Updated for the PMBOK® Guide 6th Ed.

CAPM® in Depth

Certified Associate in Project Management Study Guide for the CAPM® Exam

Second Edition

Paul Sanghera

Apress®

CAPM® IN DEPTH

CERTIFIED ASSOCIATE IN PROJECT MANAGEMENT STUDY GUIDE FOR THE CAPM® EXAM

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Printed on acid-free paper

To my wife, Renee, and our son, Adam.

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About the Author

Dr. Paul Sanghera is a leading expert in project management. He is a scientist, engineer, teacher, manager, and author. He has years of diverse hands-on project management experience, both in academic research labs—from Cornell to CERN—and in the high-tech computer industry—from Novell to Netscape to MP3. Having worked in various roles, including project manager, director of project management, director of software development, software developer, teacher and trainer, and scientist, Dr. Sanghera has developed a broad and deep comprehension of the global principles of project management applicable to all areas. In addition to authoring or coauthoring more than 150 science research papers published in American, Canadian, European, and other international research journals, Dr. Sanghera has authored several books in science, technology, and project management.

Introduction

"Begin at the beginning, and go on till you come to the end: then stop."

—*Alice's Adventures in Wonderland* by Lewis Carroll

The primary purpose of this book is to help you pass the Certified Associate in Project Management (CAPM) exam administered by the Project Management Institute (PMI). The exam, and hence this book, is based on the sixth edition of the PMBOK Guide. Because this book has a laser-sharp focus on the exam objectives, expert project managers and project team members who want to pass the CAPM exam can use this book to ensure that they do not miss any objectives. Yet this is not an exam-cram book. The chapters and the sections within each chapter are presented in a logical learning sequence. A topic in a chapter and the chapter only depend upon the previously covered topics and chapters, and there is no hopping from topic to topic. The concepts and topics, both simple and complex, are clearly explained when they appear for the first time. No prior knowledge of project management is assumed. This facilitates stepwise learning, prevents confusion, and makes this book useful also for beginners who want to get up to speed quickly to pass the CAPM exam, even if they are new to the discipline of project management. The presentation of material in such a fashion enables the book to help a wider audience, as noted next.

Who This Book Is For

With a focus on the CAPM exam topics, this book is designed to serve the following audiences:

- Project management practitioners who want to prepare for the CAPM exam
- Entry-level project managers and project team members who want to prepare for the CAPM exam
- Beginners who want to join the field of project management and get up to speed quickly

- Project managers who want a book to use as a quick and easy reference to the discipline of project management
- Instructors and trainers who want a textbook for a course on introductory project management for both exam and non-exam classes

How the Book Is Organized

This book tells the story of project management in a cohesive and concise yet comprehensive fashion. This book is written to the most current version of the CAPM exam based on the sixth edition of *A Guide to the Project Management Body of Knowledge* (PMBOK Guide) by PMI. The discipline of project management, according to the PMBOK Guide, contains ten knowledge areas, such as cost management and quality management, and five process groups: initiating, planning, executing, monitoring and controlling, and closing. The CAPM exam is solely based on the PMBOK Guide, which is organized along the knowledge areas. To keep things simple for the reader, I have also organized this book along the knowledge areas. The project management processes in one knowledge area interact with processes in other knowledge areas. That said, all efforts have been made to keep the presentation cohesive. All concepts are explained where they appear for the first time. All sections in a chapter and all chapters in the book are logically connected to each other to support sequential learning. To support this effort, the book is organized into four parts.

A glossary at the end of the book covers all the important concepts and can be helpful for a quick check of a term at any stage of your reading.

How Each Chapter Is Organized

Each chapter begins with a list of the exam objectives on which the chapter is focused. The first section in each chapter is an introduction in which we establish three or four underlying concepts or topics that will be explored in the chapter. Each chapter has the following features:

- **Exam Objectives.** All exam objectives covered in the chapter are fully explained at the beginning of the chapter.
- **Big Picture.** Each chapter begins by introducing the big picture of the topics covered in the chapter. This prepares the reader for a smooth dive into the details, which follow.

- **Study Checkpoints.** Each chapter in its body presents Study Checkpoints, which are exercises to ensure that you get the crucial points in the covered material. The solutions to Study Checkpoints are presented in Appendix A.
- **Notes, Tips, and Cautions.** As you read through a chapter, you will find *Notes* that present additional helpful material related to the topic being described, *Tips* that provide additional real-world insight into the topic being discussed, and *Cautions* on the points that would be easy to trip on for some.
- **Summary.** The "Summary" section of each chapter provides the big, unified picture while reviewing the important concepts in the chapter in a very concise way.
- **Exam's Eye View.** The "Exam's Eye View" section highlights the important points in the chapter from the perspective of the exam: the things that you must comprehend, the things that you should watch out for because they might not seem to fit in with the ordinary order of things, and the facts that you should memorize for the exam.
- **Review Questions.** Each chapter ends with a "Review Questions" section that has a two-pronged purpose: to help you test your knowledge of the material presented in the chapter and to help you evaluate your ability to answer the exam questions based on the exam objectives covered in the chapter. The answers to the review questions are presented in Appendix B.

About the CAPM Exam

This book covers the material for the CAPM exam. Passing this exam is necessary to obtain CAPM certification.

To be eligible to take the CAPM exam, you must meet a set of minimum requirements. A summary of these requirements and other details is listed in the following table.

The CAPM Exam at a Glance

Exam Detail	CAPM
Number of questions	Scorable: 135 Pretest: 15
Maximum time allowed	3 hours
Question types	Multiple choice
Minimum educational background	High school diploma or global equivalent
Minimum project management experience	1,500 hours of professional experience on a project team or 23 contact hours of formal project management education
Exam fee (given in U.S. dollars—may vary by country)	Member: $225 Non-member: $300
Sign code of professional conduct	Yes

Note For the most up-to-date and detailed information, visit the PMI website at www.pmi.org, or see the latest version of the *CAPM Certification Handbook* by PMI.

The following are a few tips that you can use both while you are preparing for the exam and during the exam:

- PMBOK has a very formal way of naming processes, process groups, knowledge areas, and documents. Know these formal names well. However, just like in real-life project management, do not expect that the exam will always refer to these names in a formal way. To help you on this issue, this book refers to these names in both formal and informal ways. For example, performing quality control (informal) means the Control Quality process (formal), scope plan (informal) means project scope management plan (formal), and initiating (or initiation) means Initiating Process Group.
- The questions in the CAPM exam are largely based on the PMBOK Guide, Sixth Edition. Still, you need to read the questions carefully and patiently and figure out what counts and what does not, and if there is some extra information.

- Get comfortable with the idea that there will be some questions that you may not be able to answer correctly. In such a situation, just believe in yourself and your experience and select the best answer accordingly. You may have the option (read the instructions before starting the exam) to leave these questions for a possible review later if you have time. Key point: Move on without getting frustrated.
- There will be questions for which you will need to choose between an innocent way of skipping the formal process to save time and following the formal project management process. In almost all cases, the correct answer will be to follow the process.
- There will be questions for which you will need to choose between facing the problem head-on and taking an easy way out, such as dodging a thorny issue, ignoring a challenging problem, or postponing a difficult decision. Almost always, the correct answer is to meet the problem head-on in a professional manner.
- To answer some questions correctly, understand that in the world of project management as seen from the perspective of PMBOK, project managers communicate directly and clearly and do not say things to be read between the lines. For example, if you have a problem with a team member, you talk to the team member face-to-face rather than going to the member's manager, which you might need to do eventually if you can't solve the problem by dealing directly with the team member.
- Understand clearly the roles of the key stakeholders, such as the project manager, project sponsor, and customer. Especially understand your responsibilities as a project manager. You need to be proactive to make decisions and manage the project, influence the factors that contribute to changes rather than waiting for the changes to occur, and have up-to-date information about the project.

- Know the details of the input, output, and tools and techniques for each process, not just the names. For example, it's not enough to remember that the project management plan is an input to a process. You should know the project management plan is an input because it contains such and such subsidiary plans from which such and such information is used in this process. Be prepared to see the subsidiary plan as an input in the answer options, whereas the PMBOK Guide might have listed the project management plan as an input.

Best wishes for the exam; go for it!

—Paul Sanghera, Ph.D.

PART

I

The Big Picture of Project Management

Welcome to the world of project management. Here is project management for you in five simple concepts: initiate, plan, execute, monitor and control, and close.

The rest is in the details. We start this journey by presenting the big picture of project management—exploring the project management framework and the environment in which the project is performed and overviewing project management via all five stages of the project: initiate, plan, execute, monitor and control, and close.

CHAPTER

1

Project Management Framework

The objectives covered in this chapter make up 6 percent of the CAPM exam, equivalent to about eight questions.

Study the whole chapter in detail. The concepts involved may not be mentioned directly in the exam objectives, but you will need them in order to answer the questions correctly.

CAPM Exam Objectives

1. Understand the five project management process groups and the processes within each group.
2. Recognize the relationships among project, program, portfolio, and operational management.
3. Define a typical project lifecycle.
4. Understand the function and importance of tailoring for different projects.

P. Sanghera, *CAPM® in Depth*, https://doi.org/10.1007/978-1-4842-3664-2_1

What do the Eiffel Tower, the Internet, and this book have in common? Projects! All three of them are outcomes of projects. Even given all the required material and knowledge, how do people really build immense and complex structures or systems, such as the Eiffel Tower of Paris, the Taj Mahal of Agra, or the Internet and the World Wide Web of the Information Age? The answer is again *projects*. Through projects, it is possible to build small and big and simple and complex things in an effective and efficient manner. All projects need to be managed. A so-called unmanaged project is simply a poorly managed project that is destined to fail. Therefore, the importance of project management cannot be overstated.

We all know from experience that each project has (or should have) a beginning and an end. Therefore, managing a project means managing the lifecycle of the project, starting from the beginning (initiating) and going to the end (closing); this is accomplished using processes, which constitute what are called *project management knowledge areas*. Although you use your knowledge in terms of processes to manage projects, the management will be greatly influenced by the environment in which the project runs, such as the structure and culture of the performing organization. Projects also originate from their environments.

The goal of this chapter is to walk you through the framework of project management. To that end, we will explore three avenues: the project lifecycle, the project management knowledge areas, and the project in the context of programs, portfolios, and the organization's strategy. In the process of doing so, we will introduce some basic concepts of project management.

Basic Concepts in Project Management

Each discipline of knowledge, from physics to biology and from computer science to poetry, builds upon some basic concepts. The terms that refer to or define these concepts make up the language of the discipline. The very basic terms in project management are described briefly in the following list:

- **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 an end, it is also called a *temporary effort* or *endeavor*.
- **Project Phase.** A project phase is a set of logically related activities that usually completes one or more major deliverables of the project. The phases are generally completed in sequence; however, an overlap is possible in some situations. Depending on its size and complexity, a project may have one or more phases.

- **Project Life Cycle.** It is the full project duration from beginning to end, including all project stages: initiating, planning, executing, monitoring and controlling, and closing. If projects have multiple phases, all of these stages are repeated in each phase.
- **Process Groups.** These are the technical names for the project stages: initiating, planning, executing, monitoring and controlling, and closing.
- **Organization.** An organization is 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 might offer products, such as books or donuts, or services, such as Internet access or online banking.
- **Performing Organization.** The performing organization, also referred to as the project organization, is the organization that is performing the project.
- **Project Stakeholder.** A project stakeholder is an individual or an organization that can affect or be affected by the project execution. A project can have a wide spectrum of stakeholders, from the project sponsor, to an environmental organization, to an ordinary citizen.
- **Process.** In the context of projects, a process is a set of related tasks performed to manage a certain aspect of a project, such as cost, scope, and risk. Each process belongs to a knowledge area and corresponds to a process group.
- **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 resource management.
- **Tailoring.** Obviously, you don't apply all the project management knowledge to a project. For a given project, with help from the project team, you select appropriate lifecycle phases and needed outputs, and to produce those outputs you choose the right processes, inputs, and tools and techniques. This method is called tailoring.

- **Project Management.** Project management is the use 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.
- **Phase Gate.** A review at the end of each phase leading to the decision to continue to the next phase as planned, continue to the next phase with changed plan, or end the project.

This is a minimal set of terms that you need to understand before you can start your exploration of the world of project management. More terms will be introduced as you continue exploring the discipline of project management in this book.

Now that you understand these basic terms, you can ask a very basic question: What does it mean to manage a project? In other words, what's involved in managing a project?

Understanding Projects

Before delving into the details of project management, you need to understand what a project is, where it came from, and why. At any organization, there are many 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 lifecycle—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 PMI defines it, "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 and unique.

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 possible 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.

Note that the temporary nature of a project does not mean that the project will be of short duration, nor does it refer to the product it creates. 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 a 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 in your living room, the Swiss watch on your wrist, and the wine bottle on your table are some examples of products.
- **Service.** Actually, when we say a project can create a service, we really 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 the 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.

In this book, quite often we will refer to product, service, or result as just "product" or "project outcome" for brevity.

■ **Caution!** Not only organizations undertake projects. A project can also be undertaken by a group of individuals or even a single individual.

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 whether an undertaking is a project, 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 what are called *operations*. An operation is a set of tasks that does not qualify to be a project. In other words, an operation is a function that performs ongoing tasks. It does not produce a unique (new) product, and it does not have a preplanned beginning and end. For example, to put together a data center is a project, but after you put it together, keeping 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, i.e., people.
- Both are constrained to limited, as opposed to unlimited, resources.
- Both are managed—that is, planned, executed, and controlled.
- Both have objectives and contribute to meeting the company's strategic objectives.
- Both can have and share stakeholders.

The distinctions between projects and operations can be made by sticking to the definition of a project—that it is 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 contributing to objectives—and possibly to a new set of objectives in the event of a change in the organization's strategy.

Projects can be performed at various levels of an organization; they vary in size and accordingly can 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 Eiffel Tower	Product
Running presidential election campaign	Results: win or lose; Products: documents
Developing a website to offer online education	Service
Setting up a computer network in one building	Service
Moving a computer network from one building	Result: network is moved to another building
Study the genes of members of Congress	Results (of the research); Product: research paper
Book sold in a bookstore	Product
A software app like MS Word sold as a CD and paid for once	Product
A software app integrated into web and paid for monthly	Service
Human Genome Project	Result

STUDY CHECKPOINT 1.1

Identify each of the following items as a project or an operation.

A. A librarian performing her daily job responsibilities

B. A bookseller processing customer orders

C. A network administrator ensuring that the network stays up and running 24/7

D. Taking a course in molecular biology

A project can result in a product (or service) that is sustained by an operation. For example, constructing the Eiffel Tower is a project, whereas managing it for the tourists visiting it every day is an operation.

Now that we have a clear idea of what a project is, we have to wonder why an organization would launch a specific project. So, let's ask a fundamental question: Where do projects originally come from?

Origins of Projects: Where Do Projects Come From?

Projects are originated by organizational leaders in response to one or more situations the organization is facing. These situations, or factors acting on the organization, may fall into one of the following four categories:

1. **Business/legal requirements.** This category includes projects based on the need of meeting legal, regulatory, or social requirements. For example, consider a building owner authorizing a project to make the building accessible to physically disabled persons in order to meet the legal requirements for using the building for a specific business.
2. **Stakeholder requests or needs.** This category includes projects based on satisfying stakeholder requests or needs. An example would be an environmental organization starting a project to raise awareness among politicians about the science behind global warming issues. Another example would be a company that undertakes a project to lessen the negative impact that its operations or products may have on the environment.
3. **Business or technological strategies.** This category of factors would give rise to projects based on the need to implement or change business or technological strategies. For example, a web design company authorizes a project to automate certain aspects of maintaining websites to increase its efficiency and revenue. For another example, based on recent technological advances, a taxi company might start a project to implement an automatic driving feature in some of its taxis.
4. **Products, processes, or services.** This category of factors would give rise to projects based on the need to create, improve, or fix products, processes, or services. For example, a biotechnology company authorizes a project to produce and implement SOP (standard operating system) in all its labs.

As a careful reader would note, these four categories of factors specified by PMI are not mutually exclusive. For example, the last category is at least partially redundant; a project in response to any of these categories may create a product or service. For this reason, or as a result of the objectives of the project, the project may fall into more than one of these categories.

For example, a car manufacturer's project to make electric cars using cutting-edge technology in response to environmentally aware customers' needs falls into all of the last three categories: 2, 3, and 4.

These categories of factors collectively are called project initiation context. As illustrated in Figure 1-1, these factors are linked, on one hand, to the strategic objectives of the organization and influence its business strategy, and on the other hand are linked to the business value of the organization though projects. In short, an organization with a certain business value, responding to one or more of these factors, runs a project that produces some business value, adding to the previous business value of the organization. This is how projects bring about change—by driving the organization from a lower business-value state to a higher business-value state—and in this way help the organization to stay viable.

■ **Note** The strategy of an organization is an action plan to achieve its business goals and objectives. It's also called the *strategic plan* or *strategic business plan*. The strategy determines the portfolio of projects and programs that the organization will execute.

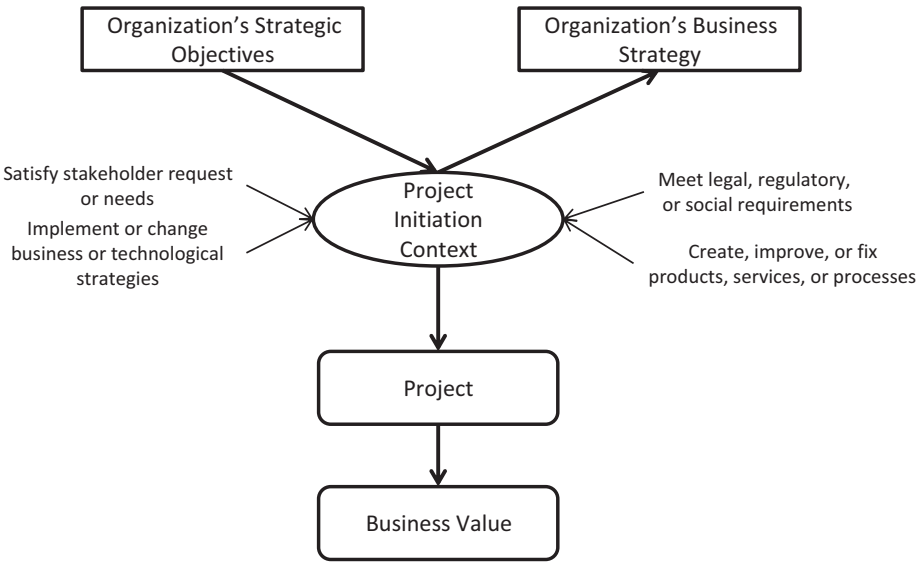

Figure 1-1. Origination of a project and its single most important outcome: business value added to the organization

■ **Caution!** The factors discussed in this section not only influence the organization's current business strategies but also its current operations because operations are there to serve business strategies or objectives.

In addition to the initiation context discussed here, in the next chapter, we will explore what other organizational and external factors may influence the project.

Where there is a project, there is project management.

Understanding Project Management

In this book, we refer to project management as defined in the project management standard by the Project Management Institute (PMI): "Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements."

This standard, contained in the *Project Management Body of Knowledge* (PMBOK) *Guide*, presents, as PMI claims, "a subset of the project management body of knowledge that is generally recognized as good practice." By *generally recognized*, PMI means two things: 1) the presented knowledge is applicable to most projects most of the time; and 2) there is consensus about its value and usefulness. The *good practice* is also the general consensus that the application of the presented knowledge, skills, tools, and techniques to project management processes can enhance the probability of project success.

■ **Note** As a result of innovation and advances in science and technology, the body of knowledge in the project management profession is constantly changing, so the standard is updated accordingly every few years.

In a poorly managed project, bad things happen to the project, such as missed deadlines, cost overruns, and poor quality, all resulting in dissatisfied project stakeholders. This will essentially fail the project and hurt the organization's reputation and viability. However, effective project management helps to manage different aspects of project, such as cost, scope, and stakeholders making the project more predictable as it's being executed. This helps to identify and resolve problems and issues—as well as to identify and respond to risk—in a timely fashion, increasing the chances of project success. Moreover, with effective project management, you can clearly link the project result to the business goals of the organization, which will enable you to adjust the project plans in a changing business environment. This way, effective project

management helps the organization to persist in a fast-changing world by staying relevant and viable. In this book, *project management* means *effective* project management until mentioned otherwise.

Projects are inseparable from project management. At initiating time, a project is just born, and it's brought up by a procedure called *progressive elaboration* through project management.

Understanding Progressive Elaboration

As the saying goes, Rome was not built in a day. Rest aside, the product of a project—even the project plan—is not built in a day either. Usually there is a concept first and a broad vision for the end product—that is, the outcome of the project. The clearer the 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*.

Here is an example of progressive elaboration. You wake up one morning with an idea to close the digital gap in your community. Now, 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 might include many things—building computers in an economical way and providing them at low prices to those who don't have them, raising awareness of the necessity of computer literacy, offering classes, and the like. 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, you are referring to the project plan. You can see that the project plan and its accuracy and details depend upon how refined the idea of the final product is. The final product or objectives and the plan to achieve them will be elaborated further in smaller steps.

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

Progressive elaboration, in general, means developing something in incremental steps. The project plan will be broadly defined to start and will get more accurate, detailed, and explicit in an incremental fashion as better understanding about the project deliverables and objectives develops. It involves successive iterations of the planning process, which result in a more accurate and complete plan.

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 later in this chapter that the execution and planning stages of the project interact with each other. Based on project performance and stakeholder requests the project plan could change, even including project scope.

Most of project management is done by performing a set of processes.

Understanding a Process

Processes are the heart of project management. In other words, processes are atoms, the smallest functional units, of project management. If you want to think of project management like a project management professional, think in terms of processes. Almost everything in the world of project management is done through processes.

What is a process, anyway? 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 coffeemaker is the tool, and how you make the coffee is the technique. A cup of freshly brewed hazelnut coffee is the output item from this process. So, a process, in general, is a set of interrelated activities performed to obtain a specified set of products, results, or services. A project management process, as explained in the example and in Figure 1-2, always consists of three parts: input, tools and techniques, and output. If you like this analogy, think of a process as a chemical reaction in which tools and techniques operate on input to produce an output. The term *raw data* in Figure 1-2 means that the input is processed to produce output.

Input		Tools and Techniques		Output
Raw data or information for the process	Tools and techniques operate on input	Appropriate tools and techniques	Produces	The outcome of the operation of tools and techniques on input data or information

Figure 1-2. Three parts of a process: tools and techniques operating on input to produce 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 developing a project schedule, directing and managing the project work, and developing and managing the project team.

Tip As phase is the atom of a project, process is the atom of project management.

As illustrated in Figure 1-2, each process consists of three parts, described in the following list:

- **Input.** The input to a process consists of the raw data—the data or information that is needed to start the process and that will be processed into output. For example, the project management plan is one of several input items in the Develop Schedule process that will be used to develop the schedule of a project.
- **Tools and Techniques.** Tools and techniques are the methods used to operate on the input to transform it into output. For example, a critical path method that helps to develop a schedule is a tool used in the schedule development process.
- **Output.** The output is the outcome or result of a process. Each process contains at least one output item; otherwise, there would be no point in performing a process. For example, an output item of the schedule development process is, well, the project schedule.

Now that you understand what a process is, you likely realize that you will be using different processes at different stages (not phases) of a project, such as planning and execution. Actually, the whole lifecycle of a project can be understood in terms of five stages, with each stage corresponding to a group of processes.

Caution! An organizational operation may also have some kinds of processes, but that does not make the operation a process.

The following are some characteristics of processes:

1. **Iterations**. Some processes, such as Develop Project Charter and Close Project, are run only once or at predetermined points in the process, while others, such as Conduct Procurements and Acquire Recourses, may be periodically run depending on the project size. Yet processes like Define Activities may be even more frequently performed.
2. **Process Interconnect**. Processes are connected with other processes by input or output. An output item of a process becomes an input to an other process or a terminal output; i.e., a project or phase deliverable.
3. **Overlapping**. Some of the input items may appear in multiple projects. This is also true for tools or techniques. From this, you can see that processes may overlap in their activities.

Now that we have a very good basic idea of projects, we can take a tour of the project lifecycle.

Understanding the Project Lifecycle

As you already know, each project has a beginning and an end. The timespan from the project's beginning to its end is called the *project lifecycle*. If a project has multiple phases, all the phases are completed during its lifecycle to complete the project. Regardless of whether the project has multiple phases or just one phase, during this lifecycle the project is started, organized and prepared for, carried out (project work is performed), watched over, and closed. In the standard terminology, a project is initiated, planned, executed, monitored and controlled, and closed.

Caution! Do not confuse *project lifecycle* with *product lifecycle*. A project is executed to create a product or products, which lasts after the project is finished. In general, the project lifecycle is contained within the lifecycle of each product it creates. For example, a project creates a product that lasts for a certain time after the project ends, and then it retires. As another example, a project is run to add features to a product that existed before the project was initiated and lasts after the project is completed.

From initiation/authorization to completion/closure, a project goes through a whole lifecycle that includes defining the project objectives, planning the work to achieve those objectives, performing the work, monitoring and controlling the progress, and closing the project after receiving product acceptance. Figure 1-3 shows the different stages of the project lifecycle; the arrows indicate the flow of information. The five stages, technically called *process groups*, of a project lifecycle are described in the following list.

■ **Caution!** I refer to the five process groups as five stages for the purpose of helping you visualize a project. Technically and in PMBOK, they are called *process groups*. However, be prepared to recognize them regardless of how they are referred to in the exam; do not expect the exam to always refer to a process group or a document by its formal technical name. This is also true with the real world out there, where you will be performing projects.

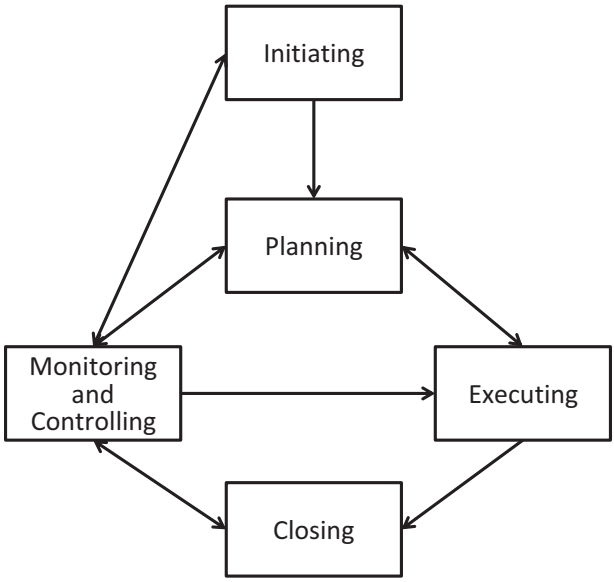

Figure 1-3. Different stages in the lifecycle of a project. Each of these stages represents a process group.

Initiating a Project

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 is a high-level document that contains items such as the purpose of the project, a product description, project objectives and requirements, and a summary of the milestone schedule. The central purpose of this stage is to align the project's purpose with the business needs and the organization's business strategy on one hand and with the stakeholders' expectations on the other.

It is good policy to involve customers and other important stakeholders in the initiating stage of the project. It will give them a feeling of shared ownership that will greatly contribute to the success of the project by positively influencing factors such as acceptance of deliverables and stakeholder satisfaction.

■ **Note** In the discipline of project management, like in many other disciplines, the term *high-level* means lacking details or not referring to details. Keep this meaning in mind when you read terms in this book such as *high-level product description*, *high-level plan*, and the like. Details are usually worked out through a process called *progressive elaboration*.

■ **Caution!** The processes in the initiating process group, just like those in any other process group, can also be used to initiate a phase of a project that has multiple phases.

After the project has been initiated, it needs planning.

Planning the Project

In this stage, you, the project manager, along with the project management team, develop the project scope, define and refine the project objectives, and develop activities to meet those objectives. You do this by developing the project management plan, which is a collection of several plans and other documents that constitute the course of action required to achieve the objectives and meet the requirements of the project. The processes used to perform this stage fall into a group called the *planning process group*. In this process group, some non-plan documents are also developed for the project.

The approved scope plan, schedule plan, and cost plan are called the scope baseline, schedule baseline, and cost baseline, respectively. These three baselines together are called the project baseline or the performance measurement

baseline (PMB). The project performance at any time is assessed by comparing the results from project execution against this performance measurement baseline (PMB). In other words, to see how the project is performing, you compare the actual project execution results against this baseline.

■ **Note** The project management plan contains plans from various project management areas called subsidiary plans, such as a project scope management plan, a schedule management plan, and a quality management plan.

You then execute the project as planned.

Executing the Project

In this stage, you, the project manager, manage the execution of the project as planned in the project management plan. 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. The stakeholders can also suggest changes, which must go through an approval process before implementation. The project execution is performed using processes that fall into a group called the *executing process group*.

So, the project work defined in the project management plan is executed by using the processes found in the executing process group. The processes in this group are used to accomplish a three-pronged goal:

- Coordinate people and resources used to perform the project activities.
- Integrate and manage the project activities being performed.
- Ensure the implementation of the project scope and approved changes.

The lion's share of project resources is consumed in performing processes from the executing process group.

■ **Note** Performing processes from the executing process group may also generate change requests, which must be processed for approval in the monitor and control group.
