

# Chapter 1

## Project, Portfolio, and Program: Mind the Gap

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### LEARNING OBJECTIVES

- ✓ Basic concepts of project management
- ✓ The project life cycle: phases and process groups
- ✓ Project management knowledge areas
- ✓ Project stakeholders
- ✓ Influence of organizational structure on project management
- ✓ Influences of organizational environment on programs
- ✓ Relationships among projects, programs, and portfolios
- ✓ Matrix management





What do project management, portfolio management, and program management have in common? Projects! The basic building blocks that constitute these three disciplines of management are projects. So, it will only be appropriate to start the story of program management by introducing the concepts of projects and project management. Let's start with a simple question: Even given all the required material and the knowledge, how do people really build such immense and complex structures or systems as the Eiffel Tower, the Taj Mahal, and the Internet? The answer is again projects. Through projects, it is possible to build small and big, simple and complex things and systems in an effective and efficient manner. All projects, however, need to be managed. A so-called unmanaged project is simply a poorly managed project and is destined to fail. Therefore, the importance of project management cannot be overstated.

Managing a project means managing the life cycle of a project from the beginning (initiating) to the end (closing), and this is accomplished by using processes that constitute what are called project management *knowledge areas*. While you use your knowledge in terms of processes to manage the projects, the actual management will be greatly influenced by the environment (culture and structure) of the organization in which projects are performed.

Although this chapter is largely focused on providing an overview of project management, I'll be linking some aspects of project management to program management throughout this chapter. After all, the book is about program management. If you are already familiar with project management, you have the option of skipping this chapter. However, you may find it helpful to quickly skim through it—especially if you're more familiar with the practical realities than with the Project Management Institute's (PMI's) terminology. The main goal of this chapter is to present a bird's-eye view of project management before we embark on the subject of program management. To that end, we will explore three avenues: an overview of project management; relationships among projects, programs, and portfolios; and the relationship between project management and program management.

## Basic Concepts and Definitions

Each discipline of knowledge builds upon some basic concepts and definitions, and project management is no exception. The terms that refer to or define these concepts make the language of the discipline.

## Basic Definitions

Although the emphasis in this chapter is on project management, we also briefly explore the relationships between project management and program management, and the relationships between projects, programs, and portfolios. Therefore, very basic terms in project, portfolio, and program management are described briefly here.

**Organization** A group of individuals organized to work for some purpose or mission. Computer companies, energy companies (to whom you pay your electric bills), and cable companies are examples of organizations. An organization may offer products such as books or donuts, or services such as Internet access or online banking. A project is usually performed inside an organization. Different organizations have different structures and cultures, which are discussed further on in this chapter due to their influence on project management and program management.

**Project** This is a work effort made over a finite period of time with a start and a finish to create a unique product, service, or result. Because a project has a start and a finish, it is also called a temporary effort or endeavor.

**Project stakeholder** This is an individual or an organization that can be positively or negatively affected by the project execution. A project may have a wide spectrum of stakeholders, from the project sponsor to an environmental activist who may oppose it, or a consumer-support group.

**Process** This is a set of related tasks performed to manage a certain aspect of a project, such as controlling cost. Each process belongs to a knowledge area.

**Management** This is the practice of directing, controlling, coordinating, and using resources, including human, financial, and technological resources to accomplish predetermined tasks with set goals and objectives.

**Project management** This is the usage of knowledge, skills, and tools to manage a project from start to finish with the goal of meeting the project requirements. It involves using the appropriate processes.

**Knowledge area** In project management a knowledge area is defined by its knowledge requirements related to managing a specific aspect of a project, such as cost, by using a set of processes. *A Guide to the Project Management Body of Knowledge*, also known as the *PMBOK Guide*, is a global standard set by the Project Management Institute (PMI) that recognizes a total of nine knowledge areas such as Cost Management and Human Resource Management.

**Performing organization** This is the organization that is responsible for performing the project. In other words, the project work is mostly performed by the employees of the performing organization.

**Portfolio** According to *The Standard for Portfolio Management* by PMI, a portfolio is a set of projects, programs, or both that is managed in a coordinated fashion to obtain control and benefits not available from managing them individually.

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**Portfolio management** This is the centralized management of one or more portfolios. It includes authorizing, controlling, identifying, managing, and prioritizing projects, programs, and other related work. The purpose is to obtain specific strategic business objectives.

**Program** According to *The Standard for Program Management* by PMI, a program is a set of related projects managed in a coordinated fashion to obtain control and benefits that would not be available if those projects were managed individually. A program can also include non-project work.

**Program management** This is the centralized coordinated management of a specific program to achieve its strategic goals, objectives, and benefits.

**Project management office (PMO)** This refers to an entity in an organization that is responsible for providing centralized coordinated management and support for projects in the organization.

**Program management office (PMO)** This refers to an entity in an organization that is responsible for providing centralized coordinated management for programs (including the projects in the program) of the organization.



Although both have the same abbreviation, PMO, the project management office and the program management office are not identical. For example, only an organization that runs programs will have a program management office, whereas the organization that runs individual projects will have a project management office.

This is a minimal set of terms that you need to understand before we start. More terms will be introduced as we continue exploring program management. Now that you know the definitions of projects, programs, and portfolios, let's explore the relationships among these three concepts.

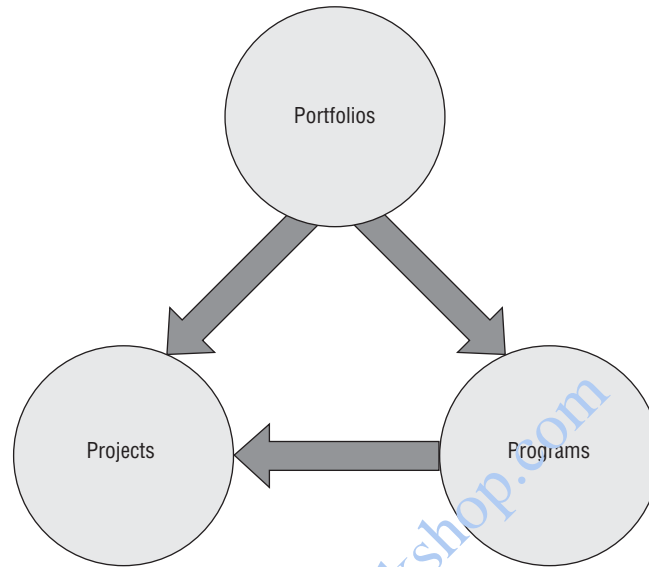
### The Triplet Relationship: Project, Program, and Portfolio

The triplet relationship among portfolios, programs, and projects is shown in Figure 1.1, in which an arrow represents containment. As the figure illustrates, all portfolios are composed of programs, projects, or both. A program consists of only projects and not portfolios. The figure also illustrates that both a program and a portfolio can have projects. That means that a project may have membership in a portfolio directly or through a program.

As compared to projects and programs, a portfolio is closer to an organization's business objectives, and therefore this is where most of the investment decisions are made. If you want to learn about an organization's business intent and direction (or strategy), look at its portfolio.

It's also important to note that an operation is not part of a project. However, a program can include non-project work. Similarly, a portfolio can also include work that is not a part of any of its constituent projects and programs.

Now that you understand these basic terms, you can ask a very basic question: What does it mean to manage a project?

**FIGURE 1.1** Triplet relationship between projects, programs, and portfolios

## Introducing Project Management

At any organization there are lots of activities being executed every day. Most of these activities are organized into groups of interrelated activities. These groups fall into two categories: projects and operations. An operation is an ongoing and repetitive set of tasks, whereas a project has a life cycle: a beginning and an end.

### What Is a Project?

A project is a work effort made over a finite period of time with a start and a finish to create a unique product, service, or result. Because a project has a start and a finish, it is also called a temporary effort or endeavor. In other words, as the *PMBOK Guide* states, a project is a temporary endeavor undertaken to create a unique product, service, or result.

So, a project has two defining characteristics: it is temporary and it creates a unique product. Let's explore further these two defining concepts.

**Temporary** The temporary nature of projects refers to the fact that each project has a definite beginning and a definite end. A project can reach its end in one of two ways:

- The project has met its objectives; that is, the planned unique product has been created.
- The project has been terminated before its successful completion for whatever reason.

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The temporary nature of projects may also apply to two other aspects:

- The opportunity to market the product that the project will produce is temporary; that is, the product needs to be produced in a limited time frame—otherwise it will be too late.
- A project team is temporary; that is, the project team is disbanded after the project ends, and the team members may be individually assigned to other projects.

However, remember that the temporary nature of a project does not refer to the product it creates. The projects can create lasting products such as the Taj Mahal, the Eiffel Tower, or the Internet. The second defining characteristic of a project is that it must create a unique product.

**Unique product** The outcome of a project must be a unique product, service, or result. How do product, service, and result differ from each other?

**Product** This is a tangible quantifiable artifact that is either the end item or a component of it. The big-screen television set in your living room, the Swiss watch on your wrist, and a wine bottle on your table are some examples of products.

**Service** When we say a project can create a service, we mean the capability to perform a service. For example, a project that creates a website for a bank to offer online banking has created the capability to offer online banking service.

**Result** This is usually the knowledge-related outcome of a project; for example, the results of an analysis performed in a research project.



Quite often I will refer to product, service, or result as just *product* for brevity.

Projects are organized to execute a set of activities that cannot be addressed within the limits of the organization's ongoing normal operations. To clearly identify if an undertaking is a project or not, you must understand the difference between a project and an operation.

### Distinguishing Projects from Operations

An organization executes a multitude of activities as part of the work to achieve objectives. Some of these activities are to support projects and others are to support operations. An *operation* is a set of tasks that does not qualify as a project. In other words, an operation is a function that performs ongoing tasks: it does not produce a unique (new) product, it does not have a beginning and an end, or both. For example, to put a data center together is a project, but after you put it together, to keep it up and running is an operation.

It is important to understand that projects and operations share some characteristics, such as the following:

- Both require resources, including human resources (people).
- Both are constrained to limited, as opposed to unlimited, resources.
- Both are managed—that is, planned, executed, and controlled.
- Both have objectives.

The distinctions between the projects and operations can be made by sticking to the definition of a project: temporary and unique. Operations are generally ongoing and repetitive. Although both projects and operations have objectives, a project ends when its objectives are met, whereas an operation continues toward attaining a new set of objectives when the current set of objectives has been attained.

Projects may be performed at various levels of an organization; they vary in size, and accordingly may involve just one person or a team. Table 1.1 presents some examples of projects.

**TABLE 1.1** Examples of Projects

Project	Outcome (product, service, or result)
Constructing the Taj Mahal	Product
Running a presidential-election campaign	Results: win or lose Products: documents
Developing a website to offer digital music downloads	Service
Setting up a computer network in a company	Service
Working on a research paper	Result: research results Product: research paper
Studying the genes of a group of politicians	Result: data or information Products: documents containing the data

A project, once completed, can leave behind it an operation. For example, constructing the Eiffel Tower is a project, whereas managing it for the tourists visiting it every day is an operation.

So, where do projects come from? In other words, how do you come up with a project? Sure, you have an idea, a concept of some final product, but how exactly do you write it down and declare that it is the project? A project is born and brought up through a procedure called progressive elaboration.

## Progressive Elaboration

As the saying goes, Rome was not built in a day, and a project plan isn't either. Usually, first there is a concept and a broad vision for the end product—that is, the outcome of the project. The clearer a vision you have of the unique product that you want from the project, the more accurate the project plan will be. So, you move toward the project plan in incremental steps as the ideas about the final product are refined and as you get more and more information about the requirements in a progressive fashion. This procedure of defining (or planning) a project is called *progressive elaboration*.

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Here is an example of progressive elaboration: You wake up one morning with an idea to close the digital gap in your community. You have a concept of the final product (result) of your project: close the digital gap in your community. But what do you really mean by that? It may include many things: build computers in an economical way and provide them at low prices to those who don't have them, raise awareness of the necessity of computer literacy, offer classes, and the like. So, now you are really working to refine your idea of the final product. The second question is, how are you going to do this? Here is where the project plan comes into play. You can see that the project plan and its accuracy and details depends upon how refined the idea of the final product is. The final product or objectives and the plan to achieve them will be developed further and further over the course of several steps.



Uncontrolled changes that make their way into the project without being properly processed are called *scope creep*. Do not confuse progressive elaboration with scope creep.

So, progressive elaboration, in general, means developing something in incremental steps. The project plan will be broadly defined to start with, and will get more accurate, detailed, and explicit in an incremental fashion as better understanding about the project deliverables and objectives develops.

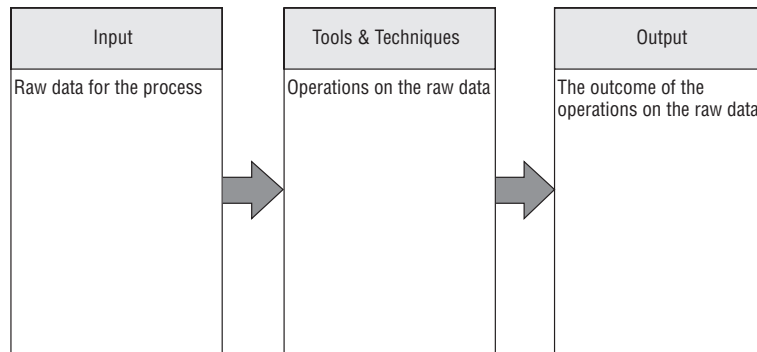
Even after you have an approved final project plan and the project starts executing, progressive elaboration continues to some extent. For example, you will see further on in this chapter that the execution and planning stages of a project interact with each other. Each stage of a project is managed by performing a set of processes.

### Processes

Processes are the heart of project management. If you want to think of project management like a project management professional does, think in terms of processes. Almost everything in the world of project management is done through processes.

So, what is a process, anyway? Well, back up a little and look around you; you will see processes everywhere, not only in project management. For example, when you make coffee in the morning, you go through a process. The water, the coffee filter, and the roasted hazelnut coffee made by grinding golden-colored beans are the input items to this process. The coffee-maker is the tool and how you made the coffee is the technique. A cup of freshly brewed hazelnut coffee is an output item from this process. So, a process is a set of interrelated activities performed to obtain a specified set of products, results, or services. A process, as explained in the example and in Figure 1.2, consists of three elements: input, tools and techniques, and output.

Of course, you can come up with other examples of processes that you have been using in your life without realizing it. In project management, you use processes to accomplish things such as develop a project schedule, direct and manage the project execution, and develop and manage the project team.

**FIGURE 1.2** The three elements of a process: input, tools and techniques, and output

**Input** The input to a process consists of the raw data that is needed to start the process. For example, the list of activities that need to be scheduled is one of several input items to the process that will be used to develop a project's schedule.

**Tools and techniques** Tools and techniques are the methods that are used to operate on the input to transform it into output. For example, project management software that helps to develop a schedule is a tool used in the Schedule Development process.

**Output** The output is the outcome or the result of a process. Each process contains at least one output item; otherwise there is no point in performing a process. For example, an output item of the Schedule Development process is, as you might guess, the project schedule.

Now that you understand what a process is, you can see that you will be using different processes at different stages of a project, such as Planning and Executing. Actually, the whole life cycle of a project can be understood in terms of five stages, with each stage corresponding to a group of processes.

## Understanding the Project Life Cycle

From authorization to completion, a project goes through a whole life cycle that includes defining the project objectives, planning the work to achieve these objectives, performing the work, monitoring the progress, and closing the project after receiving the product acceptance. You can look at the life cycle of a project from two perspectives: product-oriented and process-oriented.

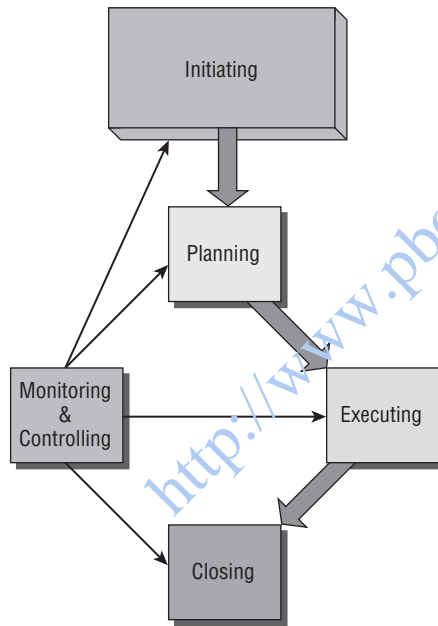
From the product-oriented perspective, the project life cycle is a sequence of project phases. A project phase is a project duration characterized by the completion and acceptance of one or more project deliverables. A *deliverable* is a work product that can be measured and verified, such as a design document, a feasibility study, or a computer program. Each phase can be initiated, planned, executed, controlled, and closed. A project may have one or more phases. What if a project has only one phase? Then the product-oriented view of the project life cycle is not very interesting. That's when it could be helpful to look at the project life cycle from the process-oriented perspective.

**Exam Spotlight**

The PMI standard adopts the product-oriented view of the project life cycle, and therefore defines the life cycle in terms of phases. However, remember that the overall project management approach adopted by PMI is process oriented.

From the process-oriented perspective, a project life cycle consists of Initiating, Planning, Executing, Controlling, and Closing. In a multiple-phase project you will need to go through these stages multiple times. These different process-oriented stages of the project life cycle are shown in Figure 1.3, where the arrows indicate the flow of information.

**FIGURE 1.3** Each of the stages in a project's life cycle represents a process group.



The five stages, called *process groups*, of a project life cycle are described in the following.

**Initiating** This stage defines and authorizes the project. The project manager is named and the project is officially launched through a signed document called the *project charter*, which contains items such as the purpose of the project, a high-level product description, assumptions and constraints, a summary of the milestone schedule, and the business case for the project. Another document that is the outcome of this stage is called the *preliminary scope statement*, which describes the characteristics and boundaries of the project. The processes used to perform this stage fall into the Initiating process group.

Table 1.2 presents the processes in the Initiating process group, along with their major outputs.

**TABLE 1.2** Processes in the Initiating Process Group

Knowledge Area	Process	Major Output
Integration Management	<ol style="list-style-type: none"> <li>1. Develop Project Charter</li> <li>2. Develop Preliminary Project Scope Statement</li> </ol>	<ol style="list-style-type: none"> <li>1. Project charter</li> <li>2. Preliminary project scope statement</li> </ol>

**Planning** In this stage, the project manager and the project management team refine the project objectives and requirements and develop the project management plan. This is a collection of several plans that, taken together, constitute a course of action required to achieve the objectives and meet the requirements of the project. The project scope is finalized with the project scope statement. The project management plan, the outcome of this stage, contains subsidiary plans such as the project scope management plan, the schedule management plan, and the quality management plan. The processes used to perform this stage fall into the Planning process group.

Table 1.3 presents the project management processes in the Planning process group, along with their major outputs.

**TABLE 1.3** Project Management Processes in the Planning Process Group

Knowledge Area	Process	Major Output
Integration Management	<ol style="list-style-type: none"> <li>1. Develop Project Charter</li> <li>2. Develop Preliminary Project Scope Statement</li> </ol>	<ol style="list-style-type: none"> <li>1. Project charter</li> <li>2. Preliminary Project Scope Statement</li> </ol>
Scope Management	<ol style="list-style-type: none"> <li>1. Scope Planning</li> <li>2. Scope Definition</li> <li>3. Create WBS</li> </ol>	<ol style="list-style-type: none"> <li>1. Project scope management plan</li> <li>2. Project scope statement</li> <li>3. Work breakdown structure (WBS)</li> </ol>
Time Management	<ol style="list-style-type: none"> <li>1. Activity Definition</li> <li>2. Activity Sequencing</li> <li>3. Activity Resource Estimating</li> <li>4. Activity Duration Estimating</li> <li>5. Schedule Development</li> </ol>	<ol style="list-style-type: none"> <li>1. Activity list</li> <li>2. Schedule network diagrams that display the dependencies among the activities</li> <li>3. Activity duration estimates</li> <li>4. Project schedule</li> </ol>
Cost Management	<ol style="list-style-type: none"> <li>1. Cost Estimating</li> <li>2. Cost Budgeting</li> </ol>	<ol style="list-style-type: none"> <li>1. Activity cost estimates</li> <li>2. Cost baseline (budget with a timeline)</li> </ol>

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**TABLE 1.3** Project Management Processes in the Planning Process Group (*continued*)

Knowledge Area	Process	Major Output
Quality Management	Quality Planning	Quality management plan
Human Resource Management	Human Resource Planning	Staffing management plan and roles and responsibilities
Communication Management	Communication Planning	Communication management plan
Risk Management	<ol style="list-style-type: none"> <li>1. Risk Management Planning</li> <li>2. Risk Identification</li> <li>3. Qualitative Risk Analysis</li> <li>4. Quantitative Risk Analysis</li> <li>5. Risk Response Planning</li> </ol>	<ol style="list-style-type: none"> <li>1. Risk management plan</li> <li>2. Risk register—contains the list of risks</li> <li>3. Updates to risk register</li> <li>4. Updates to risk register</li> <li>5. Updates to risk register and risk-related contractual agreements</li> </ol>
Procurement Management	<ol style="list-style-type: none"> <li>1. Plan Purchases and Acquisitions</li> <li>2. Plan Contracting</li> </ol>	<ol style="list-style-type: none"> <li>1. Procurement management plan and contract statement of work</li> <li>2. Procurement documents</li> </ol>

**Executing** In this stage, the project manager implements the project management plan and the project team performs the work scheduled in the planning stage. You coordinate all the activities being performed to achieve the project objectives and meet the project requirements. Of course, the main output of this project is the project deliverables. Approved changes, recommendations, and defect repairs are also implemented in this stage. But where do these changes and recommendations come from? They arise from monitoring and controlling the project. The stakeholders can also suggest changes, which must go through an approval process before implementation. The project execution is performed by using the processes that fall into the Executing process group.

Table 1.4 presents the project management processes in the Executing process group, along with their major outputs.

**TABLE 1.4** Processes in the Executing Process Group

Knowledge Area	Process	Major Output
Integration Management	Direct and Manage Project Execution	Deliverables and work-performance information

**TABLE 1.4** Processes in the Executing Process Group (*continued*)

Knowledge Area	Process	Major Output
Quality Management	Perform Quality Assurance	Change requests and recommendations for corrective actions
Human Resource Management	1. Acquire Project Team 2. Develop Project Team	1. Project staff assignments 2. Team-performance assessment
Communication Management	Information Distribution	Project reports and lessons-learned documentation
Procurement Management	1. Request Seller Responses 2. Select Sellers	1. Qualified-sellers list and proposals 2. Selected sellers and contract management plan

**Monitoring and Controlling** You monitor and control the project throughout its life cycle, including the Executing stage. Monitoring and controlling includes defending the project against scope creep (unapproved changes to the project scope), monitoring the project progress and performance to identify variance from the plan, and recommending preventive and corrective actions to bring the project in line with the planned expectations. Requests for changes, such as change to the project scope, are also included in this stage; these requests can come from you or from any other project stakeholder. The changes must go through an approval process and only the approved changes are implemented. The processes used in this stage fall into the Monitoring and Controlling process group.

Table 1.5 presents the project management processes in the Monitoring and Controlling process group, along with their major outputs.

**TABLE 1.5** Project Management Processes in the Monitoring and Controlling Process Group

Knowledge Area	Process	Major Output
Integration Management	1. Integrated Change Control 2. Monitor and Control Project Work	1. Approvals and rejections of change requests 2. Forecasts and change requests
Scope Management	1. Scope Verification 2. Scope Control	1. Change requests 2. Change requests and scope update

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**TABLE 1.5** Project Management Processes in the Monitoring and Controlling Process Group (*continued*)

Knowledge Area	Process	Major Output
Time Management	Schedule Control	Performance measurements, change requests, and schedule update
Cost Management	Cost Control	Performance measurements, change requests, and cost update
Quality Management	Perform Quality Control	Quality control measurements, change requests, and quality baseline updates
Human Resource Management	Manage Project Team	Change requests
Communication Management	1. Performance Reporting 2. Manage Stakeholders	1. Performance reports and forecasts 2. Issue resolutions
Risk Management	Risk Monitoring and Control	Change requests and risk register updates
Procurement Management	Contract Administration	Contract documentation and change requests

**Closing** In this stage, you manage the formal acceptance of the project product, close any contracts involved, and bring the project to an end by disbanding the project team. Closing the project includes project review for lessons learned, and possibly turning over the outcome of the project to another group, such as the maintenance or operations group. Don't forget the last but not the least task of the Closing stage: celebration. The terminated projects (that is, the projects cancelled before completion) should also go through the Closing stage. The processes used to perform the closing stage fall into the Closing process group.

Table 1.6 presents the project management processes in the Closing process group, along with their major outputs.

**TABLE 1.6** Project Management Processes in the Closing Process Group

Knowledge Area	Process	Major Output
Integration Management	Close Project	Final deliverable: product, service, or result
Procurement Management	Contract Closure	Closure of contracts



Remember that what we refer to as *project stages* here are not the project phases. A *project phase* is part of the whole project in which certain milestones or project deliverables are completed. All these stages can be applied to any phase of a project that is divided into phases.

Table 1.7 presents a summary of the project life cycle. The Initiating stage authorizes a project by naming the project manager, the Planning stage further defines the project objectives and plans the work to meet those objectives, the Executing stage executes the work, the Monitoring and Controlling stage monitors the progress of the project and controls it to keep it in line with the plan, and the Closing stage formally closes the project by obtaining product acceptance. Each of these stages is performed by using a group of processes, and so these stages are called *process groups*.

**TABLE 1.7** The Stages of a Project Life Cycle: The Project Process Groups

Stage (Process Group)	Main Goal	Main Output
Initiating	Authorize the project	Project charter and preliminary project scope statement
Planning	Plan and schedule the work to perform the project	Project management plan that contains subsidiary plans, such as scope management plan and schedule management plan
Executing	Perform the project work	Project deliverables: product, service, and results
Monitoring and Controlling	Monitor the progress of the project to identify the variance from the plan and to correct it	Change requests and recommendations for preventive and corrective actions
Closing	Close the project formally	Product acceptance and contract closure



Like project management, program management has five process groups with the same names. However, a process group with the same name in project management and program management does not necessarily have an identical set of processes. Furthermore, if two processes in program management and project management have the same name, they are still different processes performed at different management levels.

The stages of a project life cycle determine when a process is executed, whereas the processes themselves belong to certain knowledge areas of project management.

# Understanding Project Management Knowledge Areas

Managing projects means applying knowledge, skills, and tools and techniques to project activities to meet the project objectives. You do this by performing some processes at various stages of the project discussed in the previous section. That means processes are part of the knowledge required to manage projects. Each aspect of a project is managed by using the corresponding knowledge area. For example, each project has a scope that needs to be managed, and the knowledge required to manage scope is in the knowledge area called project Scope Management. To perform the project work within the project scope you need human resources; these resources need to be managed, and the knowledge area used to manage human resources is called Human Resource Management. You get the idea. Each process belongs to one of the nine knowledge areas discussed in the following.



The first few process groups are discussed in more detail than the others. You can always consult the PMBOK Guide for details.

**Project Scope Management** The primary purpose of the project Scope Management knowledge area is to ensure that all the required work and only the required work is performed to complete the project successfully. This is accomplished by defining and controlling what is included in the project and what is not. To be specific, project Scope Management includes the following:

**Scope plan** Develop the project scope management plan that describes how the project scope will be defined and controlled, and how at the end it will be verified that all the work within the scope has been completed. This is accomplished by using the Scope Planning process.

**Scope definition** Develop the detailed project scope statement, which forms the basis for the project scope. This is accomplished by using the Scope Definition process.

**Work breakdown structure (WBS)** Decompose the project deliverables into more-manageable smaller work components. The outcome of this exercise is called the work breakdown structure. This is done by using the Create WBS process.

**Scope control** Control changes to the project scope: only the approved changes to the scope should be implemented. This is accomplished by using the Scope Control process.

**Scope verification** Plan how the completed deliverables of the project will be accepted. Scope verification is planned by using the Scope Planning process and is performed by using the Scope Verification process.

So, the project scope management, in part, defines the work required to complete the project. It's a finite amount of work and will need a finite amount of time, which needs to be managed as well.

**Project Time Management** The primary purpose of the Project Time Management knowledge area is to develop and control the project schedule. This is accomplished by performing the following components and their corresponding processes:

**Activity definition** Identify all the work activities that need to be scheduled to produce the project deliverables.

**Activity sequencing** Identify the dependencies among the activities that need to be scheduled (that is, the schedule activity) so that they can be scheduled in the right order.

**Activity resource estimating** For each schedule activity, estimate the types of resources and the quantity for each type.

**Activity duration estimating** Estimate the time needed to complete each schedule activity.

**Schedule development** Analyze the data created in the previous steps to develop the schedule.

**Schedule control** Control changes to the project schedule.

You perform these tasks by using the corresponding processes. It will cost you to get the activities in the schedule completed, and the cost needs to be managed too.

**Project Cost Management** The primary goal of project Cost Management is to estimate the cost and to complete the project within the approved budget. Accordingly, the Cost Management knowledge area includes the following components:

**Cost estimating** Develop the cost of the resources needed to complete the project, including schedule activities and outsourced work.

**Cost budgeting** Aggregate the costs of individual activities to establish a cost baseline.

**Cost control** Monitor and control the cost variance in the project execution; that is, the difference between the planned cost and actual cost during execution, and changes to the project budget.

You will use the appropriate processes to accomplish these tasks. The resources needed to complete the project activities include human resources, which need to be managed, as well.

**Project Human Resource Management** The primary purpose of the project Human Resource Management knowledge area is to obtain, develop, and manage the project team that will perform the project work. To be specific, project Human Resource Management includes the following components:

**Planning human resources** Identify project roles, responsibilities of each role, and reporting relationships among the roles. Also, create the staff management plan that describes when and how the resource requirements will be met.

**Acquiring project team** Obtain the human resources.

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**Developing project team** Improve the competencies of the team members and interaction among them to optimize the team performance.

**Managing project team** Track the performance of team members, provide them feedback, and resolve issues and conflicts: all with the goal of enhancing performance; that is, to complete the project in time and within the planned cost and scope.

These components are performed by using the corresponding processes. There will be situations when your organization does not have the expertise to perform certain schedule activities in-house. For this or other reasons, you might want to outsource some of the project work; this outsourcing is called *procurement*, which also needs to be managed.

**Project Procurement Management** The primary purpose of the Procurement Management knowledge area is to manage acquiring products (that is products, services, or results) from outside the project team to complete the project. The external vendor that offers the service is called the *seller*. The procurement management includes planning acquisitions, planning contracts with the sellers, selecting sellers, administering contracts with the sellers, and closing contracts. You use the corresponding processes to accomplish these tasks.

Be it procured or in-house work, there are always some uncertainties, which give rise to project risks; these also need to be managed.

**Project Risk Management** A *project risk* is an event that if it occurs will have a positive or negative effect on meeting the project objectives. The primary purpose of the Project Risk Management knowledge area is to identify the risks and respond to them should they occur. To be specific, project risk management includes the following:

- Plan the risk management; that is, determine how to plan and execute the risk management tasks.
- Identify risks.
- Perform risk analysis.
- Develop a risk response plan; that is, what action to take should a risk occur.
- Monitor and control risks; that is, track the identified risks, identify new risks, and implement the risk response plan.

These tasks related to risk management are performed by using the corresponding processes. The goal of risk management is to help meet the project objectives. The degree to which the project objectives and requirements are met is called quality, which needs to be managed.

**Project Quality Management** *Project quality* is defined as the degree to which a project satisfies its objectives and requirements. For example, a high-quality project is one that is completed in time and all the work in the project scope is completed within the planned budget. The project Quality Management knowledge area includes the following:

- Perform quality planning; that is, determine which quality standards are relevant to the project at hand and how to apply them.

- Perform quality assurance; that is, ensure the planned quality standards are applied.
- Perform quality control; that is, monitor specific project results to ensure they comply with the planned quality standards, and recommend actions to eliminate the causes of unsatisfactory progress.

These tasks of the project Quality Management knowledge area are performed by using the corresponding processes. In order to unify different pieces into a whole project, the different project management activities need to be integrated.

**Project Integration Management** A project is planned and executed in pieces, and all those pieces are related to each other and need to come together. That is where integration management comes in. For example, integrating different subsidiary plans into a project management plan needs to be managed. The project Integration Management knowledge area includes developing the project management plan, directing and managing project execution, monitoring and controlling the project work, and closing the project.

So, while managing all the aspects of the project, you, the project manager, will need to coordinate among different activities and groups, and for that you need to communicate.

**Project Communication Management** It is absolutely imperative for the success of the project that the project information is generated and distributed in a timely fashion. Communication is the most important aspect of a project and the most important skill for a project manager to have. The Communication Management knowledge area includes the following:

- Plan communication; that is, determine the information and communication needs of the project at hand.
- Distribute needed information to the project stakeholders in a timely fashion.
- Report project performance, including the project status.
- Communicate to resolve issues among the stakeholders.

As you have seen, managing a project largely means performing a set of processes at various stages of the project, such as Initiating and Planning. Accordingly, processes are grouped corresponding to these stages, and these groups are called process groups. Processes are part of the knowledge required to manage projects. So, each of these processes belongs to one of the nine knowledge areas identified in the *PMBOK Guide*. So, a process has a dual membership: one in a process group indicating at what stage of the project the process is performed, and the other in a knowledge area indicating what aspect of the project is managed by using the process. Table 1.8 shows this membership for all the processes identified in the *PMBOK Guide*.

In the parentheses next to each process name in Table 1.8 there appears the letter *Y* or *N*; *Y* indicates that a process with the same name also exists in program management, and *N* means that there is no process in program management with an identical name. The processes with identical names in project management and program management reflect how closely related program management and project management are. However, as noted earlier, having two identically named processes in project management and program management does not mean that they represent one and the same process. It means that there are similar tasks to be performed at different levels of management: the program level and the constituent projects level.

**TABLE 1.8** Mapping of the Project Management Processes to Process Groups and Knowledge Areas.

Process Groups	Knowledge Areas				
	Initiating	Planning	Executing	Monitoring and Controlling	Closing
<b>Integration Management</b>	1. Develop Project Charter (N) 2. Develop Preliminary Project Scope Statement (N)	Develop Project Management Plan (N)	Direct and Manage Project Execution (N)	1. Monitor and Control Project Work (N) 2. Integrated Change Control (Y)	Close Project (N)
<b>Human Resource Management</b>	—	Human Resource Planning (Y)	1. Acquire Project Team (N) 2. Develop Project Team (N)	Manage Project Team (N)	—
<b>Scope Management</b>	—	1. Scope Planning (N) 2. Scope Definition (Y) 3. Create WBS (N)	—	1. Scope Verification (N) 2. Scope Control (Y)	—
<b>Time Management</b>	—	1. Activity Definition (N) 2. Activity Sequencing (N) 3. Activity Resource Estimating (N) 4. Activity Duration Estimating (N) 5. Schedule Development (Y)	—	Schedule Control (Y)	—
<b>Cost Management</b>	—	1. Cost Estimating (N) 2. Cost Budgeting (N)	—	Cost Control (Y)	—

**TABLE 1.8** Mapping of the Project Management Processes to Process Groups and Knowledge Areas. *(continued)*

Process Groups	Knowledge Areas				
	Initiating	Planning	Executing	Monitoring and Controlling	Closing
<b>Procurement Management</b>	—	1. Plan Purchases And Acquisitions (N) 2. Plan Contracting (N)	1. Request Seller Responses (Y) 2. Select Sellers (Y)	Contract Administration (N)	Contract closure (Y)
<b>Quality Management</b>	—	Quality Planning (Y)	Perform Quality Assurance (Y)	Perform Quality Control (Y)	—
<b>Risk Management</b>	—	1. Risk Management Planning (N) 2. Risk Identification (N) 3. Qualitative Risk Analysis (N) 4. Risk Response Planning (N)	—	Risk Monitoring and Control (Y)	—
<b>Communication Management</b>	—	Communication Planning (Y)	Information Distribution (Y)	1. Performance Reporting (Y) 2. Managing Stakeholders (N)	—



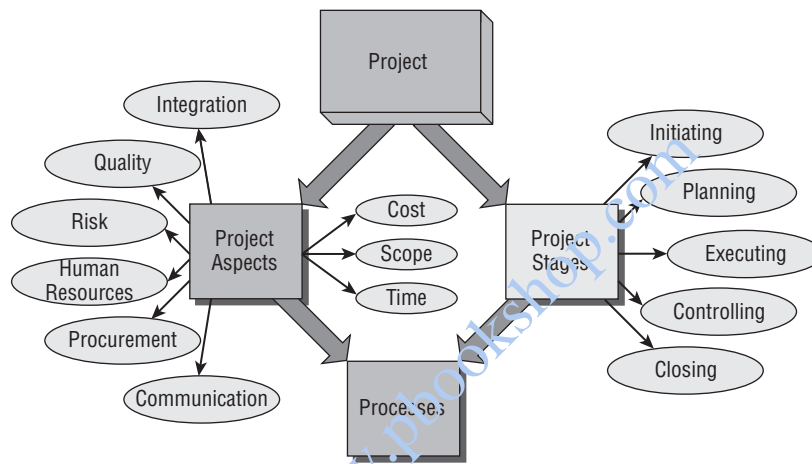
Not all the processes are used in all projects. The project management team decides which processes need to be used for the project at hand.

Figure 1.4 shows the big picture of project management: the project, the processes, the project life cycle in terms of project stages, and the project aspects managed by different knowledge areas.

There are nine important aspects of projects, each of which is managed by using the corresponding knowledge area. For example, cost is managed by using the Cost Management knowledge area, and communication is managed by using the Communication Management knowledge area.

Each project is performed by some individuals and it can also affect some individuals or organizations, even if they are not directly (officially) involved in the projects. Now we are talking about the project stakeholders.

**FIGURE 1.4** The big picture of project management: the aspects of a project that need to be managed at different stages of the project life cycle by using the processes



## Introducing Project Stakeholders

From the day a project gets into your court, you start meeting a very special class of people called *project stakeholders*. It is very important for the success of the project that you identify these individuals and communicate with them effectively throughout the project.

### Identifying Project Stakeholders

Project stakeholders are individuals and organizations whose interests are affected (positively or negatively) by the project execution and completion. In other words, a project stakeholder has something to gain or lose from the project. Accordingly, the stakeholders fall into two categories: *positive stakeholders* who will normally benefit from the success of the project, and *negative stakeholders* who see some kind of disadvantage coming from the project. The implications, obviously, are that the positive stakeholders would like to see the project succeed and the negative stakeholders' interests

will be better served if the project is delayed or canceled altogether. For example, your city mayor may be a positive stakeholder in a project to open a megastore such as Safeway or Target in your neighborhood because it brings business to the city, whereas some local business leaders may look at it as a threat to the local businesses and thereby may act as negative stakeholders.

Negative stakeholders are often overlooked by the project manager and the project team, which increases the project risk. Ignoring positive or negative project stakeholders will have a damaging impact on the project. Therefore, it's important that you, the project manager, start identifying the project stakeholders early on in the project. The different project stakeholders may have different and conflicting expectations that you need to analyze and manage.

Identifying all the project stakeholders may be a difficult task, but the following are the obvious ones, starting with you:

**Project manager** To start with, include the project manager in the list of the project stakeholders.

**Project management office (PMO)** If your organization has a PMO and it is directly or indirectly responsible for the outcome of a project, then the PMO is a stakeholder in that project.

**Project management team** These are the members of the project team involved in the project management tasks.

**Project team members** The members of the project team that are actually performing the project work are also among the project stakeholders.

**Performing organization** The organization whose employees are doing the project work is a stakeholder organization.

**Customer/user** These include the individual or the organization for whom the project is being performed and the users that will use the product that will result from a successful completion of the project.

**Project sponsor** This is the individual or group that provides financial resources for the project.

**Influencers** These are the individuals or groups that are not direct customers or users of the product or service that will come from the project but that can influence the course of the project due to their positions in the customer organization or the performing organization. The influence can be positive or negative—that is, for or against the project.

In addition to these key stakeholders, there can be a number of other stakeholders inside and outside of your organization that may be less obvious to identify. These, depending upon the project, may include investors, sellers, contractors, family members of the project team members, government agencies, media outlets, lobbying organizations, individual citizens, and society at large. Have I left anyone out?



We will revisit the topic of stakeholders in Chapter 2, “The Program Management Framework,” in the context of program management. There will be stakeholders at the program level that are not dealt with at the constituent project level.

It is critical for the success of the project that you identify positive and negative stakeholders early on in the project, understand and analyze their varying and conflicting expectations, and manage those expectations throughout the project.

## The Project Manager: A Special Stakeholder

The project manager is a very special project stakeholder. The job (role) of a project manager is extremely challenging and therefore exciting. With the help of the team, it is the project manager's responsibility to bring all the pieces together and make the project happen. The project manager does that by using a multitude of skills, described here.

**Communication** The importance of communication in project (and program) management cannot be overemphasized. Even a well-scheduled and well-funded project in the hands of a hard-working team of experts can fail due to the lack of proper communication.

You will be communicating throughout the project. So, for a given project you must develop a communication strategy that should address the following issues:

- What needs to be communicated?
- With whom do you want to communicate? You may need to communicate different items to different individuals or groups.
- How do you want to communicate? That is, what is the medium of communication? Again, this may differ depending on who you are communicating with.
- What is the outcome of your communication? You need to monitor your communication and its results to see what works and what does not, and thereby to improve the communication.

Communication is an ingredient in many other skills, such as negotiation and problem solving.

**Negotiation** A negotiation is give-and-take with the goal of generating a win-win outcome for both parties. You, the project manager, may need to negotiate at any stage of the project life cycle. Here are some examples of negotiations:

- Negotiating with the stakeholders regarding the expectations during project planning. For example, the suggested deadline for the project schedule may not be practical, or you may need a certain type or quantity of resources to make that happen.
- Negotiating with the functional managers for obtaining human resources such as software developers.
- Negotiating with the team members for specific job assignments and possibly during conflict resolution among the team members.
- Negotiating the changes to the project schedule, budget, or both because a stakeholder proposed changes to the project objectives.
- Negotiating with the external vendors in procurement. However, in the contract negotiations, representatives from the legal department may be involved.

Sometimes you will be negotiating to solve a problem.

**Problem solving** The project-related problems may occur among the stakeholders (including team members) or with the projects. Either way, they are there to damage the project. So, your task is two-pronged: identify the problem early enough and solve it. Here is the general technique for accomplishing this:

1. Look for the early warning signs by paying close attention to the formal progress reports, and to what the team members say and do regarding the project.
2. Once you identify a potential problem, do your homework: understand and identify the problem clearly by collecting more information without passing judgment.
3. Once the problem and its causes are clearly identified, work with the appropriate stakeholders such as project team members to explore multiple (alternative) solutions.
4. Evaluate the multiple solutions and choose the solution that you will implement.

The key point throughout the problem-solving process is to focus on the problem, and not on the individuals, with the goal of finding the solution to help the project succeed—no finger-pointing.

Sometimes in choosing and implementing the correct solution you will need to exercise your influencing skill.

**Influencing** Influencing means getting individuals or groups to do what you want them to do without necessarily having a formal power over them. This is increasingly becoming an essential management skill in today's information economy. In order to exercise influence, you must understand the formal and informal structure of your organization. Again, you may need to use influencing when dealing with any aspect of the project; for example, controlling the changes to the project, negotiating schedule or resource assignments, resolving conflicts, and the like.

**Leadership** In the traditional organizational structure, project managers do not have formal authority over the project team members who perform the team work. So you have no other choice than to manage by leadership and not by authority (power). The good news is that managing by leadership is overall more effective and productive than managing by authority. A project team is generally a group of individuals coming together for the lifetime of the project from different functional groups with different skills and experience. They need a leader to show them the vision and excite, inspire, and motivate them toward the goals and the objectives of the project, and you, the project manager, are that leader.

Different organizations have different attitudes and policies toward project management. The structure of the performing organization has a big influence on your job as a project manager.

## Influences of Organizational Structures on Projects

A project is typically performed inside an organization, called the *performing organization*. Therefore projects are influenced by many characteristics of the performing organization, such as culture, style, organizational structure, and maturity of the organization.

From the perspective of a project, there are two kinds of organizations: project-based and non-project-based. The project based organizations fall into two subcategories: those that derive their revenue primarily from performing projects for others, and those that do in-house projects to deliver products or services for their own customers. Project-based organizations are well aware of the importance of project management and generally have systems to support project management. The non-project-based organizations generally have a low appreciation and understanding of the importance of project management and often lack systems to support project management.

To do your job efficiently and effectively, you must figure out what kind of organization you are in. Another huge factor that greatly influences the projects and the management is the organizational structure. From the perspective of structure, the organizations fall into three categories: functional organizations, projectized organizations, and matrix organizations.

## Functional Organization

A *functional* organization is one that has a traditional organizational structure in which each functional department (such as development, marketing, and sales) is a separate entity. As shown in Figure 1.5, the members of each department (staff) report to the functional manager of that department, and the functional manager in turn reports to an executive, such as the chief executive officer (CEO). Depending on the size of the organization, there could be a hierarchy within the Functional Managers layer shown in the figure; for example, directors of development, QA, and IT operations reporting to the vice president (VP) of engineering, who in turn reports to the CEO.

The scope of a project in a functional organization is usually limited to the boundaries of the functional department. Therefore, each department runs its projects largely independent of other departments. When a communication needs to occur between two departments it is carried through the hierarchy of functional managers.

All the managerial power (authority) in a functional organization is vested in the functional managers, who control the team members' performance evaluations, salary, bonus, hiring, and firing. Project managers are held responsible for the project results even though they have little say over resource assignments and holding team members accountable for their work. As a result, project managers in a functional organization are often frustrated. Their work is, at best, challenging. You, as a project manager in a functional organization, can benefit greatly by maintaining good relationships with functional managers and team members. So, networking and leadership are the key points to your success in a functional organization.

A project manager in a functional organization has the following attributes:

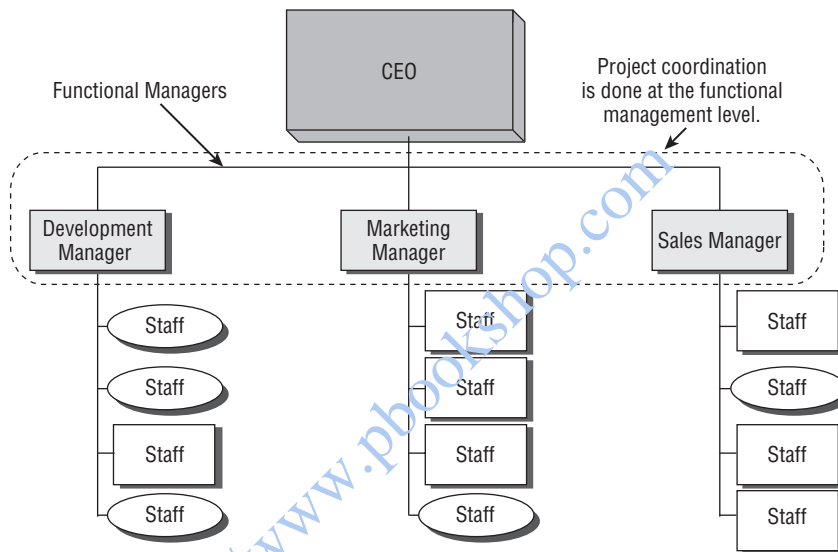
- Part-time (also with part-time project team), that is, the project manager and the project team both can be part-time.
- Little or no authority over anything: resource assignments, team members, and the like
- Reports directly to a functional manager
- Little or no administrative staff to help the project



In functional organizations, a project manager may be called something else, such as a project coordinator or a team leader.

On the other end of the spectrum is the projectized organization.

**FIGURE 1.5** An example of the structure of a functional organization. Ovals represent staff involved in a project.



## Projectized Organization

A *projectized* organization is one whose structure is organized around projects. Most of the organization's resources are devoted to the projects. As shown in Figure 1.6, the project team members report directly to the project manager, who has a great deal of independence and authority. So along with responsibility comes the high level of autonomy over the projects. The project managers in a projectized organization are happy campers. A functional organization and a projectized organization are on the opposite ends of the spectrum of a project manager's authority.

A project manager in a projectized organization has the following attributes:

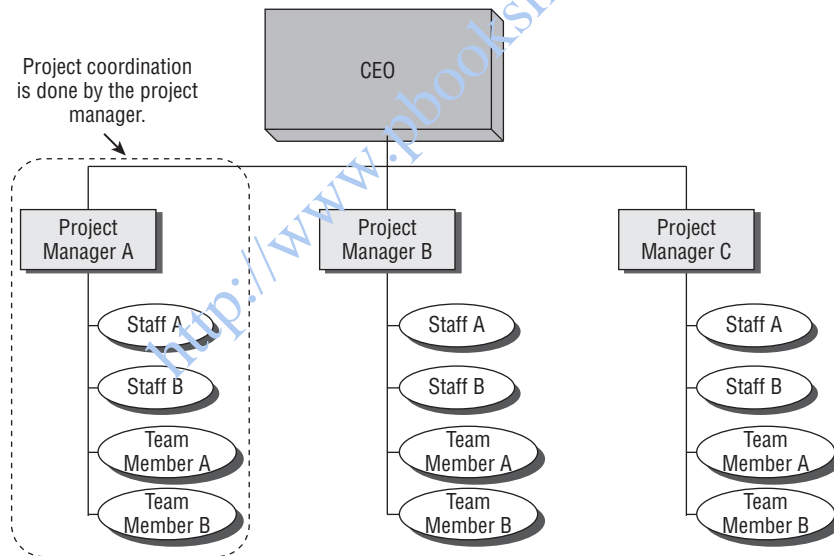
- Full-time
- Full authority over the project team
- Full-time administrative staff to help the project

In the middle of the spectrum is the matrix organization.

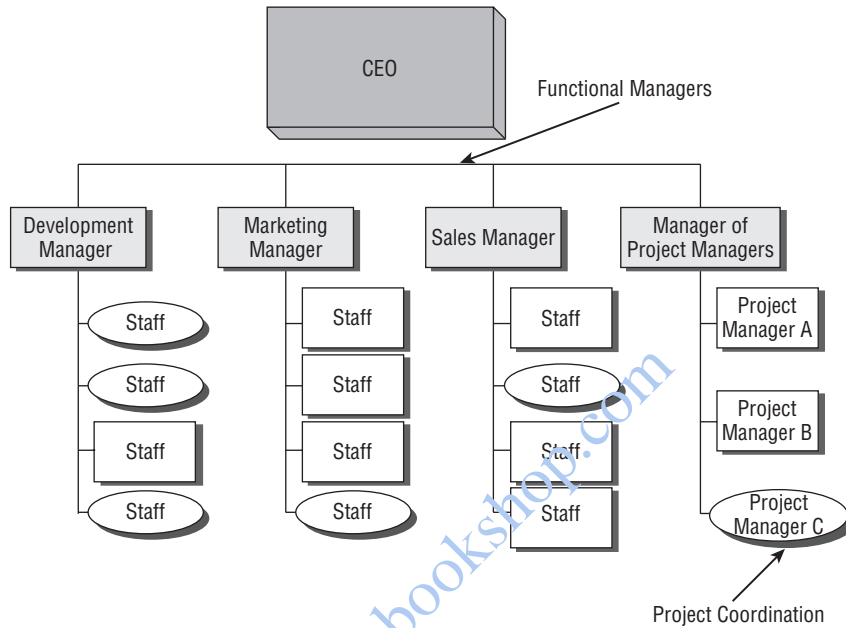
## Matrix Organization

A matrix organization is organized into functional departments, but a project is run by a project team with members coming from different functional departments, as shown in Figure 1.7. On the spectrum of a project manager's authority, matrix organizations are between two extremes: functional and projectized organizations. Matrix organizations are generally categorized into *strong matrix*, which is closer to a projectized structure, *weak matrix*, which is closer to functional structure; and *balanced matrix*, which is between strong and weak.

**FIGURE 1.6** An example of the structure of a projectized organization. Ovals represent staff involved in a project under a given project manager.



**FIGURE 1.7** An example of the structure of a matrix organization. Ovals represent staff involved in a project.



The influences of the different organizational structures on the projects are summarized in Table 1.9.

**TABLE 1.9** Influences of the Organizational Structures on Projects

Project characteristic	Organizational Structure		
	Functional	Matrix	Projectized
Project manager's authority	None to low	Low to high	High to full
Project manager's role	Part-time	Part-time to full-time	Full-time
Project management administrative staff	None to part-time	Part-time to full-time	Full-time
Project budget controlled by:	Functional manager	Functional manager, project manager, or both	Project manager
Resource availability	Low	Limited to high	High to full

So, you have learned how the five process groups (the different stages in the project life cycle), and nine project management knowledge areas constitute the project management framework. The actual implementation of project management is greatly influenced by the facts on the ground; the organizational structure, for example. Throughout this book, you will be exploring the details of project management and getting introduced to some advanced concepts up front will make that journey more pleasant and smoother. The management in a matrix organization is called matrix management, which is further discussed later on in this chapter.

The organizational structures and culture influence the programs in very much the same way as they influence the projects.

## Influences of Organizational Culture and Structure on Programs

Both projects and programs are affected by the organizational culture and structures.

### Influence of Organizational Culture

Each organization often develops its own unique culture that depends on many factors, such as the application area of the organization and the general management philosophy implemented in the organization. The organizational culture includes the following elements:

**Work environment** The organizational culture is reflected in work ethics and work hours. For example, do the employees work strictly from 8:00 AM to 5:00 PM, or do they work late into the night and on weekends?

**Management style** Do the managers manage by authority or by leadership? How much feedback is taken from the employees in making management decisions? How do the employees view the authority of the management?

**Policies** The organizational policies and procedures also reflect the organizational culture. For example, they can reflect how formal or informal the work environment is and how much room there is for entrepreneurship and innovation.

**Values** A significant part of organizational culture lives in the set of values, norms, beliefs, and expectations shared within the organization. For example, a nonprofit organization will have different values than a for-profit organization. One organization may encourage an entrepreneurial approach while another organization may be rigidly hierarchical and take an authoritarian approach in making decisions on what to do and what not to do.

Organizational culture influences multiple aspects of a program, including the following:

**Program and project selection** The organizational culture will creep into the selection criteria for program and projects. For example, a rigidly hierarchical and authoritarian organization may not be very adaptive to programs and projects with high risk.

**Program management style** The program manager should adapt his management style to the organizational culture. For example, an authoritarian style may run into problems in an entrepreneurial organization that has a participative culture.

**Team performance assessments** While making the team-performance assessment the program manager should keep in mind the established norms and expectations within the organization.

**Program policies and procedures** The program policies and procedures will be influenced by the organizational policies and procedures because the two should be consistent with each other.

The organizational structure also influences the programs.

## Influence of Organizational Structure

The influences of different organizational structures on a program are very much the same as on projects, discussed in a previous section. For example, a program manager will have the least authority in a functional organization and the greatest authority in a projectized organization. Other aspects of a program that are influenced by the organizational structure and environment include the following:

**Benefits realization plan** A program is run to create a set of benefits. The benefits realization plan describes those benefits and determines how those benefits will be achieved. Obviously this plan will be influenced by the organizational structure and culture. For example, the organizational structure may influence the way in which the benefits will be achieved. So, a program manager should adapt the benefits realization plan to the organizational environment.

**Program governance** Some aspects of program governance are also influenced by the organizational structure. For example, in a functional organization some project managers may be directly reporting to a functional manager rather than to the program manager.

The projectized organizational structure is the most suitable structure to run programs. However, there is always some matrix management built into a program.

## Matrix Management

Management of a matrix team is called *matrix management*. A matrix team is a team of individuals from different groups and departments. For example, a project manager in a matrix organization will most often be managing a matrix team, and the project management in that matrix environment is an example of matrix management.

Matrix management can be challenging due to the following:

- It involves managing individuals from different departments and groups with different and sometimes conflicting agendas.
- Quite often it requires leading by example rather than by authority.

Matrix management has its advantages and disadvantages.

## Advantages of Matrix Management

The following are some of the advantages of matrix management:

**Information sharing** In a matrix team, members can share information and work together without the functional boundaries (that is, the management boundaries) between different functional departments.

**Organizational synergy** It facilitates interaction among employees from different departments, and if properly managed, this interaction can help develop organizational synergy, which in turn contributes to the success of the organization.

**Resource optimization** In a matrix management environment the resources from across different departments are allocated to accomplish a task or project. This allows optimal use of resources.

**Career opportunities** In a matrix environment, the employees are exposed to multiple tasks and opportunities. It can help employees to transition to a different career path within the same organization.

Of course, there is the other side of this coin too.

## Disadvantages of Matrix Management

Disadvantages of matrix management include the following:

**Confusion** In a matrix management environment, quite often employees report (informally or formally) to different managers. For example, an employee working on three projects will report her work progress to three project managers, and yet her functional manager will be largely responsible in assessing her performance and determining bonuses, etc. So, employees can get confused about their loyalties. However, this problem can be solved through proper management.

**Functional gap** There is always a cultural and methodological gap between different functional departments of the same organization. Team members from different departments will have different perspectives on the project, and even different lingo. These differences, if not properly managed, can lead to misunderstandings and conflicts and thereby decrease the team productivity. This problem can be prevented or solved through team-development and conflict-resolution techniques.

**Different objectives** Team members from different departments may have different objectives and priorities. So, it's very important that the project manager keep the project team focused on the big picture and the project members on their specific assignments. It is also important that the team members interact with each other in a constructive way and try to understand and respect their objectives. In other words, communication becomes even more important.

## Matrix Management in a Program

In a previous section we explored the relevance and implications of matrix management for projects. How about programs? Programs by their definition support matrix management; that is, matrix management to some extent is built into the definition of programs. A program is run to meet some strategic business objectives of an organization. A program needs individuals with different functional expertise, such as engineering, marketing, and sales. So, even in a functional organization, a program team will obviously be a matrix team, whereas in a projectized organization, a program team will have matrix characteristics due to the different functional expertise of the team members.

The other aspect of the program structure relevant to matrix management is that the program consists of multiple projects. These projects may have different objectives, priorities, and functionalities at their own levels. So, while managing these projects from the program level, the program manager ends up dealing with a matrix environment.

## Advanced Concepts

Throughout this book, you will encounter concepts such as probability, baseline, project team, and project management team. Those concepts are introduced here.

### Probability

The theory of probability has its roots in the investigations of games of chance, such as roulette and cards, early in the 17th century. Since then a multitude of mathematicians and scientists has contributed to the development of the theory of probability. Today, the concepts of probability appear in almost every discipline, ranging from physics to project management. In the modern age, probability has already entered into the folk psyche through phrases such as “what are the odds that this is going to happen?”

*Probability* is defined as a chance that something will happen. For example, when you play the lottery and you wonder about your odds of winning, you are thinking of probability. The simplest example of probability is a coin toss. The question is, when you toss a coin, what is the probability that the coin will land with the head up? Now, when you toss a coin there are only two possibilities: it will land either head up or tail up. Each possibility is equally likely if you are not cheating. Therefore the probability that the coin will land head up is  $1/2 = 50$  percent or  $0.5$ . In general, if there are  $n$  possible outcomes of an event and each outcome is equally likely, then the probability of a specific outcome is  $1/n$ .

Another useful concept in probability is the combined probability of several events. For example, if you toss two coins, the probability that first coin will land head up and the second coin will land face down is  $0.5 \times 0.5 = 0.25$ . In general, to calculate the combined probability, you multiply the individual probabilities. If the probability that an event  $X$  will happen is  $a$ , the probability that event  $Y$  will happen is  $b$ , and the probability that event  $Z$  will happen is  $c$ , then the probability that all the three events ( $X$ ,  $Y$ , and  $Z$ ) will happen is  $a \times b \times c$ .

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**Random variable** This is a variable that may acquire any value within a given range or out of a set of values. For example, you can use a random variable to represent the results of rolling a fair die, which has six sides that display from one to six dots each. The possible outcome of rolling a die could be any number from the set of outcomes: { 1, 2, 3, 4, 5, 6 }.

**Expected value** This is the expected value of an outcome. As an example, assume you get into a bet that you will win \$10 if a coin toss results in a head, and you will lose \$5 if it results in a tail. Given that the probability for a head and a tail is 0.5 for each, the expected value for the money that you will win is  $\$10 \times 0.5 = \$5$ , and the expected value for the money that you will lose is  $\$5 \times 0.5 = \$2.5$ .

**Variance** The variance of a random variable is the deviation from the expected value. It is computed as the average squared deviation of each number from its mean. For example, assume that the values of a random variable are 2, 4, 5, 7, and 2 in five measurements. The mean value for these measurements is  $(2 + 4 + 5 + 7 + 2) \div 5 = 4$ .

The variance of the spread of these values is as follows:

$$V = \sigma^2 = [(2 - 4)^2 + (4 - 4)^2 + (5 - 4)^2 + (7 - 4)^2 + (2 - 4)^2] \div 5 = 3.4$$

**Standard deviation** This is the square root of the variance, represented by the symbol  $\sigma$ . So, in our example, the standard deviation is the square root of 3.4; that is, 1.84.

**Algebraic equations** Project/program management and some questions in the CAPM, PMP, and PgMP exams will assume that you can do simple mathematical calculations. You should also have a very simple understanding of algebraic equations. You should be able to make simple manipulations such as the following:

$$\text{CPI} = \text{EV} \div \text{AC} \text{ implies } \text{EV} = \text{CPI} \times \text{AC}$$

$$\text{CV} = \text{EV} - \text{AC} \text{ implies } \text{EV} = \text{AC} + \text{CV}$$

## Project Team and Project Management Team

In order to avoid confusion, make sure you can distinguish the project team from the project management team. The project management team for a project consists of the individuals who perform the project management activities for the project. The project team consists of all the individuals directly involved in the project: the individuals that perform the schedule activities, the members of the project management team, and some other stakeholders, such as the project sponsor.

## Baseline

The project *baseline* is defined as the approved plan for the cost, schedule, and scope of the project. The project baseline is also referred to in terms of its components: cost baseline, schedule baseline, and scope baseline. How do we know how the project is performing? We compare the performance against the baseline.

Approved changes in cost, schedule, and scope will also change the baseline.

### The Three Big Takeaways

The three most important takeaways from this chapter are the following:

- As compared to projects and programs, a portfolio is closer to the business strategy of an organization. A portfolio consists of programs and projects, whereas a program consists of projects.
- The project processes that are performed to manage projects constitute nine project management knowledge areas: Communication Management, Cost Management, Human Resource Management, Integration Management, Procurement Management, Quality Management, Risk Management, Scope Management, and Time Management. These processes also map to five process groups: Initiating, Planning, Executing, Monitoring and Controlling, and Closing.
- Like project management, program management also has nine knowledge areas and five process groups with identical names. Identical names do not mean that program management and project management have the same set of processes, however.

## Summary

Projects, programs, and portfolios have a triangular relationship. This is where this relationship comes from: The activities inside an organization are generally organized into groups, which fall into two categories: operations and projects. Operations usually consist of ongoing routine work, whereas a project has a goal to generate a unique product, service, or result in a finite time; that is, it has a planned beginning and a planned end. To obtain some benefits, multiple projects can be grouped together into a program. Both projects and programs can be grouped together into a portfolio, which is real reflection of the organization's business strategy.

Organizations launch projects for different reasons, such as to meet a business or legal requirement, or to take on an opportunity offered by the market. A project, like anything else in an organization, needs to be managed. Project management is the application of knowledge and skills to project activities in order to meet the project objectives. It involves performing a set of processes that constitute nine knowledge areas of project management: Communication Management, Cost Management, Human Resource Management, Integration Management, Procurement Management, Quality Management, Risk Management, Scope Management, and Time Management. Each process is part of a knowledge area and has a membership in one of five process groups: Initiating, Planning, Executing, Monitoring and Controlling, and Closing. Program management also has these knowledge areas and process groups with identical names.

Each project has a set of individuals or organizations that it influences positively or negatively, and they are accordingly called positive and negative stakeholders. Some of these stakeholders may influence the project. Therefore, you must identify all the project stakeholders, positive and

negative. The different project stakeholders may have different and conflicting expectations that you need to analyze and manage.

Another big influence on project management is the structure of the performing organization, which could be functional, projectized, or matrix. On one end of the spectrum, a project manager is usually part-time, with little or no authority in a functional organization. On the other end, the project manager is full-time with high to full authority in a projectized organization. In the middle of the spectrum is the matrix organization, in which a project manager has low to high authority.

Projects are grouped together into programs, and the programs need to be managed just as the individual (constituent) projects do. Programs are managed by using the processes in program management. We'll explore the program management framework in the next chapter.

### Exam's-Eye View

#### Comprehend

- According to the project management standard developed by the PMI, the discipline of project management is composed of nine knowledge areas such as project Cost Management, project Scope Management, and project Human Resource Management.
- Depending upon which stage of the project life cycle they are executed, the processes are grouped into five process groups, such as Initiating and Planning.
- The project manager's authority is none to low in a functional organization, low to high in a matrix organization, and high to full in a projectized organization.
- The organizational environment also affects the programs.

#### Look Out

- In order for a work effort to be qualified as a project, it must be temporary (that is, have a start and a finish), and the outcome must be a unique product, result, or service. A routine ongoing work is an operation and not a project.
- Any individual or organization that is positively or negatively affected by a project is the project stakeholder. So, stakeholders can exist outside of the performing organization.
- You must identify both positive and negative stakeholders for your project, and must not ignore the negative stakeholders.
- Regardless of the structure of the performing organizations, project managers are responsible for the project results.
- Project phases and process groups are not the same thing.

**Memorize**

- The life cycle of a project has five stages called process groups: Initiating, Planning, Executing, Monitoring and Controlling, and Closing. Program management also has these five process groups with the same names.
- All the processes that are executed at different stages of a project belong to nine knowledge areas: Communication Management, Cost Management, Human Resource Management, Integration Management, Procurement Management, Quality Management, Risk Management, Scope Management, and Time Management. A given process belongs to only one knowledge area. Program management also has these nine knowledge areas with identical names.

## Key Terms and Definitions

**knowledge area** A knowledge area in project management is defined by its knowledge requirements related to managing a specific aspect of a project, such as cost, by using a set of processes. PMI recognizes a total of nine knowledge areas, such as Cost Management and Human Resource Management.

**matrix management** Management of a matrix team; that is, a team composed of individuals from different functional groups and departments.

**organization** A group of individuals organized to work for some purpose or mission.

**performing organization** The organization that is performing a project.

**process** A set of interrelated activities performed to obtain a specified set of products, results, or services.

**program** A set of related projects managed in a coordinated fashion to improve their overall efficiency and effectiveness.

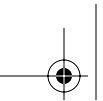
**program management** The centralized coordinated management of a specific program to achieve its strategic goals, objectives, and benefits.

**progressive elaboration** A technique to develop a plan in steps as more information becomes available. The detail and accuracy of the plan improves as it progresses with time.

**project** A work effort made over a finite period of time with a start and a finish to create a unique product, service, or result. A process consists of three elements: input, tools and techniques, and output.

**project management** Application of knowledge, skills, and tools and techniques to project activities in order to meet the project objectives. You do this by performing some processes at various stages of the project.

**project management office (PMO)** An entity in an organization that is responsible for providing centralized coordinated management for projects in the organization.



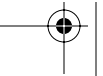
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**project portfolio** A set of projects, programs, or both that is managed in a coordinated fashion to obtain control and benefits that would not be achieved if these projects and programs were managed individually.

**project stakeholder** An individual or an organization that is positively or negatively affected by the project.

**scope creep** The phenomenon of introducing uncontrolled changes, such as adding or modifying a feature, without going through the planned change-control system for approval.

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## Review Questions

- Which of the following is not a project management knowledge area?
  - Project Integration Management
  - Project Risk Management
  - Project Stakeholder Management
  - Project Time Management
- Which two of the following are the essential characteristics that make a group of activities a project?
  - It takes multiple individuals to perform the activities, and the outcome is a new product.
  - The work is managed by a project manager.
  - It has a start date, finish date, and a budget.
  - It has a start date and a finish date, and its outcome will be a new product.
- Which of the following is a project?
  - Running a library
  - Building another school in your area
  - Keeping a data server up and running
  - Running a childcare center
- Which of the following are included in the project process groups?
  - Initiating, Planning, and Implementing
  - Monitoring and Controlling, Closing, and Designing
  - Designing, Implementing, and Running
  - Initiating, Planning, and Closing
- Which of the following is the best definition of progressive elaboration?
  - Taking the project from concept to project management plan in steps
  - Taking the project from conception to completion
  - Taking the project from phase one to Closing
  - Decomposing the project objectives into smaller, more manageable work pieces

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6. In which of the following organizational structures does the project manager have the greatest authority?
- A. Functional
  - B. Projectized
  - C. Matrix
  - D. Leveled
7. In which of the following organizational structures does the project manager have the least authority?
- A. Functional
  - B. Projectized
  - C. Matrix
  - D. Programized
8. Which of the following is not included in a program?
- A. Project
  - B. Non-project work
  - C. Portfolio
  - D. Benefits realization plan
9. Organizational environment can influence:
- A. Projects
  - B. Programs
  - C. Both projects and programs
  - D. Neither projects nor programs
10. The probability for completing a project within budget is 0.7, and the probability for completing the same project according to the schedule is also 0.7. What is the probability that the project will be finished within cost and according to the schedule?
- A. 0.7
  - B. 0.35
  - C. 0.49
  - D. 1.4

## Answers to Review Questions

1. C.

C is the correct answer because stakeholder management is part of the Managing Stakeholders process and is not a knowledge area.

A, B, and D are incorrect because these are three of nine project management knowledge areas.

2. D.

D is the correct answer because the defining characteristics of a project are that it must be temporary (have a start and finish date), and it must produce a unique (new) product.

A and B are incorrect because it's possible to have a project that will involve only one person, and there could be a project without an individual called the project manager. The only two defining characteristics of a project are that it is temporary and unique.

C is incorrect because it leaves out the third essential condition: that the project produces a unique product.

3. B.

B is the correct answer because building a school is temporary; that is, it will have a start and a finish date, and it will produce a new school.

A, C, and D are incorrect because running a library, keeping a server up and running, and running a childcare center are all ongoing operations.

4. D.

D is the correct because the five process groups of a project are: Initiating, Planning, Executing, Monitoring and Controlling, and Closing.

A is incorrect because there is no process group in project management called Implementing.

B and C are incorrect because there are no process groups in project management called Implementing or Designing.

5. A.

A is the correct and the best answer because the project plan is developed starting from the concept and going through progressive elaboration.

B and C are incorrect because B includes project life cycle and C is the life cycle. Progressive elaboration does not include the life cycle of the project; its goal is to plan the project. Because project planning may develop (or change) throughout the project life cycle, progressive elaboration may continue through the project life cycle, but it does not include the work of the life cycle.

D is incorrect because progressive elaboration can be used in decomposing, but is not itself the decomposing technique.

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6. B.

B is the correct answer because the projectized organization provides the greatest authority for the project manager.

A and C are incorrect because the authority of the project manager is none to low in a functional organization, and low to high in a matrix organization.

D is incorrect because there is no organizational structure called leveled.

7. A.

A is the correct answer because the project manager's authority is none to low in a functional organization.

B and C are incorrect because the authority of the project manager is high to full in a projectized organization, and low to high in a matrix organization.

D is incorrect because there is no organizational structure called programized.

8. C.

C is the correct answer because programs are part of a portfolio, not the other way around.

A and B are incorrect because a program can contain projects and non-project work.

D is incorrect because a program is run to generate some benefits.

9. C.

C is the correct answer because organizational environment (structure and culture) can impact both projects and programs.

A, B, and D are incorrect because the organizational environment (structure and culture) does impact the projects and the programs.

10. C.

C is the correct answer because the combined probability is  $0.7 \times 0.7 = 0.49$

A is not correct because the combined probability is not the average of the two.

B is incorrect because the combined probability is not achieved by division.

D is incorrect because the combined probability is not the sum of two probabilities; it's the multiplication.