project activity. It is an amount that is over and above the activity budget.

Why would anyone include additional money and time *not* shown to be needed by the project activities? The answer to this is obvious, but because of the practices employed by PM's in the past, management is often suspicious of these inclusions. Project managers have been aware that things go wrong, so they have often included additional time and funding into their budgets to allow them to deal with the problems when they occur. But generally they did not have any tools to allow them to justify the amounts that were included. If we were to try to include the full amount that would be needed, should every risk materialize, we would have to request such huge project budgets that no project would ever be approved. And of course, these amounts are not required, because none of the events are certain to happen, so the case in which all of them would actually occur is so rare that we will probably never experience it. So the project really needs some amount that is less than the total that could possibly be needed. The problem is, how to define this amount. Many companies estimate this by including a percentage, say 10% of the project budget, for contingency. This is a step in the right direction. It at least recognizes the need for contingency. However, some projects are very risky, which some are not. So these projects need different percentages of contingency. Wouldn't it be better to include an amount that in some rational way represents the expectations for the specific project?

Some project managers face the problem of how to convince management that contingency is required at all. In an organization that is mature in Project Management, it is recognized that contingency is required, and that it is expected to be spent. In less mature organizations, there is a need to educate the management to these facts. One suggestion would be to discuss something that is meaningful to those who need to be convinced, which illustrates the need. One example: In a congested city, propose calling a meeting at 5 am on Sunday, and ask what time they would have to leave home in order to ensure that they would be in the meeting room on time. Suppose they say 4:30. Then suggest that since most people have objected to attending a meeting at 5 am on Sunday, the meeting time has been changed to Tuesday at 9 am. Ask if the person would them leave home at 8:30. An example like this should clearly illustrate the concept of the need for contingency. We know that it will take longer on Tuesday at 9. We even know the causes: traffic, accidents, construction, etc. We just do not know

how much there will be. But we know we will need more time than the activity itself takes. Hopefully examples such as this can help to convince management that contingency must be included and will be used.

The question then is, how much should be included to enable the team to deal with those occurrences, which will affect the project, but not leave too much money locked up in places where it might not be needed? The answer to this is actually simple. The number of risks is large. The overall risk impact can be calculated for every risk, as shown above. We said that this number is meaningless for each individual risk. Possibly the risk will occur and the cost will be the full amount shown as the cost of the consequence. This is the case with both the cost in time and the monetary cost. Or the risk will not occur, in which case no time or money is required. Statistically though, the total time impact, and the total dollar impact, calculated in this manner, will give a good estimate of the amount of time and money that should be included to give the team the resources they need. And since the team can clearly show how they arrived at the number, and what they are covering for, there is backup for the request. In the past teams have 'padded' budgets by including large amounts of time or money with no clear justification, in the name of contingency. These amounts sometimes exceeded the required amounts, and the teams used them for purposes other than contingency – scope creep or scope changes perhaps. This practice has given many people the impression that contingency is not really needed, and that some people try to build in too much contingency. Project managers should work to dispel this view so that they will be more credible in the future when they request contingency. Using the technique outlined here, the PM has justification for the request, and if the risks do not materialize to the extent predicted statistically, the PM should return any unused contingency.

The question remaining then is where to include the contingency. As mentioned above, this will be discussed when we discuss the budget, and the schedule.

We incorporate contingency to deal with the risks. But we also need a risk management strategy and a plan for the most serious risks we expect to meet. Working with the Project Sponsor, the team must develop and implement the full risk management plan, identification

- probability, impact
- quantification
- response development

In addition, they must respond to potential new risks as they arise, communicate all of the information from the risk management process, continually monitor the project activities to be aware of potential risks, and their status, and when risks do materialize, implement the contingency plans.

Contingency Plans are a major factor in risk management. Using the risk analysis, the team decides which risks require contingency plans and how detailed or comprehensive these plans must be. Some plans are fairly simple, or short. But if we consider projects such as Y2K projects, or communications structure for a major event, we can see that sometimes people work for man-months or even man-years just building contingency plans. In these cases, spending the time and money to build these plans is justified because the potential loss is so much greater.

In this chapter, we have addressed the processes that are required to analyze and deal proactively with risk. We need to evaluate the environment in which the project occurs, including the tolerance of all the key stakeholders. The team must establish a risk management strategy that is satisfactory to these stakeholders. Then, actual risks are identified and analyzed, allowing the team plans for potentialities, and to deal with problems as they occur.

Where the risk analysis shows that risks exceed tolerance or jeopardize the project, the team, in conjunction with management and other stakeholders may need to decide to cancel or redirect the project.

Chapter 4

WORK BREAKDOWN STRUCTURE

In this chapter, we discuss the Work Breakdown Structure, a critical project management tool. The Work Breakdown Structure is a methodology for determining project activities by systematically breaking the project into deliverable-oriented packages. It is a systematic analysis of the full scope of the project, defining all the deliverables, and all of the activities required to produce the deliverables. The team identifies all of the project activities by creating a Work Breakdown Structure. When they finish they will have a picture of the full project. Then the team can proceed with the work, ensuring that all aspects of the project are covered. **If any activity is not in the Work Breakdown Structure, it is not in the project.** Therefore no one on the team should be working on it. So everything that is to be done to complete the project must show up in the Work Breakdown Structure – commonly known as the WBS. This includes all activities related to delivering the product as well as all activities related to managing the project. Be sure to keep this in mind as the WBS is being built. The PMBOK® Guide gives the Time Management Processes as follows:

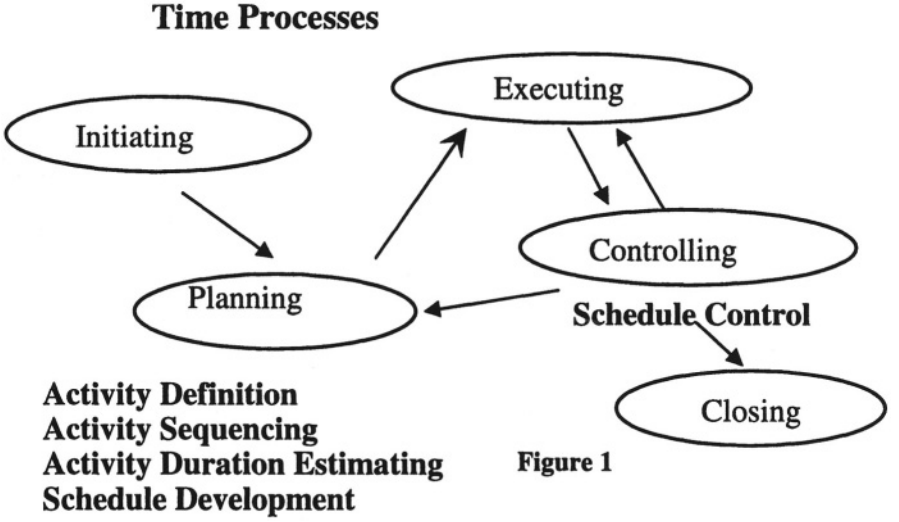


Figure 1

The WBS is a breakdown of the project into deliverable-oriented groupings. These groupings eventually turn into action items.

The purpose of the WBS is to assess WHAT is to be done (Activity Definition), and WHAT is to be produced. It must include everything that is included in the project, whether it be something for the project - in fact, all the project management must be included,- or something to create the product. The WBS shows all of this - the WHAT of the project. But only the WHAT.

The WBS is created by breaking the project into deliverables, and then further breaking down these deliverables. DO NOT think about the time. The times will be determined later. Of course the dates are critical. But they are not part of the WBS. The WBS just gives all the activities that we will need to consider when we eventually do get to consider the timing. But when creating the WBS, we want to focus on the deliverables. So we leave all the timing till later. The dates will eventually appear later in your project plan.

Another common mistake is breaking the work down by department or function. While this can certainly be done, proceeding this way has a higher risk of missing some project aspects. So do not work with departments or functions. Instead break the project down into deliverables.

The first level of breakdown is a set of major deliverables. These will probably already be listed in the charter, and if not, there should be such a list in the scope statement. Next, one by one, each of these deliverables is further broken down into more detailed deliverables.

It is not necessary, or even advisable to be rigid in the placement of the project specific content into the WBS. There are many acceptable ways in which any project can be broken down. If some system works for the team and those who need this information, that system should be used. However, there are some rules, which should be followed in creating the breakdown:

- The WBS in totality identifies all project components and deliverables
- The WBS ensures there are no gaps or overlaps
- The top levels must be deliverable-oriented
- Elements must integrate to project whole
- There should be no 'single children'
- The bottom level of the WBS shows activities, which are assignable.
- All boxes are numbered in defined patterns
- Cardinal rule: If it's not in the work breakdown structure, it's not in the project.

What does this mean?

1. The WBS in totality identifies all project components and deliverables

The content of the WBS must include everything in the project. So we will start with the full project, and break it into major deliverables. Then each of these will be further broken down. We must do this in such a way that no part of the project, no deliverable and no activity is missed. The breakdown must be very thorough to ensure that all project and product deliverables are covered.

2. The WBS ensures there are no gaps or overlaps

Every deliverable, and every activity, is included in the WBS once, and only once. To have every activity included once, we need to ensure that we include all deliverables at every step. When any deliverable is broken into sub-deliverables, the sub-deliverables must 'add up' to completely describe the initial deliverable. When using an org chart type format for the WBS, this means that the *set* of boxes immediately below any box completely describes the box above.

To ensure that each activity is included only once, we have to sift through the WBS to ensure that nothing appears twice. It often happens that a project has activities that appear to be the same, when in fact they are different. If we have a program and also a meeting, and we want to write documentation of each, documentation under the program is quite different from documentation under the meeting deliverable. Both can be included because they are different. However when two deliverables such as this occur, they should be named is such a way that they can be clearly differentiated. Therefore, do not call them both 'documentation'. Call one 'program documentation' and the other 'meeting minutes' to differentiate.

3. The top levels must be deliverable-oriented

As discussed above, there are many ways in which the project could be broken down, but the recommended decompoition is into deliverables, to keep the thought process addressing what is to be proudced, and what is to be done

4. Elements must integrate to project whole

This will happen if each box is broken down carefully to include all components.

5. There should be no 'single children'.

When decomposing a project, it is likely that at some point a deliverable will be decomposed into a single deliverable. This does not actually make sense. Either there are more than one sub-deliverables or activities making up the upper box, or the lower box is in fact the same as the upper box. So, either there will be more than one deliverable below, or there is no need for further decomposition.

6. The bottom level of the WBS shows activities, which are assignable.

At some point in the breakdown, the deliverables actually turn into activities. At this point a verb can be added to the deliverable. The bottom level activities must be assignable to a single individual or unit. Until this can be done, further breakdown is required. The bottom level activities will be used to build the project schedule, and it is these activities that will be monitored. So they need to be clear, and the accountability for each must be definable.

7. All boxes are numbered in defined patterns

There are some acceptable formats for the WBS, as shown in the examples. Regardless of the format there is an accepted numbering convention – also shown in the examples. The deliverables must be numbered according to this convention.

> Cardinal rule: If it's not in the work breakdown structure, it's not in the project.

The WBS is the CORE of the project plan. Everything else is built around the WBS. Without it the project plan cannot be properly completed. However, it is not necessary to be rigid in the way the WBS is created. There are some standard formats that need to be followed and also some rules which essentially point people to use deliverables rather than functions or time, as just described. But within this, any set of deliverables can be the top level, etc.

There is only one caution – include only work that is to be done as part of the project. Anything done *after* the project is not part of the project and

should not show up in the WBS. This might sound silly, but if the scope has not been clearly defined, sometimes items, which should not really be part of the project, work their way into the WBS. In the case of our sample project here, suppose that we had not excluded the product sales, or the establishment of prices. Some groups might have included activities related to these two deliverables in the project. This happens easily when the people who are responsible for such functions are project team members. They are aware that they have to do the follow-up functions, and they sometimes include these activities in the project work, not realizing that they are not required deliverables – from the project perspective.

Once we have the WBS the activities are defined. The PM can then assign people, time, dollars, etc to each one.

The WBS can be in chart form, along the lines of an organization chart, as shown in Figure 1 or it can use the same format as the table of contents for a book. The WBS in Figure 1 is not complete, but some of the deliverables have been decomposed to illustrate the technique.

Sample Work Breakdown Structure

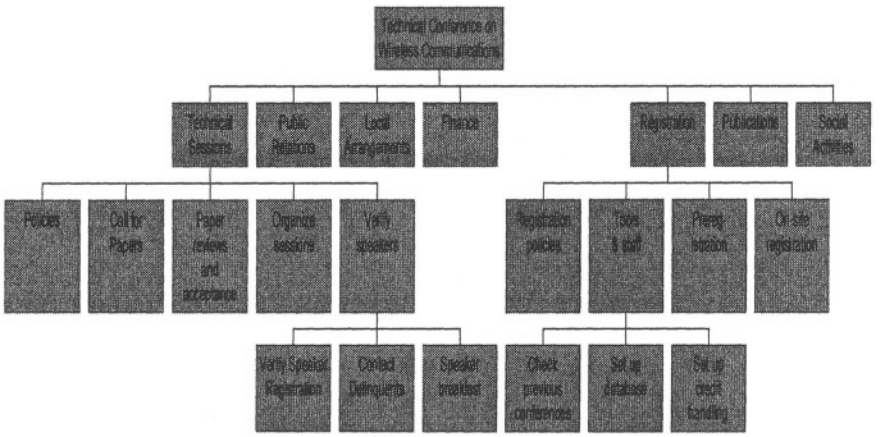


Figure 2

As discussed, the creation of the WBS starts with the high level deliverables which are listed in the charter. These are then broken into smaller deliverables, gradually working down to smaller pieces, until the

'bottom level' is reached. The bottom level elements are actually activities. Instead of expressing them as deliverables (the what) it is possible to include a verb, expressing them as activities. These activities must meet certain criteria. They must be

- assignable
- independent
- measurable
- schedulable
- budgetable
- suitable size What does this mean?

Assignable – the activities must be something that can be assigned to one person or group. If the work spans more than one unit, further breakdown is required. The reason that we want to assign to one unit is that the bottom level activities will be used to set up the project resource allocation, the schedule and the budget. The project manager will monitor these activities to ascertain that the project is on track. It is necessary to know who is responsible for each item in order to manage the completions.

Independent – each activity must be independent to facilitate management of the items. If interdependencies exist, it will be difficult to determine where problems lie. Finger pointing might become a problem.

Measurable – in order to determine whether or not the activities have been completed satisfactorily, the activities should be measurable. This will allow the team to specify the required levels for satisfactory completion, and the PM to determine when these have been reached.

Schedulable – the activities will be used to build the project schedule, so it must be possible to assign a start and end date to each. Therefore ongoing work cannot be included in the WBS. All work must be broken into units to be scheduled.

Budgetable – the project budget will be determined by assigning costs to the bottom level elements, and adding these up to determine the cost of each deliverable, and finally the cost of the full project. So it must be possible to determine the cost of each of the activity elements.

Suitable size – while there is no strict definition of what a suitable size might be, the size of the bottom level elements must be suitable for monitoring. An activity that lasts for 6 months might meet all of the above criteria, but for the PM to allow an activity to proceed for 6 months before

declaring completion would leave open too great a possibility of missed due dates. Therefore large items should be broken into smaller components to allow better control of the project. A length of something in the order of 2 weeks is generally considered to be reasonable for an activity. But there will be cases where somewhat longer or shorter is acceptable. This will depend on the project, and on how critical items are

Even at the bottom level, elements can still be broken down further, but this is not necessary for the WBS. Elsewhere in the project documentation the team should provide the detailed information for elements, which would benefit from further definition. Any tasks will be specified in this description, which is sometimes called a xxx dictionary.

Some people wonder why the project management activities should be included in the WBS. Hopefully the discussion above will clarify the reasoning behind this. It is quite possible that in the project charter, and maybe even in the scope statement, project management was not mentioned as a deliverable. That is probably fine for these two documents. They are usually focused on the product. However, given the only those items in the WBS will be included in the budget, the resource allocation and the schedule, how can the project be fully resourced if these critical activities are not included? Obviously they are part of the project, they will use time and resources, so they need to be included.

In fact, not showing them also has the effect of giving the impression that the management is in fact either easy or unimportant. Neither of these is true. The project management activities should be given the same respect as the product related activities.

When the WBS is complete, we will then move to the next steps, which are:

+ Add duration and dependencies so we can build the logic network
+ Add the calendar to the logic network to give the schedule
+ Add resource names to each activity
+ Add dollars to each activity

This will allow us to calculate the budget, and also, using the schedule, to plot out the cash flow – which might in turn influence changes in the schedule. We will be able to determine the flow of work, and using that along with the activity durations, build the project schedule.

This next step is a systematic analysis of the full scope of the project, defining all the deliverables, and all of the activities required to produce the deliverables. In this step we will identify all the project activities by creating a Work Breakdown Structure. When we finish we will have an analysis of the full project and all the activities that comprise it. Then the team can proceed with the work, ensuring that all aspects of the project are identified and covered. If any activity is not in the work breakdown structure, it is not in the project. Therefore no one on the team should be working on it. So everything that is to be done to complete the project must show up in the work breakdown structure – commonly known as the WBS. This includes all activities related to producing the product as well as all activities related to managing the project. Be sure to keep this in mind as the WBS is being built.

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The first level of breakdown is a set of major deliverables. These will probably already be listed in the charter, and if not, there should be such a list in the scope statement. Next, one by one, each of these deliverables is further broken down into deliverables, continuing until tasks of an appropriate level are reached. A common mistake is breaking the work down by department or function. While this can be done, proceeding this way has a higher risk of missing some project aspects. So do not work with departments or functions. Instead break the project down into deliverables.

DO NOT attempt to schedule tasks at this point. The times will be determined later, as shown in Chapter 8. Of course the dates are critical, but they are not part of the WBS. The WBS just gives all the activities that we will need to consider when we eventually do get to consider the timing. But when creating the WBS, we want to focus on the deliverables. So we leave all the timing till later. The dates will appear later in your project plan.

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- The WBS ensures there are no gaps or overlaps
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- There should be no 'single children'
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- All boxes are numbered in defined patterns

What does this mean?

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Therefore, do not call them both 'documentation'. Call one 'program documentation' and the other 'meeting minutes' to differentiate.

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As discussed above, there are many ways in which the project could be broken down, but the recommended decomposition is into deliverables, to keep the thought processes address what is to be produced, and what is to be done.

4. Elements must integrate to project whole

This will happen if each box is broken down carefully to include all components.

5. There should be no 'single children'.

When decomposing a project, it is likely that at some point a deliverable will be decomposed into a single deliverable. This does not actually make sense. Either there are more than one sub-deliverables or activities that make up the upper box, or the lower box is in fact the same as the upper box. So there will either be more than one deliverable below, or there is no need for further decomposition.

6. The bottom level of the WBS shows activities that are assignable. Accountability for bottom-level tasks must be clear.

At some point in the breakdown, the deliverables actually turn into activities. At this point a verb can be added to the deliverable. The bottom level activities must be assignable to a single individual or unit. Until this can be done, further breakdown is required. The bottom level activities will be used to build the project schedule, and it is these activities that will be monitored. So they need to be clear, and the accountability for each must be definable.

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Once we have the WBS the activities are defined. The PM can then assign people, time, dollars, etc to each one.

The WBS in chart form, along the lines of an organization chart, is shown in Figure 1. Alternatively, it can use the same format as the table of contents for a book, as shown in Figure 2.

The following is a somewhat humorous version of a WBS in the alternate form. Normally the lowest level would not be as detailed or menial as is included in the example, but this serves to show how the numbering works, how the chart is still hierarchical in nature, and honours the rule about no single children.

Project: Get to Work in the Morning!

1.0 Wake

1.1 Setting the Alarm

1.1.1 Decide on time necessary to get up

1.1.2 Change alarm time on clock

1.1.3 Choose the appropriate am/pm settings

1.1.4 Select music or buzzer

1.2 Getting out of Bed

1.2.1 Turn off alarm, or set to snooze

1.2.2 After appropriate number of "snoozes", put feet on floor and move

2.0 Freshen Up

2.1 Clean Self

2.1.1 Shower

2.1.2 Dry

2.1.3 Brush teeth

2.1.4 Brush hair

2.1.5 Apply toiletries (anti-perspirant, powder, etc.)

2.2 Tidy Up Bathroom

2.2.1 Clean & Dry Mirror

2.2.2 Collect towels, clothes and put in laundry

3.0 Dress

3.1 Select clothing

3.1.1 Consult calendar for appointments, etc. necessitating particular dress

3.1.2 Check weather

3.1.3 Choose according to the above conditions

3.2 Prepare clothing

3.2.1 Iron clothing

3.2.2 Spray with anti-static spray

3.3 Select accessories

3.3.1 Consult calendar for appointments, etc. necessitating particular style

3.3.2 Review clothing chosen to determine metal, stones, etc. to correspond

3.3.3 Choose watch to match

3.4 Complete Task, put all selections on

4.0 Breakfast

4.1 Decide what to consume

4.1.1 Consult calendar for appointments, etc. to nutritionally balance the day

4.1.2 Choose something from each of the 4 food groups

4.1.3 Choose a beverage

4.2 Cook Breakfast

4.3 Eat Breakfast

4.4 Tidy up Kitchen

4.4.1 Fill sink with hot soapy water

4.4.2 place dishes in sink

4.4.3 Wipe firmly with cloth

4.4.4 Place dishes in rack to dry (or alternatively, dry and return to pantry)

5.0 Travel
- 5.1 Determine mode of transportation
  - 5.1.1 Consult calendar for appointments, etc. to determine if a car is required
  - 5.1.2 Check driveway to see if the children have left you one
  - 5.1.3 Walk to train station
- 5.2 Buy ticket for chosen mode of transportation

6.0 Arrive at work, ready to start your day.

Figure 3

Some people wonder why the project management activities should be included in the WBS. It is quite possible that in the project charter, and maybe even in the scope statement, project management was not mentioned as a deliverable. That is probably fine for these two documents. They are usually focused on the product. However, given that only those items included in the WBS will also be included in the budget, the resource allocation and the schedule, how can the project be fully resourced if these critical activities are not included? Obviously they are part of the project, they will use time and resources, so they need to be included.

In fact, not showing them also has the effect of giving the impression that the management is in fact either easy or unimportant. Neither of these is true. The project management activities should be given the same respect as the product related activities.

When the WBS is complete, we will then move to the next steps, which are to:

- Add duration and dependencies so we can build the logic network
- Add the calendar to the logic network to give the schedule
- Add resource names to each activity
- Add dollars to each activity

This will allow us to calculate the budget, and also, using the schedule, to plot out the cash flow – which might in turn influence changes in the schedule. We will be able to determine the flow of work, and using that along with the activity durations, build the project schedule.

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Chapter 5

SCHEDULE CREATION

Now that we have the Work Breakdown Structure, we can think about building the project schedule. Before the project schedule can be created, the team must identify the activities, and determine all of the interdependencies. In doing this the team can build a logic diagram illustrating the 'shape' of the project. Once the optimal structure has been determined this can be overlaid on a calendar, yielding a schedule. The techniques for producing a critical path schedule are explained. In this chapter we also discuss how to manage some typical schedule problems.

Everyone associated with a project is impacted by the schedule, and a wise project manager will use assistance from all key people when building the schedule. The project manager has the overall accountability for the schedule, and will be the prime player in building and monitoring it. If there is a project assistant or planner, he or she may prepare the schedule and possibly also monitor it, particularly on a large project. Full team involvement is required to build and adhere to a schedule in order to take into account all potential dependencies, and to accurately estimate the activity times. Functional managers in matrix organizations are impacted; all stakeholders are affected. All should be informed about the end result at the very least, and possibly also asked to contribute at some point during the development.

In the PMBOK® Guide there is a systematic analysis of five processes that are related to project time management. See Figure 1 for an illustration of these processes. The diagram shows the stage of the project at which each of the five processes occurs.

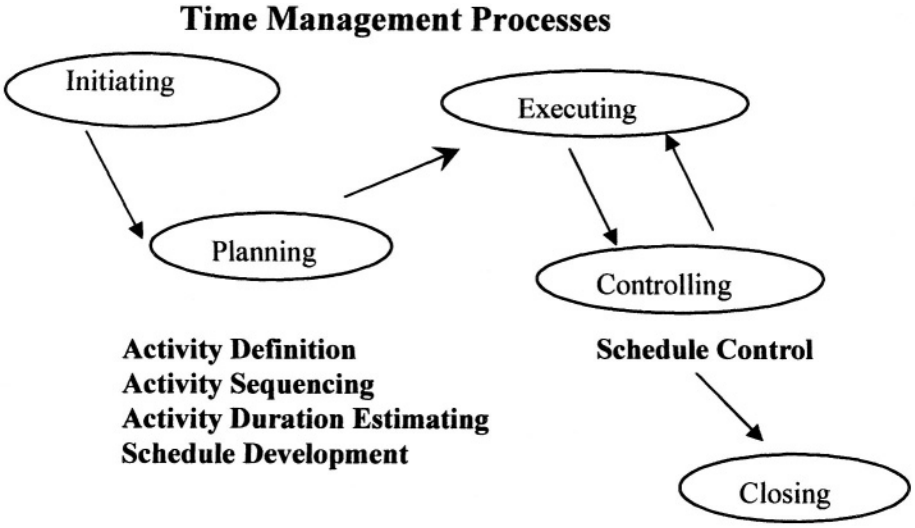


Figure 1

The five time management processes are:

1. **Activity definition**

   In order to build an accurate schedule, we need to know all of the activities that must happen. The work breakdown structure, once fully completed, identifies all project activities.

2. **Activity sequencing**

   Once identified, the activities must be ordered. In order to do this, the team must identify all the dependencies of any activity on other project activities.

3. **Activity duration estimation**

   The schedule must allocate time for every activity. The activity durations must be estimated, using all appropriate inputs.

4. **Schedule development**

Schedule development consists of first building a logic diagram to illustrate the activity flow, and then overlaying the diagram onto a calendar, once the start date is known. Further manipulation might be required to accommodate considerations such as resource allocation or time constraints.

5. Schedule control

Once the schedule has been developed and approved, the work can begin. In order to ensure that all critical dates are met, it is necessary that someone monitor the activity completions, and take any required action to get things back on track if problems occur.

The main focus of this chapter is the development and management of schedules. Schedules can be developed a number of different ways, including

- Top down
- Bottom up
- By phase
- For specific purposes
    - planning
    - control
    - production

Top down schedules are often prepared at the early stages of a project, considering either major milestones, maybe drawing parallels with previous similar projects, to estimate reasonable timeframes for a project before the full details can be known.. This technique can be quite effective as long as the basis from which the information is estimated is sufficiently similar to the case at hand.

Bottom up schedules require knowledge of all project activities, all activity durations, all activity dependencies. In order to get this level of information, project details such as resource assignment are needed for each activity. Therefore, it often takes considerable time to obtain this information, and sometimes, full information is not available until after the fact. However, this is the only fully accurate schedule for a project, so it is highly desirable to build the project schedule in this way. Bottom up schedules are built from work breakdown structure elements once these are available

When a project is divided into phases, schedules are needed for each phase. When one phase depends upon previous phases, it may be necessary to wait for some critical completion point in one phase before a subsequent schedule can be can be prepared.

When schedules are prepared for specific purposes, the requirements may differ. A control schedule might show points prior to activity completion, at which the PM might follow-up on the activities, whereas a production schedule might show only activities that are included in production.

In this chapter we will walk through the steps for preparing the full bottom up schedule. First the project manager must prepare high-level WBS, usually with the involvement of the project team.

Secondly, the team must complete the full WBS. At the outset of this step, the bottom level activities must be identified. (One technique that works effectively for manipulating these activities to decide on appropriate positioning is to put these bottom level activities on stickies, and post them on a whiteboard. Identify dependencies and constraints for the activities. This is best done with the full team, or at least with input from people with experience in the specific functional or technical areas. This allows for the creation of the project network - i.e. logic diagram of the project. When the network is complete the paths can be identified, and the critical path can be identified. The network can then be overlaid on a calendar to determine the completion dates. If the full project duration is too long (often the case) or too short (rare!), or if some crucial milestone dates are not met by the resulting schedule, the team may want to apply logic and experience to make the path fit the requirements. When it is verified that the constraints are met, at this point the team should computerize this information. The resulting schedule can then be published as a communications tool.

Developing the Logic Network

- **Defining the Activities**

Generally everyone associated with a project is anxious to understand the project schedule. As can be seen from the discussion so far, we cannot get to the schedule until the activities are first identified. These activities constitute

the bottom level of the work breakdown structure. How are activities defined? The team can use many methods:

Use knowledge gained through experience
Develop from the structure of previous projects
They may be defined in a contract or customer agreement
Many may be defined in practices or procedures
They may be defined by the structure of another current project

- **Determine the Activity Durations**

For each activity, we need to know the anticipated duration. Activity duration is best estimated by the person who will perform the task. The project manager should collect this detailed information from all team members. If the specific team member is not yet available to provide the information, someone with knowledge of the function should give the estimate, or one of the above techniques should be used to determine the best estimate. The duration of any of the activities is independent of any activity dependencies, and is determined by the work that must be performed.

When creating a time estimate, be sure to consider

- the work to be done
- the person doing work
- any equipment/resource requirements which might impact the duration
- other commitments of the people or resources
- corporate overhead
- project overhead

When obtaining duration estimates, the project manager should request that each person estimate the actual work time to perform the task, without adding contingency time. Contingency will need to be included in the project schedule, but this will be defined and added by the PM, to account for uncertainties in the activity durations, as well specific project risks. Including contingency in the activities as well will result in double accounting, hence reducing the accuracy of the schedule. The PM needs to maintain control of the inclusion of contingency.

When an estimate is requested, the project manager should also ask for background on how the number was determined, because there are many ways to arrive at such numbers. For example, there are often standard estimates, values that are the usual time required for such tasks. Statistically

such tasks will fit these durations, however, if there are specific differences in the current project the PM may need to modify these estimates to fit the project conditions. So it is important that the PM be aware that standard numbers are being used, and also be aware of the potential differences in the current project. Another good source of time estimates is the time result from previous experience. Again any differences between previous experience and the current situation need to be factored in. Records from previous projects might provide good information if there is not enough first hand experience available. For a new activity, where history is not a good guide, expert judgment is the preferred technique. Here the project manager should still take into account all knowledge available about the person doing the estimating. Some people consistently over or under estimate, so numbers from these people should be adjusted appropriately. It is always best to use actual estimates from project team, as they can best take into account their own abilities and limitations. When the details are not clear, people sometimes provide loose estimates that are the best information available. In this case the risk of inaccuracy is high, and this risk needs to be taken into account in the contingency planning. When all else fails, guessing is all that's left; as the project unfolds it will be necessary to revisit and correct such estimates.

The project manager should request that all inputs include project and non-project time. Before the schedule has been laid out it is difficult to build in some of the non-project time, such as specific holidays, or preset meetings. These will have to be added during the schedule adjustments after the final dates are laid out.

For the project it is recommended that the team estimate optimistic, realistic and pessimistic times. In order to accomplish this it is useful to obtain a range of estimates for each activity, or at least a distribution within which the times might vary. In fact, some risk programs that can be used with project management software can take these distributions into account, using them to estimate a range of values for the full project.

- **Dependencies**

Once all of the activities have been identified, and their durations determined, it is necessary to determine which activity has any dependency on other activities. If there were no dependencies amongst the activities at all, the best strategy would be to start every activity on day 1 of the project. If there were enough available resources to do this, the project could then be completed after the number of days required for the longest activity. For any

real-world project, there are always some dependencies amongst the activities.

The PM and the team need to look each all of the activities in the work breakdown structure, one by one, and figure out what the dependencies are. One technique that has been very successful for this is to write each activity on a sticky label, and to line up the stickies with the initial activities first, on the left, followed by those that depend on the initial ones. The more activities the project has, the more complex the project network diagram can become.

Often people ask about creating the project network by computer. Of course there are tools available to produce these diagrams. However, before the program can form the network, someone has to input the dependencies. The team needs to define these dependencies, and tell the program what they are.

Then the network can be formed either using software or manually. If the 'stickie' technique described above is used the team will in fact have formed the network manually as the dependencies are being identified. Afterwards it is a good idea to run the program as well, and to compare the manual network to the one the program creates. In the comparison the team often finds interesting information about the project.

There are actually four different types of dependencies. The most common, and the default, is Finish to Start.. When a dependency is one of the others, this must be specified. We now describe each of the four types. In the diagrams that follow the symbol ♣ shows the trigger that has to occur before something else can occur. The symbol ♦ shows the item that is dependent on the trigger ♣.

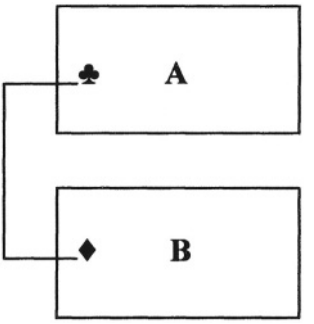
FS - Finish to Start

1. The start of activity B is dependent upon the finish of activity A
2. The finish of A triggers, or allows for, the start of B
3. When A finishes, B can start

4. B cannot start until A finishes.

Example: When the sanding of the drywall (A) is finished, the painting of the walls (B) can start.

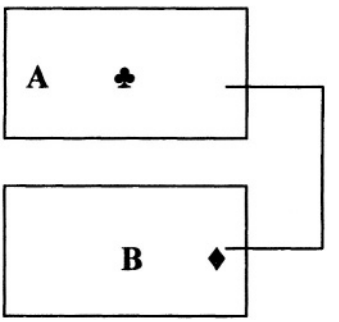
SS – Start to Start



1. The start of activity B is dependent upon the start of activity A
2. The start of A triggers, or allows for, the start of B
3. When A starts, B can start
4. B cannot start until A starts.

Example: I am going to paint the walls a plain colour, and then put my hands in a different colour to add hand details. I cannot start the hand detailing (B) until I at least start the painting (A).

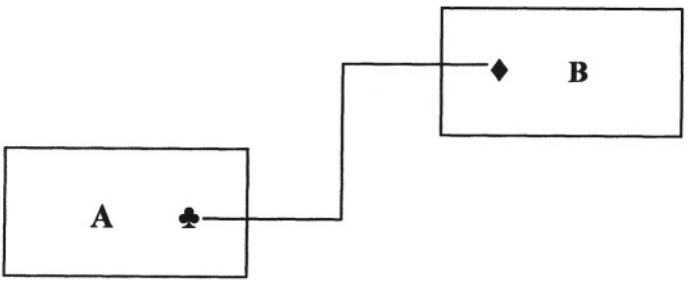
FF– Finish to Finish



1. The finish of activity B is dependent upon the finish of activity A
2. The finish of A triggers, or allows for, the finish of B
3. When A finishes, B can finish
4. B cannot finish until A finishes.

Example: I am painting lines on the road, which I am paving. I must finish the paving (A) before I can finish painting the lines (B)

SF– Start to Finish



1. The finish of activity A is dependent upon the start of activity B
2. The start of B triggers, or allows for, the finish of A
3. When B starts, A can finish
4. A cannot finish until A starts

Example: The night shift can finish looking handling the trouble calls when the first person from the day shift starts.

This dependency is very rare, but it is included here because it is needed in a few situations.

NOTE: In every case the occurrence of one event allows for either the start or the finish of the other. The dependency should be real, or it does not need to be shown. However, in addition to these dependencies, there are other considerations that are related. These are:

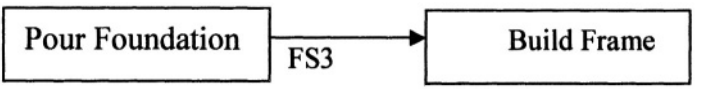
- Can versus must
- Leads and lags
- Soft and hard dependencies
- Multiple dependencies
- Activity duration

Can Versus Must

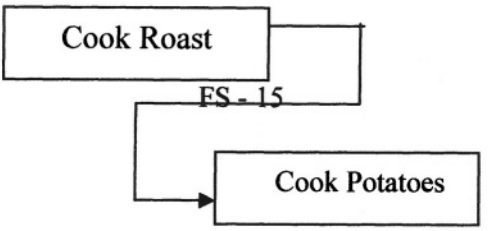
Note that in each case we say that the triggering activity allows for the other one. The occurrence of the trigger makes it possible for the other occurrence. It does not mandate it. In other words, when the cake is baked I can ice it. I might not. I might prefer to wait until just before dinner because I like my icing fresh. But the real dependency is that I have to finish baking the cake before I can ice it. Once the baking is finished, there is no longer a dependency. I can ice it at any time I choose. So I fit this into my schedule at whatever time is good for me. I can't put it before the end of the baking but I can put it anywhere I like after the baking finishes.

Leads and Lags

For each of the dependencies FS, SS, FF or SF, we can have either a lead or a lag. So, if it takes 3 days for cement to cure, and I need to have the cement fully cured in the foundation before I can start to build the frame of the building, I can ensure this by adding a lag of three days to the "pour foundation" activity. We would indicate FS + 3 to show the lag.



Perhaps I can start cooking the potatoes 15 minutes before the roast is cooked.



When there is a dependency, there is a need to tie the two dependent items together in the right way so that if one of the items moves in time, the other moves with it. Project Management software will do this for you. Although it is somewhat cumbersome, this can also be done manually. The PM should always select dependencies to produce the simplest possible model.

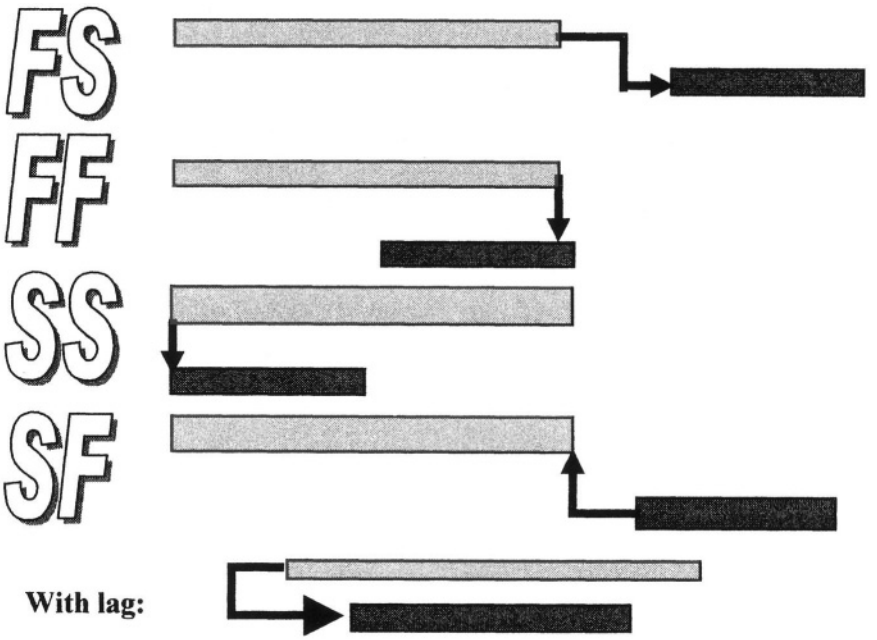


Figure 2

Soft and Hard Dependencies

Dependencies can be either hard (mandatory) or soft (preferable). Hard dependencies must happen. It is preferable that soft dependencies happen, but if the project comes to a time crunch, we might remove or lessen some of the soft dependencies. Hard dependencies are very real, while soft ones are usually related to rules or good practices. For example, we probably prefer to completely finish programming before we test a program. But we often don't have the luxury of enough time to do this. So we would declare the FS dependency, and set our schedule to allow for it. Then if we find that our

schedule is too long to meet the due final date we might move the testing back to overlap the programming. In this case there is a hard dependency on the start of programming plus some time for the actual program development that will prevent total freedom of movement of the timing, even when we remove the initial dependency on the completion of the programming.

Multiple Dependencies

In any of these cases there can exist more than one dependency. For example, it may be necessary to finish multiple items before something else can be started. I cannot put up drywall in a new office until the communications wiring, the electrical wiring, the plumbing and the furnace ducts are installed.

In some cases there may be multiple dependencies affecting the same pair of items. Consider paving a road and painting lines. In this case we have both a start-start and a finish-finish dependency relating the two items.

When the network is built, dependencies must all be built into the flow of the activities. For FS it is fairly easy to work with the flow. But when other classes of dependencies occur, it takes more thought to ensure that the linkages are properly defined. For example, for a finish to finish dependency, initially determine the timing for the first activity, then link the finish of the second to the finish of the first. This, with the duration, will give the finish timing of the second.

The start of A and B are not linked in an FF dependency, so the start time of activity is not relevant in making the determination; t is the finish times that must be linked. The start of the second activity will be determined by working back from the finish. It must start enough beforehand to allow for the full duration. The condition is that A cannot finish before B finishes. If desired or necessary, it can actually finish later - just not earlier.

Constraints

Once the dependencies have been identified, it is a good idea to think through any constraints that exist as well, and these can also be tagged to the appropriate activities.

A number of constraints could possibly exist, such as:

- ASAP : as soon as possible
- MSO date: must start on

- MFO date: must finish on
- SNLT date: start no later than
- SNET date: start no earlier than
- FNLT date: finish no later than
- FNET date: finish no earlier than

Logic flow

The next step in the process is determining the logic flow for the project activities. This is done by determining all of the dependencies, and using them to line up the activities sequentially. The end result will be a chart which shows all of the activities, and when each will start relative to each other. Note that there are no actual dates assigned at this point, and dates are not considered in the flow. The first step is to determine what the optimal flow would be, according to the tasks and the dependencies, without worrying about other factors. Later, changes can be incorporated if necessary to take into account constraints, or resource requirements.

The output of the process can be called a project diagram, a network diagram, or a logic network depending on the source. All refer to the same thing – a diagram showing the logic flow of the activities.

There are two different accepted techniques for creating these diagrams, the Arrow Diagram Method (ADM) and the Precedence Diagram Method (PDM). The second is by far the more popular today, mainly because it allows much more flexibility.

In the first method, Arrow Diagram Method (ADM), the project activities are shown on arrows that run between nodes. The nodes are effectively dummies, showing only as indications of the ends of arrows. In addition to naming the activity, it is usual to also show the duration of the activity on the arrow. Any given activity must have its source in one and only one node.

As we know, in real projects, there are many project activities that are dependent on a number of activities and yet the ADM rule seems to say that an activity can be dependent on only one. In fact, that is not what the statement is saying. Any activity can have any number of dependencies, and these all have to be shown. But the rules that apply to the ADM method. say that you have to have one arrow for each activity, and that each arrow has to start from its own node. So, sometimes you have to put in a number of dummy nodes, to allow you to show all the dependencies.

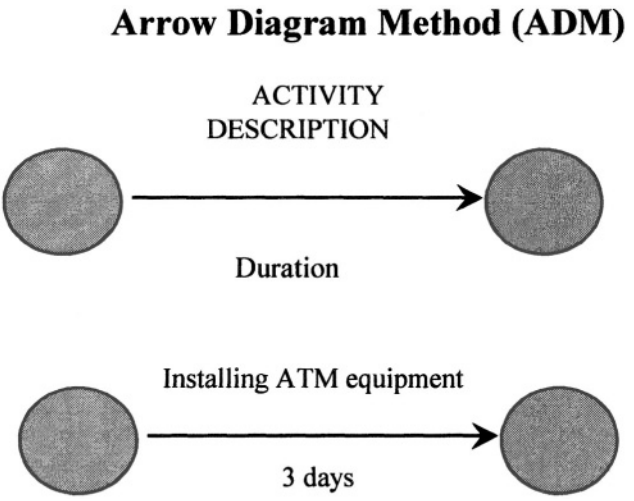


Figure 3

The name of the activity and the duration are specified on the arrow.

Nodes delineate ends of the arrow. Only one arrow can join two nodes.

If two activities can occur in parallel, a dummy node must be added to terminate the second activity.

In the Precedence Diagram Method (PDM), the project activities are shown on nodes that are interconnected by arrows, which show the dependencies:

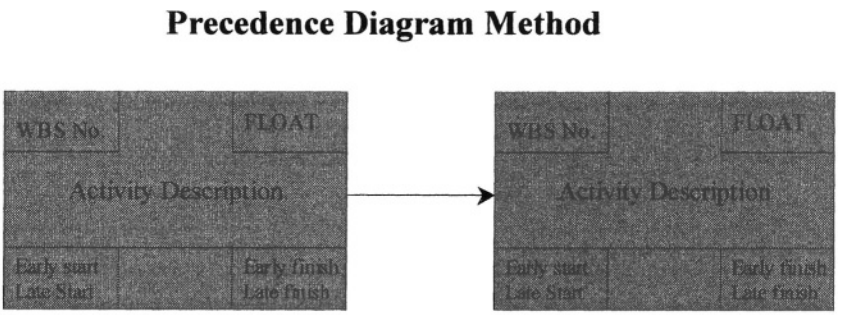


Figure 4

PDM puts the activity in the node. This technique also allows you to specify not only FS dependencies, but also SS, SF and FF dependencies. This is useful, because in real projects we have all of these. The ADM method does not really allow for this.

PDM also allows many arrows to flow into one box, although it is preferred that these be drawn clearly so that it is clear which arrow is going to which box. Sometimes problems can arise in reading diagrams with multiple arrows that cross) The diagram can be drawn your network the way an electrical circuit is drawn, with little blips to show the point at which one line crosses another.

In order to illustrate the techniques let us draw the ADM and PDM for a project with two activities, to program a module for a service order system and test/debug.

The project has two activities:
1. Program an order module
2. Test and revise

We have some duration information on these activities:
Programming takes 20 hours.
Testing takes 10 hours.

We also have some dependency information about the activities.
Testing cannot start until 4 hours after programming starts
Testing cannot finish till 5 hours after programming finishes

Using the ADM technique, the logic diagram would be:

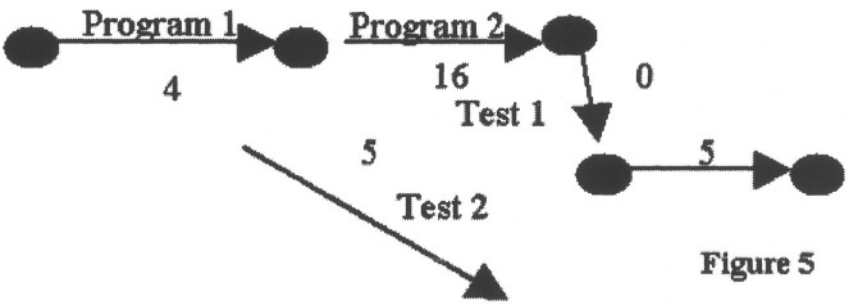


Figure 5

In order to show all of the information we must split each activity into two parts and add a dummy activity to show the dependency. Dummy activities MUST have 0 duration.

Using the PDM method, the network looks simpler, even though it shows the same information:

PDM

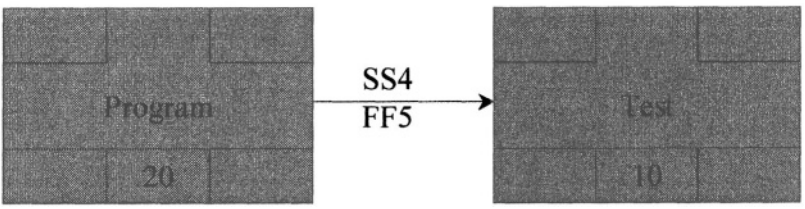


Figure 6

Let's look at a network that is a bit more complex, first in ADM form,

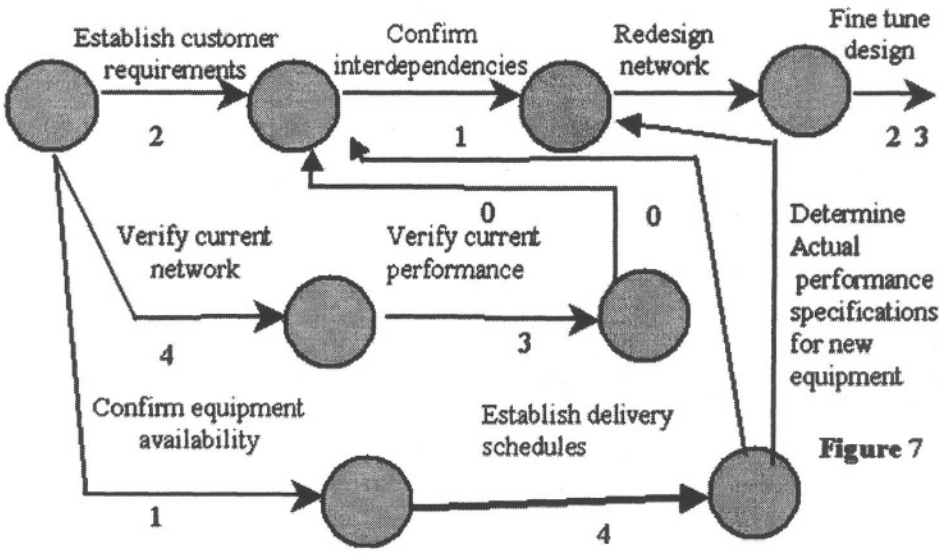


Figure 7

Then PDM a network that is a bit more complex in first ADM form

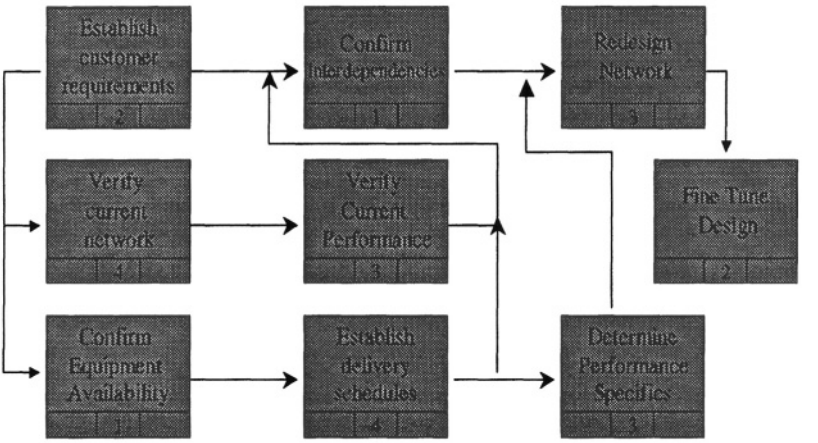


Figure 8

Let's impose an additional condition on this network:

Suppose that establishing customer requirements can't start without initial data on the performance of the current network and it will take us 2 days to measure this.Let's see what then happens to the diagrams:

The ADM diagram becomes:

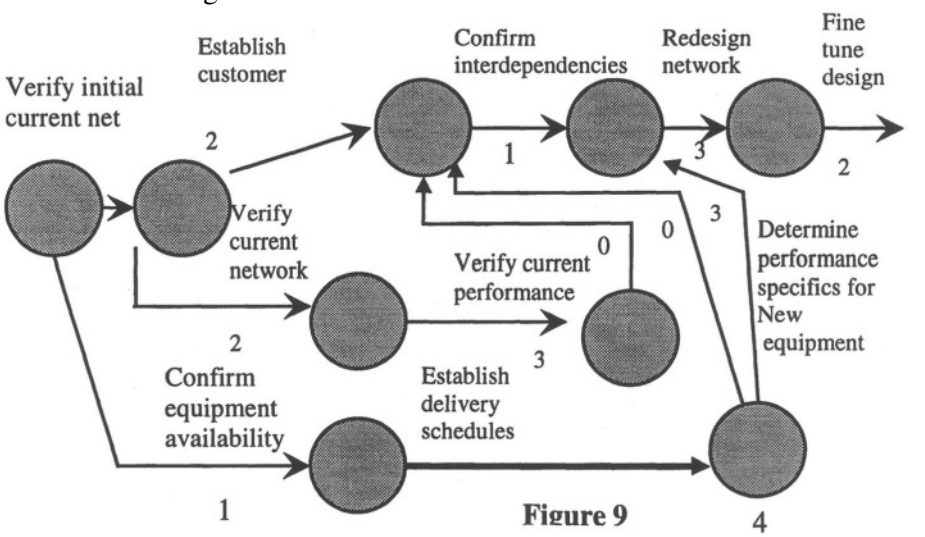


Figure 9

And the DM becomes:

- Initial 8 nodes and 11 arrows become 9 nodes and 12 arrows.

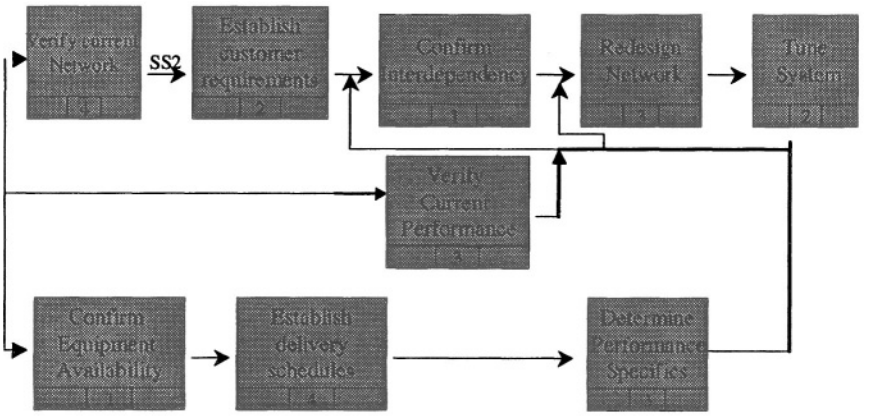


Figure 10

Thus both techniques can be used. But it is cleaner to show the more complex information using PDM.

Once the structure of the diagram has been created, the next task at hand is to determine the actual timing of each of the activities. This is done first in general terms. Later the calendar can be added to determine the exact dates. But initially we can work with activities starting on day x of the project, and completing on day x+d, where d is the duration of the activity. This will give the eventual duration for the full project, at least until problems with resources, or constraints or the addition of contingency cause it to change.

Using the sample of a logic network shown in Figure 11, we can work initially on finding the early dates – the earliest date at which each activity can start, and thus the early finish for each activity.

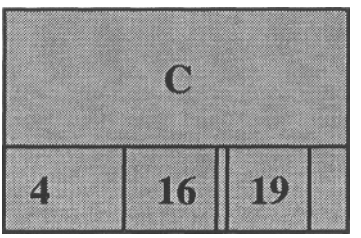


Figure 11

In this diagram we can see the early start and finish for each activity.

These are found by making what is called a Forward Pass. The rules used for the forward pass are:

- Start with the initial activity
- All activities start at 8am on the start date and finish at 5pm on the finish date
- The early start date of an activity with multiple predecessors is determined by the latest early finish of the predecessor activities
- Be careful to note the types of dependencies

The late finish date of an activity with multiple successors is determined by the earliest late start date of successor activities.

Critical Path

In the end we have a network of project activities, and we can see within the network a number of activity paths, each of which must be completed before the project will be finished. In our example we see four paths:

ABF
ACF
ADEF and
ADEGF

Besides the relative timing, we can also determine the lengths of the paths, and we can decide which path is the one that must be constantly on track in order to prevent the overall end date from slipping. This path is called the Critical Path. The critical path is defined as the longest path in the network. Since it is the longest path, its length defines the shortest time is which the project can be completed. And, if any activity on this path is not completed on time, the project will be late. So it is very important that the project manager carefully monitor all of the activities on this path to ensure that none of them will be late.

Generally, the critical path does not have any float. This is there is usually time pressure on projects, so once someone calculates the longest path in the network, they set the finish date as the date determined by this process, and this leaves no float on that path. When it happens that the finish date for the project is set independently of the detailed project planning, the pre-set date is usually tighter than the one that is determined by the optimum project network with the durations, constraints and contingency included. But it could happen that the finish date is in fact a bit later than the required time, so the longest path gets things done earlier than this date. If this happens, then the critical path in fact has float.

Since the definition of the critical path is the path that is the longest, it would be easy to presume that there is only one critical path in any network. However, it is easy to see that this is not necessarily the case. Why could two or even more paths not be the same length, and if this happens, of course these paths could be the longest length. So, while it is much easier for the PM to manage a project that has only one critical path, it is quite possible that there are multiple critical paths.

Also, there can be what are called near-critical paths. These are paths that have only a small amount of float. In a project that runs for maybe 500 working days, a path that has only 3 days of float is not technically a critical path, but obviously there is very little room for slippage, so the PM will want to treat this as a critical path to ensure that no slips jeopardize the project completion.

Float

In this discussion we have introduced the concept of float, but this has not yet been defined. In fact, there are a number of different types of float, so we need to define each of these.

Free float: is the amount by which an activity can slip without affecting the early start date any other activity
Total float: is the amount by which an activity can slip without affecting project completion date
Negative float: is what occurs when the project cannot finish by predetermined completion date
Slack time: is the difference between scheduled completion date and term required to meet critical path dates.

NOTE: The PMBOK® GUIDE calls float slack time, so in some references the distinction mentioned here is not made.

Schedule

Now that we have the structure for the optimum network, we can look at some of the other considerations. We can line up the activities along a timeline now, even though we may not yet know the exact start dates. When this has been completed, we might also be able to note the names of the people assigned to each of the tasks. Once the tasks have been assigned, we can work through the timeline to ensure that no one is double booked – or

worse. If resource problems are found decisions will have to be made about how to solve these.

Finally if we know the start date, we are now ready to create the actual schedule. We can do this by lining up all the activity start and end dates with the calendar.

Schedules can be shown as:

- Lists of activities, with associated dates
- Only high level milestones, with completion dates
- Gantt chart
- Logic network with calendar

Any of these formats may be acceptable. The PM should determine which is the most useful to him or her, and which would best meet the needs of the key stakeholders.

One of these formats shows only milestones. Milestones are significant events in the project lifecycle. Many people do not need to know the details of the schedule, but they are interested in when major accomplishments will occur. For these people, the milestone schedule is sufficient. In the chart below we can see why it is wise to include milestones in a project schedule.

This chart, sometimes called a hammock diagram, shows the effort levels that are usual as people work on tasks or activities. They start out very ambitiously until either interest wanes, or other activities encroach. Then the activity slides a bit until an imminent due date provides the impetus to increase the focus and energy to complete the item. If the project is divided into milestones, there are multiple opportunities for smaller catch-up periods, so not as much work is at risk as would be if the milestones were not considered.

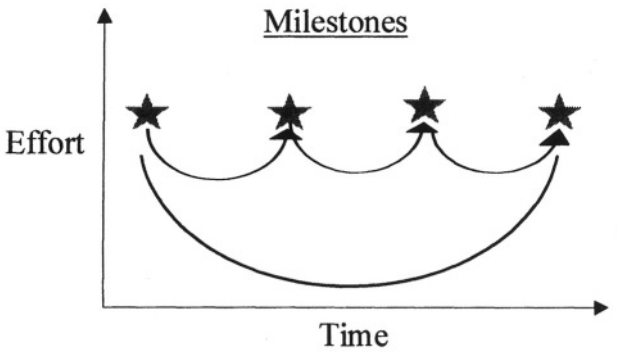


Figure 12

Figure 13 shows a screen shot from a project Gantt chart.

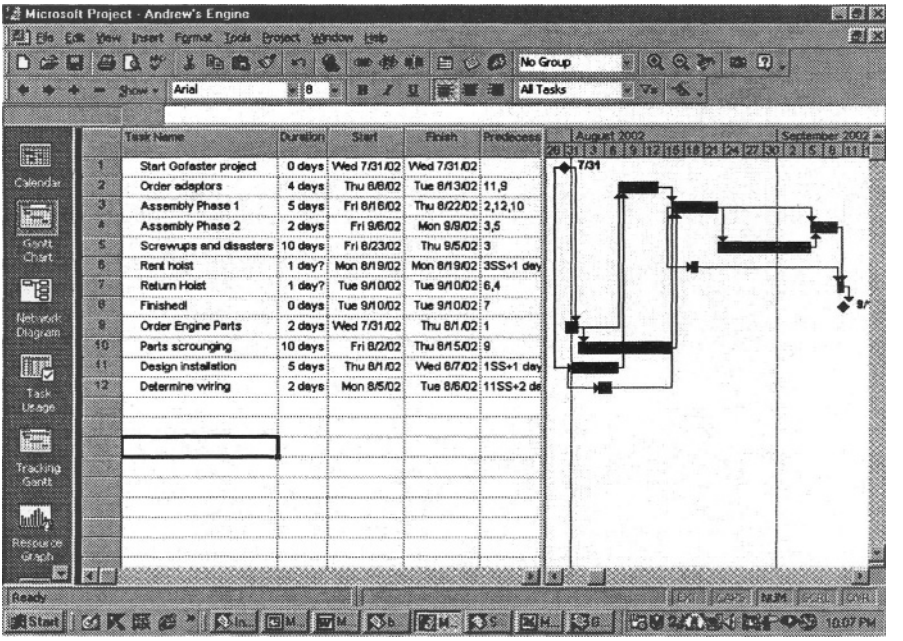


Figure 13

Contingency

Once the project network is defined, we must build in the schedule contingency. A better approach is to wait until the schedule is laid out on the calendar, and any constraints have been established, and then include contingency. It is preferable to wait, especially if there are time related constraints, because the flow of activities may change when the constraints are included.

The amount of time contingency that must be included is known from the risk analysis. The question at this point is where this additional time should be included in the schedule.

The options for the inclusion of contingency are similar to those for then inclusion of budget contingency, and some of the issues are the same. We could add the full contingency at the end of the schedule, immediately prior to the due date, to allow the PM maximum flexibility in managing it. However, this would not make sense to the team, as it would be obvious that

they were being driven to complete their tasks too early. Some would balk; some would simply procrastinate, feeling that they were entitled to use the contingency to cover for their own problems. And of course, every time during the project that contingency was needed, the PM would have to readjust the full schedule, moving time from the end of the project back to the spot where it was needed. Another approach would be to distribute the contingency time evenly across all activities. This would have the unfortunate, but expected result that every activity would overrun, using up the contingency in bits and pieces for activities that it was not anticipated would need contingency. So this is not a good method of including it.

A better solution is to allocate time in smaller packages, to different locations. These locations should be on the critical path, and they should follow activities that have time risks. It is always wise to put some time contingency at a point where multiple paths feed into the critical path. This allows some room to maneuver if problems do occur.

So, recapping, after we have the activities from the work breakdown structure, and we work through the dependencies, we can create the project network. Next we have to determine the expected duration time for each of the activities. At that point, we can then take the project network, and lay it out along a calendar. We would line up the activities with no predecessors at the beginning of the network, and they will extend along the calendar over the appropriate times. We can work forward one by one, till all of the activities are lined up along the calendar in the optimal configuration according to the dependencies. Then we look at every activity and determine who will do it. Some of these will be clear, because they are skill based. For others we may have some flexibility. At this point the picture starts to get interesting. We can now look at the calendar, and walk through day by day, or week by week, etc. We can look at this from the perspective of the resources. And we can get a resource profile for every resource on the project.

Dealing with Challenges

In an ideal world, everyone works out to be 100% (of their allocation to the project) loaded consistently throughout the whole project. But then, we should be so lucky. It is far more likely that variations in the workload vs resource availability will perturb the project schedule

Suppose that someone (person 1) is severely overloaded weeks 2-6, and someone else (person 2) is seriously under-loaded weeks 5 and 6. But the

first person has nothing weeks 7-10. The PM should take some action to remedy this, distributing the load so that everyone is consistently loaded over the time of the project. Let's consider how this can be done. The PM could take load from person one and give to the less loaded person. Of course this assumes that both people are equal in ability, skill sets, etc. In practice that is quite rare. If both people are 100% assigned to the project through weeks 1-10, we would really like to have each loaded to 100% for this full time. Maybe someone else is available for 50% for 3 weeks, then 80% for 3 weeks, then 50 %. This third person's profile is different so when we assign load to the third person we are fitting the load to a different profile than that of the first two.

We can assign any work to a resource other than the one initially selected, but we may have a skill match problem. The impact of this substitution will probably be to extend the duration of the project, since the replacement person will probably take longer to do the work. We might also be lowering the quality. We need to assess the situation carefully to see how good or bad any such substitution will be.

If it isn't practical to reassign the tasks, or we do not want to move some activities to another resource, what other possibilities do we have?

We could hire additional people. Of course, this will impact the budget, and maybe also the time, because maybe people will have to help the new resource get up to speed. But this is one possible solution.

If we can extend the due date of the project we could use the current staff. This might be the best solution if the budget is tighter than the time, or the quality is the major issue.

We could consider working on activities in parallel. If we change the pattern of the activities, we are, in effect, attacking the dependencies. This also has potential impacts. In particular, risk goes up, and maybe other activities will need to be reordered elsewhere in the schedule. We can do this but first we have to assess the impact.

Another possibility, although an understandably unpopular one, is to require everyone to work additional hours per week or per day, without additional compensation. This has been becoming more the norm over the past few years as budgets tighten. As long as no individual is loaded to more than 24 hours in a day, it is possible to do this; preferably people should be left enough time to eat and sleep a bit - but this sort of "stretch" work assignment is now very common when a project is facing critical delays. If it

becomes necessary to do this, the project manager needs to be careful not to schedule someone for long days – 16-hour days for long time periods. Eventually something will certainly give. Even if it isn't the project that suffers the loss, does the project manager want to be responsible for this? In fact, any such overtime scheme should be limited to something less than say 10 hours per day. If hours extend beyond this, productivity suffers, and it can cost more time or dollars to fix the damage than it is worth.

Another way to solve scheduling problems would be to eliminate some project scope. This can certainly save time. But before doing this, the PM must check with the key stakeholders to ensure that they can live with the reduced scope. Otherwise the time required to build in the removed material might even exceed the original requirements.

We could look into shortening critical path activities. The critical path is the longest path: if the schedule is too long to complete by the due date, it will be necessary to shorten it. Shortening activities that are not on the critical path does not buy us anything, but shortening critical path activities does produce value. Activities can be shortened in three ways. One way to do this would be to decrease the actual scope of the activity. This could lead to the problems discussed above. A second way would be to reduce the quality of the output. There should be specifications indicating the acceptable level of quality. If so, we need to verify that these are still met. If they are not, the key stakeholders need to be consulted for their acceptance of the new reduced standards. Or we could add resources to complete the activities in a shorter time. This needs to be done carefully, and two factors need to be considered.

First, it is necessary to understand the difference between duration driven activities and effort driven activities. Effort driven tasks can be completed earlier by adding manpower. i.e. installing 42 ADSL cards in parallel using 7 people rather than in series using one. Duration driven tasks cannot be shortened. i.e. measuring error performance for a 24 hour period. Second, even for effort driven activities, adding resources does not necessarily linearly decrease the required time. There is a learning curve that comes into play as the additional resources learn the task, there can be differences in skill level, and there is often a communications requirement amongst people sharing a task that causes the total required time to increase, even though the elapsed time may be shorter. At some point the gains will not exceed the cost incurred due to learning or communications and coordination requirements.

When we assign a task to multiple resources rather than one, this is called crashing the activity. Crashing attacks the durations, which means that you put additional resources onto one or more activities to finish it (or them) faster. Crashing raises the risk level, which in turn raises the possibility of something going wrong. Crashing should be done with careful forethought to determine where it would be best to do it. Crashing differs from another solution, which is called fast tracking the activity. Fast tracking attacks the dependencies, moving activities to earlier dates in the schedule than the dependencies originally allowed. In attacking dependencies, it is best to back off from a soft dependency to the true hard dependency that might underlie it. This will change the nature of the dependency, and also raise the risk level. In both techniques the length of the schedule is reduced, but they do it in different ways.

We have considered quite a number of possible solutions, each of which has impacts - extending the project time occurs in almost every alternative, and if the time doesn't increase, the budget usually does. At the same time the quality might go down, and people may experience unacceptable stress. Choosing a solution to the challenges that arise to trouble the project plan must be done carefully, and by people who have a view of the big picture in the face of very real obstacles and constraints. These impacts will come back to haunt the project.

One key principle in project management is that a good PM only agrees to do what he or she can do with the resources provided. The techniques we have been discussing allow the PM to determine whether the scope can legitimately be provided with the resources allocated. In the required resources are not initially, available, and the resulting scheduling problems seem to cause additional problems, the PM should stand as firm as possible in requesting that appropriate resources be assigned. At the very least, the PM should ensure that he or she goes on record with a statement that more resources are needed. Sometimes politics etc get in the way, but even here, at the very least, the project manager needs to be on record with the reality of what the true requirements are.

The specific solution selected for project challenges will be different in different situations, and for different projects, activities, groups and people. This is what makes project management interesting. We can work the concepts and the theory, but we then have to apply these in a real world. The project manager needs to line the assigned work up with the profiles of available resources, within the constraints of budget, time, and dependencies. In summary, we can do this by

- Attacking the dependencies: “fast-tracking”
- Attacking the durations: “crashing” - trade-off cost vs. schedule
- Reassigning certain tasks
- Extending the due date
- Dropping some of the scope
- Compromising the quality
- Obtain work for no compensation

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Chapter 6

PROCUREMENT

Many telecom projects require procurement of equipment of services from outside the company. Most service development projects involve some acquisition - perhaps purchasing ATM or DSL equipment or service components for wireless service. Some marketing studies involve outside help. E.g. we might want to contract some user-needs studies for a new e-commerce service. Many operations projects involve acquisition of either goods or services.

Any outside procurement should be done with the involvement of the Purchasing department. While most project managers are aware that they should work through Purchasing, some are not. Even when PM's are aware of the proper processes, they sometimes do not understand why this is necessary. Some even see the purchasing department as a roadblock to their project, adding unnecessary bureaucracy. Some of the newer companies do not even have a purchasing department, which puts the project managers at risk of legal problems unless they have a good understanding of the implications of purchasing activities. However, in most telecom companies of any size, the purchasing department is responsible for the procurement processes, and this department works closely with project teams. Depending on the organization structure selected for a specific project, the procurement person may actually report to the PM for the duration of the project, or may continue to work within the home department, contributing to the project from there. The project manager and project team also play and integral role in procurement, as they define what is required, produce the specs and handle the control. The purchasing cycle and implications of the different components are discussed in this chapter. We also discuss contracts, and the management of disputes.

Before we start into the details of the purchasing processes and tools, let's consider briefly why it is that companies have purchasing departments. It is obvious that a central department can more easily maintain an ongoing relationship with suppliers, and can take advantage of the company wide purchasing power to negotiate better deals. A central department also provides a focus on the purchasing function, which allows time to research offered products and prices. In addition, the purchasing department can focus on process and procedures for purchasing. Even more important, this department will be fully aware of the uses and implications of all purchasing tools, such as contracts, Requests for Proposal, Requests for Quote, etc. And, in the case of a project, this department provides additional manpower for purchasing functions on the project, which is often not charged back to the project. Of course, if there is no charge to the project for this time, sometimes project teams forget that this department is an extended team member. Given that very important project work is done by this department, PM's are reminded to ensure that they are included in team information and recognition.

The strategy and processes that will be used for any project depend heavily on the corporate strategy and processes, as well as on the project strategy and processes. The team needs to ensure that they are aware of both of these dimensions as the planning proceeds.

The purchasing processes

From the PMBOK® Guide, procurement processes are:

- Procurement planning - determining what to procure and when
- Solicitation planning - documenting product requirements and identifying potential sources
- Solicitation - obtaining quotations, bids, offers, or proposals as appropriate
- Source selection - choosing from among potential sellers
- Contract administration - managing the relationship with the dealer
- Contract close-out - completion and settlement of the contract, including resolution of any open terms

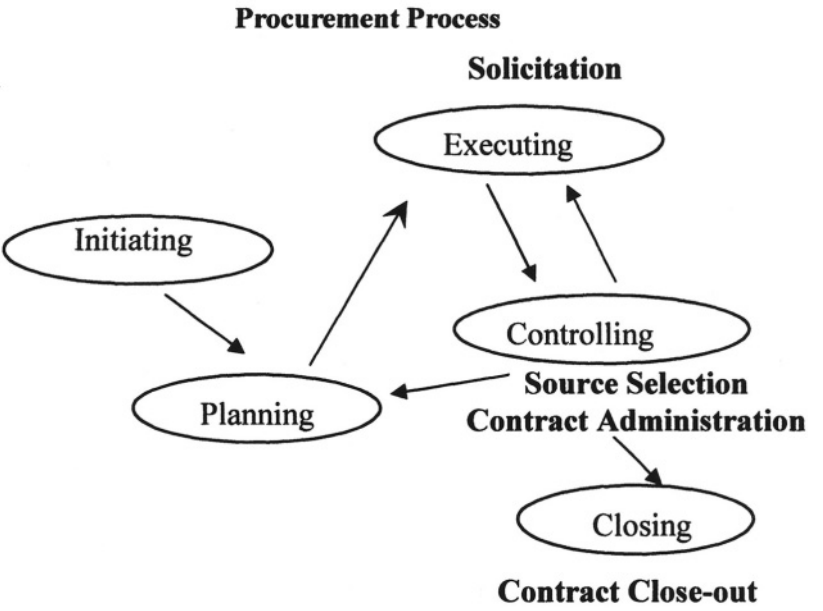

Figure 1

Within these processes the procurement of services required many functions. Not all of these functions are used every time, but it is best to understand all of them. Figure 1 shows the functions, and where they fit into the process continuum.

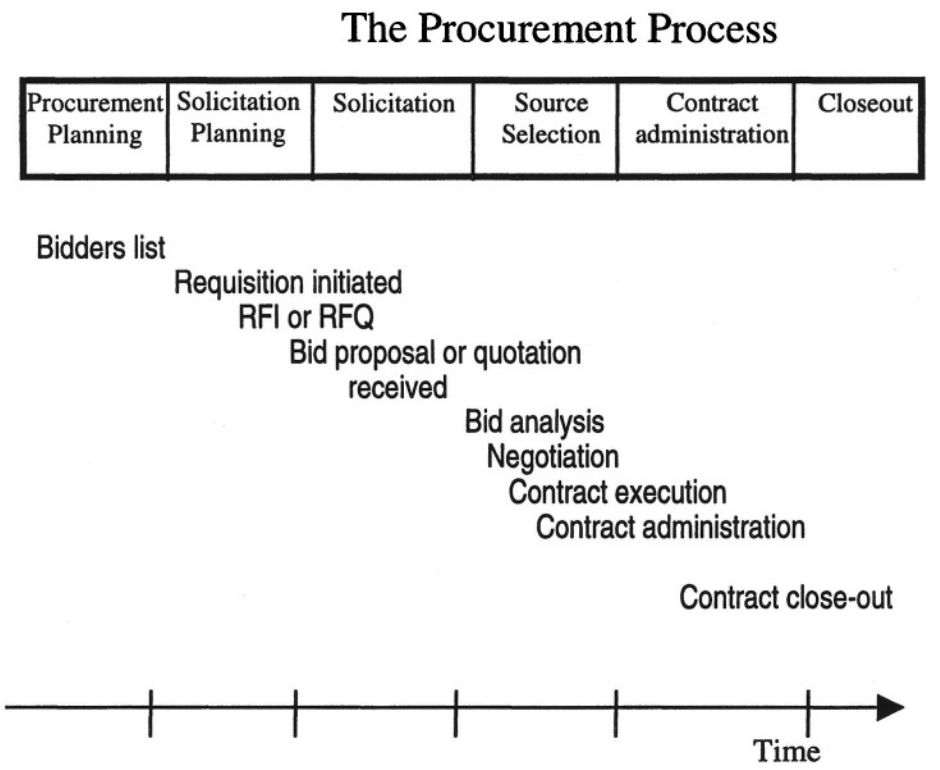

Figure 2

Let's consider the processes.

Procurement planning - determining what to procure and when

The project team is the main source of procurement planning for the project, even if the purchasing resource is not part of the project team. The team needs to first decide what aspects of the project should be contracted out. This might mean capital expenditure to purchase equipment, or the hiring of manpower, or contracting of specific expertise. The team should evaluate what can be done in-house, and what would be best handled externally.

According to the PMBOK® GUIDE, the inputs to procurement planning are

1. Scope Statement
2. Product description

3. Procurement resources
4. Market Conditions
5. Other planning outputs
6. Constraints
7. Assumptions

The tools used for this process are

a. Make or buy analysis
b. Expert judgment
c. Contract type selection

The team should use these, but the purchasing input should be strong, as they should be most familiar with contracts, corporate policies on out-sourcing, and possible issues that might arise in the specific type of agreements.

The outputs of this process are

1. Procurement management plan
2. Statements of work

The statements of work will become part of any contracts that are issued.

The activity identified for this part of the process is the preparation of the bidders lists. These are lists of companies who might potentially bid on a product or service that the company wants to procure. If the team is familiar with the companies that offer these products, the lists can be prepared directly. These lists might be reduced later in the process, if the team feels that some companies no longer qualify to bid, or if the team thinks that they cannot afford the time to evaluate a large number of proposals. Of course this might also cut out some good proposals that might be of interest to the team.

If the team is not familiar with the potential suppliers, they may prepare a list at this point of vendors who should receive an RFI. The results of the RFI will then determine which suppliers should receive any RFQ or RFP to be issued later.

Solicitation planning - documenting product requirements and identifying potential sources

In order to go outside for products or services, the team must issue some information to potential suppliers describing the requirements. These

documents are generally quite formal, and the suppliers will then reply (or not) with their offers.

According to the PMBOK® GUIDE, the inputs and outputs for this process are as shown in Figure 3:

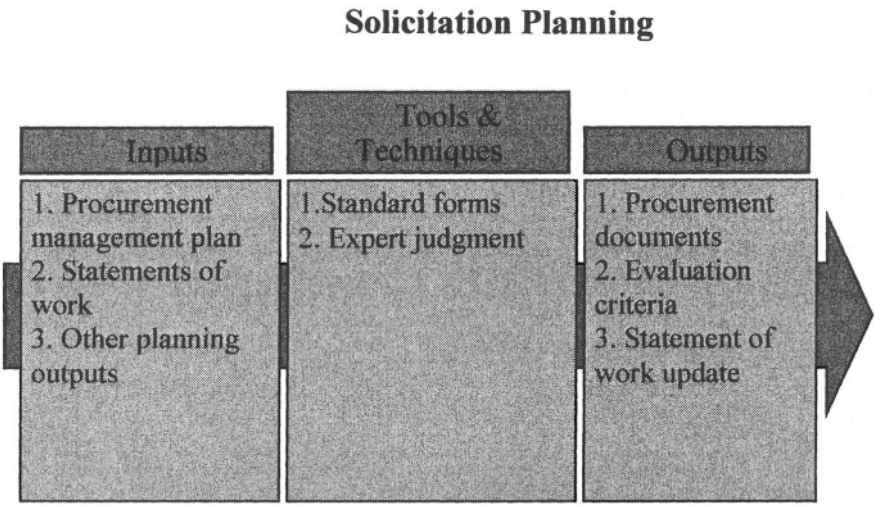

Figure 3

At this point the team clearly defines the product (or project) requirements, and documents these in one of the solicitation documents. At this point the PM must proceed with caution, as some of these documents carry inherent legal implications, which the PM should understand before anything is issued. Because of this any document issued should be reviewed by the lawyers unless it is a standard format which has already been approved.

The documents which might be used include:

- RFI - Request for Information
- RFP - Request for Proposal
- RFQ - Request for Quote
- Proposal
- Contract

Of these, only the RFI does not carry legal implications. But even with an RFI the PM should be careful. An RFI should not ask for prices. In his response to the RFI, the vendor is welcome to provide pricing information, especially if he feels that doing so will gain him a competitive advantage. But the issuer cannot ask for prices, because doing so would turn the RFI into an RFQ or RFP, and this would change the legal obligations of the parties. Of course, the team needs to have a general idea of the cost, in order to decide whether they can afford to even pursue the opportunity. For this purpose they might request a planning cost. However they need to be aware that vendors are not bound by any prices provided in responding to this request, so the price could change if serious interest is shown.

Solicitation - obtaining quotations, bids, offers, or proposals as appropriate

When a project team has decided to obtain goods or services from outside the company, the team needs to 'shop' for the best available goods or services at the best available price. In some situations the team can simply go to a store or a web site and order the desired product. In other cases, the team does not have ready access to information about what is available, or the company is required to allow fair opportunity to multiple bidders. Governments, for example, do not award contracts for services without first opening the opportunity for multiple providers to propose their solutions. When companies wish to allow or encourage multiple vendors to present their offerings, the solicitation process starts. At least one of the solicitation documents is used.

The first step in the process is the qualification of bidders, This will allow the invitation to bid will go to those who appear to be reasonable contenders. The project team or the purchasing department may be familiar with the vendors and their products, in which case qualification might consist of reviewing information collected from previous purchases or projects from experience of others, and deciding which vendors might possibly qualify to make a good proposal. If the team is not familiar with what is available in the marketplace, qualification can be done via an RFI. The Request for Information consists of the specifications for the product or service required, and a request for information about solutions that the vendors might wish to propose. The buyer then reviews the inputs to evaluate which suppliers to include on the bidders list.

Thus the RFI is a useful tool because it helps to qualify availability and capabilities. It is not binding on requesting organization in the sense that the

recipients cannot presume that the buyer will actually buy anything. He is simply asking for information. For this reason, many sellers chose not to respond to an RFI. An RFI response can be time consuming, and if the buyer then decides not to buy anything that time has been spent in vain. Since there is no commitment on the part of the seller, responses to RFI's come in many forms. In one case, in which an RFI was issued for information about billing systems, 5 responses were received, which encompassed a wide range of formats. First, one company said simply, "Call me if you decide to move on this, and I'll make you a proposal". They were not prepared to put any time into something that was not a real opportunity. This is not uncommon for small vendors who cannot afford the time to respond to all requests when there is real work on the table. Another company prepared a beautiful custom reply, addressing each element of the specification carefully, printed nicely and laid out in a binder with both the bidder and the buyer identified throughout. Two companies sent boilerplate – standard product description material with the name of the buyer inserted. Another suggested that the buyer check their web page, sending the url. One company did not respond. The final company sent a CD, with a sample of their billing system! An RFI gives the buyer a great deal of useful information. However, the disadvantage of using this tool is that it introduces a sizable delay into the overall procurement process while the Request is prepared, the sellers are allowed time to respond, and the responses are analyzed.

Once the bidders list is ready, an RFP or RFQ can be issued A Request for Proposal is generally used when skills or knowledge are a key part of the work. The buyer issues a specification, and requests a description of what the seller will provide. A Request for Quote is Similar to an RFP, but is used when price, as opposed to knowledge or skills, is the deciding factor. The appropriate response may be simply a price quote for some equipment, rather than a systems approach. Sellers choose whether or not to respond.

Either of these documents has legal implications. The implication of issuing an RFP or RFQ is that a vendor will be chosen. A bidder has the right to assume that he has a chance of selling his product unless it is clearly specified in the request that it is possible that no bidder will be selected. The wording for this statement should be reviewed by lawyers to ensure that it satisfactorily protects the buyer. The inclusion of such a statement has the potential to cause some bidders not to respond, if they think that they might be preparing a bid for no purpose. Otherwise, if it should happen that the buyer decides not to select any bidder, some bidders, particularly the lowest bidder, but possibly also others, might be able to sue for at least their costs for preparing the bid, and possibly even for some revenue. It is probably also

wise to include a statement that the buyer reserves the right to select other than the lowest bid, if there are factors which might override the price in the selection. Otherwise in some situations an unsuccessful bidder with a lower price than the selected seller might be able to sue. The PM should review the implications and the wordings with his lawyer, since laws vary from place to place and from one situation to another. This book is not a legal text**.**

The RFP should contain a clearly written specification of the requirements, to allow the bidder to prepare the best solution. Specifications can be functional, detailed or performance specs. A functional specification describes the purpose for or use of the product or service, to give the bidder the context in which it will be used. Since the seller then proposes something that he presumes will perform in the way the buyer expects, the seller takes the risk of proposing something that does not meet the expectations.

A detailed spec describes in detail the service or product required. To do this the buyer must give detailed information. To do this he perhaps uses:

- standards
- samples(s)
- multi-page description of all aspects, or
- network or product diagrams
- Brand name
- Specify an existing standard

Performance specifications detail measurable capabilities – perhaps for switches the specification gives the number of calls/second that can be processed, or the number of lines or trunks that can be terminated, etc. risk of performance is on the seller. A well-prepared RFP has the potential to attract some excellent bids. The team might then want to follow up with the bidders if they require further information. But this must be done carefully.

Source selection - choosing from among potential sellers

An RFQ or RFP gives a date, and usually even a time, at which the bids are due. Both before and after this time all bidders must be treated equally and provided with the same information. Any discrepancy in treatment of the bidders can be construed as giving one an unfair advantage, which can be grounds for legal action. Therefore if any potential bidder asks a question, the recommended procedure for the seller is to document the question, document the answer, and then share these will all potential bidders. This way all bidders will receive identical information.

Another technique that buyers use to ensure that all questions are answered equally for all bidders is to hold a bidders meeting. All potential bidders must be invited to the meeting. If a bidder does not attend, this is not an issue for the buyer, as long as there is no question that the invitation was received, in time to give the bidder fair opportunity to attend.

The dynamics at these meetings are interesting because all bidders are hoping that someone else will ask questions. They all have questions about the request, but generally they worry that in asking a question they will reveal their strategy for responding, giving competitive advantage to the other bidders. So some bidders meetings are quite tense, but quiet, until someone finds a way to ask a question.

Bids should be time stamped to show the time of receipt. It is in the seller's interest to submit the bid by courier, requesting a signature with the time of receipt, to give a record of the delivery and the time. Any bids received after the deadline should not be accepted, unless all bids are late. In the bid evaluation process the buyer should first ascertain that each bid is compliant. Any non-compliant bid should not be accepted, but sometimes these are determined to be acceptable. If the team wants to consider non-compliant bids, the legal implications should be determined.

The team evaluates all compliant bids to select the one that best meets their needs. There should be an objective ranking scheme that assigns weightings to each criterion in the specification. Then each response should be rated on the degree of compliance to each requirement. Some of the rankings will have a degree of subjectivity, but the existence of the ratings and the weightings will allow the team to select the seller offering the best value.

Once bids are received and evaluated contract negotiation begins. In order to select the optimum vendor, the buyer might need to negotiate some issues with the winning vendor.

The goal of any negotiation is to satisfy the needs of both sides with a mutually beneficial solution. Negotiation experts recommend that that the participants think objectively, take a positive approach to finding a solution, and envision creative solutions that will create a win-win situation. It is recommended that the participants adhere to the following principles:

- Do not take a position; then bargain just to reach that position. There should be something behind each position, which is the real crux of the issue. Focus on the interests of the parties, and build the

bargaining proposals on arguments on these, not on what was requested.

- Take the people out of the problem. What matters is the issue, and the needs if both parties. It does not matter whether the bargainers like each other. What is relevant is that the solution meets the needs.
- Look for and propose alternative solutions that might possibly meet the needs of the other party. Put these forward as proposals for consideration, and be prepared to consider such alternatives to your own proposals as well.
- Insist on using objective criteria. These criteria can be industry standards, information obtained from independent sources such as consultants or studies, or criteria mutually established through discussion with the other party.
- Know what you will do if things fall completely apart. Suppose that the other side cannot meet your request, and at some point walks away. What would happen then? Knowing this will probably change your approach. What would happen to them if you walk away? Can you use this as an argument in your favour? The output of source selection will be an agreement to obtain products or services from a successful supplier. In most cases this will involve a contract. Therefore it is important to understand what makes up a contract, and the types of contracts to ensure that you are properly covered. As with anything legal, it is always best to have a lawyer involved in any contract.

Five elements make up a contract.

These are:

1. Offer and acceptance
2. Mutual intent
3. Consideration
4. Capacity to Contract
5. Lawful purpose

1. Offer and acceptance

One party must make an offer to the other, which the other accepts. This offer and acceptance can be written or oral, but of course written agreements are more clear, and easier to prove in the case of a dispute.

The offer can be made is such a way that it is valid for only a certain time period, or under certain conditions, and these then define the boundaries of

the offer. It is not valid outside these boundaries unless the offering party decides to extend it.

The offer must be in accordance with the laws, which apply geographically and otherwise to the situation. In the case of international services, this can become quite complicated, as the laws in each location as well as international law might all come into play. And in the case of services such as internet, even the location of the service can be tricky to define.

Contracts can include many additional options and clauses, all of which should be worded according to the applicable laws.

Problems can occur when negotiations stretch over a period of time, if each party does not wait for the other to respond before taking the next action. Since many agreements move forward before the paperwork has been completed, there is considerable possibility for disagreements or misunderstandings to occur. If one party provides service or delivers the product before the contract is complete, or if both parties independently start to mark up the contract, in order to save time, there is obvious potential for misunderstanding.

When such misunderstandings lead to actual contract disputes, these may need to be settled in court, and there is no clear direction that the courts will take. There are three different principles that a court might use to rule on such an issue, and these would lead to different conclusions.

A. Mirror Image Rule: This rule might be used when both parties are exchanging amended forms without waiting to hear from the other party. When the forms exchanged are materially different, the court would rule there was no contract formed. However, if one party has performed the contract, the court is not likely to use this rule as at least one of the parties believed that there was a valid contract.

B. "Last Shot" Rule: In this case the court would rule that the final document sent is the contract. This can be a good solution, particularly if one party has delayed for some time in responding. However in some cases this can be inappropriate. The last document could be an invoice sent by a contractor after performing service which includes additional time, or a higher rate than had been under consideration in earlier correspondence.

C. "Wink of the Eye" Rule: In this case the court chooses one point in time during the negotiations and declares the conditions in this document to be the contract.

2. Mutual intent

A contract must have two parties, and both parties need to understand that there is an agreement. It is not enough for one party to propose an arrangement without an indication from the other party that he has interests along the same line. In many cases involving the purchase of telecom equipment, a buyer issues a letter to the seller stating that he is intends to accept the sellers offer, and purchase some amount of equipment. This letter of intent clarifies the intentions of the one party.

3. Consideration

A legal contract must have consideration. The consideration may be in the form of money, goods, or services. In some cases in which consideration cannot be provided initially, one party can provide a 'seal' – usually an imprint made in melted wax as an indication that he is intending to provide his consideration at a later time.

4. Capacity to Contract

In order to have the legal capacity to execute a contract, one must be a legal entity, either a person or a corporation, which always has the rights of a person. It is also necessary for a signatory to be of legal. Traditionally, age was not a problem in telecommunications, but with the advent of Internet, some very young persons have been creating services. In addition, the parties must be of sound mind, and also not be impaired.

5. Lawful purpose

A contract must have a lawful purpose. We cannot, for example, contract someone to hack the users of a competitive Internet service provider. The purpose must be considered legal within all applicable legal systems.

Next let's consider the types of contracts that could be signed between two (or more) parties. The variations apply to the payment structure. Each is used within the telecom environment, but one contract type would yield different total payment that another.

The parties might want to consider one or more of four options:

- Firm fixed price (FFP)
- Cost plus percentage fee (CPPF)
- Cost plus fixed fee (CPFF)
- Cost plus incentive fee (CPIF)

Firm fixed price (FFP)

The buyer agrees to pay a fixed price for the product or services. This contract type is usually used when the deliverable is clear, and/or the scope is well defined . e.g.. provide expert witness testimony at a trial, providing an initial report, and being available for court appearance for up to 5 days, or install 40 terminals which are already on the premises, and connect each to the LAN. Even though the LAN connection might be more time consuming that expected, if difficulties are encountered, an experienced installation company might be happy to accept a firm price arrangement. If the buyer is worried that that the supplier might be late, or provide inferior work, it is possible to include incentives to encourage the supplier to be early, or to provide additional or better quality products than the contract calls for, or to include a statement requiring the payment of liquidated damages – reimbursement to the buyer for costs incurred due to lateness or poor quality work. It is also possible to structure a contract to provide payment which is based on benefits received from the work. For example, someone providing an e-commerce service platform might require no payment, or a small payment for the use of the platform and service application, but instead collect a percentage of every transaction when a sale is made.

Cost plus percentage fee

In this case the buyer agrees to pay the costs that the seller incurs, plus an amount which is a percentage of the cost, to provide the seller with overhead and profit. Here the fee varies with direct cost - time and material charges apply, plus the percentage. This model might be used when the seller is providing some professional services which cannot be clearly pinpointed in length, such as digging to replace or upgrade the access facilities in a neighbourhood.

Cost plus fixed fee

Here the seller also receives compensation for actual direct expenses, but, instead of receiving a percentage of the cost as his payment, he receives only

a fixed fee for overhead, profit, etc. If the seller is optimistic about the time that will be required to do the job, he might be happy to agree to the fixed fee, hoping that it will give him an even greater margin than a percentage fee might. The buyer, on the other hand, wants to limit the amount that he must pay, and he may feel that giving the seller his costs plus a percentage opens the door for misuse by the supplier.

Cost plus incentive fee

With this structure, the buyer and the seller agree to cover the sellers costs, but beyond that, they will share any cost overruns and under runs according to an agreed upon formula. This might be used when two companies are not familiar with each other, they need to work together to complete the project, and neither is certain that the other has a strong focus on enabling the completion. Perhaps this would be used in the case of a network move, which accompanies a corporate relocation to a new office.

With some types of contracts the onus is on the buyer to ensure that the seller have complete and clear information, plus full access or anything else required to complete the project, whereas with other types the seller is taking the risks. Which type of contract is better for a PM who is managing the development of a service which will allow his company to provide their services electronically, dealing as a buyer with a supplier who is doing the actual service development? Which type for the seller in this project? Why?

With a firm fixed price contract the risk is on the seller to provide the buyer with the required services within the allocated price. The seller needs to cover his direct costs, his overhead and his profit margin within the amount. Of course, the seller should not agree to a price which would be less than his estimate of these costs, but he takes the risk that he can meet the buyers requirements within the agreed to price. In order to ensure that he is covered, the seller will build in some contingency along with his estimate of his costs. If he does not include enough, the loss is his. For very risky cases the buyer might have to agree to a very high price so that the seller can protect himself. However, if there is any competition at all, this will hold the prices as low as the sellers can manage within their risk tolerances.

For cost plus percentage contracts, the risk is completely with the buyer, as the seller is covered no matter how much work he does. But when there is significant risk, sellers may not agree to any other option.

For our electronic service project, the seller would love to have cost plus percentage, but would probably not bid this as there is likely to be a competitor who would bid something more favourable to the buyer. The buyer would prefer a fixed price, and could probably get this. But since the neither the buyer nor the seller would likely know up front the full scale of the project, the sellers would likely insist on some type of cost plus contract.

Cost plus fixed fee would work well in this case, because the seller is covered at least in terms of his costs, and the buyer at least limits his risk by fixing the overhead fee. However, if the buyer does not trust the sellers to agree to a fair fee for the overhead, he may not want to agree to this option. If even one seller offers the cost plus incentives option, the buyer would be attracted to it, because the seller shares in the risk. In fact, if the seller can come in under the anticipated cost level, the buyer benefits from both a lower base cost and a lower overhead fee to be paid. If the seller goes over, he does not receive the margin he wants. Thus the incentives are a strong motivation to the seller to contain the costs. They also motivate the buyer to cooperate in providing any required information and access, to help the supplier complete in less time, and with less effort.

Contract administration - managing the relationship with the dealer

The PMBOK® GUIDE describes the contract administration process as shown in Figure 4

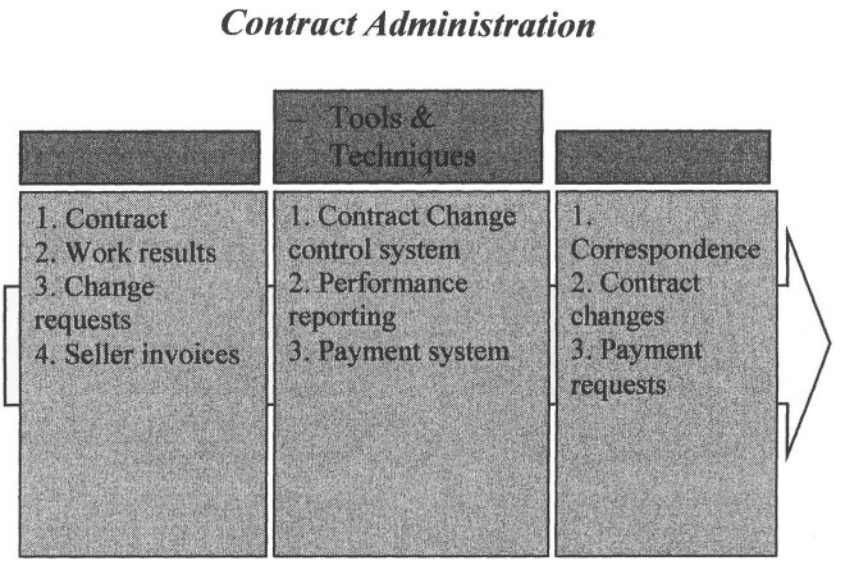

Figure 4

In this process the team ensures that the contractors performance meets contractual requirements, but also that the buyer meets his contractual requirements. To do this the team should build key millstones into the schedule at reasonable time periods and then manage these milestones. To ensure that the performance is as required, the team might need to inspect (products, installations, reports etc), test (software, networks, etc.), receive material (servers, switchers, fibre, etc.) and check quality. In many situations, particularly when people skills are involve i.e. outsourcing a call center, maintaining a positive relationship is key.

Warranties

Every contract has warranties, either expressed or implied. Even if they are not explicitly expresses, they still exist, and the seller is bound by them. Therefore the onus is on the seller to ensure that his product or service quality will minimize any need for claims. The team should complete all inspections and testing, and report to the seller the need for any adjustments.

Waivers

If one party ignores a contract clause, and the other party allows the clause to be ignored, the second party waives their right to enforcement of the clause.

Contract close-out - completion and settlement of the contract, including resolution of any open terms

When the work has been performed and accepted, the parties need to perform the handoff of the product or service, complete all required documentation, and process payment. Contract work does not always go smoothly, and if there is any disagreement about what has been or should have been provided, the parties need to resolve any continuing disputes. Both parties hope that there will be no such problems, because these are time consuming and costly for both parties.

Contract Disputes should be avoided by identifying potential problems early, and having both parties work actively to find a resolution before too much has been spent by either party. Such problems can often be prevented by ensuring strong communications between the buyer and the seller as the work proceeds. It is better for the seller to ask for additional information, and for the buyer to provide this before the work advances too far, to prevent any wasted time and effort. The PM must know the contract and ensure all performing parties are familiar with the details. If, in spite of all of this, there are disputes, there are a number of ways to handle them- listed from the cheapest to the most expensive:

- Negotiation
- Mediation
- Arbitration
- Disputes Review
- Litigation

It is recommended that given any choice, the PM use techniques as close to the top of this list as possible, to save time and money. In negotiation, the parties work together to find a solution that meets the needs of both parties. The principles of negotiation mentioned above should be applied. This is the cheapest method of resolution, because it involves the time of only the parties involved. If both parties follow the negotiation principles, it can also lead to some innovative solutions, and should satisfy both parties in the end. This should be abandoned only if it becomes evident that no acceptable solution will be reached.

With mediation, a neutral person works with both parties to find mutually acceptable resolutions. Thus the people who would be involved in negotiation will still be involved, and the cost of one additional person is added to the equation. But this might bring a level of objectivity which cannot be reached in some cases by the parties themselves.

In arbitration, an appointed arbitrator makes a decision which is binding on both parties. Both parties must agree ahead of time to go to arbitration in the case of a dispute, because they will be bound by the decision, even if they do not like it. So not only does this add the cost of an arbitrator, it also raises the risk of dissatisfaction of one of the parties.

In some cases a Disputes Review Board is used. Three people are involved to come to a decision about the issue in question. One of these is chosen by the buyer, one by the seller, and the third by the first two. The review board probably follows the project on an ongoing basis, in order to be informed in case any disputes arise. Or, the board can simply be convened to resolve disputes on demand.

Litigation is most expensive and time consuming option. Sometimes it is the only acceptable option, but it should be avoided unless nothing else can effect a resolution. The time for a case to come to trial can be significant, and once there, the time to resolve can also be significant. There is also the time of both parties, plus their lawyers, to prepare which must be considered. This is not a desired solution in terms of time or money, unless it is really necessary.

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Chapter 7

BUDGET

Every project has costs, including direct costs, indirect costs, sometimes capital cost, always expense cost. Cost management on a project is generally done partially by the project team and partially by people in other departments. In this chapter we discuss many aspects of project cost management. Cost management encompasses estimation and tracking of costs, as well as cash flow and other economic concepts. We discuss cost control and other aspects that are project related. Also we discuss building cost contingency into the project budget. One very important concept related to cost is Earned Value. This concept is covered separately in Chapter 11, because it is a project management concept that links the budget to the schedule, and hence is not strictly a financial concept.

Some PM's never have to address financial issues, but for others, it is a critical part of the job. In telecom, even during the good years, finances have been a critical component of projects. In fact the financial aspects have been so critical that not only are project managers required to estimate, get approval for, track, and justify all of their project costs, but many cost items are calculated and reviewed by financial departments as well. Engineering Economics departments exist to work the numbers for major investments such as network upgrades, new services, new products, maintenance, etc. And since so much of the telecom environment had traditionally been regulated, very precise and careful methodologies were adopted for calculating the costs. Every cost the company incurred was tracked, and assigned to an appropriate category. Even today, when the level of regulation has significantly decreased, companies are still extremely cost conscious, and extremely careful to manage all costs professionally. Therefore for many projects, Engineering Economics will be involved. Someone from the

Engineering Economics department might be a member of the core project team, or the department might be involved as part of the extended team. In either case, this brings a professional perspective to the project costs that this person handles. Engineering Economics generally handles costs that are related to the product that the project is producing. Of course these are usually a major component of the project costs, and they need to be carefully developed. In this chapter we will introduce some of the tools that Engineering Economics uses, such as NPV, ROI, etc. If these costs are required for the project but there is no Engineering Economics involvement, the project team will have to calculate them. However, we will not cover these topics in extensive detail, as they are really a functional input to the project, and in some cases, the project manager does not even have to deal with them.

Another department involved in the financial aspects of projects, is Accounting. The role of the Accounting department is to track the spending on each project, and to flag to the management (and hopefully also to the Project Managers) any problems that appear. When any project deviates from the planned spending curve, Accounting will generally take some action. This department is generally not included as part of the project team, but since they do have the potential to impact the project, they are stakeholders, and the PM will do well to keep them informed of potential problems, as well as current status. We will discuss some issues in the cash flow section that show the differences in the perspective Accounting might have of a project from the project management perspective.

In telecom, it is almost unheard of that a project manager will not be involved in the financial aspects of a project. Even if the financial aspects of the product are handled completely by Engineering Economics, the PM will have to prepare the project budget, prepare the plan for the cash flow, and manage the spending. This chapter addresses the project related financial concepts. Many project managers have strengths in non-financial areas, such as the soft skills, or technology, and do not enjoy doing the financial work. However, it is integral to the project, and whatever financial aspects the company expects from the team will have to be managed by the team. Given that the PM has to do some of this, if it is not something he enjoys, he should try to hire a team member to manage this aspect of the project. But, as PM, he needs to at least understand what was done, and what the results mean.

In short, Accounting will be involved in tracking the actual expenditures against the budget. Engineering Economics may be involved in project/product assessment. The PM and the team will define the budget; report the progress and monitor results. Senior Management will receive

Accounting reports, and if the project is a high priority project, or one that consumes large resources, the team will be called upon to provide periodic status reports and explanations of the spending. If there are significant deviations from the budget, the PM will have to answer to Accounting and maybe also to senior management. The PM can best manage the budget if he compares actual costs to the budget for the actual work accomplished, and he compares actual work accomplished with planed accomplishment. Therefore all project managers should understand the concepts presented here.

The process areas for cost defined in the PMBOK® Guide are:

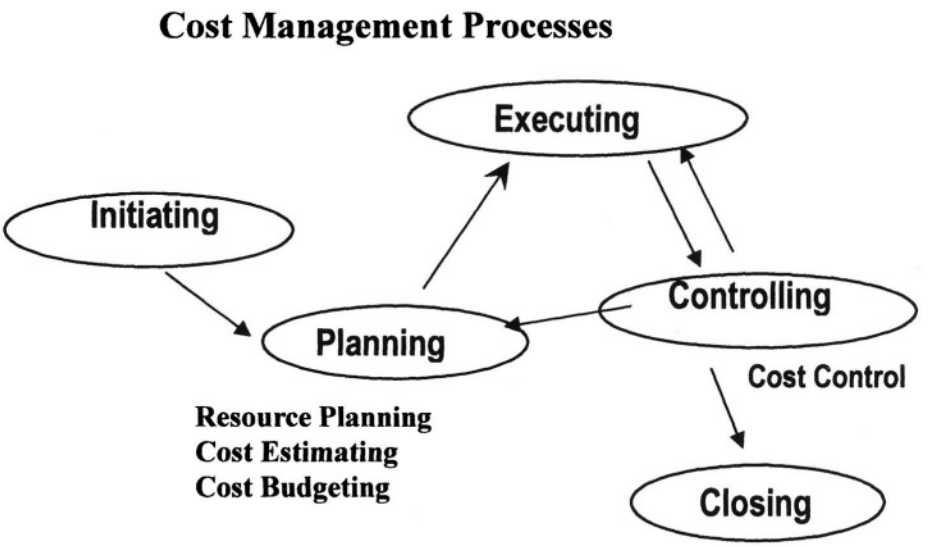

Figure 1

Specifically, this chapter addresses:

1. Some concepts
2. Cost estimation
3. Creating the project budget
4. Including budget contingency
5. Cash flow
6. Project cost management
7. Cost tracking and controlling

1. Some concepts

In cost estimation, the team may be called upon to produce estimates for different cost categories. Most of our discussion will center around the specific expense cost of manpower, as this cost occurs in every project. But most projects also incur other costs as well. The team may need to estimate capital costs, expense, sunk cost and/or opportunity cost.

Capital costs result in owned assets such as

- switches
- billing systems
- multiplexors, concentrators, bridges, routers
- transmission facilities and equipment
- computers
- office furniture
- buildings

Capital costs must be depreciated over the life of a capital asset. The company will have a policy that defines the standard lifetime for types of assets, and the project team will use these lifetimes to calculate the depreciation. The company should also specify the methodology by which the depreciation is calculated, as there are different accepted methods in the industry, and the PM needs to ensure that the project uses the technique that is accepted by the relevant stakeholders. Working with depreciation is relevant to the product, and is used to create business cases or regulatory justifications. It may or may not be something that the project team is involved in, as it is not a project management cost per se. However since it is integral to the business case for the product, the PM should understand it, and at least be aware of the implications, as these could well need to be factored into project decisions. A short overview is included in this chapter. Costs that are **expensed** are costs expended for items that do not produce some tangible owned asset, such as travel, salaries, rent, and often software. These costs are part of the project budget, and the PM is accountable for estimating them. On the corporate books, expenses can be deducted from income for tax purposes

Sunk cost is money that has already been spent. As the project proceeds, the sunk cost will increase. The sunk cost is what the project manager is called upon to justify, so prior to any expenditure, the PM should ensure that it can be justified within the project constraints and the corporate ethics. Once a certain amount of money has been invested in a project, people tend to think that they should see a return. This is understandable. However, the fact that money has been expended is not a factor that should be used in

deciding to spend more money to obtain the value. Sometimes projects go off the rails, and in some cases, bringing them back on track would actually cost more than the results are worth. In those cases the company would be better to write off the losses incurred and start fresh with something else. There is no point 'pouring good money after bad'. Instead the PM should base decisions on future costs and impacts.

Opportunity cost is an interesting concept. It is the amount of benefits foregone as a result of choosing one alternative. Opportunity cost is usually used as comparative measure, which is useful in making decisions. Companies sometimes use it to compare project benefits to opportunities from other projects, in order to decide which project(s) to fund.

EXAMPLE: We could upgrade our current billing system, at a cost of $800K or purchase a new standalone system for the long distance service we are designing for $500K, in 3 months time. Purchasing the new system would require process changes of an additional $800K to integrate the output with the currently issued bills. However once the systems and integrated processes are in place, we expect to save $500K on each of four upcoming planned services.

Therefore the opportunity cost of upgrading is

(4x$500K) - ($500K+$800K) = 700K

because we are foregoing $700K savings to upgrade now. This can be compared to the increase in profit expected over the next 3 months to decide whether to go ahead.

Let's consider some concepts that will be used by Engineering Economics to assess the project value.

- Benefit-cost ratio
- Payback period
- Discounted cash flow methods
  - NPV, net present value
  - IRR, internal rate of return
- NPAT
- Depreciation

Payback Period forecasts how long it will take for the net cash inflow to pay back the investment outflow. This is a straight addition of the values. It ignores time value of money, and cash flow after payback is irrelevant.

Payback Period

Year	0	1	2	3	4
Cash Flow	-2.1M	500k	1.2M	1.5M	900k

Payback Period 2.4 years

Figure 2

Net Present Value is a concept that requires more explanation.

Present Value: is the discounted value of a series of cash flows to a point in time. Knowing the present value facilitates comparisons of proposed investment choices.

First, some background information.
Let F be a future sum
A = an annuity (regular series of future sums)
i = discount rate per period (cost of capital)
n = number of periods (usually years)

Present Value

The future value F of a current sum at its present value PV, depends upon the interest/investment rate *i* and the number of years involved, m.

$$FV = PV(1+i)^m$$

Net present value NPV of a series of sums is

$$NPV = \sum_{i=1}^{m} \left[\frac{FV_i}{(1+k)^i} \right] - II$$

when II is the initial investment.

An annuity, is the amount of money to be invested (A) each year over m years at a rate of investment (i) to provide the required amount i.e. enough to buy a customer care company.

$$PV = A\left[(1+i)^m - 1 \right] / i\,(1+i)^m$$

Consider Future Value
10% Discount Rate

YEAR	0	1	2	3	4
CASH FLOW	(2,100,000)	500,000	1,200,000	1,300,000	900,000
FACTOR	1	0.91	0.83	0.75	0.68
PV	(2,100,000)	455,000	996,000	975,000	612,000
NPV	938,000				

Figure 3

Economic analysis: Internal Rate of Return

Internal Rate of Return is the discount rate that will make the net present value of all cash outflows and inflows equal to zero. Found by iteration.

Year	0	1	2	3	4
CF	-1500	800	650	750	500
Factor	1	.91	.83	.75	.68
PV	-1500	+728	+540	+562	+340

IRR = 30.5% **Net Present Value = $0**

Figure 4

Internal Rate of Return

The discount rate that makes the present value of all cash flows (in and out) equal to zero.

The IRR is found by iteration

$$\sum_{i=1}^{m} \left[\frac{FV_i}{(1+IRR)^i} \right] - II = 0$$

This may or may not be used to compare projects.

Figure 5

Net Profit after Taxes (NPAT) is the bottom line of an income statement . It might also be referred to as NI (net income). Many companies expect the project manager to work with the income statement, although others do not. Many experienced project managers do not understand financial statements, because this is an accounting concept rather than one which is necessarily integral to project management. It is quite possible to use the project costs into financial statements if desired, and using this statement the team can evaluate the profitability of the project. The financial statements that would be used would be an income statement, a balance sheet, and a cash-flow statement.

Balance Sheet

Dec 31, '03

ASSETS	
Current Assets	
Checking/Savings	
Checking-Bank One	43617
Checking-1st Nat'l Bank	5798
Petty Cash	235
Total Checking/Savings	49650
Accounts Receivable	
Accounts Receivable	
Receipts from Project Owners	2000
Accounts Receivable-Other	250
Total Accounts Receivable	2250
Total Accounts Receivable	2250
Total Current Assets	51900
Fixed Assets	
Project Equip	
Equip - Other	13202
Accumulated Depreciation	-12009
Tot	1192
Total Fixed Assets	1192
Other Assets	
Investments	40784
Prepaid Expenses	126
Total Other Assets	40909
TOTAL ASSETS	**94002**
LIABILITIES & EQUITY	

Liabiliti	
Current Liabilities	
Accounts Payable	
Accounts Payable	300
Total Accounts Payable	300
Other Current Liabilities	
Loans Payable	2000
Total Other Current Liabilities	2000
Total Current Liabilities	2300
Total Liabilities	2300
Equit	
Opening Bal Equity	69037
Retained Earnings	9618
Net Income	13047
Total Equity	91702
TOTAL LIABILITIES & EQUITY	94002

A balance sheet shows the value of assets and the sources of funds for assets. When this is used for a project, it reflects the assets of the project. A balance sheet shows a financial position at a given point in time. An income statement summarizes the results of business operations over any given operating time period. Again, when this is applied to a project, we consider the project related finances during the period under consideration. The bottom line of the income statement is referred to as NPAT. A cashflow statement shows the sources and uses of cash over the timeframe covered on the income statement. When income is reduced by deducting certain revenue in order to reduce taxes, this cash recovered from the net income is adjusted by this amount. In other words, income statement expenses such as depreciation and amortization are added back to NPAT. Thus, there is a difference between NPV and NPAT. NPV includes depreciation as an expense, whereas NPAT does not include it.

Depreciation is

1. A decrease in the value of an asset, as a result of wear or obsolescence
2. Allocation of the initial investment of an asset as an expense over the life of an asset

For projects with capital costs, depreciation may be a factor in life cycle costing of the product. Let's look at four methods of calculating depreciation. Any of these may be used by companies to calculate depreciation. The project manager should check with Engineering Economics or Accounting to ascertain which should be used for a specific project.

Straight-line depreciation
Sum-of-the-years-digits
Double declining balance
Capital cost allowance or ADR

Suppose we purchased in early 2001, fiber equipment to connect 20 locations. The total cost of the equipment was $26M and we want to depreciate it over 5 years to $6M. Let's look at how the value would have dropped using each depreciation method.

Straight line depreciation is depreciation by a percentage each year, applied to the value to be depreciated. Since the value is to depreciate to $6M we must depreciate $20M from $26M to $6M.

Economic Analysis: Methods of Depreciation

STRAIGHT LINE DEPRECIATION (SLD)

Since the value is to depreciate to $6M we must depreciate $20M from $26M TO $6M

YEAR	DEPRECIABLE COST	DEPRECIATION RATE	ANNUAL DEPRECIABLE EXPENSE	REMAINING DEPRECIABLE AMOUNT	YEAR END BOOK VALUE
2001	20,000,000	20%	4,000,000	16,000,000	22,000,000
2002	20,000,000	20%	4,000,000	12,000,000	18,000,000
2003	20,000,000	20%	4,000,000	8,000,000	14,000,000
2004	20,000,000	20%	4,000,000	4,000,000	10,000,000
2005	20,000,000	20%	4,000,000	0	6,000,000

Sum-of-the-years-digits depreciation applies a decreasing fraction each year to the amount to be depreciated. Again we must decrease by $20M over the 5 year period

Economic Analysis - Methods of Depreciation

SUM OF THE YEARS DIGIT (SYD)

Again we must decrease by $20M over the 5 year period

YEAR	DEPRECIABLE COST	SYD FRACTION	ANNUAL DEPRECIABLE EXPENSE	REMAINING DEPRECIABLE AMOUNT	YEAR END BOOK VALUE
2001	20,000,000	1/3	6,666,667	13,333,333	19,333,333
2002	20,000,000	4/15	5,333,333	8,000,000	14,000,000
2003	20,000,000	1/5	4,000,000	4,000,000	10,000,000
2004	20,000,000	2/15	2,666,667	1,333,333	7,333,333
2005	20,000,000	1/15	1,333,333	0	6,000,000

Double declining balance depreciation applies a depreciation rate that stays the same throughout, applied to the remaining value each time period.

Economic Analysis: Methods of Depreciation

DOUBLE DECLINING BALANCE

YEAR	DEPRECIABLE COST	DEPRECIATION RATE	ANNUAL DEPRECIABLE = EXPENSE	YEAR END BOOK VALUE	
2001	26,000,000	25.4178%	6,608,628	19,391,372	
2002	19,391,372	25.4178%	4,928,860	14,462,512	
2003	14,462,512	25.4178%	3,676,052	10,786,460	
2004	10,786,460	25.4178%	2,741,681	8,044,779	
2005	8,044,779	25.4178%	2,044,806	5,999,973	

Capital cost allowance calculates depreciation according to specifications set out by government allocations. The PM needs to obtain the required specification from his government at the time of calculation.

In the US, ADR (Asset Depreciation Range) depreciation is used. This method uses the three other types of depreciation over the life of the asset. The method that yields the highest depreciation expense is used over the life of the asset.

2. **Cost estimation**

As mentioned, the project manager will have to estimate the project costs, including all cost types which are relevant to the project. There are a few techniques which can be used for estimation. Many projects use all of these at different points in time. These include:

- analogous estimates

These are "top-down" estimates. This technique is usually used early in the project, by senior management and/or the project sponsor, to obtain an estimate of what the company might have to invest if a specific project is undertaken. These are generally formed by considering the cost of previous similar projects, and making adjustments to actual cost of these past projects to reflect such items as inflation, differences in the product, differences in the resources available, etc.

Such estimates are generally made before the project details are known,. Without the details it is impossible to make specific project estimates. But the company needs to have some estimation of the potential cost and benefits in order to justify undertaking the project, so this type of estimate is very useful. From a PM perspective though, these estimates can be problematic, because once they have been reviewed and accepted by management, they often set the budget for the project, and this amount may not be sufficient to obtain the desired results. The PM must accept the project before he has the detailed estimates, and if he does not have enough knowledge of the project area, he might find later that he has committed to something he cannot produce. These estimates can be very accurate, especially when management has a lot of experience with such projects. But they can also be wrong. Therefore it is recommended that the PM understand that these initial numbers are targets, that they must be taken very seriously, but also, that he might need to adjust them once the planning details are fleshed out. The PM should attempt to negotiate some leeway any analogous estimates, to allow them to be tightened and adjusted if needed after the project planning phase.

- Parametric estimates

Parametric estimates use some measurable characteristic e.g. cost per line of code or per screen to estimate the cost of some portion of the project. This is generally applied to the product to be produced, but could even be used in the project management area – say to estimate the cost to analyze a change request, times the number of change requests anticipated. There is margin for error in the calculation of the parametric value, although many standard such values exist. If the team uses standard values, they should ascertain the basis

for the estimate, determine whether their situation is actually the same, and make any required adjustments. This is particularly important when a large number of such units will be used, because of the obvious budget impact.bottom-up estimates

These are detailed estimates that take into consideration all of the details of the specific product and project. Of course, these cannot be obtained until all of the project details are known, which is not till the end of the planning phase. However, this is the only estimate that includes all of the relevant aspects. In order to get a full bottom-up estimate, the team needs to first create the wbs, in order to know all of the activities involved. Once the wbs has been prepared, the team can estimate the cost of each activity at the bottom level. Since the items below any specific deliverable completely add up to that deliverable, we can then start at the bottom and add up all of the numbers, working to the top of the wbs. This will then give us the total project cost. Actually, the last statement is true only if all project costs have been included within the activity estimates. Often the activity estimates include only expense costs, and if this is the case, then the capital costs must also be added, and perhaps some indirect or overhead costs might also need to be included. To show these additional costs, some teams prepare a separate structure, called a cost breakdown structure, which includes all the costs. It will differ from the wbs where there are costs that do not fit well into the wbs structure.

- order of magnitude estimates

Order of magnitude estimates are estimates that give the cost to within a percentage, such as plus or minus 15%. These are likely based on analogous or parametric estimates. Early in the project management will generally allow costs to be forecasted within a window, but as the project moves forward, this window will shrink. By the time the project has completed, the costs will be known exactly. Prior to this, any cost figure is an estimate. The more information we have (which we get as the project moves forward) the more accurate this estimate can be expected to be.All estimates are produced by people. All people are individuals. As any experienced project manager knows, different people estimate differently. Therefore it is always wise to learn something about the characteristics of the person doing the estimate, in order to understand the probably accuracy.

Sometimes there are standard estimates for portions of a project, and the PM is expected to use these. Even here, he needs to be able to make some judgment of the probability of accuracy. In building estimates for a project

the recommended practice is to ask the individual who will be involved with an activity for an estimate of the cost/time required, and then to consider the probable accuracy. When the individual has not yet been identified, or there is some question about the ability of that person to produce a solid estimate, it is a good idea to ask a number of people to estimate. This will produce a set of numbers, which could vary over a large range. The PM then needs to determine what number to use. The number chosen can be an average of all numbers, but the mode is probably a better estimate. However, in all cases it is best if the PM can base the selection on factors which are relevant to the situation. For example, maybe the largest number is far greater than any of the others, but it was provided by someone who has a good track record of estimation, considerable experience on similar products, and the best insight into some of the issues for this project. While some rules suggest throwing out the largest and smallest estimate, and then selecting from those remaining, in this case the best choice is probably the largest number, despite the fact that it is out of line with the rest.

Another issue often arises in estimation, and project managers should be proactive in dealing with it. This is the fact that when people provide estimates of cost or time, they often include contingency. Although we will obviously include contingency in our budget, we will do this later and the PM needs to be in control of the amount of contingency, as well as where it is placed in the budget. Honest estimating recommended as good PM practice, but this is not usually what people are used to. So the PM needs to work with the team to create a culture in which people provide him with honest estimates, and trust him to include contingency later. He needs to work with management for the same reason. It might take one or two rounds for the management to understand that they can trust the PM and the team – maybe one or two projects which are well run to demonstrate that the technique can work. We also need to keep in mind that none of these estimates are perfect. But if people are honest and objective, and communicate fully what they are including, and why, the team has a much better chance of producing a workable budget. Project Managers need to show management skill, not gamesmanship. This is one area in which they can do this, but it will take effort in an organization that is not used to working this way.

Another consideration that the team might keep in mind when estimating for projects which have repeated activities such as installing equipment or writing programs, is that with repeated activities there is usually a learning curve. People might give their estimates for time (which converts to dollars) in the time it will take them initially. It is up to the PM to understand this,

and then to estimate how much the numbers will change as the people learn the tasks. There are some tasks in which academic background is useful - perhaps doing traffic modeling, say. On many tasks, doing the work is the way to generate learning which allows for more efficiency in doing similar work.

When a learning curve is used, the PM needs to determine when this curve will level off. All learning curves do level off after an initial period. If the PM decides to have the learning curve continue for too long, always expecting continued improvement, this will be discouraging to the workers, because people start to think that the harder they work the harder they'll be expected to work.

Another consideration for estimates is the accuracy. All estimates are just that- estimates, so there is a probability that they will be wrong. When expressing or accepting any estimate, the accuracy of the estimate needs to be specified.

3. Creating the project budget

The Project Manager must work with the team to create the project budget.

This is the bottom-up budget as described above. Working with the bottom level elements of the wbs, the PM must obtain estimates for the cost of each.

If there are multiple types of cost, such as capital costs as well as expense, the budget must reflect these. The PM needs to determine what formats the company required, and if income statements or cash flow statements are required, these need to be prepared.

All costs and factors which influence cost must be taken into account, such as salaries, equipment and software purchases, rent, project overhead costs such as vacation and training, inflation, waste, spoilage, personnel replacement costs, and contingencies for unexpected difficulties. The PM should make educated estimations of the degree to which each is relevant to the project in order to get accurate cost estimations.

The end result will be at the very least a list of deliverables, with associated costs, listed by category. In addition, a cost breakdown structure should be produced, along with any accounting statements that are needed.

In this chapter we discuss cash flow, and the implications for the project budget.

Contingency must be included in the budget. The method of calculating the amount of contingency that should be included is covered in Chapter 3. Once this has been calculated the project manager must decide how to include it in the budget. Contingency is addressed next.

4. Including budget contingency

Contingency is the extra money or time that you build into a project to cover known unknowns - risks that you can predict and quantify. Recall from Chapter 3 that the project needs to include contingency time and also contingency dollars. In this chapter we are discussing budget, so contingency is in dollars. Contingency is included to cover for risks, which are known unknowns. As discussed in Chapter 3, contingency is calculated in the planning stage of the project by making a list of all the risks, and estimating for each the probability of it occurring and the impact to the project if it does occur. Once all the risks have been quantified, the PM uses the statistical technique shown in Chapter 3 to calculate the amount of contingency to include in the project overall. Once this number is know, it is added to the budget and it is expected that this amount will be spent in the project. It is to be spent to cover the risks identified on the list, and not for any other purpose. For scope changes it is never acceptable to use money included in the project budget, and it is never acceptable to use contingency. Doing either is bad management. For scope changes the additional resources must be obtained from elsewhere, usually from either the customer or management.

Since this contingency value is a statistical number, it may or may not be the right amount to cover all the risks. It is clear that for any risk that does not occur, another one does, and that the ones that occur will be funded with contingency funds. In fact, if we can hit the amount right on, this is excellent management. But since the probability and the impact numbers are both really estimates, people can be forgiven for not always being completely accurate every time when estimating contingency. For this reason companies generally allow some tolerance - they allow people to come within a percentage of their budgets. However, the tolerance level is telecom companies is often only about 5%, which is quite tough to meet unless the team has done very careful planning, and made excellent judgments about the requirements and costs. Since the contingency amount is statistical, and since there are sometimes single ‘big hit’ risks, if even one risk occurs which

has an impact that is higher than the contingency value, all the contingency will be spent on this item, and the project will still be over budget. In fact, if any risk occurs, that risk will use more than the contingency amount included for it, so some other risks will have to be avoided if the project is to be on track.

The next question is where this money is included in the budget. It could be incorporated in a few different ways, such as:

- As a single line item
- As a standard % overall
- As a weighted percentage
- By system or project phase
- By milestoneAs a single line entry for the project

Let's look at the issues with each of these methods.

Adding a percentage to each activity is a simple way to handle contingency. In fact, the proper percentage to use would be the percentage obtained by dividing the total contingency by the total project budget. However, although this technique (adding some percentage to each activity) is widely used, it is not the recommended method of including contingency.

One reason that the method is widely used is that it allows contingency to be included without highlighting that it is there. People do this for a few reasons. One reason is that they think that management might try to cut out the contingency if they know it is there. This is definitely a problem, but the solution to this problem is to work with management to help them to recognize the need for, and value of, contingency. Hiding the contingency just aggravates the problem because it appears that there is no contingency, which implies that it is not needed. Therefore it is recommended that contingency never be hidden. It does not have to be set out front and center, but there should be no question that it is there, and people should be able to find out where it is.

Another reason that people use the technique is that they do not know how to calculate the correct amount of contingency, so they apply a standard percentage to ensure that contingency is there. At this point the technique for calculating the correct amount is known, so the less accurate method of assuming a percentage should be discontinued.

A third reason for using this method is that the PM does not know where to put the contingency, so spreading it over all of the activities seems to be

fair. However, putting contingency into every item will in fact cause problems. When the prime for each activity sees an amount allocated to the activity, they will not worry about the spending level as long as it does not exceed the amount shown, which includes the contingency. Thus the team will be misusing this funding. In fact, when Accounting sees these amounts, they will also not worry about the spending if it runs at the level shown in the plan. However the level shown is clearly not higher than the desired spending level. In essence, the team will be 'nickeling and diming' away the contingency when it is not really needed, leaving little or nothing to be used when a risk materializes.

Using a **weighted percentage** is better than the first method, but still has some of the same problems. In this case the percentage that is allocated to each item is weighted in some way, generally by some assumption of the level of need. Therefore the weighting helps to assign the funds more realistically. But if a standard percentage is used, rather than a calculated value, the amount of contingency included overall is not correct. Also, the tendency for people to use the money allocated to them will still kick in.

Assigning contingency by **system or project phase** can be a good method for getting contingency to the right place. However, this depends on how it is done. If the total contingency amount is simply divided equally amongst phases, or by some formula, it is probably not assigned optimally for the specifics of the project. If the assignment is done taking into consideration the probability of risk occurrence in each system or phase, and the relative impacts of the risks are considered, this can be quite a good way to get the funds allocated to the right areas.

The same comments apply to the addition of contingency by **milestone**. When milestones are used, it is most likely that the risk probabilities and impacts will be considered in the allocation, so this is the method most recommended.

Contingency can be included by simply adding one line to the budget, called contingency. The advantage of this method is that the contingency is not hidden, so management and the team members know that it is there to be used when needed. It will not be used inadvertently because it is not associated with any individual activity. And the PM can most easily control the contingency allocation, as people will have to come to him to obtain the funds. On the other hand, if management decides to cut the budget, having a large amount of money sitting in a line item which does not have any specifically defined purpose might prove to be too tempting, and the

contingency might be lost. So this method is recommended only in organizations with a high level of project management maturity. It is recommended that the amount be spread by allocating smaller amounts to activity groupings such as milestones where the risks are liable to cause it to be needed.

It should be the PM who decides when to use the contingency. Further, if the project finishes without needing all the contingency, the PM should show which risks did and did not occur, to explain why some of the money was needed and some was not. It is recommended that the PM then return the unused contingency to the grateful company for use for some other purpose.

The main reason that management tries to cut contingency from projects is that PM's have had a history of building in slush funds, or padding, to projects, and then many times misusing these funds, for things like scope changes. Because this has happened, contingency funding is suspect, and this will continue to be the case until PM's can include contingency properly, and demonstrate to management that they are including only what is needed, and that they have some rationale for the amount. Of course, managing the contingency is also required to build the required trust levels for management to believe that the allocated contingency will be properly used.

Management Reserves

The purpose of contingency funding is to cover the known unknowns. In most projects there will be a need for funding to cover something which was not identified as a risk. In fact, in many cases these items could not have been predicted. If an emergency occurs which was not expected, this is an unknown unknown, and there is nothing built into the contingency funding to cover it. Therefore contingency should not be used for this purpose. The PM must go to management, or to another source, to obtain additional funding, This additional funding is called management reserves, and it is needed in addition to the budget plus contingency.

Projects also face scope change requests. These can also not use the project funding, including contingency. On principle, the PM must get new money for a scope change. This can also come from management reserves, or even from the customer.

If a project team identified a problem that surfaces after the budget has been calculated, so that now the cost to complete the project is higher than the planned costs, there is a problem. This was obviously not reflected in the

initial budget, but is something new - an unknown unknown,. This would then have to be funded via management reserves. If there is no process for requesting management reserves, the PM needs to find out what sort of proposal has the best chance for acceptance, and pull together the required information to request the funds..

5. Cash flow

Cash Flow occurs when money is withdrawn from the bank. Cash flow can be shown on the project schedule.

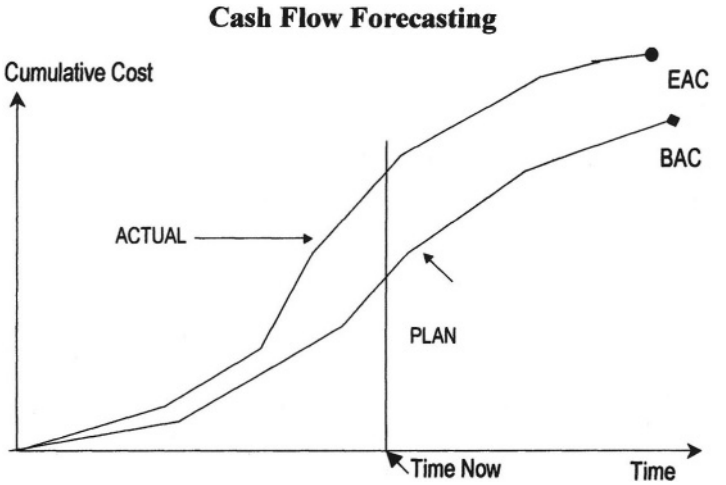

Figure 6

This figure is a chart showing the cash flow on a project.

The acronyms shown in this chart are:

BCWS- budgeted cost of work scheduled or **PV** – planned value
BAC- budget at completion
ACWP- actual cost of work performed or **AC** – actual cost
EAC- estimate at completion

In order to create such a diagram can be prepared, information must be collected about the costs, and to complete this, a number of questions need to be answered. The main issue is the determination of the amount of money to

be spent over time. This is done by assigning cost to all of the bottom level wbs elements, and then lining up the activities on a schedule. With the schedule in place, the PM can prepare a graph showing the timing of the expenditures. The curve starts at zero at the beginning of the project, then continues to rise at whatever rate the money is spent. However, the creation of the actual curve requires the answers to some questions.

The questions apply mainly to the curve for the actual expenditures, but in some places they could also apply to the budget curve. Two curves are shown in Figure 6. The bottom curve, labelled Plan, plots budgeted amounts over time. In project terminology, this curve is called the Budgeted Cost of Work Scheduled, or BCWS. The upper curve shows the timing of actual expenditures, otherwise known as Actual Cost of Work Performed, or ACWP.

To plot these curves, we take the cumulative (total of all such amounts to date) amount budgeted, or the cumulative amount spent, and plot it.

However, the question is, when do we include expenditures in the actuals? And when do we include the cost of accrued work? To understand the implications of these questions, consider a project to establish an internal corporate network to allow all employees in a call center to access various corporate information databases, and to allow them maintain all current customer records on the network with detailed call log information. The project includes activities to purchase 15 servers, connect these servers together in a mesh network, and set up access to the server network for all employees. Suppose that on July 15 the company issued a letter of intent to the successful bidder on the RFQ for the computers. The order was issued July 19. The computers were delivered August 12, accompanied by an invoice. (Note: if this example were work done by a contractor, the contractor might not issue the invoice till some time after the work has been completed, adding yet one more complication.) The invoice was sent to management for approval on August 13, and to Accounting on August 16, for payment. The cheque was cut September 8, and mailed September 9. The supplier received it September 16, and deposited it September 17, The cheque cleared on September 18, When should the expenditure be entered on the ACWP curve? When was the money actually spent?

The actual cash flow occurred on September 18. That's when the money left the bank account. However, most would agree that the money was actually spent long before this. In fact, once the letter of intent was issued, the company was bound to buy the computers. It could be argued that the

money was spent on July 15. However, as far as Accounting is concerned, they are completely unaware of this expenditure at least until it has been submitted to them for payment. And if they do not process payment, the true cash flow does not occur. If the PM tracks the expenditure as occurring on July 15, his records will be out of line with those in Accounting. If he does not log it till September, his actual spending is misrepresented. Should a decision be made to cancel the project between July 15 and September 17, the total spent could easily be calculated incorrectly. This illustrates how project records can appear to be different from reality. The project team needs to establish some policies for tracking this information.

If the project budget, BCWS, is plotted according to commitments, the project will sometimes appear to be under budget when in fact it is not. The problem is just that the accountants see the charge come through much later than the commitment date. However, if the budget is plotted according to cash flow, the planned amount will often appear to be lower than it actually is at that date. Then if some work is accelerated, or some invoices are processed more quickly than expected, the project will appear to be overspent, when this is not in fact the case. Occasionally project managers work out an agreement with the Accounting departments on how they will track costs on a project, but there is generally no flexibility in most systems to allow any deviation in accounting from the standard methods.

6. Project cost management

Using the chart shown in Figure 6, along with the policies developed for cost tracking,the project manager will first budget, then track, and finally manage the project costs.

BCWS and ACWP are as defined above. BAC, the budget at completion, is the budgeted amount for the full project. EAC is the estimated cost for the full project, at some point during the project. Estimate at completion is the current estimate of what the project will cost. It is the total of what has been spent to date plus the estimate of the amount that is expected to be spend to complete the project, given the amount that has already been completed on the evaluation date. If we assume that the current productivity rate will apply to the remainder of the project, the productivity rate to date can be calculated, using methods which are outlined in Chapter 11. Then , the budgeted amounts for the remaining activities is calculated, and the current productivity rate is applied to that number to get the expected cost to complete (CTC) the project. This CTC is added to the actual costs to date to get the current EAC.

If however, the team foresees a that something will occur during the remainder of the project that was not anticipated in the initial budget or the risks, the CTC will include both the original estimated plus the cost for this new event.

7. Cost tracking and controlling

Cost tracking is also not completely straightforward. In addition to the problems regarding when costs should be tracked, there is the problem of determining how much of the work has actually be done on an activity, and hence how much time and hence cost should be tracked to the project. This is parallel to the issue experienced in time tracking. It might be wise to clearly communicate the tracking methodology to the team members, to ensure that they are consistent within the project, and also to management, so that they can correctly interpret project management data.

Cost control falls to the project manager as well. The initial step in cost control is the cost tracking, together with comparison of the actuals to the budget. However, this is really cost accounting, and cost control is much more than that. In order to manage the budget, the PM must motivate the team to control costs. Given that funding is usually very limited on projects, this will require concerted effort, and considerable project time. The PM must monitor all activities on predetermined schedule, to determine the current status. This control schedule should be included as part of the project schedule. Also, the team needs to keep in mind that commitments, once made, are real costs, even when these are not tracked as such. Then if and when things go off track, the PM must take all required corrective action to get the budget back on track.

Overall, project finance is a very complex business, with many facets. In this chapter we have explained the basic concepts and tools, discussing some of the issues a project team faces. In Chapter 11 the concept of Earned Value will be added to the picture as a tool to enable the project manager to see trends in the project which might indicate the need for management earlier that other tools will identify problems.

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PART II RUNNING A PROJECT

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Chapter 8

COMMUNICATIONS

One of the key PM responsibilities is communications. In fact, the PMBOK ® GUIDE defines communications management as one of the Process Areas of Project Management. Four processes are defined as communications processes:

- communications planning
- information distribution
- performance reporting
- administrative closure

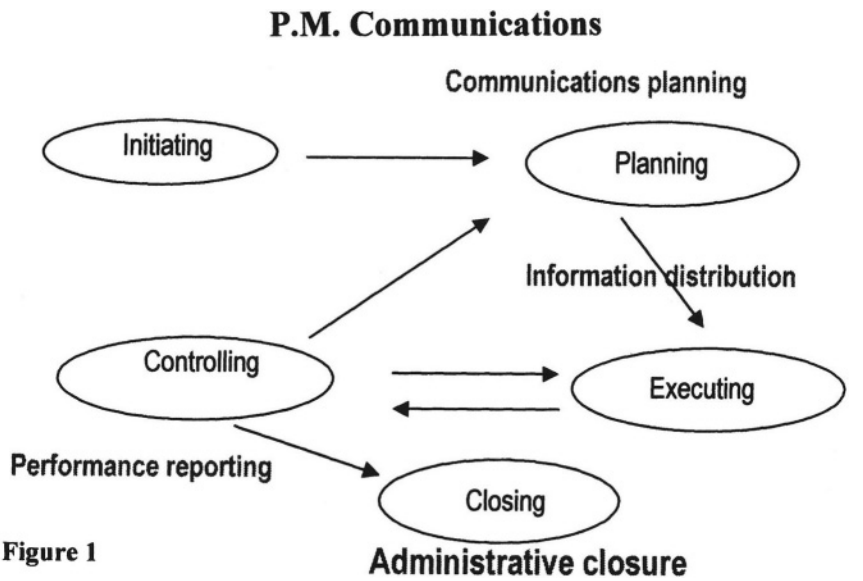

Figure 1

While there are many formal communications associated with projects, including items such as meeting minutes, contracts, project charter, status reports, etc, most project communications are informal. All communication affects the project, so the PM and every team member needs to be aware that communication should be as accurate and as professional as possible, aimed at ensuring that the project moves smoothly.

Project communications can be oral or written. They may even be non-verbal, such as facial expressions, movement and positioning of hands/arms/body, impressions created by clothes, accessories or make-up and even furniture arrangement. In some Asian cultures, seating arrangement conveys considerable information, such as who is the host, and who is important. Many people are unaware of cultural differences, and in fact, many are not at all concerned with the messages that are conveyed via these channels. Not being aware, these people run the risk of sending unintended messages, which might be quite contrary to the messages that they wish to convey. So the PM should ensure that someone on the team is aware of such messages, and that people help each other to ensure that the messages conveyed are the desired ones.

Although it is recommended that all plans and results be written, most project communications will be oral. When there is information that has legal impact, such as specifications, contracts or RFP's these should also be carefully written and archived to avoid any potential misunderstanding.

The team needs to plan all the important project communications, at a detailed level. Obviously the specific content can not be planned, as this will de determined as the project evolves. However, many details of the communications can and should be planned. The team needs to determine and list all of the important project communications, and build a plan for each. For each communication the team needs to define who is responsible for the communication, what they are to communicate, to whom, the purpose of the communication, when, and via what media. Some information should also be included to specify the level of detail required. Some communications involve the collection of information and some involve the distribution of information. The information specified above will specify which category in which each communications belongs.

The overall communication plan should contain information about each of the process areas – the charter, scope statement, scope management plan and work breakdown structure to define the scope, the risk management plan, the quality management plan, the schedule information, the budget and

cost management plan, information about the team and team management, the communications plan and the procurement plan. This can be short for smaller projects, but all relevant information should still be documented. Larger projects generally do have more structured communications, but even here, the project team still has to define all the specifics for the particular project, even if an overall framework is provided.

Many engineers are aware of Shannon's model for communications. This model was developed for the building of electronic communication mechanisms. However, the model actually applies quite well to all communications, even oral face to face communications. See Figure 2 for the model.

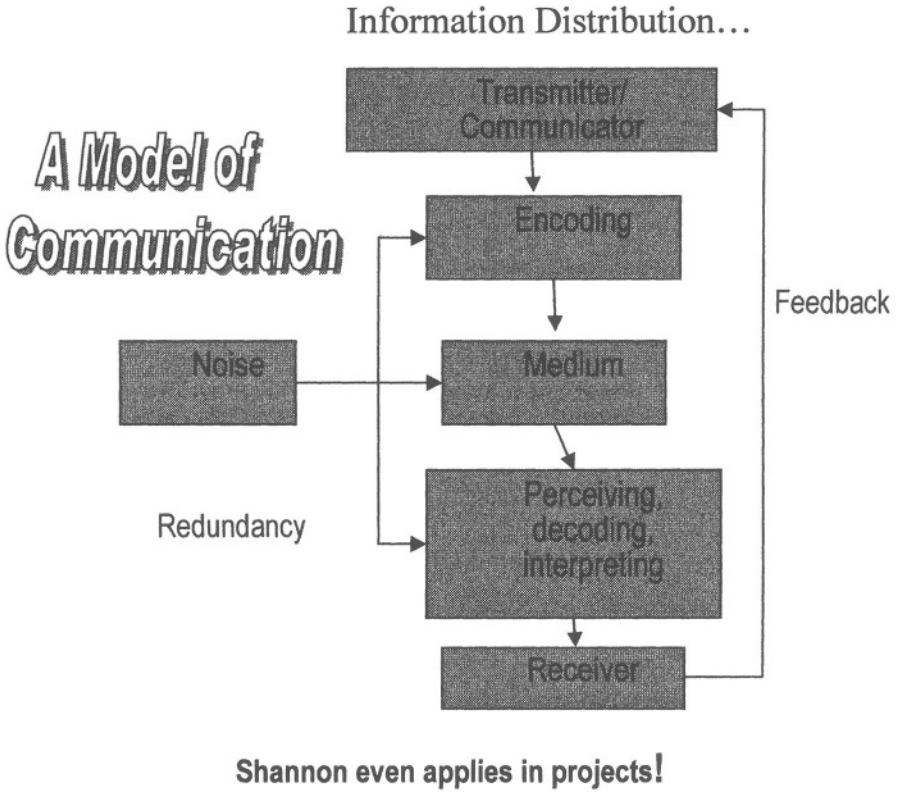

Figure 2

In every communication there is some information which is to be communicated. This information is encoded in some way – the English (or

other) language, a diagram, etc. The encoded information is then transmitted through a medium – maybe that's air, if two people are standing talking, or mail when a signed contract is mailed back, or email, when meeting minutes are distributed. The transmitted information travels along a path to the receiver, who will decode it, and hopefully interpret the information as that which the sender intended to send. However, associated with every transmission there is noise. The noise might be in the environment, as in a meeting is a room with open windows, with construction underway outside. The noise might be introduced by some participant or other factor, such as a secretary transcribing a voice message for a manager, where the secretary is unfamiliar with the issues and the participants, and therefore misinterprets some of the message, or misspells someone's name. Noise can even be generated in the mind of the receiver, who might be thinking about something else while listening to a presentation, or interpreting a word or phrase differently than the sender intended because the receiver's background in that area is quite different. In order to ensure that there were no encoding or interference problems with the communication, it is always wise to include a feedback loop, which can help to identify the fact that a miscommunication has occurred, and allow for early correction. In cases in which correct communication is critical, it is wise include some redundancy, just in case the primary communication is lost or corrupted.

Oral communications should always be kept to a professional level, even when high stress is involved, or disputes arise.

For all communication, the following principles should be adhered to:

- ✓ Be objective
- ✓ No surprises
- ✓ Communicate what the listener needs/wants
- ✓ Establish procedures and guidelines for communication
- ✓ Keep it focused

Be objective

Most project communications are objective. However, in some environments, objectivity can get lost. In an environment which is fraught with politics, maintaining objectivity can be quite difficult. When any environment becomes stressful, especially over a long period of time, people can lose objectivity. Both politics and stress tend to be part of every project to some degree; so maintaining objectivity becomes a challenge in a project environment. Therefore the PM and the team need to plan for this, and to

give some focus to ensuring that the communications remain objective. When objectivity begins to fail, it is important that this is recognized, and that everyone then works to remedy the problem. It is also important that people realize that this is a natural problem with project communications, and when it does happen, they need to refrain from blaming or pointing fingers. The important thing is to correct the problem, and get back to the work at hand.

No surprises

This means that when there is news that will have an impact on any stakeholder, this news should be communicated to the stakeholder. Even if the news is bad news. No one likes to receive bad news, and therefore people hesitate to communicate bad news. But if the project is going to be late, or over budget, or if the specs for some deliverable will not be met, people need to know this as early as possible. In fact, this knowledge will allow the affected party to plan for the altered situation, rather than being hit with the problem at the last minute when there might be much more difficult to deal with some of the problems.

Communicate what the listener needs/wants

Consider a management meeting at which corporate senior management are reviewing the status of multiple projects. Perhaps they have earlier reviewed the corporate financial picture, and found that in fact they cannot continue to fund all the projects that are currently underway because some critical project has seriously overspent, and their backers will not extend any further credit. Suppose that the PM for one project arrives to give project progress information and that this PM is a very technical person, working on a project that is the creation of a new service using some new technologies. To the PM, the biggest and most significant challenges with the project are probably technical. He is quite likely to focus heavily in his presentation on technical aspects of the project, to ensure that the management understands the issues and the excellent solutions his team is working on. In most cases, the management team will not consist of only technical people, so at least some of this team will not have a strong interest in the technical aspects of the project. For at least these people, the PM needs to ensure that other aspects are covered in the presentation. In addition, even if the management team were all technical people, their job is management, so their interests will be in the management information, such as the schedule and the financial aspects. In fact, by making the effort to get their agenda for their meeting ahead of time, and considering it carefully, the PM can determine

that they are addressing finances, and can then conclude that he should be prepared to address this area clearly as they will undoubtedly be interested – probably more interested that they might normally be.

The point of this discussion is that the purpose of communications is to give information to the receiver. Therefore, the content and the style of any communication must be something that is meaningful and interesting to the receiver. Content that is of interest to the transmitter might be information that the receiver should have, but the responsibility lies with the transmitter to convey to the receiver why he needs to know. If the transmitter just conveys information that is interesting to him, there is no guarantee that it will be received. This should be clear to the reader if you think about sitting through a boring presentation. Probably the presenter was very interested in the information being presented. But if it was boring to you, you did not relate to the material as being either interesting or useful to you. In that case, how much of the presented material did you retain? If you needed to have all of the information, the sender should have prepared it differently to ensure that you would actually receive it all

Establish procedures and guidelines for communication

Since effective communication requires significant planning, the team needs to do significant planning. All of this is documented in the communications plan. As mentioned above, the team needs to document what needs to be communicated, by whom, to whom, when, why and how. And in determining the answers to these questions, the team needs to take into account the mindset and style of the receiver(s) of each communication.

One of the best tools for communications planning is a communications matrix. It is not necessary to use a matrix for this plan, but when communications are not overly complex, the creation of such a matrix can be relatively straightforward, and the tool provides concise but clear documentation.

One model for such a communications matrix is shown in Figure 3.

Communications Matrix

Stakeholder	Awareness	Support	Motivation	Information Gathering	Information To do job	Co-ordination
Owner						
Operator						
Maintainer						
Function Mgr						
Designer						
Regulator						
Consultant						
InfoTechnology						
Finance						
Supplier						

Figure 3

Here we can see that the matrix shows the people involved in transmitting the communications on one axis and the categories for the purposes of the communications along the other. This would be further refined to show the actual communication events themselves along the top.

In the boxes the team puts the answers to the questions of when, why and how. This is often done by using letter codes if the picture is not too complex. At a minimum, the matrix should include the creation of, and communications of the wbs, charter, risk plan, etc.

Another key communication for every project is status reporting. Reports from the project team members to the PM should be included, as well as reports from the team to management, the customer, and perhaps other key stakeholders should also be planned.

Once the matrix has been created, someone must then be assigned to manage the activities identified in it to ensure that they occur. The PM can allow the team to determine the format, if that fits his management style, or, even allow the person assigned to matrix maintenance to come up with one - which consumes less time, and is fine, as long as it works for everyone.

This tool can be built fairly quickly, and it gives a structured way to consider all of the required communications. If something is forgotten it can be added to the matrix later.

In addition to the matrix, it is also wise to document some processes, formats or samples of any types of communications that might not clearly be understood by all senders. This avoids rework later.

One common method of communication is the holding of meetings. As important as meetings are in enabling communication and decisions, there is still a lack of understanding of how to use them most effectively. Particularly in a project environment, where time is generally in very short supply, it is very important for the team to use every minute productively. This can be done in meetings, as long as the meeting is properly planned. However, the planning must be done carefully, with thought given to the items to be covered, the people who should attend, the optimal sequence of events, and the time required. There are a number of established techniques for this, which differ from each other somewhat, but all have the goal of making the meeting productive, enjoyable and worthwhile for everyone involved.

The first step is the meeting planning. The chair of the meeting must carefully think through the details mentioned above. He can do this alone, or with some team members, or with someone whose specific role is meeting facilitation. We'll come back to the facilitator later. Start with the purpose of the meeting. Decide on the overall purpose of the meeting, and the objectives to be met – just as we do for projects. This will give a framework for the rest of the planning. Then think carefully through the steps that are required to attain the desired results. This takes some time, and some serious thought. It is a far cry from listing a set of topics and sending them in an email to a group of people.

The idea is that with proper planning, the meeting can flow well, with the attendees having all of the information they need at any given point in the meeting, either because they brought it with them, or because it has already been covered during the earlier part of the meeting. The agenda can be drawn up from these thoughts, with each step being entered into the agenda in the order in which they need to occur. So, step one in drafting the agenda is to determine the meeting purpose and objective. Step 2 is to list the items which need to be covered, in the order in which they should be addressed so that everyone will be properly informed. But, the agenda preparation does not finish here. Next the planning team must identify the purpose of each item on the list, and decide who would be the best person to handle that item

to achieve the desired results. Then they need to decide how much time would be required to complete each item properly. In effect, the planning team thinks through the entire meeting, item by item, to ensure that they have things lined up properly, with everything included, all the right people in attendance, and the right amount of time allowed for addressing each item. They should also consider the fact that there is some overhead required as well. People may not all be sitting in the room at the appointed start time, so there should be an item listed first that allows for this. They should also ensure that they get feedback from the attendees on how each thought that the meeting went for him, in order to better plan for the next one. Including a few minutes at the end to summarize and evaluate the benefits and issues regarding the meeting overall can do this. Team and or corporate culture should be considered as well. Are people in the habit of coming to meetings on time? If not, they are not respecting the time of others. Do meetings usually start on time? If not, the chairs are not respecting the time of those who are there, and waiting. If the corporate culture is not one incorporating such respect, the PM might want to build such a culture for his project team, in order to both help people understand that they are respected, and also maximize the effectiveness of the meetings.

But we are not ready yet. Once the agenda has been established, the planners need to contact all of the people who will be playing major roles, such as making a presentation, or acting as a note-taker, to ensure that they can attend the meeting, and that they will be prepared and able to take on the responsibility.

In addition to the people handling each of the items, and the people who need to participate in these, or learn the information, there are some other key roles that should be filled. These are related to the running of the meeting itself, and most will generally be filled by people who are already attending the meeting anyway for other reasons. These roles include:

- meeting chair
- timekeeper
- note taker
- scribe
- facilitator

The meeting chair is generally the project manager, for project meetings, but this does not have to always be the case. If the meeting is focused on a specific project area, perhaps the prime from that area will chair the meeting. Sometimes a stakeholder, such as the customer, calls a meeting and then this stakeholder acts as chair. In formal meetings, which follow structured rules,

such as Robert's Rules, the chair plays the specific role of directing the meeting, and generally does not vote unless there is a need, such as to break a tie. Even if the meeting doesn't follow strict structural rules, the chair should control the meeting, ensuring that the topics are addressed as planned, the behaviour of the participants is appropriate, and the objectives are being met, with clear action items being specified and assigned. The chair can participate in discussion, but he should show an open mind and attitude, not be pushing the participants towards his own desired conclusions.

The timekeeper plays a very important role at meetings. This person ensures that each item starts and finishes at the specified time. This includes giving the attendees advance notice prior to the arrival of the finish time. There will be times when the discussion of an item should really continue because the participants feel that they cannot reach the required result in the remaining time. The timekeeper is then faced with a problem, because this impacts the remaining agenda items. He should ask, at the time of the decision, which option the group wishes to chose. They can terminate the agenda item at the specified time, and set a later time at which they will reconvene to continue the discussion. They could allow the item to run on for a set additional time. But this means that they will then have to decide what to do about the impact on the agenda. They can extend the meeting end time, and just move the times for the remaining items back by the amount of overflow time. Or, they can reduce the time for an upcoming item, or postpone one of those items to another time. While it might well be necessary to extend the item, each of the consequences does have an impact on the attendees, and if this impact is problematic, it should be mentioned in the meeting evaluation report, to facilitate better planning for future meetings.

The role of the note-taker is to document the meeting flow clearly and later, prepare the minutes. Meeting minutes should not be written as a novel. They should be concise, and clear. They should mention all of the agenda items, showing the key results, and identifying all action items, with the names of the people responsible for them, and the due dates. Before minutes are finalized, they should be circulated to the attendees in draft form for their approval. In some cases all attendees should be polled to identify errors or omissions; in others just some key people participate in this process. Once the minutes have been approved, they become the official record of the meeting, and the chair should follow up on the action items until all have been completed.

The function of the scribe is different from that of the note-taker. The scribe writes things in real time, on a whiteboard, computer screen, or pad-board, for the attendees to view as the meeting progresses. This can be very useful when the group is discussing an item, or drawing up plans, to keep all of the information available.

A meeting may or may not have a facilitator, and the facilitator may or may not be a member of the project team. This is a non-essential, but often very valuable role. The main role of the facilitator is to act as a neutral party in the meeting, to help the chair keep the discussion focus on the topic under discussion, and to ask questions which will open the breadth of the views on the topic being discussed. The facilitator might ask the tough questions that the team members do not want to ask, or the dumb questions that the PM doesn't want to ask, or some insightful questions that may not occur to the team members simply because they are so close to the action. Also, if the meeting chair would like to participate in some of the discussions, it is more appropriate for him to step down from the role of chair during these discussions, in order to take sides. This leaves the chair position temporarily vacant, and the facilitator is an appropriate person to fill in. As mentioned above, when there is a facilitator, it is most appropriate to have this person work with the meeting chair to plan the meeting as well. For some of these roles, it is most appropriate to have someone from outside the team as a facilitator, allowing the team members to participate in their regular roles.

Prior to the meeting the chair must also confirm that the people in these overhead roles are planning to attend the meeting, and willing to take on the specific roles. He should also clarify whether or not they need to come prepared.

Once all of this has been done, the agenda can be issued. Figure 4 shows a sample of a meeting agenda. Note that it includes all of the information that is suggested in the planning. The attendees can see all of the details regarding the administration of the meeting along with the content information.

WBS Meeting for Bluetooth Service
Date: July 13th, 2003
Place: Wistonhall
Time: 8:00am – 3:00pm

- Objective: to create the WBS for the Bluetooth project to develop and implement a service based on Bluetooth capabilities.
- Chair: John Wayne
- Facilitator: Carol Bush
- Scribe: Emily Strauss
- Note taker: Richard Taku
- Timekeeper: Sonia Friedman

Time	Item	Method	Expected outcome	By whom
8:00	Welcome	All find seats	Everyone ready	President
8:15	Review project objective	Discussion	Understanding	Mr. Russell
8:30	Project charter	Stated understanding	Discussion and agreement	Mr. Clarke
9:30	Project scope	Presentation	Acceptance	Ms. Bell
10:00	Break	Coffee and muffins	All refreshed	
10:15	Workshop	Groups of 5	WBS Breakdown	
12:15	Debrief	Separate Presentations	Eliminate overlaps % full gaps	Mrs. Sung
12:50	Meeting evaluation	Solicit individual inputs	Understanding for future	Mr. Russell

Figure 4

After every meeting there should be documentation distributed to all who attended. Unless there is confidential material in the minutes preventing it from being made more widely available, this information should also be shared with any stakeholders who would have a desire or a need to know. All meeting records should be filed with the project documentation for reference during and after the project.

In fact, looking through the preceding discussion, it is apparent that a meeting is essentially a project in itself. All of the same discipline need for project planning and implementation is required for meetings, for the same reasons.

In this Chapter we have discussed some of the forms of communication used by project teams, and some methods for managing the communications

to ensure that all required information is effectively received by the appropriate recipients.

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Chapter 9

THE PEOPLE

At the core of every project are the people. People make the project successful, people cause the project problems, people make it enjoyable to work on project teams – or otherwise. The project manager first and foremost must be able to work through the people involved to make things happen and obtain results. In this chapter we will look at many different aspects of people skills – because working with people has many different dimensions.

First we will look at the environment in which the team works. Projects exist within organizations. The organizations already have a structure, and the project work is then overlaid on that structure. We need to understand the organization structure from the project perspective in order to be aware of the types of problems that are likely to occur, and to understand where the team can capitalize on its strengths.

Leadership, a key characteristic of a successful project manager, is analyzed. Next we discuss the importance of team building for the success of the project. Another core aspect of project management is motivation. Team members must be motivated to perform at optimal levels, sometimes over extended periods of time, and often with interference from their usual departments with additional or even conflicting demands. We review some theory and some techniques in these areas. Some conflict is inevitable on a project, so conflict management is discussed. Since learning is a core concept in project management, we discuss the ways to allow learning on a project.

Before we start into the organization structures, let's consider the processes which are associated with Human Resources in the PMBOK® Guide. Figure 1 shows the processes:

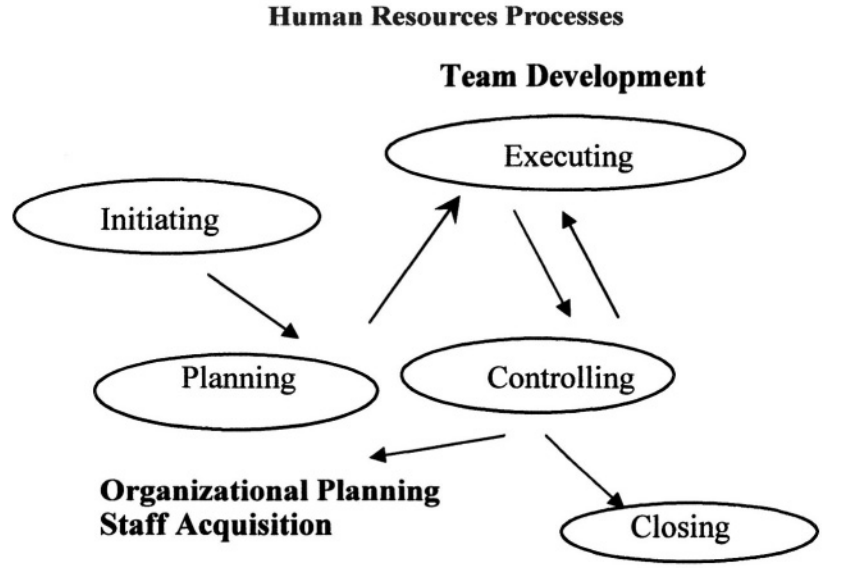


Figure 1

Organization Structure for Projects

In any organization there is an existing organization structure. Traditionally companies have been organized along functional lines, but recently more companies have been moving toward an organization which is based on groups working on projects. Almost all companies have activities which are in the category of ongoing operations, where things are relatively well defined, and typically don't change significantly over time: these activities are best supported by a functionally-oriented organization. At the same time, developing anything new or making significant changes is usually best undertaken by a project-oriented team. Some degree of hybrid structure, then, is to be found in almost any company. When the organization

takes on a project, they must decide how to most effectively treat the project within the structure of the company.

In all but a completely project-oriented organization, the team members continue to report to their usual supervisors. When a project is launched, the team members are moved from their usual groups to report to the Project Manager for the duration of the project.

1. FUNCTIONAL ORGANIZATION

In a purely functional structure, people are in defined positions in the hierarchy, reporting to their usual supervisor, in their normal departments. There is no project manager in this structure, so the focus on doing projects is quite low. This is usually a very inefficient structure for undertaking projects. Communication generally flows up the management paths, across and down, so the project communication can be poor, especially if there are many functional groups involved. Team members may not be cognizant of the goals and objectives, or even of the work and developments in other departments.

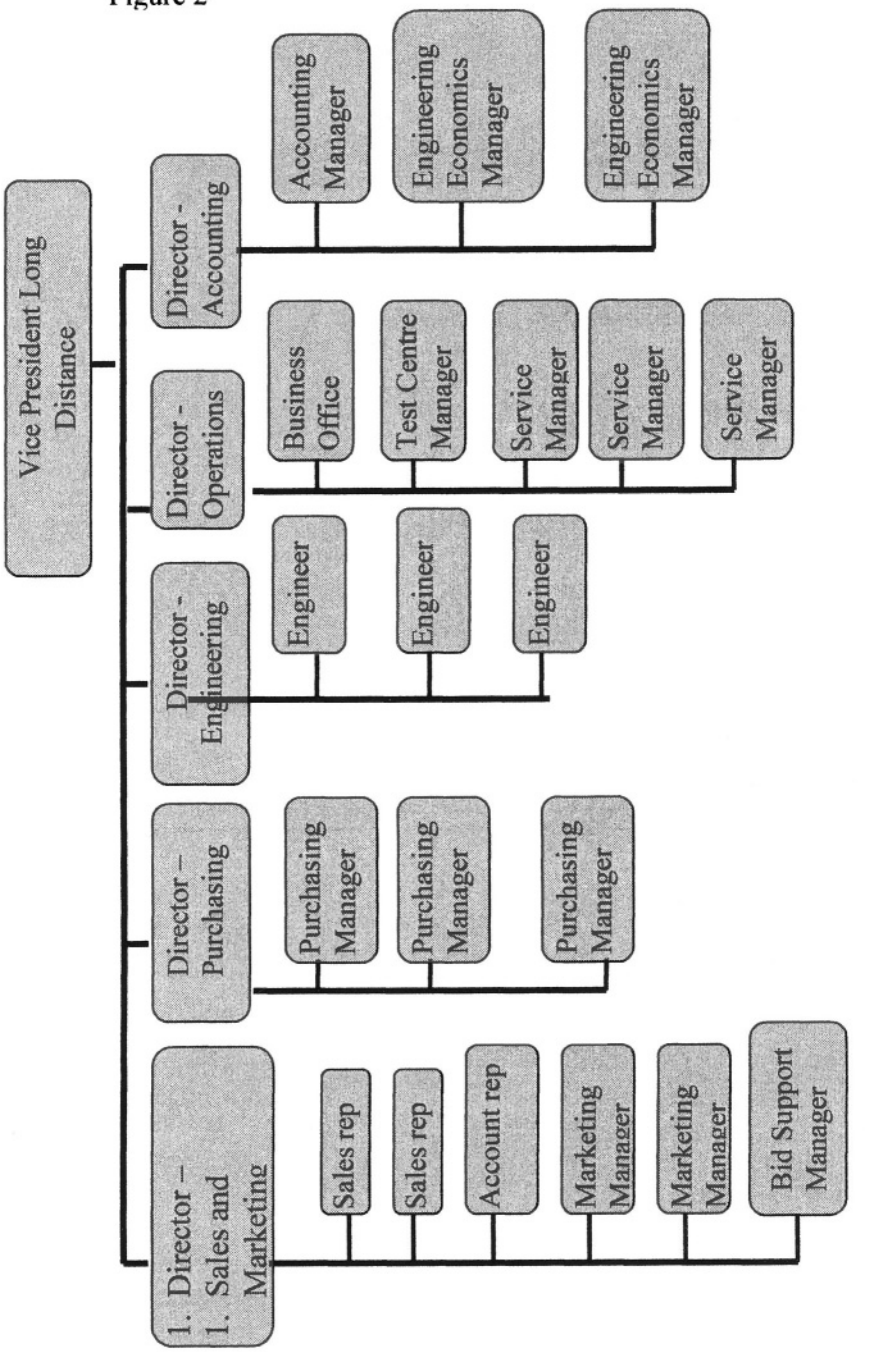
It's hard to imagine an organization that is more hierarchical by definition than the military. Yet the military has been instrumental in advancing the science of project management, and was indeed the source of much of the early project management software.

How does that square with the popular image of the military as a place where "you salute anything that moves and paint anything that doesn't"? The answer of course, is that they know better. The military undertakes an enormous number of projects, from the development of elaborate weapons systems, down to the details of combat operations, which are really a series of projects dealing with dangerous and rapidly changing environments.

For most peacetime projects, cross-functional teams are assembled, with the project manager appointed by the sponsoring organization. Interestingly, rank isn't a big factor in selecting the PM and running the project. Very large projects are handled in a more formal manner, with officers specializing in

The Functional Organization

Figure 2



program management running things, but even here, cross-functional direct communication is key.

Projects do occur within purely functionally organized groups, but for them to really be effective, it really helps if the PM is also the functional manager, and the majority of the work is within the functional area of responsibility of the PM.

2. PROJECTIZED ORGANIZATION

In a purely project-driven organization all activities are projects, and all people are on project teams headed by a Project Manager, with all team members reporting to the project manager.

The project organization must exist as a subset of a larger group. Some functional groups will usually also be present for any company to operate. Usually the PM and the team members are all full time. For a project-oriented approach to succeed, it is preferable for the team members to report solely to the PM for the duration of the project.

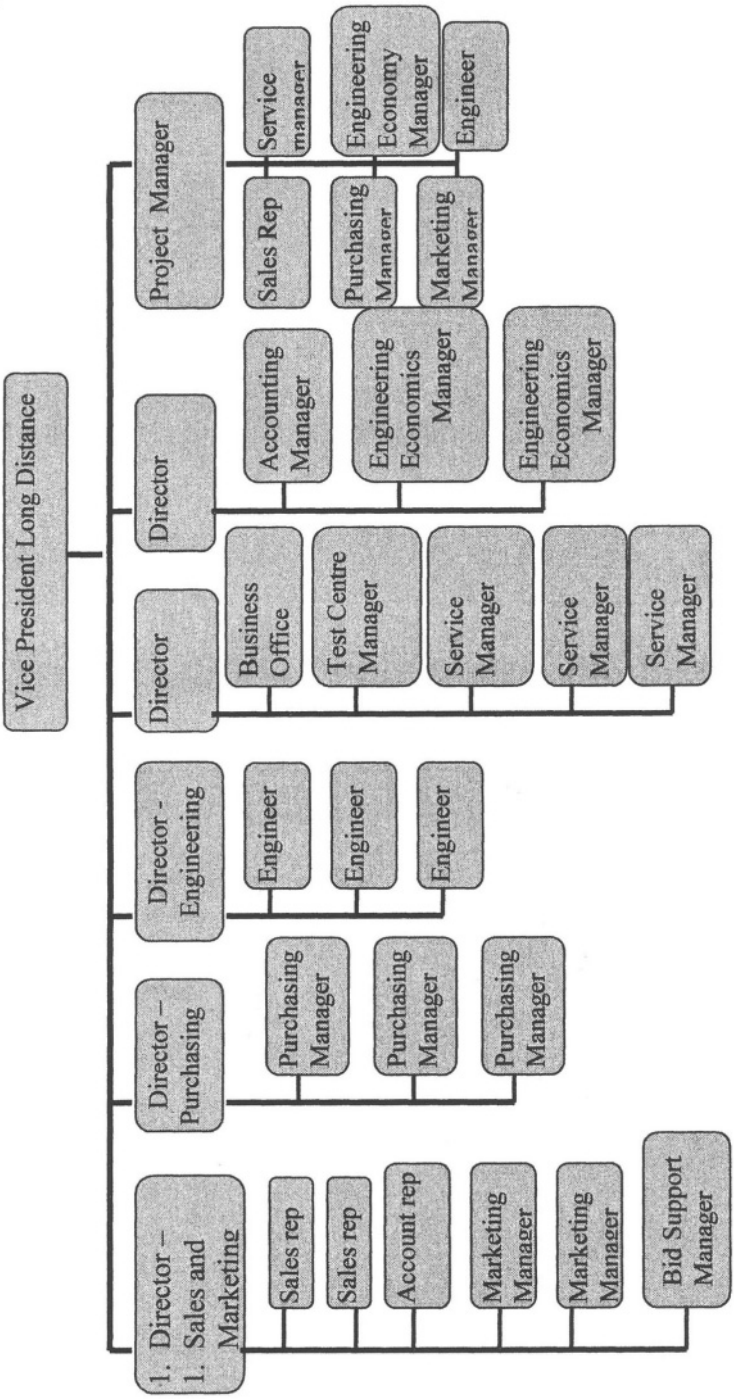
Since in a project-oriented organization, the team reports to the PM, the communications amongst the team members are usually very good. The team understands the goals and objectives of the project because the group can collectively focus on the project. There are few non-project interruptions and it is unusual for the regular functional managers to disrupt the project direction, since they must now negotiate with the PM for the time of the people. Motivation for project activities is generally high since this is the main focus of the team and they work together towards the goals. The team generally gels well, since they report to the same supervisor.

Of course, the PM needs to use strong negotiation skills prior to the project in order to hire the strongest resources away from their normal departments.

In this environment people are removed from their functional organizations, and from the support of others in their functional area, so there is no support for someone learning a new area, or backup in the case of overload. Therefore technical quality can be lower in this environment. Removal of staff from functional organizations for long periods can result in loss of opportunity for training and career growth. If a team member requires

The Projectized Organization

Figure 3



training which is related to the project, there is generally no question that the project will pay for the training. But suppose that a team member wants some training that is not related to the project. If isolation from the functional department prevents this, the engineer with the best skills for this project may be reluctant to join the team because he has been working on this existing technology now for 2 years, and wants to be trained in some of the newer technologies to update his skills. The danger of becoming stale is very real for development personnel. In a project environment, the company needs to make sure that the career development needs of the team members are still met.

In addition, no matter whether the project is large or small, exciting or routine, at the end of the project, each of the team members will need to move on to something else. If there is an existing functional structure in the company, generally people move back to their previous functional department. However, this does not always happen. Sometimes the functional department has no position for the person to return to. Or the person was ready to move on, and took the project as a stepping-stone towards something else. If the person is to return to the usual department, the project completion may not be cause for anxiety due to job placement, but there could be some concern about what positions will be waiting. And if there is no functional structure in place, then project resources will need to find another position to move to. This will generally mean moving to another project. And the start date of the new project could even occur prior to the finish of the current project. So, as the project end approaches, the team members will be at least as focused on finding a new position as they will be on project completion. Also, after having worked on the higher profile project, a return to the usual day to day functions might be a let down to many team members. There might be a need for the PM to assist with this transition.

Thus, there are both pros and cons with this structure. These need to be considered by any PM working is this environment to help him to anticipate the types of problems he is liable to face, and to be prepared to deal with them.

3. MATRIX ORGANIZATION

In order to take advantage of the strengths of each of the above structures, most organizations use some form of matrix structure for their

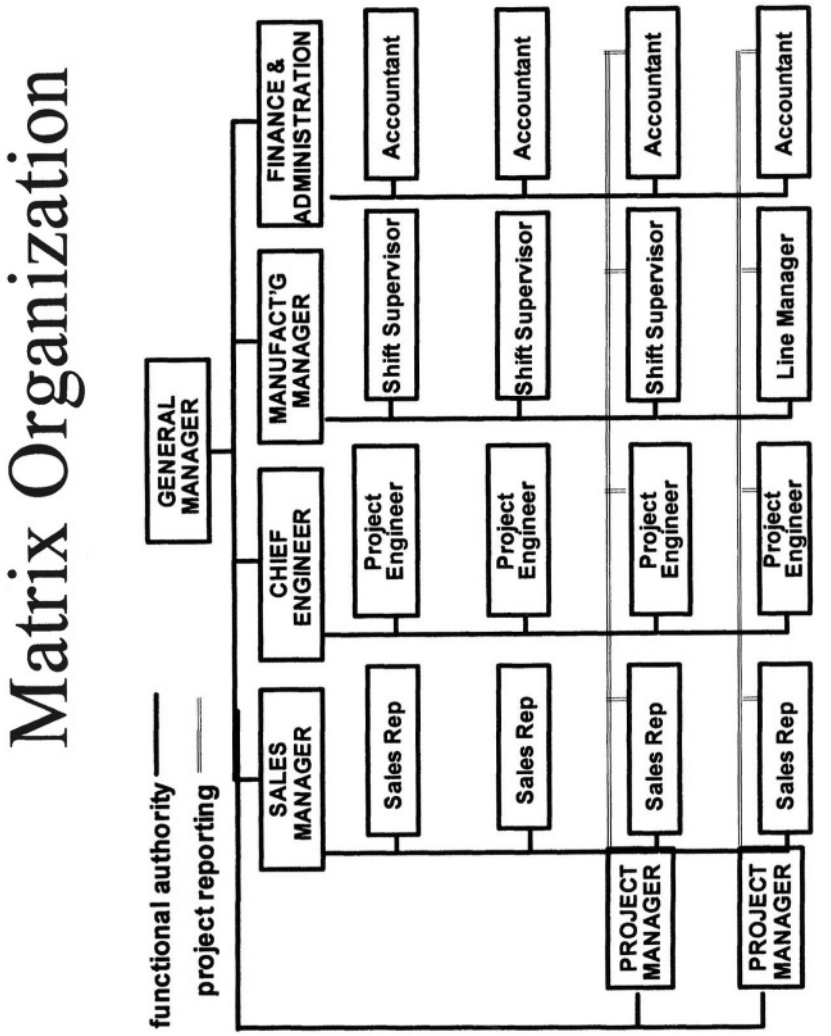
projects. In this structure the project team members continue within their own functional groups, reporting to their usual managers for purposes of career development and performance evaluation. A Project Manager, or Project Coordinator, is put in place to manage the project. The team members report on a "dotted line" to the PM as well for activities related to the project. The project manager must also have substantial input into the performance reviews of the people on the project team, as he or she is in the best position to judge the team members' performance against project goals. Thus every team member has two bosses. The team members might work full or part time on the project, As is the case in the two previous organizational structures. Because there are two 'bosses', the PM and the Functional Manager, the team members risk being overloaded by being given work by both, neither caring particularly about the goals of the other. For a matrix structure to work, there needs to be co-operation between the PM and the functional manager to avoid putting the team members in this difficult position. It is often useful, and fairly common in mature matrix organizations to formalize the responsibilities of the team member, and of the two managers, before the person is assigned to the project. Such a prior agreement makes it harder to pass the buck later if something goes wrong.

Because people continue to report to their normal supervisors while they work on the project, with the procedures, processes, support and training near at hand, their technical skills are usually up to date, as in the functional organization. The quality of work is also strong because of the availability of support and processes. Project focus is better than in the functional organization because team members are accountable to the project manager who brings the project focus, and who communicates the objectives, budget, schedule, etc with the team members. And the anxiety at the end of the project is lessened, as the team members have somewhere to call home.

The corporate culture will largely determine the relative strengths of the functional and project organizations, and their influence on the team member. There is a wide variation in the relative strengths of the project and functional groups.

Primarily in organizations in which most of their business is in ongoing operations, projects are likely to be considered of secondary importance. The project manager is more of a co-ordinator, and has very little actual authority. In this structure, the team members are accountable mainly to their functional manager, who will have a significant input to the relative importance, and the amount of support to be offered to the various ongoing projects.

Figure 4



From Keith Farndale's "Comprehensive Project Management"

In the other extreme, the primary accountability of the project team members is to the project, with the role of the functional manager focused on support and career development of his employees. The team member's performance review, while usually officially within the framework of the functional department, is usually driven mainly by input from the PM.

Most companies operate with a structure somewhere between these extremes, with a more balanced mix of functional and project authority. A well-balanced matrix structure is very hard to attain, and the key to making it work is to have a well-defined division of responsibility. Generally the PM makes the calls on the 'what' and the 'when' and the functional manager makes the calls on the 'who' and the 'how'. This can work very well. But it also makes a difficult environment for the team member who is caught between the two influences, often in situations of conflict. It is difficult for the team member to decide which one to please, yet there might be too much work for him to be able to please both, requiring someone (the team member?) to use strong problem solving skills to create a solution which meets the needs of both supervisors.

There is no "correct" approach to balancing project versus functional priorities. All structures have their advantages, and for some projects, one works better than the others. For some people, one works better than the others. So, where the flexibility in the corporate culture exists, it would be wise for management to consider the alternatives carefully to determine which would be best for each project. Not many companies are flexible enough to be able to vary the structure used from one project to another, so there may be times in any company where the culture becomes counter-productive.

One sort of project structure that is very difficult to characterize into categories of functional, project, or matrix organization is that of a research and development organization. A development group's workload is a succession of projects, which typically are well organized and tracked on a formal basis. Yet the development personnel are organized according to narrowly defined functional categories: hardware and software design, system verification, etc. The multidisciplinary development team is entirely project focused, but typically reports to the same manager who performs both functional and project management duties. The development company then, can be characterized as a functionally oriented organization designed to support ongoing operations. The product that is churned out by this operational structure, however, is a series of well-managed projects!

With all these alternatives for the project team, what of the project manager himself? Some companies, mostly larger ones, will have a Project Management functional department, led by a senior manager who may be titled Program Director, or something similar, and with a staff of project management specialists who are assigned to projects in the same manner as the other team members. The Program Director has to have a uniquely good view of all the ongoing projects in the overall to be able to make correct decisions regarding the priorities of the ongoing projects.

Another approach for providing project managers is more appropriate for smaller companies. In this case, a functional organization that has a vested interest in mounting a project will act as champion of the project, and provide a project manager to run it. Marketing or Product Management organizations, for example, would be likely candidates to initiate a project to introduce a new product to market. Manufacturing Engineering departments are likely sources of projects to introduce new test equipment, or redesign a production line. With this structure, it is likely that the project manager will be very well versed in important skills relevant to the project at hand. However, it is not always the case that such a person will have classical project management skills such as scheduling and budgeting. This approach works surprisingly well when the organization is used to doing things on a project basis.

These different approaches reflect different cultural approaches to the role of the project manager. Larger organizations with Project Management departments tend to consider that classical project management skills are of paramount importance, and they believe that a sufficiently expert PM is able to successfully run a project regardless of the technical content. The smaller companies will tend to feel that the key technical competencies of the PM will more than make up for his lack of classical PM training.

Neither is correct. To be successful the PM needs to have both sets of skills. Technical ability is critical for gaining credibility, and thereby influence, with members of the project team. On the other hand, lack of competence in the classical PM skills can lead to severe problems if a well-intentioned PM, however technically astute, fails to provide the objectivity that classical project management teaches.

Leadership

We have noted that a PM needs to have a very wide range of skills in order to do his job successfully. But there is one skill that is very critical for a PM. That skill is leadership.

Leadership is the ability to get others to commit to the project in order to accomplish the stated objective. A leader is someone who can get people to do things that they would otherwise not have done – in other words, someone who can get people to follow him or her. One of the biggest requirements for a leader is the ability to engender trust. People will not follow someone who they cannot trust. Therefore the leader must possess characteristics, and perform actions that lead others to trust him. This generally means that the leader lives up to high standards, sets goals that others respect, respects other people and shows it, and shows empathy for the team members problems and concerns. The leader must be honest with the team. He also needs to give them feedback, positive and negative, in such a way that people can improve and work effectively towards the project goals. If the leader cannot make people like and respect him, possessing the other traits will do little to achieve success. Charisma is also good, but you need more than just charisma. If the leader cannot back it up, things tend fall through in the long run

The leader has to have vision. This is another absolute 'must' for a leader. He needs to understand the vision and be able to communicate it effectively. Often, setting an example is important. Asking someone to do something you wouldn't do yourself is not really a valid request. If the leader stands up for what he believes, makes it known to others what his vision is, and in which direction he is headed, others are more comfortable following him.

One quality of leadership is good communication. Leadership is also the ability to motivate and empower people to do work. Demonstrating and using leadership and is a key to project success. It is also useful to use such skills to obtain the support of higher management, as this will add to the strength of requests from the PM.

The leader must communicate the vision for the project, organize and communicate the necessary information, form the right alliances with those who can help the project along, keep the team moving, and help the team overcome obstacles. As a leader the PM must be able to reason, make decisions, see the whole picture and think quickly and out of the box!

A true leader can ask people to do things and get results because the people respect him. But respect does not come automatically. Respect is earned. The leader must possess most of the characteristics mentioned here, and sometimes more, in order to gain that respect.

In a project, there are always people who do not report to the project manager. In the case of some organizations, the PM is often selected from the lower levels of the management ranks. In these cases leadership skills are invaluable, as the PM needs to have others assist the team in proceeding towards the vision for the project, and he cannot use rank to do this. Even with rank, politics can get into the way of someone who does not display strong leadership skills. So it is recommended that the PM work on building and demonstrating these skills at every opportunity.

Models do exist to describe leadership styles and management styles. The Bonoma Slevin Model is one such model describing the styles of leadership. This model divides leadership styles into four categories: Shareholder, Consensus Manager, Consultative Autocrat and Autocrat. The distinctions are created by the level of input that subordinates have to decisions as opposed to the leaders input, and the amount of authority the leader gives to the team in making decisions. Each leader falls into one of these categories, as shown in Figure 5. Once a team knows which category a PM fits, they can make some good predictions about how he will act in specific situations.

Bonoma/Slevin Leadership Model

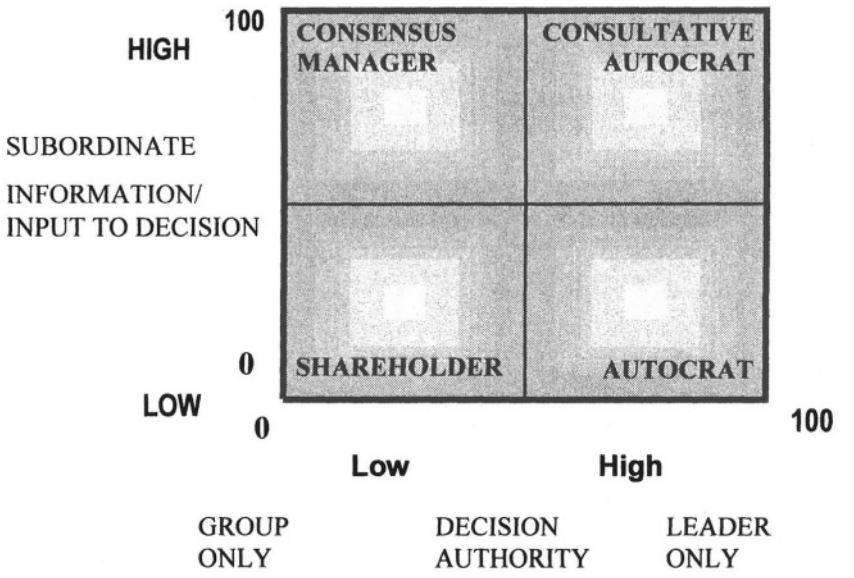


Figure 5

Slevin & Pinto, PMJ March 1991

Here are a few effective leadership techniques that project managers can use:

- ⇒ Use objectives for managing the team
- ⇒ Listen
- ⇒ Create a psychologically safe environment
- ⇒ Take time to encourage competence
- ⇒ Aim for quality
- ⇒ Keep group focused on goals

The fact that someone has a title does not in itself make that person a leader. The title does give the person authority, and with authority comes a degree of power. But a leader can gain power by other means if he does not have the title. Without the title the leader needs to use influence to get others to do things. Influence comes from many sources, including knowledge, who you know, having resources, strength, charisma, communication skills, using force, being annoying, reputation, humour, negotiation, education, experience, personality, common interests, and many more.

Team Building

As a project leader, a project manager must inspire a project team to meet all the project objectives. This must be done within one of the environments described above, which means that in some cases the team is not really a team in the sense of being organizationally structured as a team – but they must act as a team none-the-less if the project is to be completed within all the constraints. The project manager is responsible for creating a team atmosphere for this group of people, and getting them to operate as one, rather than as a set of individuals.

The PM and the core team are responsible for planning and executing all project activities. In every project there is a core team, and then there is one or more level of extended team as well. The core team should include all the functional skills required to complete the project. It is a subset of the stakeholders, and in fact a subset of the full project team. The core team is made up of the people who do the project work. One might ask whether it is work to say "That looks like a good proposal. I'll give you the money to do that project"? The sponsor does this. Is the sponsor on the team or not? Generally people would say that the sponsor is a member of the extended team, since he funds the project, and may also provide support when issues arise. But generally he does not work on this project activities on a day to day basis. So this is one example of someone who is a stakeholder, and even a member of the extended team, but is usually not a member of the core

team. It is mainly the core team that the PM must pull together, but the project will be even more effective if the extended team members also identify as themselves as part of the project. In fact, there is often more than one layer of extended team. In the case of the development of an e-commerce service, the core team might consist of marketing, engineering, operations, and programming managers from the company, and the first layer of the extended team might be the sponsor, the functional managers who meet biweekly with the PM to hear about the status and react to requests, and three contacts from the three customer departments who will be involved in the customer use of the service. The next layer of the extended team might be the people who work in those three customer departments, who will use the e-commerce system, and also implement the offering of their own services via the e-commence service to their customers. There might well be questions that the core team comes upon which need to be answered by members of the second layer of extended team.

The team might also vary over time –some people might work on the core team for some time, until the portion of the project that needs their skills has been completed, then move off the team for the duration of the project.

The PMBOK® GUIDE describes the Team Development process:

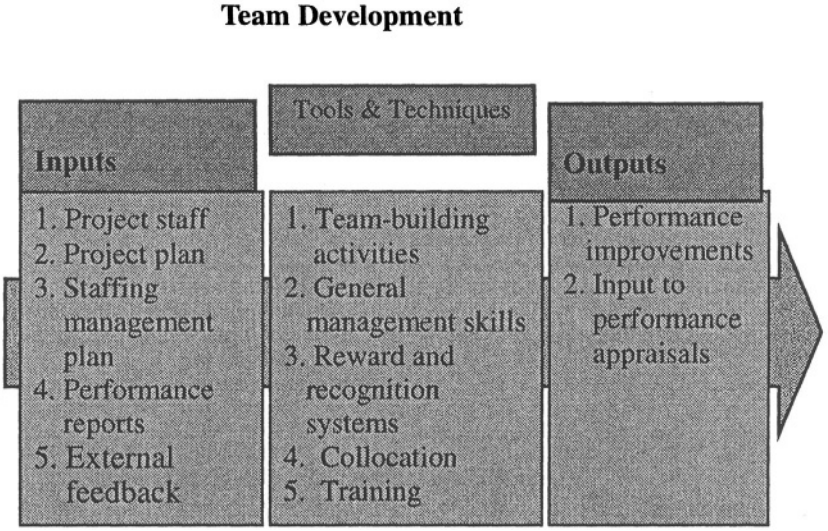


Figure 6

These processes encompass the actual selection of the team, the process of obtaining these resources, then also working with them. Although not all of this is team building, team building should be a factor throughout these activities. Right from the initial selection of team members, the PM must keep in mind both the person's technical skills and his interpersonal abilities. When the initial team is formed, the PM must initiate some activities that will help them to feel and act like a team. Then, as additional people come on board, the PM needs to ensure that the new people integrate well into the team, and that the changes they will undoubtedly create in the team dynamics are positive.

The PM should be aware that he needs to observe and manage the group dynamics in order to create the best atmosphere for the team. He needs to consider the roles of the individuals, and how the individual interactions will contribute to the group roles. The PM should work with the team to determine the type of culture that will be pleasant and motivating for them, and to build this culture within the team. The culture can impact everything from the frequency of meetings, to the sharing of information to the decision making methods, and even the amount of social interaction of the team members. They must all be comfortable working within the culture the team adopts.

The project manager needs to consider all aspects of the personalities of the people on the team, and ensure that he selects team members who will complement each other. Extroverts like to work on teams; introverts may prefer not to work closely with others. Generalists love projects with multidisciplinary teams while specialists prefer to work in their own area only. Thus the PM with a project requiring a multidisciplinary team but also some very specialized skills will have a challenge to help the specialists to feel comfortable inter-working with the other team members.

In order to create the right atmosphere for a professional team, the PM must build a relationship in which the team trusts him and each other. To ensure this, the PM should ensure that he always treats everyone fairly, and that he gives each team member responsibility, and the opportunity to excel in this responsibility. He needs to ensure that each member of the team is living up to expectations, and is acting in a way that supports the team and its goals. The PM must ensure that all team members, including himself, share any communication which is needed by the team. He must also ensure that all interactions amongst team members are at a professional level.

The goals of team building are:

- Having all team members committed to the project and its objectives
- Having all required skills and expertise on board
- Building consensus on project goals and objectives
- Ensuring that all team members enjoy working together
- Enabling cross fertilization of ideas (creativity and innovation)
- Engendering loyalty to the project
- Engendering loyalty and respect to the project manager
- Creating team spirit and building morale
- Engendering trust within the team interactions

There are many books on team building, with hundreds of suggested activities to help build and maintain a team atmosphere. A few such suggestions for project teams are:

- Build communication skills (times, paths, locations)

A suggested PM activity is to build a communications plan, with all required communications identified. Beyond this, the team needs to encourage and facilitate as much communication as possible, and to work on improving the communication skills of the team members so that these communications will be as effective as possible

- Conduct team building exercises

Often team building exercises are social outings, but it is also possible to reserve some of the time during a project meeting to play some small games that enable people to learn more about each other, and to build trust.

- Incorporate team building activities into project activities

This might happen by default, but it is best if the PM uses some energy to ensure that people do have the opportunity to do more than just focus on deliverables during the project. The effort spent in building the team will be more than paid back in success.

- Build a professional atmosphere

A professional atmosphere can be one of the strongest factors in building trust amongst team members. People who work in telecommunications are professionals, and they appreciate being treated as such. But a professional atmosphere is not easy to maintain without maintaining an ongoing focus on interactions.

- Present a challenge

A challenge does bring people together, and when people meet the challenge, this engenders respect from others. A challenge encourages people to work together to overcome obstacles, and meet goals.

- Set up a war-room

When the team has a place that they can go to work together, and a place to post ideas and information, this makes it much easier

- Team rewards

Team rewards do not have to be expensive, if the project cannot afford them. A reward can be having the PM or, even better, the Vice President deliver coffee to someone who has made a great contribution. People like to have meaningful contributions recognized.

- Be careful not to create yourself as a bottleneck to communication

The PM and every team member needs to ensure that communication does occur, and to ensure that nothing stops with them.

- Accept responsibility for your actions

Not many things can kill a relationship as surely as finger pointing. In the heat of the moment in a stressful environment, fingers do start to point, and the PM needs to create a culture which discourages this, and ensures that it is curbed immediately.

- Location

Co-location can help with communication, although this is not always possible in today's environment. If team members are not co-located, the team needs to work harder to create a team atmosphere

Every team has its own culture, so it is wise for the project manager to work to create the culture he would find comfortable for working, and hopefully he would do this with the core team so that they will also be comfortable. Together the team should develop team culture within desired bounds. Initially the PM would have team members define the cultural attributes they desire. It might even be wise to use the brainstorming technique at a team

meeting to allow all inputs to be considered. Before working to establish any particular state, the PM should ensure full acceptance of all desired cultural conditions. Once the end result is known, the team must define actions which will enable/build the desired cultural aspects. As the project progresses, the team should allow respectful reminders when someone's actions fall outside accepted culture. One basic principle that should apply in every case is the assurance of professionalism at all times.

Motivation

The PM must motivate all team members, to ensure project success in all dimensions of the project. Motivation is encouraging others to perform by fulfilling or appealing to their needs. No one technique or reward mechanism will work for all. Motivation is individual and situational.

Let's take a look at some theories of motivation. These are not new theories. They have been studied for many years, but still survive, indicating that there is probably merit in each.

- Maslow's Hierarchy of Needs
- Herzberg's Motivation-Hygiene Theory
- Mac Gregor's X/Y theory

Maslow's Heirarchy of Needs

Figure 6 shows the hierarchy that Maslow uses to illustrate different categories of needs.

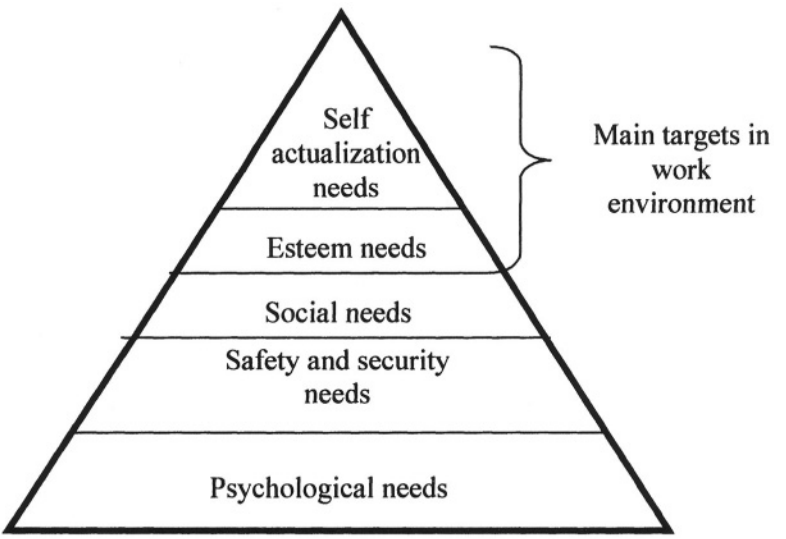


Figure 7

According to Maslow the needs at the lower levels must be fulfilled before a person can focus on the higher levels. Trying to meet higher level needs will not be effective if a lower need is not met. Since most business environments focus on the top two layers, people will find that there are times when efforts to motivate are unsuccessful. If the team members have unmet needs at the lower levels, anything that addresses the top levels will not be successful, because the person will remain focused on the lower levels until those needs are met.

Herzberg's Hygiene Factors

Herzberg divides factors into two categories, hygiene factors and motivations. The "Hygiene factors" or turn-offs are related to company policy and administration, to supervisory styles, to the interpersonal relations that exist for the person, to working conditions or salary, or possibly job security. Once this type of need is satisfied, doing anything more to meet the same need is not a motivation. At this point achievement and recognition can be motivators instead of things that address the environment. If any of these factors are not met, this is definitely a demotivator.

Motivators, or "turn-ons" include achievement, recognition of achievement, the work itself (nature and meaningfulness), responsibility and advancement. *Providing these will motivate team members.*

MacGregor's Theory X and Y

THEORY X (autocratic)

- People want situations well-defined; and to carry out orders
- Some people are strong, wise, aggressive and creative
- A manager gives orders, does not explain
- People want to be controlled and directed
- People are happy when under wise and tight control

THEORY Y (democratic)

- People have creative capacity and want to use it
- Most people can be developed to be wise, strong and aggressive
- A manager encourages participation in all decisions at all levels
- People want to make their own decision and resent coercion
- People are happiest when given wide responsibilities and will

Figure 8

In general, following principles presented by such theories, the some good motivational techniques include:

- Give people a sense of pride/satisfaction
- Recognition
- Empowerment – properly done
- Interesting challenging work
- Appropriate control
- Clear role definition
- Clear direction
- Professional environment
- Positive feedback
- Be honest
- Show respect

Many people believe that money is a motivation. Some people say that money is not a motivator. Herzberg says that absence of enough money is a

demotivator, but more money beyond 'enough' doesn't motivate people to work harder or better. For PM's this might be fortuitous, since project budgets don't always have the flexibility and resources to allow the PM to give people money. In fact, if money were the panacea that a lot of people think it is, many companies would be much more successful in retaining more of their key talent. Some people leave for reasons other than the money, or lack of it. In fact, in the heyday of the dotcoms, companies were almost throwing money at people, and in the end it didn't engender loyalty, or productivity. The volunteer culture is an excellent example of motivators other than money. People who volunteer clearly get something from it - so there are other very strong motivators that can be used, even when one has no ability to give money.

Managers understand that motivators are different for different personality types. Therefore it is necessary to know people well enough to know what drives them in order to know how to motivate them.

Recognition works in well all cases - as long as the recipient has respect for the source of the recognition. From this it follows then that it is important for the PM to generate the respect of the team members.

Dealing with Conflict

Even with all the team building, and the motivation, at some point every project manager will have to have to deal with a situation in which there is conflict. Conflict exists in all organizations and especially on projects organizations because there is usually high stress, often ambiguous roles for the team members, who might at the same time have multiple bosses. We need to understand conflict, and how to manage it.

Views of Conflict

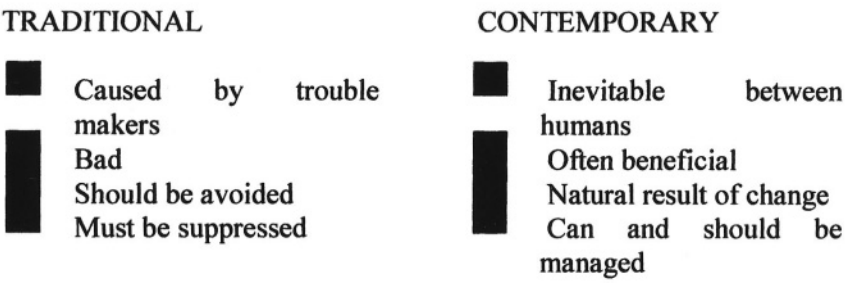


Figure 9

In one view, there are two types of organizations or people, those labelled traditional in Figure 9 and those labelled contemporary. The labels apply to management theories used by companies in North America. In projects conflict is definitely inevitable, and if it's going to be there, PM's must be prepared to manage it.

Many factors cause conflict, amongst them

- Communication barriers
- Conflict of interest/attitudes
- Differentiation in the organization
- Need for consensus
- Unresolved prior conflict

In spite of the fact that some people think that conflict is bad, and that most people do not like to be in conflict situations, there are some PM's who admit that they try to stir up conflict. Their reasoning is that there are benefits from conflict, and they want to take advantage of these. There are, in fact, benefits that can arise from conflict, but it takes proper management to ensure that the benefits do not outweigh the negative implications.

The benefits include:

1. Stimulation of a search for new facts or resolutions

When conflict arises, each party attempts to justify their opinion. This brings new information forward, and can have the end result of making everyone more aware, and possibly unearthing new possibilities.

2. Improved communication

As above, more information will be shared due to the conflict.

3. Diffusion of more serious conflict

If one conflict occurs and occupies the team, potential other conflicts can be avoided.

4. Increase in group cohesion and performance

When two parties have been through conflict together, even if they have been on opposite sides at the time, they can form strong bonds, having shared a difficult situation, and these bonds bring them closer together in the future.

5. Development of problem solving techniques

Recommended techniques for dealing with conflict are:

- Withdrawal
- Accommodating
- Compromising
- Forcing
- Problem Solving

Withdrawing, also called avoiding in some models, is passive, and while it alleviates the symptoms, it doesn't solve the underlying problem that caused the conflict. It is used in many situations, such as by parents with children, or in cases of potential physical violence because it can provide a cooling off period.

Accommodating, also known as smoothing de-emphasize differences between the parties and emphasizes commonalties in motivations or interests and goals. This solution can also clear the symptoms but the solution is only temporary. For those who are uncomfortable with confrontation, accommodating keeps atmosphere friendly.

Compromising is essentially bargaining to an "acceptable" resolution. While it might be necessary to use this technique in some cases, this is also a temporary solution which in the long term usually satisfies no-one but it is decisive.

Forcing or competing is just what it appears to be. Force should be used as a last resort, because it creates a win-lose environment, which fosters antagonisms. It does not resolve the underlying issue, but it is rapid and decisive, and when things are going in circles, it can be a welcome solution.

Problem Solving, also called collaborating or confronting is a solution in which the participants confront the problem, collect information, develop alternatives, analyze & select a solution that which meets all needs.

Principles similar to those of negotiation are used, such as separating the people from the problem. When a solution is found both parties can be satisfied, and all needs are met, so the underlying issue goes away - but it is time consuming.

Conflict Management Techniques

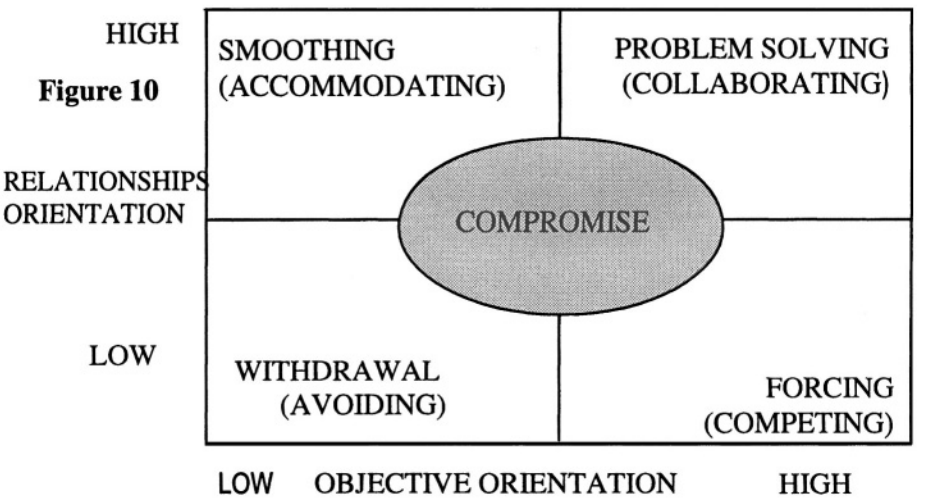


Figure 10

It is interesting to note that the quadrants in this model can be aligned with the quadrants in the Bonoma Slevin model described earlier. What this means is that if people can determine someone's leadership style, they should be able to predict how the person would deal with a conflict situation.

Another similar model is the Thomas Kilmann model, which has similar categories.

All of these techniques are valid for some situations and it is recommended that PM's use all of the techniques at different times. Consider when it would be useful to use each technique.

WITHDRAWING or AVOIDING
- When you cannot win
- When the stakes are low
- When the stakes are high, but you're not ready yet
- To gain time
- To unnerve your opponent
- To preserve neutrality or reputation
- When you think the problem will go away
- When you win by delay

SMOOTHING or ACCOMMODATING
- To reach an overarching goal
    - To create obligation for a trade-off at a later date
- When the stakes are low, or to gain time
- When liability is limited
- To maintain harmony
- When any solution will be adequate
- To create goodwill
- When you will lose anyway

COMPROMISE
- When both parties need to be winners
- When you cannot win
- When others are as strong as you are
- When you haven't time to win
- To maintain your relationship with your opponent
- When you are not sure you are right
- When you get nothing if you don't
- When stakes are moderate
- To avoid giving the impression of fighting

FORCING or COMPETING
- When you are right and stakes are high
- When a "do or die " situation exists

- When important principles are at stake
- When you are stronger
- To gain status or demonstrate power
- In short term, one shot deals
- When the relationship is unimportant
- When it is understood that a "game" is being played

PROBLEM SOLVING

- When you both get at least what you wanted and maybe more
- To reduce costs
- To create a common power base or to attack a common foe
- When skills are complementary
- When there is enough time
- When you want to preclude later use of other methods
- When there is trust
- When you have confidence in the other person's ability
- To maintain future relationships

Learning

Learning is a basic premise of Project Management. All team members should buy in to the need for project teams and members to learn – from their efforts, and from their mistakes. Mistakes must be allowed to occur, but used to effect positive growth. This is a difficult concept for many companies, who in fact punish people who make mistakes. But, if order for people to gain the most, projects should document what went right, and also what went wrong, so that information can be gained from the mistakes.

Every project manager should develop a culture of learning for the project. Then all team members should be encouraged to share and document all lessons learned. The post project review is then the tool to facilitate learning. But the organization must ensure that project lessons are made available to future project teams, and encourage the new teams to invest the time to review and digest the lessons early in the new project.

All of these topics – leadership, team-building, motivation, dealing with conflict and learning are thoroughly covered in psychology and management literature. Theories presented here are not new, but are still widely accepted. Research continues in these areas, and many books are published to assist managers. A wise PM will develop these skills, and always be on the lookout for new, more effective techniques.

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Chapter 10

QUALITY

Inherent in the project design, as well as the product design, we must find quality. Everyone on the team must contribute to producing quality results. Engineering will often be the lead for the quality planning and implementation, and of course the PM has the overall accountability for quality.

There are three processes associated with quality – quality planning, quality assurance and quality control.

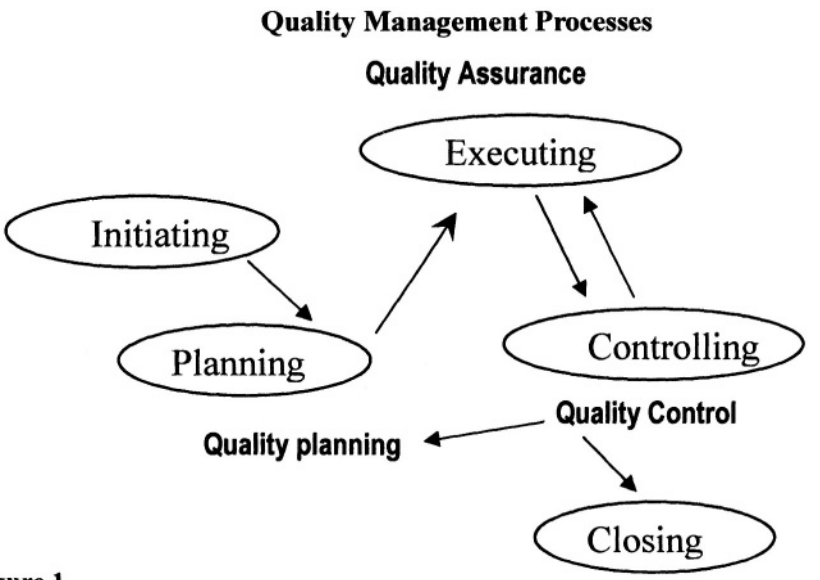


Figure 1

Quality Planning is identifying which quality standards are relevant to the project and determining how to satisfy them. Quality Assurance is the evaluation of overall project performance on a regular basis to provide confidence that the project will satisfy the relevant quality standards. Quality Control is defined as the monitoring of specific project results to determine if they comply with relevant quality standards, and identifying ways to eliminate causes of unsatisfactory performance. Lastly, Quality Management is determining and implementing the quality policy.

If the customer defines the expectations, and the team gets agreement on these, this sets the quality standards. But if the team sets the standards, and the customer doesn't agree, it doesn't matter how well the product meets the standards, the client will not be happy. So it is crucial that there be early agreement on the standards. It is recommended that this agreement occur before the project parameters are set. Otherwise the team may not have the right type and amount of resources to meet the quality requirements: a set up for failure. It is the responsibility of the PM to ensure that there is full buy-in to the standards at a detailed level, then to manage the expectations as well as the project.

Since quality standards have to be set, these must be communicated, agreement must be reached, work must be monitored, and continued communication is required, it is obvious that there is a cost to producing quality. This cost includes not only the cost of the work mentioned, but also any cost that is incurred to meet the standards that are set. This cost can be considerable. On the other hand, what is the cost of not meeting agreed upon standards? Possibly dissatisfaction with the whole project, which might have consequences like non-payment for the work, non-acceptance without significant rework, loss of future business, difficult working environments if there is future business with the customer.

Who is the customer? In some projects the answer to this question is obvious. The project is in place to satisfy an external client or set of clients. In other cases, the project deliverable might be going to someone internal. There is always a customer, and this is the person or group whose expectations need to be met.

Most quality programs were put into place for corporations rather than for projects, but the principles apply well to projects in most cases. Let's look at a few of these programs.

1. QUALITY MODELS

W. Edwards Deming was one of the world's leading experts in quality management. He gave 14 points which will lead to quality management.

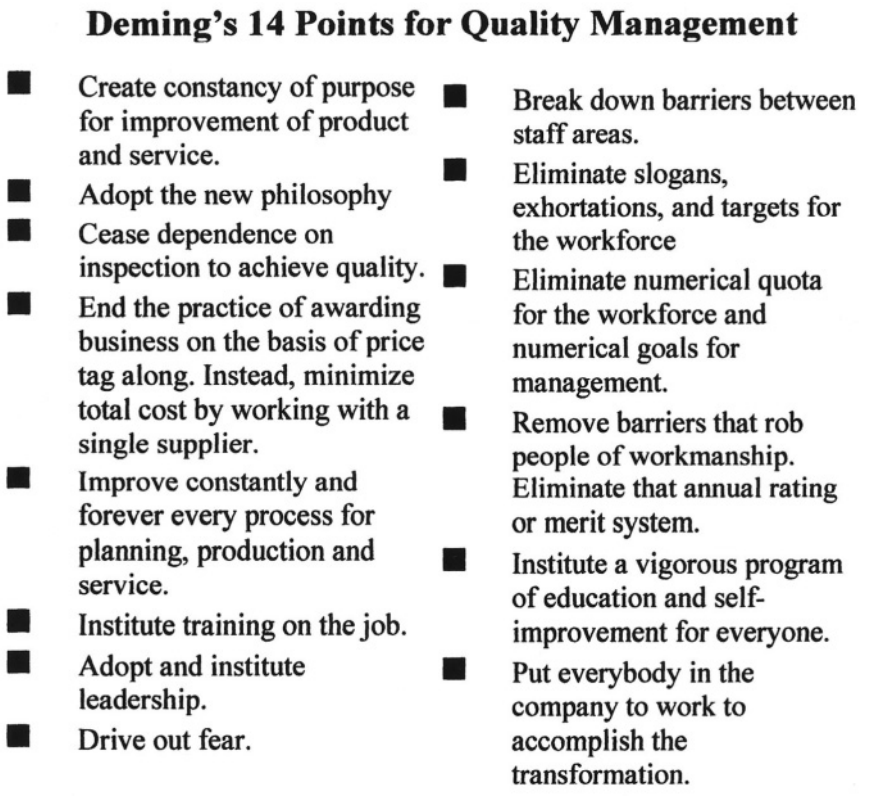


Figure 2

Another quality guru, Joseph M. Juran recommends 10 steps to producing quality, which look at the issue differently.

Juran's 10 Steps to Quality Improvement

- Build awareness of the need and opportunity for improvement
- Set goals for improvement
- Organize to reach the goal (establish a quality council, identify problems, select projects, appoint teams, designate facilitators).
- Provide training
- Carry out projects to solve problems
- Report progress.
- Give recognition,
- Communicate results.
- Keep score.
- Maintain momentum by making annual improvements part of the regular systems and processes of the company.

Figure 3

Crosby suggests 14 steps which are slightly different.

- Make it clear that management is committed to quality.
- Form quality improvement teams with representatives from each department.
- Determine where current and potential quality problems lie.
- Evaluate the cost of quality and explain its use as a management too.
- Raise the quality awareness and personal concern of all employees.
- Take actions to correct problems identified through previous steps.
- Establish a committee for the zero-defects program.
- Train supervisors to actively carry out their part of the quality improvement program.
- Hold a "zero-defects day" to let all employees realize there has been a change.
- Encourage individuals to establish improvement goals for themselves and their groups.
- Encourage employees to communicate to management the obstacles they face in attaining their improvement goals.
- Recognize and appreciate those who participate.
- Establish quality councils to communicate on a regular basis.
- Do it all over again to emphasize that the quality improvement program never ends.

Figure 4

Common threads can be seen through all of these approaches. These are:

- demonstrate the management commitment to quality
- involve all employees in the production of the quality
- measure the quality of the results
- reward the desired behaviours

However, Deming does also say that quality is a management responsibility. Poor employees do not produce poor quality – poor management does. So management cannot pass off the responsibility to anyone. In the case of projects, this makes the PM accountable overall for the quality of the deliverables.

In Project Management A Systems Approach to Planning, Scheduling and Controlling," Harold Kerzner provides some good insights into the problem of quality management and some suggestions for success in this area. His observations span a wide range of potential actions and they are quite consistent with the principles espoused by the gurus. Kerzner says that quality is everyone's responsibility, including white-collar workers, the indirect labor force, and the overhead staff. Defects should be highlighted and brought to the surface for corrective action. Quality problems lead to cooperative solutions. Documentation of "lessons learned" is essential so that mistakes are not repeated. Improved quality saves money and increases business. Quality is customer focused. People want to produce quality products do so. Quality occurs at project initiation and must be planned for within the project. Let's analyze this further, since there is so much information packed into these few sentences.

Quality is everyone's responsibility. This is consistent with what has already been said, but this takes it further. When work is done, everyone who has an impact, even an indirect impact, contributes to the quality of the results. This means that the project team needs to ensure that all project participants are aware of the quality standards, and are willing to contribute to meeting them. And this might necessitate having to compensate for some outside influences, if these influences cannot be brought into line with the project quality standards.

Defects should be highlighted and brought to the surface for corrective action. We should ensure that we evaluate project deliverable results, to ensure that these meet the standards. If we find that something falls short, in

spite of the other project pressures, we need to take corrective action, in order not to risk producing unacceptable results later.

Quality problems require cooperative solutions. The team needs to work together to solve quality problems. Problems may occur within the responsibility area of one individual, and sometimes this person can implement the correction, but in many cases the problems exist because of the influences impacting the person or group not meeting the standards, and this brings out the need for cooperative action to reach the desired results. People generally do not produce poor quality work because they want to, or don't care. The cause is usually related to influences from others.

Documentation of "lessons learned" is essential so that mistakes are not repeated. Documenting lessons learned is a technique used in project management to benefit from any mistakes that have already been made. When people take risk, there is a potential for mistakes. In projects there is a need to take risks, since projects produce change. Therefore there will be some mistakes. The idea is that we need to learn from these mistakes, as opposed to blaming and punishing the people who make them. If people are placed in positions where mistakes are certain to happen, it is only professional to tolerate some mistakes, as long as the people involved acted to the best of their ability. However, it is not wise to make these same mistakes again. To prevent this, we need to document them, make the potential known, and ensure that people working in similar situations in the future will be forewarned not to make the same mistake again. This requires maturity on the part of the overall management involved. If this is not yet there, the project teams will have to work to educate the company about the value of these principles.

Improved quality saves money and increases business. This was discussed above. Just as poor quality can lose business, better quality can attract new or additional business, this leveraging the return on the investment in planning and producing it.

Quality is customer focused. There is no point in producing something that does not meet the customer requirements. Not so obviously, producing something that is much better than the customer needs may also create a negative reaction, if the customer thinks that he is paying extra for something he does not want.

People want to produce quality products. This implies that management should take a positive view of the intentions of the employees and the project

teams. If poor results have been obtained in the past, look for a cause other than poor motivation on the part of the workers. People do want to do a good job, and will do so, unless some influences make this too difficult for them.

Quality occurs at project initiation and must be planned for within the project. As discussed, we need to set our standards early, before the work begins, and then engineer the project to ensure that the resources are in place to allow the appropriate quality to be produced.

Kerzner also outlines the factors which affect quality, and these should be kept in mind as project planning proceeds. They are generally related to the product that the project is producing.

- Salability: the balance between quality and cost
- Produce-ability: the ability to produce the product with available technology and workers, and at an acceptable cost
- Social acceptability" the degree of conflict between the product or process and the values of society (i.e., safety, environment)
- Operability: The degree to which a product can be operated safely
- Availability: the probability that the product, when used under given conditions, will perform satisfactorily when called upon
- Reliability: The probability of the product performing without failure under given conditions and for a set period of time.

Quality requirements can be actively expressed, but sometimes they are only implicit. In fact, included in every project there will be some standards that are implied. It is not always possible to state everything explicitly, yet people have a right to expect certain standards will be met. To give a simple non-project example, let's consider a recent experience. While traveling in Europe, staying in hotels that were not modern, and also not cheap, a group of North American professionals began to wonder whether they should have specified that they wanted a bed when they booked a hotel room. Each new room was different from the last, but each time many of the things the people were used to getting in a hotel room were missing – things like note paper, shampoo, a bathtub. And whenever they asked about the things they wanted, the general reaction was "Oh. You wanted that. Well, we could have provided it, if you had requested it with your booking. While these things were included as basic in the minds of the travelers, they were not basic in the minds of the hoteliers. Hence the need to define the requirements, and the level of quality. The bed, fortunately, seemed to be considered an implicit requirement by all parties. The more clearly the standards are defined, the higher the probability that they will be met.

Of course, the customer sets the expectation levels – but if the customer is not able to clearly state what he is looking for, the project team must work with him to ensure that there are commonly understood specifications. For example, suppose you are designing a new electronic service to be offered publicly. How can you determine the specifications, so you can design something that you are quite certain will be attractive to all stakeholders, especially customers? The requirements can probably be determined from market studies. To determine the quality standards it will often be necessary to hold focus group discussions, or even better, to build a sample or simulation of the proposed service, and run a trial. However, just building the prototype can be quite expensive and time consuming, so there could be a high cost to just obtaining the right quality standards.

Quality specs need to be stated in such a way that common understanding will occur. This might mean including diagrams, or referencing standards, or just clearly specifying what is expected, and how this would be measured. They should be specific enough that they can be measured.

For projects and products which have high yield outputs - i.e.. Many boxes, many screens, many response times - statistical analysis techniques can be used to determine the extent to which quality standards are being met. We will mention a few of these within this chapter. For projects without high volumes, quality must be determined by direct comparison to defined and agreed to expectations.

Statistics might also be employed to measure the quality of the product. In a production environment, with products produced in high quantities, sampling is often used to measure the quality of the product. In a telecom service, samples or full statistics can be used to measure items such as response time, call answer time or MTTR. In manufacturing, products from assembly lines can be evaluated. In the upcoming discussions, it is assumed that the reader has a basic understanding of statistical terms such as probability distribution, mean, standard deviation, and variance.

Some statistical techniques that might be used in the determination of quality are:

- benchmarking
- Pareto Charts
- cause and effect diagrams
- histograms
- statistical process control

Benchmarking is frequently used in the definition of telecom services. Here benchmarking is the comparison of the a new service to one which already exists, where both are probably targeted towards the same market segment, and the existing service is known to be successful, to determine the best service characteristics to include in the service under development. Similarly, in projects, people often study another project with similar objectives or product components to determine the best processes to use on their project to ensure quality results.

Pareto was an Italian economist who studied ways to improve life for people in Italy. He originated the well-known 80/20 rule, which today is widely applied to issues in almost every area. His premise was that 20% of the people will always make 80% of the money. Therefore improving the lot of the poorest people will only cause a shift in the balance, or a raising of the overall curve, because after the change, 20% of the people will still have 80% of the money. This is widely applied in telecommunications. 20% of the trouble calls take 80% of the effort to resolve. 80% of the revenue comes from 20% of the customers. Etc. The Pareto rule can be modified to predict that 80% of all problems are caused by 20% of the causes. We can use this technique to help in solving problems.

For example, suppose that following the installation of new fiber facilities throughout three major cities, a number of troubles have been found. Some troubles occur in each city, and others (most) occur in only one location. In testing the facilities, the technicians have identified about 15 different problems which they have listed. A summary of the lists can be created. The technicians now need to locate and fix all of the problems, but finding and fixing all of the problems will take quite a lot of manpower and time. The first step in the Pareto analysis would be to create the summary list identifying the problems and the frequency of occurrence of each. Then to maximize the return on the effort, for those two (or other meaningful number) problems which occurred most frequently, estimate potential causes. The list of causes of each problem can also be summarized, and the probability that each would be the cause can be estimated. This then gives the technicians a basis for selecting the approaches which are most likely to yield the desired return in the shortest time. In fact, in real life, many telco technicians do this automatically, without taking the trouble to make the lists and show the numbers. But the process is applied nevertheless. On projects, the documentation of such processes can be kept to show what certain paths were taken over others.

Using the cause and effect technique, the analyst uses a systematic methodology to analyze the cause of each major defect, then determines corrective actions for the most significant causes. In the case of the fiber installation above, he could look for causes that fall into various categories, such as those that are due to human error, are due to measurement error, are due to equipment failure, or time of day, or installation methodology, or even the environment – say water in the ducts.

Histograms can be used to illustrate the relative frequency of problems, and to decide which to tackle for the best return. For example, Figure 5 shows the problems that occur in the use of a web site. We can quickly see that we might first want to tackle the entry of the payment information, first because it has the highest frequency of occurrence, and also because there is a high impact if people cannot pay properly. The team needs to brainstorm possible causes, and investigate those that are most likely, in order to fix this problem with the least loss of time and effort.

Histogram

Our website offers visitors the opportunity to purchase a variety of phone sets, mobile phones pagers, and answering devices. Problems reported by people using the site are logged. Some sample results show:

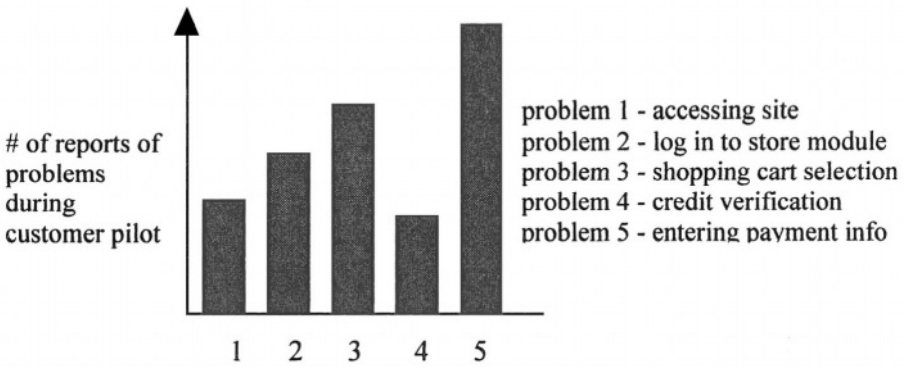


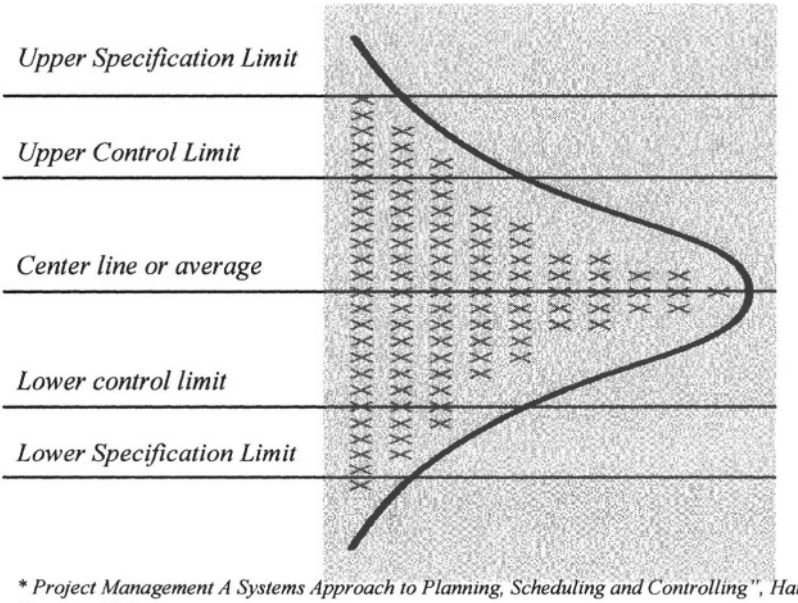
Figure 5

Statistical process control is the comparison of values obtained by sampling to pre-established control values, in order to determine when action

needs to be taken to meet the set standards. The goal is to produce a service or a product that conforms to design specs or, in the case of projects, to use processes that allow the project management to produce the results required. The process is as follows:

1. Select a parameter to be measured (i.e. call answer time, number of billing errors, computer response time, download time etc).
2. Set the desired (mean) value for the parameter.
3. Set upper and lower control limits (range within which values are acceptable).
4. Determine % of values which can tolerably fall outside the control limits (control limits should be tighter than specification values).
5. Sample.
6. Take action as appropriate when "too many" values fall outside the required range.

The Control Chart



** Project Management A Systems Approach to Planning, Scheduling and Controlling", Harold Kerzner, Ph.D.*

Figure 6

Examples of control and specification limits are shown in Figure 6 above.

Many companies have elected to impose rules that define the proportion of production that they will tolerate falling outside of the specification limits. For example, operating companies specify for internal measurement purposes that 99.999% of the time the network will be available for calls. This means if we were to check all call attempts made, no more than .01% will have failed to connect due to a network failure. Note that this specification typically refers to network failures only, not call failures due to overloading of capacity.

If this stringent specification is to be met, the telephone company cannot wait until it starts seeing a .01% call failure rate before taking action. Obviously at this point, the specs are not being met, and further failed call attempts will no doubt occur while the telco analyzes and fixes the problem. To head this off a control level must be set which is stricter than the desired success rate, sufficiently more rigorous to allow the telco time to resolve the problem.

The most common techniques used are called **3σ** and **6σ,** representing failure rates that are represented by three and six standard deviations from the mean in a normal distribution. In a **3σ** standard, we specify that the upper and lower specification limits are **± 3σ,** in a **6σ** standard, correspondingly at **± 6σ.**

In a normal distribution, the percentage of values falling within the acceptable range is shown for 1, 2, and **3σ** thresholds. At **6σ,** this rises to 99.999%, a stringent requirement indeed!

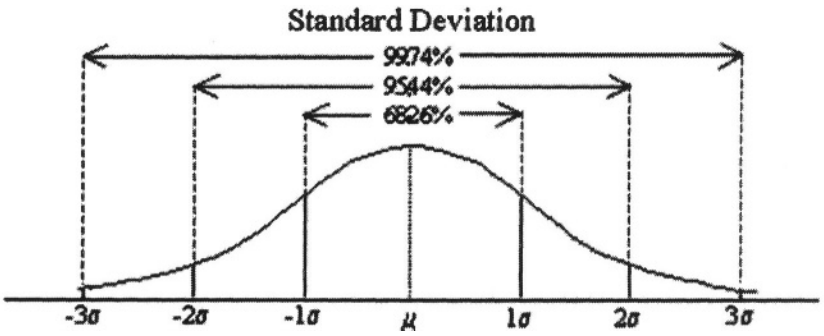


Figure 7

There are many quality programs such as TQM and the ISO standards. Each has it's own criteria and methodology for ensuring quality. If one such technique is used by the company, this one should also be used by the

project. Using one of these techniques for a project only, rather than corporately would probably create too much overhead for a project. But some technique should be used on every project to control quality. As one illustration, let's look at the TQM process. The steps are:

- Solicit ideas for improvement from employees.
- Encourage and develop teams to identify and solve problems.
- Encourage team development for performing operations and service activities resulting in participating leadership.
- Benchmark every major activity in the organization to ensure that it is done in the most efficient way.
- Utilize process management techniques to improve customer service and reduce cycle time.
- Develop and train customer staff to be entrepreneurial and innovative in order to find ways to improve customer service.
- Implement improvements so that the organization can qualify as an ISO 9000 supplier (or other selected standard).

Finally, the team needs to put in place quality audits. The responsibility must be assigned to someone. The timing of the audits should also be specified to ensure that these are completed within the project timeframes.

As stated above, generally engineering will ensure that definition, design and development are structured to produce the best possible results.

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Chapter 11

ETHICS

Ethics (Greek *ethika,* from *ethos,* "character," "custom") are principles or standards of human conduct, sometimes called morals. Ref.

"Ethics," Microsoft® Encarta® Online Encyclopedia 2003 http://encarta.msn.com © 1997-2003 Microsoft Corporation. All Rights Reserved.

From the Encarta, we find that:

Philosophers have attempted to determine goodness in conduct according to two chief principles, and have considered certain types of conduct either good in themselves or good because they conform to a particular moral standard. The former implies a final value, or *summum bonum,* which is desirable in itself and not merely as a means to an end. In the history of ethics there are three principal standards of conduct, each of which has been proposed as the highest good: happiness or pleasure; duty, virtue, or obligation; and perfection, the fullest harmonious development of human potential.

Many companies, and most organizations, subscribe to a code of ethics. For example the codes for the Institute of Electrical and Electronics Engineers (IEEE) and for the Project Management Institute (PMI) are shown.

Project Managers are responsible for determining the ethics that are to be used by the project team, for ensuring that all team members are aware of these rules, and then ensuring that everyone acts in a totally ethical manner at all times during the project. This is obviously a challenging assignment,

but it is critical that the PM assumes this responsibility, and that all team members act in an ethical fashion at all times.

PMI MEMBER ETHICAL STANDARDS

MEMBER CODE OF ETHICS

The Project Management Institute (PMI) is a professional organization dedicated to the development and promotion of the field of project management. The purpose of the PMI *Member Code of Ethics* is to define and clarify the ethical responsibilities for present and future PMI members.

Preamble:

In the pursuit of the project management profession, it is vital that PMI members conduct their work in an ethical manner in order to earn and maintain the confidence of team members, colleagues, employees, employers, customers/clients, the public, and the global community.

Member Code of Ethics

As a professional in the field of project management, PMI members pledge to uphold and abide by the following:

- I will maintain high standards of integrity and professional conduct
- I will accept responsibility for my actions
- I will continually seek to enhance my professional capabilities
- I will practice with fairness and honesty
- I will encourage others in the profession to act in an ethical and professional manner.

Also from the Encarta, we learn that through history morals and ethics have developed because they were necessary for the well being of the group. Why would projects be any different?

For as long as people have been living together in groups, the moral regulation of behaviour has been necessary to the group's well being. Although the morals were formalized and made into arbitrary standards of conduct, they developed, sometimes irrationally, after religious taboos were

violated, or out of chance behaviour that became habit and then custom, or from laws imposed by chiefs to prevent disharmony in their tribes. Even the great ancient Egyptian and Sumerian civilizations developed no systematized ethics; maxims and precepts set down by secular leaders, such as Ptahhotep, mingled with a strict religion that affected the behaviour of every Egyptian. In ancient China the maxims of Confucius were accepted as a moral code. The Greek philosophers, beginning about the 6th century BC, theorized intensively about moral behaviour, which led to the further development of philosophical ethics. Ref: Encarta

The team must be clear about the ethical standards to be applied in the project work, and to subscribe to these. Particularly in the technical areas, but also on the project as a whole, engineers must ensure that their own behaviour and in fact all behaviour of project personnel is ethical. Some projects are multi-company, and even multinational. In these projects, teams may find themselves dealing with people who subscribe to different ethical codes. Most of the basic standards will be the same everywhere, but there can be deviations which must then be identified, understood and resolved as much as possible. This can cause stress and problems for the team members in both areas. If this is the situation on a project, the project manager should be aware of the situation, and may need to clarify for the team which standards are to be followed for the project. As long as the standards do not conflict, the team should honour both sets. If there is a conflict, the PM must decide which to follow, and this should be done with input from the team, and discussion. This can be one of the more challenging aspects of project management on such projects.

IEEE Code of Ethics

We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

1. to accept responsibility in making engineering decisions consistent with the safety, health and welfare of the public, and to disclose promptly factors that might endanger the public or the environment;

2. to avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist;

3. to be honest and realistic in stating claims or estimates based on available data;

4. to reject bribery in all its forms;

5. to improve the understanding of technology, its appropriate application, and potential consequences;

6. to maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;

7. to seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others;

8. to treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin;

9. to avoid injuring others, their property, reputation, or employment by false or malicious action;

10. to assist colleagues and co-workers in their professional development and to support them in following this code of ethics.

Approved by the IEEE Board of Directors, August 1990

Chapter 12

EARNED VALUE

Earned Value is a tool which enables project managers to determine where the project stands in relation to the budget and the schedule, even on projects with hundreds or thousands of activities, some of which are on track at any given time, while others are either ahead of schedule or behind. Since Earned Value refers to cost, this concept could have been introduced in Chapter 7 with the other financial concepts. Or, since Earned Value shows the status of the Schedule, the concept could have been introduced in Chapter 8. But, given that the main value is as a tool for project management, this project management chapter seems to be the best place to cover this very important concept.

In order to describe this concept, we use the terms already mentioned in Chapter 7:

BCWS- budgeted cost of work scheduled or **PV** – planned value
BAC- budget at completion
ACWP- actual cost of work performed or **AC** – actual cost
EAC- estimate at completion

The PMBOK® Guide uses the terms PV and AC. Both terms are included here because some people use one version, while others use the second version. Then we add some additional concepts, related to the amount of work completed, and the overall schedule and budget status:

BCWP- Budgeted cost of worked performed = Earned Value
CV- Cost variance - which is BCWP - ACWP
SV- Schedule variance - which is BCWP - BCWS

BCWP is also called Earned Value (EV). Using this tool at any point in time we can evaluate the amount of work actually completed. Then we calculate the dollars that were budgeted for completing that work. The cumulative graph of these budgeted costs is the budgeted cost of work performed. Let's walk through this.

First, we have a list of project activities. For each of these activities, we have a planned cost, or the amount that we budgeted to complete that activity. And, for each, we have a start date and a finish date in the schedule. At any given point in time some activities will have started, some will not, and others will be finished. If we can get a solid estimate of how far along each of the activities is at the point in time – and this is a big if in itself – then we can determine the overall status of the project using Earned Value.

Let's look at this graphically.

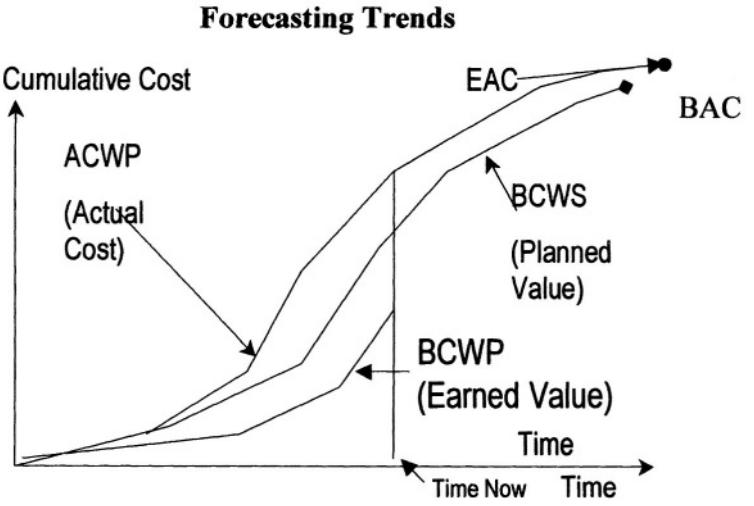

Figure 1

The Earned Value is the Budgeted cost of Work Performed. What does this mean. For any item there is a budget. If we have completed that item, we have obtained a value. What value? According to our plan, the value of that item is the amount that was budgeted. So we have obtained the value that was in the budget. Note that this does not reflect in any way the actual cost to obtain this value. The cost of this item might have been higher then, the same as, or lower than the budgeted value. If the actual cost was higher, then for this item we are under budget; if lower we are obviously over budget. If

we can calculate this amount for each of the action items, then we can determine for the project as a whole whether we are over budget, under budget, or on track financially.

For items that have not yet started, the value obtained is zero. But for items that are partially completed, things become more complicated. Someone has to determine the value obtained for each of these. Probably the best way to determine this value is to ask the people working on the activity how much work has been completed to date. This needs to be done carefully. Most people feel that they have worked hard, and accomplished quite a lot when they are working on activities. It is quite common for people to estimate that an activity is 80% finished, then find that the last 20% of the work takes 80% of the time. So, in order to balance this, the PM should ask how much work is remaining on the item. An estimate of the remaining work, subtracted from 100%, should give a more accurate reading of the percentage complete. Once this percentage completion is known, we know what percentage of the value has been obtained. We can then multiply the budgeted amount for the activity by this percentage to calculate the value obtained to date, or the earned value. Again, when we have all of the earned values, we can add these to get the overall EV for the project. This can then be compared to the actual cost to determine the budget status, called the cost variance, (CV) and to the planned value to get the schedule status, called the schedule variance (SV). See figure 1.

CV = BCWP-ACWP
SV = BCWP-BCWS

Forecasting Trends

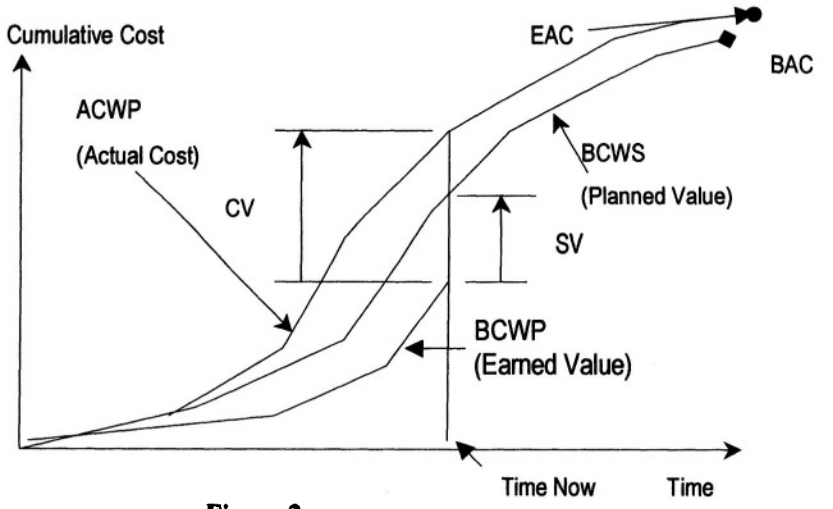

Figure 2

This technique can be used to identify trends early. In fact, problems will show up even if these are masked by the usual calculations of actual cost versus budget. Because it takes all related factors into account, even on a complex project, this technique can unearth problems that are undetectable using other methods of analysis. Because this tool identifies potential problems early, the PM should start using this technique early in the project.

Additional information can also be calculated, if required, as shown in the following formulae.

- SPI: Schedule performance index is BCWP/BCWS or EV/PV
- CPI: Cost performance index is BCWP/ACWP or EV/AC
- EAC = BAC/CPI
- ETC = EAC/ACWP
- VAC: Variance at completion BAC- EAC
- TCPI: To complete performance index (BAC-BCWP)/ (BAC-ACWP) or (BAC – EV)/(BAC-AC)
- Percent complete BCWP/BAC or ACWP/EAC

However, be careful in using such calculations. You must know more than the numbers to apply these formulae properly. If people have been working hard, but facing some difficulties in the work, and these are expected to continue, so that the project is expected to progress at more or less the same rate as it has been progressing in the past, then the formula for EAC can be used. However, if the current variances are negative due to some significant one time problems that occurred in the early stages of the project, then the formula does not apply, because the performance indices are valid for the conditions experienced to date, not for those expected in the remainder of the project. In that case, to calculate the EAC, the PM would have to get estimates for cost to complete each of the remaining activities, add these, and then add on the cost to get to the current point. That would give the actual estimate to completion. Another technique which should give a reasonable estimate in these circumstances would be to calculate the amount budgeted for the work remaining, and add this to the actual cost to date. Since the remaining work is expected to proceed according to the original plans, this should give an accurate completion estimate.

To look at another parameter, consider CPI. CPI is a productivity measure. It is measuring how well the project is doing against the planned budget. If it is less than 1, then the project is in trouble. The same is true for SPI. If it is greater than 1 then the team has completed more work than planned by this time (SPI). But be careful in making this assessment. Maybe the team put a large amount of contingency into the early portion of the

schedule to help cover for a risk, but it did not happen. So that contingency may not have been needed yet. The project will appear to be doing better than budget. However, if the contingency is needed later instead, this would bring the index down at that time.

In summary, earned value is a valuable tool. Some of the benefits of using it are that it shows trends early, so that these can be dealt with. It allows calculation of completion time even when the order of tasks is shuffled. The calculations can be done by milestone or by discipline if desired. These calculations can be combined with critical path analysis to give an even more comprehensive picture of the project status.

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PART III ROLES OF TEAM MEMBERS

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Chapter 13

SALES & MARKETING

Many projects start with activities that originate in the sales and/or marketing groups. These groups identify an opportunity, and work with customers to create a customer request for a product or service. Sales may even drive the project definition to a very detailed level by submitting a bid requiring new product development. In the early stages we need to build as clear as possible a description of the purpose and scope of the project, so that all stakeholders will understand what is to be done, and to ensure that the aspects of cost, time, and quality can be clearly planned. If the project is a sales or marketing-driven project, or one that involves these job functions, the departments will be integrally involved throughout, although the most obvious contribution of these groups is during the definition phase. But even in the case of projects for customers, which are sold by sales and marketing but implemented by others, it is wise for sales and marketing to remain involved from time to time – especially sales – to maintain the desired relationship with the customer. In this chapter we will discuss the project definition and scope, from the early stages of the interaction with a customer through to the development of a detailed scope statement. We will also explain the technique of developing a work breakdown structure. The need to have strong sales/marketing involvement in the scope development will be evident as the discussion enfolds.

It is important to distinguish between the sales and marketing functions. Sales is a line function which deals directly with customers. Sales people often have quotas they must meet, selling services or products. While the main job of the sales group is obviously to bring in the sales revenue, this is primarily an ongoing operational function; the prime project responsibility of

a sales department is to own and manage the project team's relationship with the customer. Sales people usually handle all or at least multiple products.

Marketing is a staff function that uses customer input re: needs and requirements to develop and manage product lines. The prime project responsibility of this group is determine which potential projects are desirable and to justify the use of the company's resources to undertake them. A subset of the marketing organization has a line function in producing marketing communications, and running advertising campaigns. This group is often treated as a separate team member with contributions later in the project. Hence sales involvement in projects differs from marketing involvement.

In Chapter 17 we discuss the project lifecycle, and the phases into which a project can be dissected. Here we will briefly introduce the concept of dividing a project into phases. As a project progresses the nature of the work evolves through different stages, and it is these stages of the work that are discussed in Chapter 17. Each phase of a project exists to meet certain objectives. For example, the first stage, Project Initiation and Definition, is the point at which the overall goals and objectives are defined, and the reasons for the project are clarified. In this phase of the project, the marketing group often takes a leadership role in prioritizing and justifying the project. At this stage there are often not many people involved, because organizations generally evaluate more than ten times as many potential projects as they activate, so teams are kept small until a decision is made to move forward. In this initial phase we want to determine whether or not this specific project is worth doing. In order to determine the goals, objectives and general deliverables, the initial project team will ask, and hopefully answer, many questions. The answers to these questions will allow decisions to be made on whether further resources should be allocated to the project.

Questions for this initial phase will certainly include:

What is this project?
What are we doing?
What are we producing?
Why are we doing this?
What would happen if we didn't do it?
Is this the right thing to do?
Is there something better we could do to meet the same goals?

And if we do decide that this is something we really do want to do, then we need to ask questions such as:

How would we do it?
When?
If I can figure out all the things I need to do, when will I do each one in order to be done in time to meet the required finish date?
Who do I need?
What technologies might be used to produce the end result?
What's the best way to do it?

Those questions we have to ask at the beginning of every project, no matter who initiated it, or who will do the majority of the work, no matter whether the project is in place to solve a problem or to take advantage of an opportunity. And while the marketing group may find that the answers to these questions might be very evident to them, others who will be involved in the project will still need to ask these questions, and to understand and accept the answers before they will be able to produce the required results. No matter what the nature or importance of the project, and no matter how far sales and marketing have taken the project initiative before bringing others into the loop, the team and the stakeholders will have to ask and understand these questions before they become fully engaged. Therefore, from the beginning the project, originators need to ensure that they allow time to have these questions answered and to have the answers digested by the appropriate parties. Given that this must occur, it is generally recommended that those who will need to be involved in the later stages of the project be involved as much as possible in the first stages of the development. This not only reduces the learning and acceptance time later, but it will also allow the project definition and design to incorporate answers to the needs and concerns of the team.

In many cases the sales or marketing groups may attempt to take the project as far as possible without involving others, in hopes of ensuring that the design will be dictated strictly by the needs of the market. This might be a good way to meet the customer needs, but if, in doing this, the needs of other parts of the project team or the company as a whole are not met, serious problems will eventually occur. The result of this could well be delays, and possibly design changes, later in the project. Even when dissention is expected when certain departments or team members come on board, it is better to have this resolved at the early stages, before much of the cost has been incurred.

Therefore it is best to bring together as many people from the team as possible at an early stage, and to jointly address the initial questions: What's to be done, why are we doing it, what are the risks in doing it? Not doing it?

Using new technology? Old technology? Etc. There are many such questions that should be asked. When should we expect the major deliverables? When do we need the product marketing material to be printed? If I am going to do a web page, when should I expect that I would have something to test? Who is responsible? At some point the PM needs to know, who is responsible for every single activity. In the early stages, it will probably not be possible to go beyond who is responsible for the major milestones or deliverables. Who is responsible for Project Management? Is it a sales or marketing responsibility to find a PM, or to do the Project Management? Or can they approach a specific department such as engineering, or the Project Management Office, to request a PM. If marketing passes a project to a specific PM, what is included in the responsibility of the PM, and what remains with Marketing? It doesn't really matter what is assigned to each of the parties, as long as they both know and accept their own portions, and all the work that needs to be done finds someone accountable for getting it done. How will the work be done and how much will it cost? Those are the kinds of things the team determines at the front end of the project. In the initiation phase, this is done at a high level then in the definition stage, we need to detail all the specifics, down to the activity.

Once the initial scope is defined, the project team will continue through the remaining planning process and into implementations. If the project is a marketing project or is related to a new product line, the marketing contact(s) will probably remain actively involved. If the project is an implementation for a customer, sales may not be actively involved except as a conduit to the customer, but will continue to monitor the progress of the project in order to tell his key customer contacts what they need to know.

Chapter 14

SENIOR MANAGEMENT

The responsibility of senior management within a company is to guard, further and strengthen the business of that company. Each senior manager oversees some area of the overall business, generally managing a subset of the corporate staff. This concept is true no matter what the type of company, and it applies even in an association or government organization. Because of the breadth of this responsibility, senior management is generally not intimately involved with any particular project. Instead the responsibility is to support a number of projects, to prioritize a broad set of project under his control, and to help with prioritization of a broader set of projects underway within the company as a whole. The executive is generally measured on contributing positively to a subset of the business. He will take any required action to ensure that the corporation is strong overall, and that in particular, his responsibility areas are successful. The nature of this job necessitates that no one senior manager is familiar with many projects. Most senior managers are not familiar with the fine details of even one project; it is not their job to be so. They need to focus their energies on the higher-level picture. They rely on their staff to keep them informed of those aspects of the ongoing work that they should be aware of. A good executive is able to understand the situation based on the reports he is given, and will assist with appropriate support when presented with problems.

Senior management is involved in all projects, by necessity, because, if nothing else, senior management is responsible for the allocation of the funding. In project management terms, this puts senior management in the role of project sponsor. This chapter starts with a discussion of the project sponsor – who can be a sponsor, and what this role entails. Senior management must also consider the amount of risk the company is taking

when any project is undertaken. Here we discuss risk management and how it applies to projects.

Let's start with the concept of sponsor. There are various views on what constitutes a project sponsor. All of the views include some sort of project ownership. In some cases people describe what might be called a project champion. In other cases, where a project is being done for a specific customer, the people mention the customer. Still others mention senior management within the company.

From the PMBOK® Guide we get the official definition of a project sponsor:

- "The individual or group within or external to the performing organization that provides the financial resources, in cash or in kind, for the project" PMBOK® Guide, section 2.2

The two points to consider from this definition are that the sponsor is within the performing organization, and that the sponsor provides the financing for the project. These two points let out the customer as the project sponsor, and also disqualify some project champions. When we consider the roles for the sponsor we will see why an internal sponsor is needed. As for choosing the person with the financial stake rather than a project champion who may not have a financial stake, the premise is that if someone has the major financial stake, this person will have a strong interest in the project, and thus will be interested in and willing to fulfill the sponsorship roles. While this is generally true, there are sometimes cases in which the project champion might be more useful to the team than the defined sponsor. Let's look at the roles of a sponsor.

The roles of the sponsor include:

- guardian of the "business vision"
- resource allocator, negotiator
- clarify critical issues
- communication link
- support the PM and the team

The sponsor usually issues the Project Charter and evaluates project performance and deliverables. He should be senior enough to resolve conflicts.

As the guardian of the business vision, the sponsor must ensure that the project objectives are consistent with the corporate objectives. He will ensure that the company management understands the value the project brings to the company within the business vision. He will also ensure that the project team clearly understands the corporate strategic goals, and how the project fits with them

The financier of the project is essentially the resource allocator. The sponsor will usually approve the allocation of funds, and also select the project manager, but usually he will delegate the allocation of personnel resources to the project manager.

If there are project issues to be solved, the sponsor can help the team to understand the corporate implications of the potential directions, to ensure that they make decisions that are most beneficial to the corporation.

The project sponsor should be senior to the project manager, and should hold a position senior enough to enable him to protect and support the project. This includes bi-directional communication regarding any issues related to the project. When the executives discuss potential budget cuts, the sponsor speaks for the project, to protect the funding. When projects are discussed, the sponsor touts the project benefits to the corporation. When project prioritization is discussed, the sponsor fights to maintain a high level of priority for the project. When corporate issues threaten the project, the sponsor provides information to the Project Manager to enable the team to prepare their response. Communication is a key function provided by the sponsor. The PM needs to keep in mind that executives are not able to be aware of the details of all projects underway. In fact, one of the duties of the PM is keeping the sponsor well informed about the status of the project, the success, and the problems that the team is facing.

The sponsor supports the PM, the team and the project. When additional resources or specific skills are required, and the PM's requests do not yield satisfactory results, the team depends upon the sponsor to help with the negotiations.

Considering these responsibilities of the sponsor, it is clear that there is a need for an internal sponsor. This does not diminish the role of the client. If the project is being done for a client, this client is a very key stakeholder whose requests must be carefully considered. But there is also a need for someone within the company who has access to the right information, who can speak for the project and who can assist with resource or conflict issues.

The sponsor usually writes the charter, or at least approves the charter. One of the main reasons that this is the case is that the project has to be implemented in such a way that it aligns to the overall corporate strategy. Therefore the sponsor's input is invaluable in defining the project. This should apply to all projects, even though they occur in different forms and very different industries.

It is expected that the individual who provides the funding will have significant interest in the project, and generally this is the case. Thus most projects have the required support available. However, from time to time the person providing the funding is not appropriate as the sponsor, or the sponsor takes either too much interest, or too little interest in the project. In any of these cases, the PM has a problem that must be addressed.

Consider the first case. How could the project-funding provider not be appropriate as a sponsor? In one case, this happened because of the business relationships amongst companies. The project occurred in one of three sister companies. The books of the three companies were completely separate, but there were close working relationships amongst the three. The PM was in one company, but the senior manager who had the most interest, and the most at stake, in the project, was in one of the other two companies. However, since the books of the companies were separate, it was not possible for the manager to provide the project budget. Instead, the funding was provided by senior management within the company in which the PM worked. Technically, the owner of this budget was the project sponsor. But this manager did not have a strong interest in the project, knowing that the project champion was in the sister company. So, in this case, the technical sponsor did not provide the project support. The project champion fulfilled this function.

In the case of a sponsor who does not have the expected interest in the project, if the PM can find a project champion, this might solve the problem. If this is not possible, the PM will need to work with the sponsor to attempt to generate the required support. In this case, the PM should allocate some additional project management time to allow for the extra effort.

Why might the sponsor exhibit too much interest? Maybe the sponsor was a PM, and still enjoys being involved. Maybe the sponsor has such a strong stake in the success of the project that he believes he cannot afford to leave it in the hands of others. Or perhaps the sponsor does not trust the skill of the PM, so he steps into the picture to ensure his project is successful. In

any of these cases, the PM will have to spend time with the sponsor to build the required trust, and to work towards more appropriate relationships.

Once the relationship has been satisfactorily established, the sponsor can provide all the required support for the project. The sponsor will provide the communication to and from management bodies about the project, and to and from the PM about corporate developments. The sponsor can be called upon to assist with problems in obtaining the needed skills. It is the sponsor who will be approached if there is a need for management reserve funding. And perhaps the sponsor will need to enter into customer discussions when agreements are difficult to obtain.

Senior management will also be involved corporately in the prioritization of projects. It is very useful to the project team to have a spokesman in the prioritization discussions to protect the project, and also to have someone to share priority information with them. An project which is liable to be targeted in executive discussion benefits from having a sponsor senior enough to be included in the discussions. When accepting a project, the PM should judge whether or not the designated sponsor is at the appropriate management level to protect and support the project.

Senior management should also be involved in the definition of the success measures for the project. Management will generally provide some criteria that they expect to be met. These criteria should be accepted by the team unless there is some reason that they cannot be met – in which case it is the responsibility of the PM to let management know about the problems early. In addition, the team should suggest any success measures that they feel would appropriately measure success. Management should then assess these, and either approve them, or provide reasons why they should not be used.

In fact, before any project is even accepted, most companies work through some sort of project selection process. The most objective way to handle this is to have a project selection model that is based on numerical values. Then the team making the project proposal will analyze the benefits, and the costs, along with some of the risks the project will encounter. This process will yield some of the success measures before the project even begins. These models consider many factors, amongst them the potential revenue, the potential loss or build of reputation, the return on investment, the potential for success, the availability of needed resources, including money, skills, etc, the potential market demand, the potential competition,

the fit with corporate strategic goals, the potential risks and ability to deal with them.

One of the key responsibilities that the sponsor should be involved with is the project risk assessment. This does not necessarily mean that the he works directly with the team in the risk assessment, although this could certainly be useful to all concerned. But as the risk assessment proceeds the sponsor should be made aware of all the potential risks, and should ensure that the team includes enough contingency time, money and plans to ensure project success.

Senior management will actively monitor all projects on an ongoing basis, and may request project details from time to time when they are needed for evaluation.

Chapter 15

PROJECT MANAGEMENT

Throughout this book we have been describing the roles of people from every department of the company who work on projects. But so far we have not address the most critical project role – that of the Project Manager. In this chapter we address the role, the requirements and the characteristics of the Project Manager, and we also look at some aspects of the project that are strictly project related. These include:

- The Role of the Project Manager
- PM Characteristics
- Earned Value
- Project Communications
- Project Closure

Earned value and communications have already been covered. The remaining topics are covered here.

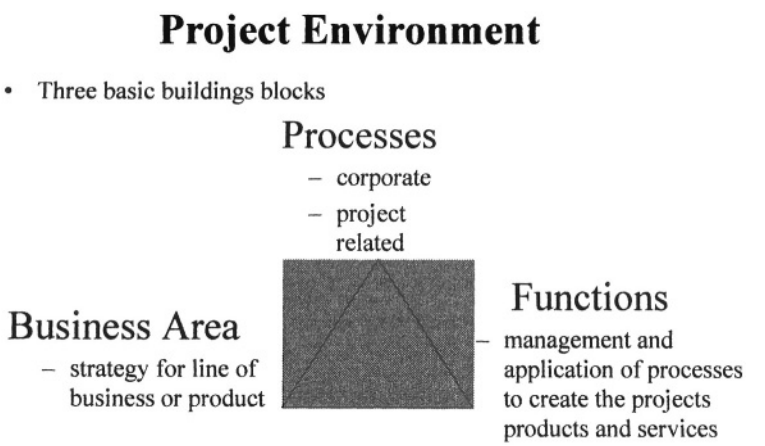

Figure 1

In project management, there are a number of process areas for which there are defined processes. These areas are:

- initiating
- planning
- controlling
- executing
- closing
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We identify processes in each chapter, and each of these processes falls into one of the five areas listed.

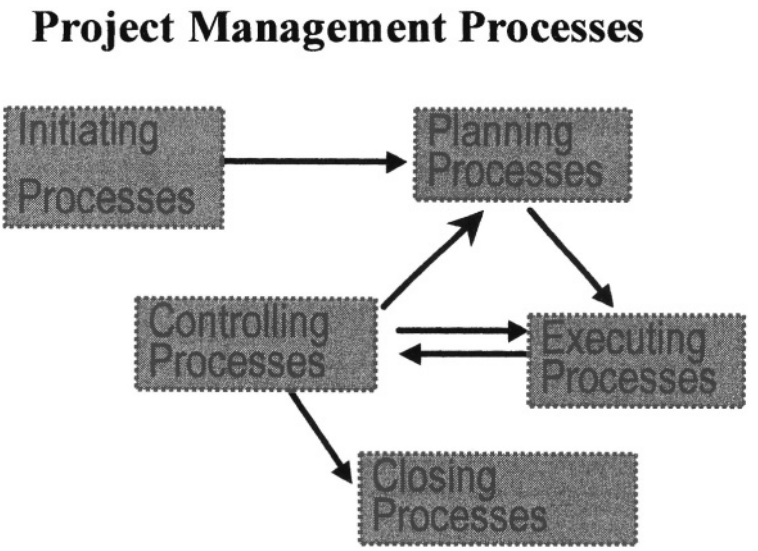

Figure 2

The Role of the Project Manager

The role of the project manager is multi-faceted. He has accountability for all aspects of the project. He must lead the team in producing the desired project results. The team has responsibility for the project activities;this involves strong leadership. And it requires the use of effective motivation techniques. He must resolve any conflict that arises. He is accountable for all project work, including the planning, product design and development, the implementation, the administration, and the setting and meeting of all deadlines. He must make project decisions, and ensure quality work. He needs to secure agreement on the project scope, and to ensure that all project

communications occur smoothly. He needs to think clearly, and to understand the politics that inevitably surround a project. He needs to understand all of the aspects of a project at a high level, whether they be technical, social, political or business.

The project manager may write the project requirements himself, or receive these from the sponsor or other stakeholders. However, no matter who writes the requirements, the first neck on the line if the project does not meet them is the project manager's. So the PM has to be sure he or she knows them, understands them, agrees to them, can communicate them clearly to others, and can get the resources to produce them. This is no small task.

Let's look at the key responsibilities of the Project Manager. The work generally starts when the potential PM is approached by the sponsor, asking about his interest in the project. The role at this point is to understand from the sponsor as much as possible about the expectations for the project. The Project Manager should address all the aspects of the project, right from the beginning, including potential scope, timing, budget, expectations regarding outside procurement, availability of resources, etc. He should also try to understand as much as possible about the sponsor himself – his characteristics, his attitudes, what drives him, and his general expectations. These will also be indicators of what the PM will be dealing with if he accepts the project. Many times a sponsor comes up with a project that looks like such a fantastic opportunity to the potential project manager that he forgets to do due diligence. This might get the team into a difficult and unexpected situation later in the project. The time to start the negotiation for the things the team might need is before the project has even started, and this responsibility falls to the PM. It is often easier to obtain agreement for critical items at this early stage, before any resources have been committed and before people have set their minds on specific directions for the project.

Once the Charter has been established and signed, the next step is to define the project. This is the development of the scope statement, as described in Chapter 3. Once the scope has been defined, the next step is to add some structure to it, to enable the team to define the work elements, and the PM to determine what needs to be managed, and when. The team moves next to the creation of the Work Breakdown Structure, one of the most important project management tools. This is described in Chapter 5. Once the wbs is complete, the bottom level elements become the project activities, and these can be used to obtain the resources, the budget, and the schedule. We have described techniques for obtaining each of these as well. In every

case it is recommended that the PM lead the development, with assistance from the full team. In order to do this, the project manager also has to identify people with the required skills, convince them to join the team, and negotiate with their current managers for their availability for the project. This will require negotiation skills, as discussed in Chapter 10.

When all of these aspects have been determined, the team can complete the remaining aspects of the project plan, including the risk management plan as described in Chapter 4, the procurement plan in chapter 9, the communications plan which we will cover in this chapter, and the quality management plan as per chapter 5. With the plan completed, there should be enough information to proceed to the gates for approval to move into the implementation phase.

Once the gate has been passed, the implementation phase can begin. At this point the role of the project manager changes into one of monitoring and control. The team starts focused, heads-down work on the project activities, and the PM ensure that all product related, and all project related work proceeds as planned, meeting all specifications and quality objectives. During this phase the skills that the PM uses most are different from those used in the initial project stages. Initially, strategic vision and open thinking were the key skills. In implementation the PM needs to clearly focus on getting things done, and doing them properly.

Once the implementation completes, the project will move forward again, into the closure phase. We will discuss this phase in this chapter as well.

Characteristics of a Project Manager

In order to be successful at the wide variety of requirements, the PM should possess special skills. Some of these skills are technical (that is technical in the area of project management) while others are soft skills. We know from psychology that although most people do possess both types of skills, almost everyone has much more strength in one of these areas than the other, and even if the skills are somewhat evenly matched, most people prefer to use one type over the other. However, every project requires the use of all of these skills, so if the PM does not have the time, interest or ability to use all, he needs to ensure that someone on the team will be able to pick up those areas he does not cover himself.

The technical project management skills include such areas as time management, cost management, scope management, project integration,

quality management, and risk management. Techniques and processes for each of these areas are included in the relevant chapters of this book.

The soft skills include such areas as leadership, team building, motivation, communication, conflict management, expectation management, and so on. We cover many of these later in Chapter 10, but communications will be handled later in this chapter.

In addition to the PM skills, the project manager should have some background in the product area of the project. But what does this mean? There is more than one dimension to any project. In every case the project could benefit from a PM with background in the processes, the business area, and/or the functions required to complete the project.

The PM needs some level of 'technical' understanding. Now, what this means can vary from one person to another. It is pretty clear that a good construction PM will not necessarily be a good PM for a software project. Some level of competence in understanding the software development environment is required.

However, beyond this, there is a question of what this means. Does it mean that the PM must have personally developed code? or would it be good enough to have been the marketing prime on a team or three that develops software? Or even worked very closely, maybe as a customer, with a team that develops software? Any of these gives the person a level of 'technical' understanding. Any of these could be enough, given the right person and the right project, but there are no guarantees. In some projects, notably ones where there is a major development engineering component, a significant degree of relevant technical experience may be crucial for the PM to maintain credibility.

However, too much technical knowledge could also be a problem. If the PM is an engineer with strong technical interests, but he is not also the technical prime, then it can difficult for him to back away and let the actual tech prime do his or her job. If the PM meddles, this can cause bad feelings and problems. It may even split the team, or cause time delays. And, if the PM carries dual roles of PM plus tech prime, it will be difficult for this person to fairly assess questions which would best go one direction from a technical perspective, but another from a business perspective. Of course this can be done, and it is done every day, but it less likely that the PM will succeed. In the case where the PM is also the tech prime, it is obvious that

technical skills are needed, both in the area of technical project management skills and also in the project subject matter.

Also, we need to be careful when we mention technical skills. This should be used to refer to skills related to the project - which could be marketing, purchasing, various types of engineering or programming, etc. A PM who has some level of grounding in many or all of these areas, but not extensive background in any of them would be considered a generalist - but one with good technical knowledge.

It's an interesting question.

Consider the skills required for good project management. There are many skills listed in different references, and all are quite valid. For instance, in

A Leadership Profile of American Project Managers
Engineering Management Review Vol. 26 Number 4 Winter 1998

We see that the *most significant* characteristics of an effective project manager are:

1. Leadership by example

2. Visionary
3. Technically competent
4. Decisive
5. Good Communicator
6. Good motivator
7. Stands up to management when needed
8. Supportive team member
9. Encourages new ideas

From the same review, we find:
The 12 *highest ranked* characteristics and behaviours for effective Project Management

1. Team Builder
2. Communicator
3. High self esteem

4. Focuses on results
5. Demonstrations of trust
6. Goal setter
7. Demonstration of respect
8. Flexibility in response to change
9. Team player
10. Employee developer
11. High level of interpersonal skills
12. Empowers subordinates

Which of the PM traits is most important to project success, and why? This is greatly dependent on the project. A worthwhile exercise is to consider some actual projects which were successful or not, and determine which of these traits (or lack thereof) caused this.

It is interesting to sit with a group of people experienced in project work, and discuss which characteristics they feel are important on their projects. Many of the skills listed above will appear, as will additional characteristics. Project management is a field where the team will never be handed most of the things that they need to manage and complete the project. The PM must be able to analyze information and form solid conclusions. He must have the skill to communicate these conclusions, and to decide who are the relevant recipients of project communications. This requires both the ability to analyze and knowledge of the project environment.

With leadership skills and technical credibility, the PM can engender the trust that is required to allow him to motivate that the team to buy into the project plan to meet the project objectives.

The Project Manager needs to be politically savvy in order to understand the implications of different decisions and directions, and to be able to manage the environment so that the project decisions will be accepted by those whose opinion is important to the project.

Along with this, the PM needs to be able to build good rapport and relationships with other people, and especially to be able to gain the support of higher management. Here sales skills can help.

Project Closure

Project closure need not be intensive or time consuming. This is the phase in which the project activities are completed, any cleanup is done. Project documentation is completed and filed, product hand-off is completed, and team records are finished off. If necessary, the PM finds new positions for the team members, and personnel review information is prepared and communicated.

According to the PMBOK® Guide, the outputs are project archives, lessons learned and formal acceptance. See Figure 3.

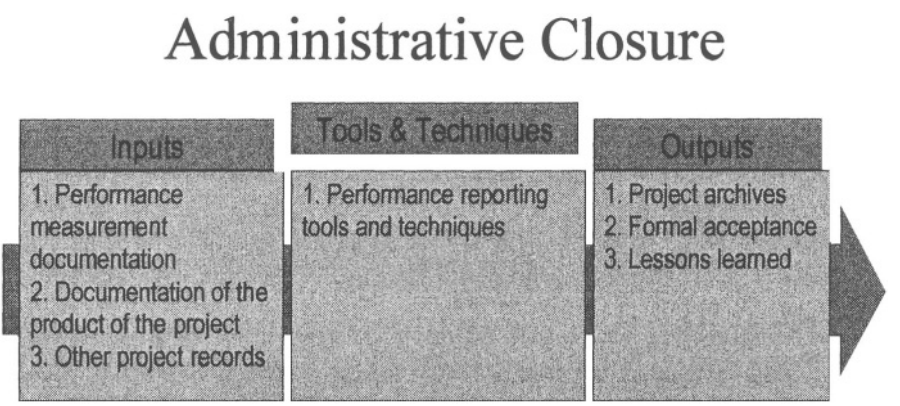

Figure 3

Any loose ends are tied, and the project is essentially 'closed'. Although many team members are leaving the project, or maybe even have already left, the PM should get input from each of them on the lessons learned during the project, in order to help the next team to avoid the problems that this one faced. The intent is one of helping future projects – not to cast blame on the current team or team members. So this should be done in a positive way.

All project results must be collected and included in the documentation. If this was not done as the project was underway, it can take considerable time at the end. So it is always best to collect as much as possible, and keep it well organized, as the project proceeds, to prevent loss or contamination of information. Then the closure can run smoothly, the team will look professional, and future project teams can benefit.

Chapter 16

ENGINEERING

Engineers can be involved in any aspect of project management and the project team. The primary role of the engineer is generally that of the team member responsible for the technical components of the product or service development. But frequently the project manager also comes from engineering. It is hard to imagine a telecom project that does not have engineering involvement, almost certainly using a technical prime, and probably also using engineers in other roles as well, such as project management or marketing.

The Engineering Role

Engineering departments are the home for many types of technical skills, and these skills are in high demand for telecom projects, since most telecom project are highly technical. This includes hardware and software skills, from design to building and testing. Engineering will ensure that definition; design and development are structured to produce the best possible results

Many engineers love their work, and enjoy having their technical skills appreciated. This makes them good candidates for working on projects, as the project teams generally appreciate having someone to provide the technical expertise. For some engineers, though, projects can be a challenge. In engineering, maybe more so than in other disciplines, there are people who are generalists, and people who are specialists. Projects are a good environment for generalists, because team members should be aware of, and have a good understanding of, the full projects – its scope, goals, objectives, timeframes, etc. Many times team members are called upon to assist others, when the work loadings do not match the staff availabilities. If one person is

too heavily loaded, while another is too lightly loaded, the project benefits from having people share the load. With highly technical work, this can be difficult, if the assister does not have the required skills. It is often possible for an unskilled person to assist with technical tasks, but not all engineers have the ability to segregate their work to allow someone without the relevant skills to assist. And as with many functions, it can take more time and effort to break up the work, and show someone how to assist than it would have taken to just do the work. Schedule slips associated with engineering tasks are therefore very difficult to recover. On the other hand, the engineer might well be asked to assist others with their work. To a specialist who prefers working in his own area, this can be quite disconcerting. Many will accept this 'problem' occasionally, but people who have a strong preference for working in their own field sometimes avoid projects because they do not at all enjoy doing other work. To many engineers, this other work seems to be a waste of their time and skills. And, for an engineer who has a niche skill which is needed on many projects, projects become somewhat of a threat because they interfere with his opportunity to develop new skills, or even keep his own skill current. Project teams should keep this in mind. Whereas in some areas just using skills is enough to reinforce them, in technical fields, technologies are rapidly changing, and those working in these fields need to have training, and/or the opportunity to work with the newer technologies in order to keep their skills current.

In addition to having strong technical skills, many engineers also demonstrate strong management skills. Such people are very useful resources for projects, often even as project managers. If the engineer has both the skill and the interest to manage projects, using him as a project manager is a very good idea. Before this is done though, it would be wise to provide PM training, so that he can use the proper PM techniques. It is surprising how many companies take people with good management skills and expect that to manage projects well, without giving them any related training. While it is true that good management skills are required for PM, and that these skills will enable the PM to do much of the work well, it stands to reason that with the appropriate PM knowledge, tools and skills, the results should be better, and the work should be easier to accomplish. Possessing the abilities does not automatically give a person the knowledge and skills.

The other issue that should be considered is the interest of the engineer. The fact that an engineer has demonstrated good management skills does not mean that he is interested in doing a job that is essentially a management job,

as opposed to a technical one. I have been approached by engineers wondering what they need to do to be able to get back to doing "real work", when their companies keep pulling them off to manage projects. It is the responsibility of the engineer to identify that he really isn't interested, as the management probably think that they are giving him a reward by allowing him to manage projects. But not everyone is interested in this sort of work.

As mentioned, technical background is needed on most telecom projects. The environment is by nature a technical one. However, in addition to the advantages of engineers' having technical background, there are also some dangers in this. First, the engineer might be assigned a dual role, of both project technical expert and project manager. This frequently happens on smaller projects where the workload of each position may not require a full person. In this case either the team is staffed by people who are also assigned to other work, or some people play double roles. For many, this is an interesting challenge, because it offers the opportunity to use two sets of skills and to see the project from two different perspectives. For others it is a problem. Some personality types need to work within a defined environment, and a dual role can be more than the usual challenge for this type of person.

In addition, the dual role can place the holder into a compromising position from time to time. There are bound to be occasions when decisions must be made which involve the technical aspects of the project. Sometimes the best decision from a project management perspective is to move in one direction, while from a technical perspective the best decision would be to move in a different direction. Even when the engineer is not placed in a dual role, but in just the PM role, this same type of situation can occur, and the engineer who is loyal to his field, or who would strongly prefer to be doing the technical job, is in a very difficult position, with a tough decision to make. Given that the project manager views the project from a broader perspective, the PM direction is usually the right one to take. But this is very hard for the engineer, who might even be viewed by his peers as selling out.

Engineers must take great care to ensure that they are acting in the best interests of the project overall, while still holding to their ethical convictions, and ensuring that the best technologies and designs are used.

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Chapter 17

OPERATIONS

Many projects in the telecom environment are operations projects. Most projects require some involvement from operations organizations, even if they are not centrally operations projects. In the telecom industry, "operations" encompasses many diverse functions, and often aspects of many such systems are needed. These aspects impact the product at different times during the product life cycle, so operations people should be involved in determining the aspects of the project lifecycle. The different aspects of project integration are also examined.

In a telephone operating company, the term operations applies to many functions which support a multitude of vastly different functions. On the line side, operations includes taking trouble calls, and testing circuits or equipment to locate troubles. It includes finding and fixing major problems such as fibre cuts or switching centre failures. It includes taking customer orders and maintaining customer profiles and data in databases. In the staff area, operations involves the selection of development of and maintenance of operational equipment such as network management systems, test systems, billing systems, provisioning database systems, order tracking systems, etc.

The operations labour forces are huge, and it's obvious that they are involved with products throughout their life cycle. No matter what the product is, the cost of operating the product is very often greater than the cost of development and building combined. So operational considerations need to be taken into account on all products. Representatives from operations departments should participate in the planning of every project, particularly in the design stages, to ensure that the design can be maintained and supported, hopefully at reasonable cost, over the long term.

In most cases the company will be providing some ongoing support for the product or service being developed. This support will be provided by someone from operations, whether the company is a telco, an internet provider, an equipment vendor, etc. In order to protect the company from high long term costs, or loss of reputation due to the inability to provide proper support, operations should be involved in every project as a team member.

Let's look at the lifecycle concept first. The product has a lifecycle. And also the project has a lifecycle. The two are quite different. Consider the product – maybe a web site, a fast digital switch or the deployment of a network upgrade. The product lifecycle starts with a definition of the requirements, followed by the product design. Once the design is complete the product is built, and then the support phase begins. The product lifecycle thus consists of four phases: Requirements Definition, Design, Build and Operate/Support. This is never the same as the project lifecycle. The project might occur within one of these phases, it might be one of the phases, or it might span a few of the product lifecycle phases.

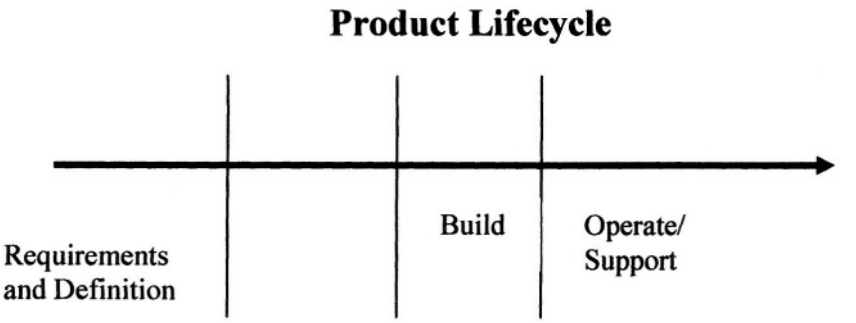


Figure 1

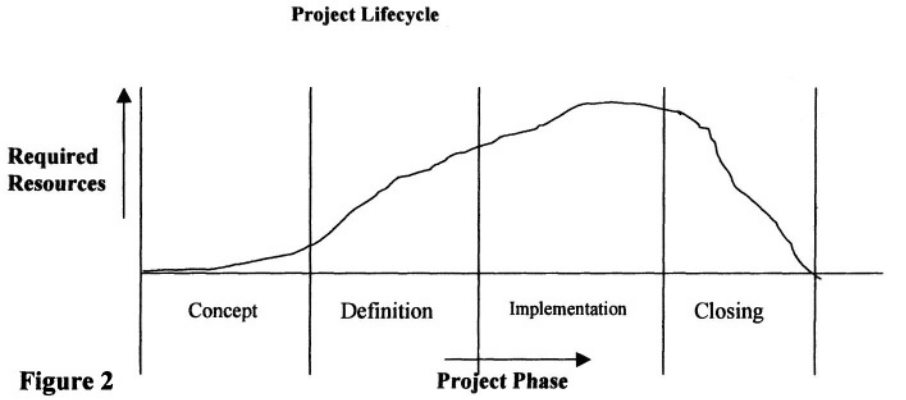


Figure 2

Operations concerns often relate to the time period after the project completes. However, even in such projects operations involvement is needed early to ensure the development of a product which can be effectively maintained. Also in a telecom environment, many projects produce operations deliverables, such as new processes or systems. In these cases operation involvement is required to design and develop the product. Someone from operations might possibly also be the PM.

Project lifecycle

The project lifecycle starts at the point at which an idea is generated that might be considered as a project. It shows the project from the initial concept stage till full closure. The lifecycle shows the project divided into project phases. Generally it is also marked with flags for gates or indications for milestones

A sample of a project lifecycle is shown in Figure 2. This sample illustrates the lifecycle by plotting the number of resources used against time. The cycle could also be plotted as number of work hours over time, or

cost over time. Sometimes these three would yield the same pattern, but sometimes these would differ from each other.

Another lifecycle sample is shown in Figure 3.

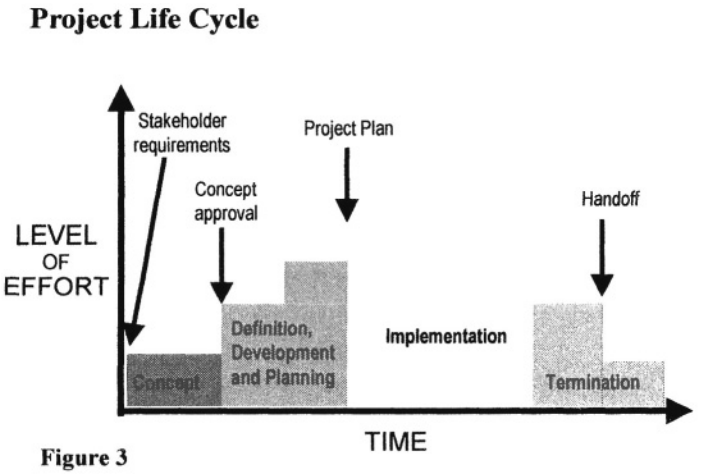
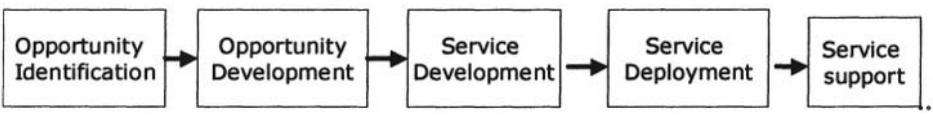


Figure 3

This illustration includes more detail showing possible project milestones.

A project could occur at any point within the product lifecycle. However, the project will have a defined end date, by which certain specified deliverables will be produced. The project lifecycle ends when the deliverables have been completed, and the project closure activities are finished. Unless the purpose of the project is to close down the product, the project will end before the product. Figure 4 shows some possible places that projects might occur during the life of a project.

Consider the example of a fairly major project, such as the development and market launch of a new service. This could be shown as shown here.



Note that the last box, service support, is smaller than the others. This was done to show that this segment occurs after the end of the project. In all

likelihood, in fact, the chain shown here would consist of multiple projects, as illustrated by the diagram. When that is the case, we have a **program** of related projects, and each succeeding project is dependent on the completion and scope delivery of the previous one. Another example of a program could be the development of a service or product in stages, where an initial set of features and/or functionality is developed in the first project, then enhancements and additional features are added in the succeeding projects. The interdependence is obvious.

Each project has a lifecycle, and each is different. The team needs to determine what the lifecycle of the project will look like. The PM will need to know this to determine the resource requirements. The lifecycle will give an indication of the pattern and timing required for the project cash flow, and it can be used as an illustrative communications tool to communicate the flow of the project.

Project phases

As mentioned, each project is broken into phases. What is recommended from a PM perspective is that the overall project follow a standard lifecycle, with four phases -concept or initiation, planning and definition, implementation and closure. During the implementation phase, the project can then be broken up into whatever number of product phases makes sense. These are mini phases within the one larger product. Each of these sub-projects should then have its own four project phases – concept or initiation, planning and definition, implementation and completion phases. But they are still components of the larger project. In some cases these smaller phases might have different team leaders, but the overall project manager is accountable for all components of the overriding project.

The short **concept** or **initiation** phase, is the point at which the idea for the opportunity or the problem solution is assessed and determined to be something that is worth pursuing. The level of involvement is usually very low at this stage because it would not make sense to use many corporate resources until a decision is made to move ahead. The decision taken at this point should be to move forward, but it should be conditional on the results of the next planning or definition phase. As long as the project continues to look viable at the end of the second phase, it will be worth allocating resources to completing it. This does not mean that this initial decision should be taken lightly, because corporate resources are used to complete the second phase, and as the diagrams show, generally the level of involvement, and hence the cost, starts to grow significantly at this point. This initial phase

is used provide the information required to obtain approval and sign off on the concept. In this phase the participants evaluate the concept to determine whether or not it is a good idea for the company to invest resources into the project. The team should make a recommendation, and the management or customer should make the go/ no go decision.

The Planning or Definition phase is used to expand the project concept. Product/service developers and other project team members work together to define what will be produced, and develop the project plan. If this phase is completed properly, the end result will be a complete project plan, with a full scope definition, complete with all the details down to the activity level, a detailed project budget, defined resource allocations, quality standards defined, a risk management plan developed, a complete project schedule, a communications plan, and a procurement plan. In other words, the complete development of the project plan occurs here. We need to have involvement from all parties related to the project and the final product in order to accurately determine the details for the plan. Thus if this is done properly, there is a significant cost involved. But then, in exchange for funding this work, management has a right to expect that they will be provided with prediction of the time and funding required to complete the full project. Each company establishes their own tolerance limits for the information provided at these gates. At the end of the concept phase the budget and time forecasts might be accurate to within plus or minus 100%. But the planning phase should produce information that is closer to 10% accurate. Some companies require 5% accuracy at this point. The management then has a right to expect that the project team will produce the defined deliverables within 10% of the provided budget and timelines. So the team should work diligently to ensure that these projections are as accurate as possible.

Implementation includes the development work required to produce the desired outcome. Here the project manager introduces control and management to hold the team to the predictions for budget and time that were developed in the planning phase. The team responsibility is to do the work as carefully as possible, and to ensure that all required communication flows according to plan. This can mean that bad news is communicated early, but that communication might just enable the determination of some creative solutions to the problem. At the very least it can allow the impacted parties to adjust to accommodate the problem.

Since some projects have phases related to the context within the implementation phase, there will be some additional time required within the implementation phase to work on these sub-phases. For each of these it is

wise to do additional definition and termination phases. That will ensure that nothing is forgotten or missed in the early stages which might cause delays or additional work at the later phases, and allow the team to switch to contingency plans if needed due to problems early in the project. It will also ensure that project documentation is not lost or forgotten as people move on to subsequent work.

Termination includes completing all project management work, as well as obtaining closure from the client and management for all requirements. It is during this phase that the handoff generally occurs. Probably shortly after the project enters the termination phase, the project team will hand off the product to the customer or the department that provides ongoing service and maintenance. This receiving group must agree to accept the product, so the project can close. To achieve this, a hand-off document should be developed, which can be signed off when all parties are satisfied. This hand-off document should be prepared in the definition phase, and all involved parties should agree to the contents and requirement levels before the implementation begins. Doing this will prevent the project deliverables from being thrown back 'over the wall' in the final stages. It does not mean that there will be no discussion about whether the project deliverables have been satisfactorily completed. But it will provide a frame of reference for these discussions, since all parties have previously signed off on the requirements for a successful handoff. In this phase all project documentation is completed. Hopefully most documentation has been kept up to date during the project, so that the work effort at this time is minimized. This is critical since many project team members abandon ship by this point, moving on to the next exciting project. Even though people are leaving, lessons learned need to be documented and communicated so that they can be used on future projects, contracts have to be closed out, plans and minutes need to be filed for future reference, the change request documentation must be completed, showing the actual results of each request, user documentation needs to be completed and shared, training of support staff must be completed, etc. There are many activities that must be completed, albeit many of them administrative. The project cannot completely end until these are all completed.

The life cycle diagram shows the project flow from beginning to end. A simple form of life cycle plots the effort, or maybe the number of resources, over time. Then the gates that are to be passed can be added at the appropriate times. One of the early gates might be project approval, and one of the later gates could be product acceptance. And there will be specific criteria that must be met in order for the project to pass each gate. For the

product acceptance, these are defined in the handoff document. The criteria for the early gates need to be defined in the early project documentation. In fact, each of the early gates could be a point at which the project may die. If the criteria required for project success cannot be met, the project should not proceed. So we can say that these gates, or evaluation points, are critical points within the project life cycle.

When the project work begins, it is critical that each of the phases proceeds independently of the others. That is to say that work which belongs in any one phase should be completed when the project is in that phase. Any overlap between phases increases the risk of the project. For example, suppose that during the concept phase a project which requires major changes to the billing structure looks like a corporate necessity in order to maintain major customers who might move to a new service about to be introduced by a major competitor, which uses a more flexible billing structure measured by different parameters than the current billing system uses. One way to implement such a service could be to make major changes to the current billing system. Another solution could be to implement a new billing system for the new service. If this were to happen, either the new system would have to replace or be integrated with the current system, or any subscribing to the new service as well as existing services would receive two separate bills – never a popular situation with customers. Suppose that it was decided that the current system had already been modified too many times to make another such addition feasible, so the new service would initially be introduced with a separate billing system until such time as a separate operations project could find a better solution. Also, given the timing of the competitors service introduction, it was deemed that an RFQ would have to be issued for the new system because there was not time to develop one in house. In fact, even if the RFQ had already been issued, there was probably not enough time to have the system in place before the required service launch. So, specifications were drawn up as carefully as time allowed, and the RFQ was issued. Then in the planning phase the service implementation is changed in such a way that the new billing system is not needed. However since the RFQ had been issued, responses received, and evaluation almost completed prior to this decision, they were costs for getting out of the purchase, over and above those of just the internal time to issue the RFP and evaluate the responses. In essence, issuing the RFQ is work that belongs in the implementation phase. Not in the concept or even the planning phase. So having it happen too early increases the risk of the project.

Longer term operations concerns

Since a significant percentage (over 50% by most studies) of the overall cost of any product or service occurs after the product development, operations concerns have a very major impact on the corporation providing the product or service, and also on the customers. From the project management point of view there will be many decision points in the product design and implementation at which there will be a 'right' decision from the perspective of the cost of completing the project. This 'right' decision is often not a good direction for the long term: the product operating cost may turn out to be much higher than it could have been if the project had taken a direction that cost more money during the project implementation phase. In most cases an operations perspective is needed to identify this pitfall, and to work with the project team to make the best overall decision.

Such decisions usually take the form of seemingly harmless compromises in the scope or quality of project deliverables. A simple and common example from the telephone industry might be the development of a new suite of OSS (Operations Support Systems) features for the control of the switching network. Developers might be faced with a decision whether or not to buy an unlimited use license for a block of third-party software for inclusion into the system. If the budget is getting tight, "penny wisdom" might call for forgoing paying this one-time fee. The resultant "pound-foolishness" however, is that the operating company will have to pay per-site license fees in perpetuity for the use of this software in the completed product. There was a project cost saving, and there was no difference in the features of the completed system, but did the project manager really do the right thing?

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Chapter 18

PURCHASING

Recall the full procurement cycle includes:

- Procurement planning - determining what to procure and when
- Solicitation planning - documenting product requirements and identifying potential sources
- Solicitation - obtaining quotations, bids, offers, or proposals as appropriate
- Source selection - choosing from among potential sellers
- Contract administration - managing the relationship with the dealer
- Contract close-out - completion and settlement of the contract, including resolution of any open terms

The Purchasing Department is often not intimately involved with projects, which is surprising considering the potential impact of purchasing activities. The PM should ensure that purchasing is brought into the project early. He should also ensure that he can work well with this department to take advantage of their knowledge and skills.

In a projectized company, sometimes purchasing departments do not even exist. In this case, the project team must perform this function. The information in Chapter 6 should be considered seriously and the legal department should be consulted.

Contract Close out

In the final stage the team closes the contract by:

- verifying that the product or service meets the specifications or requirements, and if necessary, following up with the vendor re any gaps or missing material.

- documenting all aspects of contract management and vendor management

- auditing the product/ service provision to ensure that everything was handled properly, and

- evaluating the supplier and the relationship, as input to further teams or individuals who might deal with this supplier in the future.

Chapter 19

PROJECT MANAGEMENT SUMMARY AND TRENDS

Project Management is increasingly being used in companies, with companies developing better maturity in understanding and using the processes. In this final chapter we look at the trends in project management, and also consider models for project management maturity. Trends in project management in telecommunications companies are impacted both by general project management trends and also by trends in the telecommunications industry in general.

In this age of computers, software and cheaper communications rates, many companies are working much differently from the way they did in the past. Telecom companies are no exception. Records kept in binders and cabinets in the past are now kept digitally. Of course this also applies on projects, where the use of servers, and application software enable teams to share project records not only with each other but also with the an external customer, management, and even suppliers, of access is provided. Current project management tools allow optimal organization of project records, from tools such as the Charter, WBS, Project Network, etc, to minutes of meetings, budget tracking and lessons learned. Today's network and server technologies allow anyone with authorization to enter data, while those with lower levels of authorization can read the stored information. These tools make not only save time by allowing records to be created only once, but they enhance communication, and improve the probability that project records will be created and communicated.

With the lower cost communications, many companies are farming out work to other countries where either they can find exactly the skills they

need, or they can pay lower rates. This means that many projects have to deal with issues such as international law, international bids in the procurement cycle, significant time zone differences when calling project meetings, cultural differences, differences in ethical codes, etc. This presents challenges for the project manager far beyond those presented in the past.

With the many mergers and alliances in the telecommunications industry today, many projects have teams that are not co-located. These teams might not be international, and might even be in the same city, but different office locations. However the different locations present communications issues. Using the technologies available can help the teams considerably – they can hold web meetings, and post discussions in non-real time. But this requires people to learn to work with others who are not physically present, and this is a new skill for most project teams. However it is a fact of life today in high tech companies.

Another factor that impacts today's projects is the speed of service development and technology change. With the move from a regulated environment to a competitive one, and the rapid changes in technology capabilities the expectations for delivery times on projects are becoming more and more challenging. Not so many years ago a service development time of 3-5 years was the norm. Today many project managers are being pushed to complete development of much more complex services, using less familiar technologies, in 6-8 months. This obviously requires much more effective project management skills.

Another issue in telecommunications today is the lack of funds. All businesses believe that they do not have enough money to do the things that they really want to do. However over the past few years the bottom has fallen out of the telecommunications market completely, creating a situation in which free cash is a significant problem. Companies have significantly downsized if they have not collapsed altogether, leaving fewer people to work on projects, and less funding as well.

Another change which has been working it's way into operating companies for over 5 years now is a change from an internal focus on projects to a customer focus. This is consistent with all the PM recommendations – but still presents a challenge within the companies as people must work to change attitudes and working methods to make the change.

These changes are specific to the environment, as opposed to being PM specific. What the overall picture adds up to is a need more professional PM to allow for success. Project Management offices are being created in many telecom companies. This trend is also occurring in other industries, which is hastening the overall understanding of PM concepts, and appreciation of the need to use the tools and processes discussed in this book. Telcos always used PM extensively, but today Project Management process disciplines are being applied more ubiquitously, which is enhancing the PM maturity within the organization, and raising the overall probability of project success. The use of decision sciences is increasing in Project Management

The Internet/intranet is being used for:

- project data repository
- on-line procedures/guidelines
- electronic status reporting
- lessons learned database
- video/electronic meetings

Management of stakeholders and formal risk assessment are becoming more common in project management. Given the environment described above, it is clear that both of these changes are much needed in the telecom environment.

Influence is power, especially in today's flatter organizations. With the extensive downsizing telecom companies have also significantly restructures, becoming much flatter while becoming leaner. PM's are left more to their own resources to get things done, without the hierarchy to back them up. With their standard positions disappearing, middle managers becoming project managers, bringing some excellent skills and some bigger picture views to the projects. Project management is being used as training for senior management, probably bringing more value to the senior positions than some of the previous middle management experience. In this new environment there is also a trend to structure as matrix and projectized organizations.

Academics are becoming involved with Project Management, which indicates a level of maturity of the discipline. Research in PM solutions and processes are advancing the knowledge base and the development of the field. Project management is emerging as a discipline and Project standards are emerging.

Most organizations are applying PM in a multi-project management, and some of the available PM tools can now handle multiple projects. Computer software for PM is becoming more sophisticated, taking advantage of the advanced environment with complex applications interconnected in a multi-site environment.

Given all the turmoil in the industry and the problems with lack of personnel, changes in management structure, and much more limited finds, the telecom environment is benefiting from the general PM increased focus on soft skills.

enior management must buy in and visibly support project management as a separate function within the organization. Project management training must be provided to ensure that the project managers understand and can use all the concepts that are covered in this book, since these are not just common sense in many cases. Project leaders must be carefully selected, trained and allowed to build experience. This means that the company must define and build a career path towards project management, and support the function. In addition, Project sponsors must be defined and trained so that they can effectively assist the project teams and the business. The company must help the PM to emphasize "team approach", and help people to understand and appreciate the need to record "lessons learned". The company should decide which methodologies to support to allow transition of knowledge from one project team to another. The PMO can issue guidelines, and ensure that PM tools are available to all projects. Central procedures and systems need to be developed for tracking project accounting and status information. And finally, the functional managers need to understand and buy in to the need for the more structured project management.

The culture must be in place to ensure successful projects Learning must be part of the culture

Any of these responsibilities can logically fall into the Project Management Office

- Set standards for project management
- Standardize PM policies and procedures
- Support the project managers in their ongoing work, and their development
- Provide training and support
- Act as a PM reporting center

- Provide assistance to Project Managers
- Establish processes for the company in project management
- Implement project control systems, and establish project control
- Support project managers, team members and management in the PM discipline

The PM and the core team are responsible for planning and executing all project activities. The core team should include all functional skills required to complete the project. In thinking back through the concepts covered in this book, the following concise list of PM concepts provides a backdrop for good PM within the company.

- A project starts and finishes with the stakeholders
  - identify their requirements and design to meet them
- Ensure that you build a WBS
  - for definition and control of scope, cost, time
- Have a clearly defined and understood process for change control
- Start risk management early in the project and continue it throughout the project
- Implement early and continued identification, analysis and response to risksInclude contingency in milestones rather than as a percentage across all activitiesPrepare a hand-off checklist early in the project, and get buy-in early from the recipients of the product as well as the team
- Use earned value analysis in addition to standard progress tracking
- Adopt and use a technique for network diagramming and CPM
- Encourage team involvement in project planningEmphasize clear and complete communication
- Emphasize estimate (commitments) to complete
- Every estimate to be accompanied by accuracy, range, schedule
- Pre-qualify your bidders
- Be aware of legal implications of procurement processes, such as RFP, RFQ
- Place some priority on contract administration
- Plan your communications
- Take time and include funding to enable team building
- Encourage situational leadership
- Ensure that PM's and team members can use influence vs. authority
- Train team members and PM's in conflict management techniques

If you really want to run your projects properly you have to use all of the techniques that we have covered consistently. However, if you are not already using many of them, you're not going to be able to just read a book, and start using all of them. The best approach is to determine which ones are most applicable to your projects, start with those and then increase your repertoire as you go develop the initial skills.

When teams begin implementing these techniques, the project success rate should rise. The projects will not all be perfect. In the real world, many things do go wrong. But the techniques are designed to enable teams to anticipate and deal with the problems. The techniques can be used to improve the overall probability of success on projects.

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Acronyms

ACWP – Actual Cost of Work Performed
ADSL – Asymmetric Digital Subscriber Line
ADM – Arrow Diagram Method
ADR – Asset Depreciation Range
ASAP – As soon as possible
ATM – Asynchronous Transfer Mode
BAC – Budget at Completion
BCWP- Budgeted Cost of Work Performed
BCWS – Budgeted Cost of Work Scheduled
CATV – Cable Television
CPE – Customer Provided Equipment
CPFF – Cost Plus Fixed Fee
CPI – Cost Performance Index
CPIF – Cost Plus Incentive Fee
CPPF – Cost Plus Performance Fee
CTC – Cost To Complete
CV – Cost Variance
DSL – Digital Subscriber Line
EAC – Estimate at Completion
EMV – Expected Monetary Value
ETC – Estimate to Complete
EV – Earned Value
FF – Finish Finish
FFP – Firm Fixed Price
FNET – Finish No Earlier Than
FNLT – Finish No Later Than

FS – Finish Start
ICC – International Conference on Communications
LAN – Local Area Network
MFO – Must Finish On
MSO – Must Start On
NPAT – Net Profit After Taxes
PDM – Precedence Diagram Method
PERT – Program Evaluation and Review
PM – Project Manager
PMBOK - A Guide to the Project Management Body of Knowledge
PMI – Project Management Institute
PMP – Project Management Professional
PV – Planned Value
RFI – Request for Information
RFP – Request for Proposal
RFQ – Request for Quote
SF – Start Finish
SNET – Start No Earlier Than
SNLT – Start No Later Than
SPI – Schedule Performance Index
TCPI –To Complete Performance Index
TQM – Total Quality Management
VAC – Variance at Completion
WBS – Work Breakdown Structure

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