CHAPTER 1

INTRODUCTION TO PROJECT MANAGEMENT

LEARNING OBJECTIVES

After reading this chapter, you will be able to:

- Understand the growing need for better project management, especially for information technology (IT) projects
- Explain what a project is, provide examples of IT projects, list various attributes of projects, and describe the triple constraint of project management
- Describe project management and discuss key elements of the project management framework, including project stakeholders, the project management knowledge areas, common tools and techniques, and project success
- Discuss the relationship between project, program, and portfolio management and the contributions each makes to enterprise success
- Understand the role of project managers by describing what they do, what skills they need, and career opportunities for IT project managers
- Describe the project management profession, including its history, the role of professional organizations like the Project Management Institute (PMI), the importance of certification and ethics, and the advancement of project management software

OPENING CASE

Anne Roberts, the director of the Project Management Office for a large retail chain, stood in front of 500 people in the large corporate auditorium to explain the company's new strategies during a monthly all-hands meeting. She was also streaming live video to thousands of other employees at other locations, suppliers, and stockholders throughout the world. The company had come a long way in implementing new information systems to improve inventory control, sell products online, streamline the sales and distribution processes, and improve customer service. However, a recent security breach had alarmed investors and the stock price plummeted. People were anxious to hear about the company's new strategies.

Anne began to address the audience, "Good morning. As many of you know, we have completed many projects successfully, including the advanced data networks project. That project enabled us to provide persistent broadband between headquarters and our retail stores throughout the world, allowing us to make timely decisions and continue our growth strategy. Our customers love that they can return items to any store, and any sales clerk can look up past sales information. Local store managers can make timely decisions using up-to-date information. Of course, we've had some failures, and we need to continually assess our portfolio of projects to meet business needs.

Two big IT initiatives this coming year include providing the best computer security possible and providing enhanced online collaboration tools for our employees, suppliers, and customers. Our challenge is to work even smarter to decide what projects will most benefit the company, how we can continue to leverage the power of information technology to support our business, and how we can exploit our human capital to successfully plan and execute those projects. If we succeed, we'll continue to be a world-class corporation."

"And if we fail?" someone asked from the audience.

"Let's just say that failure is not an option," Anne replied.

1.1 INTRODUCTION

Many people and organizations today have a new—or renewed—interest in project management. Until the 1980s, project management primarily focused on providing schedule and resource data to top management in the military, computer, and construction industries. Today's project management involves much more, and people in every industry and every country manage projects. Project management is a distinct profession with degree programs, certifications, and excellent career opportunities.

New technologies have become a significant factor in many businesses. Computer hardware, software, networks, and the use of interdisciplinary and global work teams have radically changed the work environment. The following statistics demonstrate the significance of project management in today's society, especially for projects involving information technology (IT):

- Worldwide IT spending was $3.8 trillion in 2014, a 3.2 percent increase from 2013 spending. Telecom services accounted for 45 percent of the spending.[1]
- The Project Management Institute estimates demand for 15.7 million project management jobs from 2010 to 2020, with 6.2 million of those jobs in the United States.[2]

- The unemployment rate for IT professionals is generally half the rate of the overall labor market in the United States. Between 2011 and 2014, and during the recession, the average unemployment rate for workers not in science, technology, engineering, and mathematics (STEM) was 7.4 percent, as opposed to just above 3 percent for STEM workers.[3]
- In 2013 (the most recent year of PMI's salary survey), the average salary in U.S. dollars for someone in the project management profession was $108,000 per year in the United States; $134,658 in Australia, (the highest-paid country); and $24,201 in Egypt (the lowest-paid country). Of the 11,150 people from the United States who responded to PMI's salary survey, 80 percent had the Project Management Professional (PMP) credential, and their salary was over 20 percent higher than professionals without it.[4]
- The top skills employers look for in new college graduates are all related to project management: team-work, decision-making, problem-solving, and verbal communications. The three degrees most in demand are business, engineering, and computer and information sciences.[5]
- Organizations waste $109 million for every $1 billion spent on projects, according to PMI's Pulse of the Profession® report. Excelling at project management definitely affects the bottom line.[6]

The complexity and importance of IT projects, which involve using hardware, software, and networks to create a product, service, or result, have evolved dramatically. Today's companies, governments, and nonprofit organizations are recognizing that to be successful, they need to use modern project management techniques, especially for IT projects. Individuals are realizing that to remain competitive in the workplace, they must develop skills to become good project team members and project managers. They also realize that many of the concepts of project management will help them in their everyday lives as they work with people and technology on a day-to-day basis.

WHAT WENT WRONG?

In 1995, the Standish Group published an often-quoted study titled "The CHAOS Report." This consulting firm surveyed 365 IT executive managers in the United States who managed more than 8,380 IT application projects. As the title of the study suggests, the projects were in a state of chaos. U.S. companies spent more than $250 billion each year in the early 1990s on approximately 175,000 IT application development projects. Examples of these projects included creating a new database for a state department of motor vehicles, developing a new system for car rental and hotel reservations, and implementing a client-server architecture for the banking industry. The study reported that the overall success rate of IT projects was *only* 16.2 percent. The surveyors defined success as meeting project goals on time and on budget. The study also found that more than 31 percent of IT projects were canceled before completion, costing U.S. companies and government agencies more than $81 billion. The study authors were adamant about the need for better project management in the IT industry. They explained, "Software development projects are in chaos, and we can no longer imitate the three

continued

monkeys—hear no failures, see no failures, speak no failures."[7] Although this study was done 20 years ago, it was significant in making senior executives pay attention to the importance of IT project management.

In another large study, PricewaterhouseCoopers surveyed 200 companies from 30 different countries about their project management maturity and found that *over half of all projects fail*. The study also found that only 2.5 percent of corporations consistently meet their targets for scope, time, and cost goals for all types of projects.[8]

Although several researchers question the methodology of such studies, the results have prompted managers throughout the world to examine ways to improve their practices in managing projects. Many organizations assert that using project management techniques provides advantages, such as:

- Better control of financial, physical, and human resources
- Improved customer relations
- Shorter development times
- Lower costs and improved productivity
- Higher quality and increased reliability
- Higher profit margins
- Better internal coordination
- Positive impact on meeting strategic goals
- Higher worker morale

This chapter introduces projects and project management, explains how projects fit into programs and portfolio management, discusses the role of the project manager, and provides important background information on this growing profession. Although project management applies to many different industries and types of projects, this text focuses on applying project management to IT projects.

1.2 WHAT IS A PROJECT?

To discuss project management, it is important to understand the concept of a project. A **project** is "a temporary endeavor undertaken to create a unique product, service, or result."[9] Operations, on the other hand, is work done in organizations to sustain the business. Projects are different from operations in that they end when their objectives have been reached or the project has been terminated.

1.2a Examples of IT Projects

Projects can be large or small and involve one person or thousands of people. They can be done in one day or take years to complete. As described earlier, IT projects involve using hardware, software, and networks to create a product, service, or result. Examples of IT projects include the following:

- A large network of healthcare providers updates its information systems and procedures to reduce hospital acquired diseases.
- A team of students creates a smartphone application and sells it online.
- A company develops a driverless car.
- A college upgrades its technology infrastructure to provide wireless Internet access across the whole campus as well as online access to all academic and student service information.
- A company develops a new system to increase sales force productivity and customer relationship management that will work on various laptops, smartphones, and tablets.
- A television network implements a system to allow viewers to vote for contestants and provide other feedback on programs via social media sites.
- A government group develops a system to track child immunizations.
- A large group of volunteers from organizations throughout the world develops standards for environmentally friendly or green IT.
- A global bank acquires other financial institutions and needs to consolidate systems and procedures.
- Government regulations require monitoring of pollutants in the air and water.
- A multinational firm decides to consolidate its information systems into an integrated enterprise resource management approach.

Gartner, Inc., a prestigious consulting firm, identified the top 10 strategic technologies for 2015. A few of these technologies include the following:

- *Computing everywhere*: The needs of mobile users in diverse contexts and environments will continue to drive companies to develop new products and services.
- *The Internet of things*: Expanding digitization and connectivity will continue to enable companies to combine information from people, places, and things to extend services, improve how assets or machines operate, or create new sources of revenue. One example, according to Gartner, is that "the pay-per-use model can be applied to assets (such as . . . equipment), services (such as pay-as-you-drive insurance), people (such as movers), places (such as parking spots), and systems (such as cloud services)."
- *3D printing*: Worldwide shipments of 3D printers are expected to nearly double in 2015 compared to 2014 and double again in 2016. New applications continue to be found for producing items at lower costs through improved designs, streamlined prototyping, and short-run manufacturing.
- *Advanced, pervasive, and invisible analytics*: Analytics continues to grow in importance as the volume of data generated by embedded systems increases. The challenge is analyzing data to provide "the right information to the right person at the right time."[10]

As you can see, a wide variety of projects use information technologies, and organizations rely on them for success.

MEDIA SNAPSHOT

One of Gartner's top 10 strategic technologies for 2012 included application stores and marketplaces for smartphones and tablets. Gartner predicted that by 2014 there would be more than 70 billion mobile application downloads every year, but the actual number was almost double![11] Facebook is by far the most downloaded app, and the most popular category of all apps continues to be games.

There are over 1.3 million apps in Apple's App store and another 1.3 million in Google's Play Store. Of course, business professionals use phone applications for productive purposes. The challenge is to develop useful apps and get workers to focus on them instead of the many distracting options available. *Business Insider*, *Forbes*, *PC Magazine*, and website Lifehacker.com provide lists of top productivity apps "to keep you focused and get things done."[12]

1.2b Project Attributes

Projects come in all shapes and sizes. The following attributes help define a project further:

- *A project has a unique purpose.* Every project should have a well-defined objective. For example, Anne Roberts, the director of the Project Management Office in the chapter's opening case, might sponsor an IT collaboration project to develop a list and initial analysis of potential IT projects that might improve operations for the company. The unique purpose of this project would be to create a collaborative report with ideas from people throughout the company. The results would provide the basis for further discussions and selecting projects to implement. As you can see from this example, projects result in a unique product, service, or result.
- *A project is temporary.* A project has a definite beginning and end. In the IT collaboration project, Anne might form a team of people to work immediately on the project, and then expect a report and an executive presentation of the results in one month.
- *A project is developed using progressive elaboration.* Projects are often defined broadly when they begin, and as time passes, the specific details of the project become clearer. Therefore, projects should be developed in increments. A project team should develop initial plans and then update them with more detail based on new information. For example, suppose that a few people submitted ideas for the IT collaboration project, but they did not clearly address how the ideas would support the business strategy of improving operations. The project team might decide to prepare a questionnaire for people to fill in as they submit their ideas to improve the quality of the inputs.
- *A project requires resources, often from various areas.* Resources include people, hardware, software, and other assets. Many projects cross departmental or other boundaries to achieve their unique purposes. For the IT

collaboration project, people from IT, marketing, sales, distribution, and other areas of the company would need to work together to develop ideas. The company might also hire outside consultants to provide input. Once the collaboration project team has selected key projects for implementation, each of those will probably require additional resources. To meet objectives of these new projects, people from other companies—product suppliers and consulting companies—may be added to the team. Resources, however, are limited and must be used effectively to meet project and other corporate goals.

- *A project should have a primary customer or sponsor.* Most projects have many interested parties or stakeholders, but for a project to succeed someone must take the primary role of sponsorship. The **project sponsor** usually provides the direction and funding for the project. Executive support is crucial to project success, as described in later chapters. Anne Roberts would be the sponsor for the IT collaboration project. Once further IT projects are selected, however, the sponsors for those projects would be senior managers in charge of the main parts of the company affected by the projects. For example, the sponsor of a project to improve online product sales would be the vice president of sales. In this situation, Anne might become part of a project steering committee, helping other managers understand different project objectives, resolve priorities, research issues, or alter constraints within a given project or across multiple projects.
- *A project involves uncertainty.* Because every project is unique, it is sometimes difficult to define its objectives clearly, estimate how long it will take to complete, or determine how much it will cost. External factors also cause uncertainty, such as a supplier going out of business or a project team member needing unplanned time off. This uncertainty is one of the main reasons project management is so challenging, especially on projects involving new technologies.

An effective **project manager** is crucial to a project's success. Project managers work with the project sponsors, team, and the other people involved to achieve project goals.

1.2c Project Constraints

Every project is constrained in different ways, often by its scope, time, and cost goals. These limitations are sometimes referred to in project management as the **triple constraint**. To create a successful project, a project manager must consider scope, time, and cost and balance these three often-competing goals:

- *Scope*: What work will be done as part of the project? What unique product, service, or result does the customer or sponsor expect from the project? How will the scope be verified?
- *Time*: How long should it take to complete the project? What is the project's schedule? How will the team track actual schedule performance? Who can approve changes to the schedule?
- *Cost*: What should it cost to complete the project? What is the project's budget? How will costs be tracked? Who can authorize changes to the budget?

Figure 1-1 illustrates the three dimensions of the triple constraint. Each area—scope, time, and cost—has a target at the beginning of the project. For example, the IT collaboration project might have an initial scope of producing a 40- to 50-page report and a one-hour presentation on about 30 potential IT projects. The project manager might further define project scope to include providing a description of each potential project, an investigation of what other companies have implemented for similar projects, a rough time and cost estimate, and assessments of the risk and potential payoff as high, medium, or low. The initial time estimate for this project might be one month, and the cost estimate might be $45,000–$50,000. These expectations provide targets for the scope, time, and cost dimensions of the project.

Note that the scope and cost goals in this example include ranges—the report can be 40 to 50 pages long and the project can cost between $45,000 and $50,000. Because projects involve uncertainty and limited resources, projects rarely finish according to their original scope, time, and cost goals. Instead of discrete target goals, it is often more realistic to set a range for goals, such as spending between $45,000 and $50,000 and having a 40- to 50-page report. These goals might require hitting the target, but not the bull's eye.

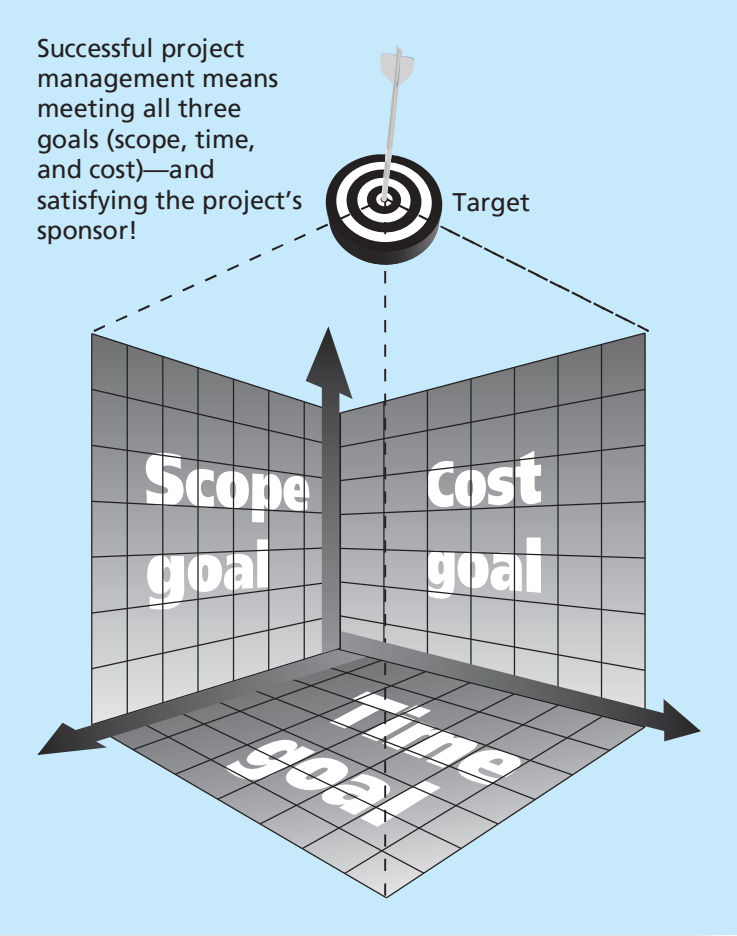


FIGURE 1-1 Project constraints

Managing the triple constraint involves making trade-offs between scope, time, and cost goals for a project. For example, you might need to increase the budget for a project to meet scope and time goals. Alternatively, you might have to reduce the scope of a project to meet time and cost goals. Experienced project managers know that you must decide which aspect of the triple constraint is most important. If time is most important, you must often change the initial scope and cost goals to meet the schedule. If scope goals are most important, you may need to adjust time and cost goals.

To generate project ideas for the IT collaboration project, suppose that the project manager sent an e-mail survey to all employees, as planned. The initial time and cost estimate may have been one week and $5,000 to collect ideas using this e-mail survey. Now, suppose that the e-mail survey generated only a few good project ideas, but the scope goal was to collect at least 30 good ideas. Should the project team use a different method like focus groups or interviews to collect ideas? Even though it was not in the initial scope, time, or cost estimates, it would really help the project. Because good ideas are crucial to project success, it would make sense to inform the project sponsor that adjustments are needed.

Although the triple constraint describes how the basic elements of a project interrelate, other elements can also play significant roles. Quality is often a key factor in projects, as is customer or sponsor satisfaction. Some people, in fact, refer to the *quadruple constraint* of project management, which includes quality as well as scope, time, and cost. A project team may meet scope, time, and cost goals but might fail to meet quality standards and satisfy the sponsor. For example, Anne Roberts may receive a 50-page report describing 30 potential IT projects and hear a presentation that summarizes the report. The project team may have completed the work on time and within the cost constraint, but the quality may have been unacceptable.

Other factors might also be crucial to a particular project. On some projects, resources are the main concern. For example, the entertainment industry often needs particular actors for movies or television shows. Project goals must be adjusted based on when particular people are available. Risk can also affect major project decisions. A company might wait to start a project until the risks are at an acceptable level. The project manager should be communicating with the sponsor throughout the project to make sure it is meeting expectations. Chapter 10, Project Communications Management, and Chapter 13, Project Stakeholder Management, address communicating with stakeholders and understanding their expectations in greater detail.

How can you avoid the problems that occur when you meet scope, time, and cost goals, but lose sight of customer satisfaction? The answer is *good project management, which includes more than managing project constraints*.

1.3 WHAT IS PROJECT MANAGEMENT?

Project management is "the application of knowledge, skills, tools, and techniques to project activities to meet project requirements."[13] Project managers must strive not only to meet specific scope, time, cost, and quality goals of projects, they must also facilitate the entire process to meet the needs and expectations of people involved in project activities or affected by them.

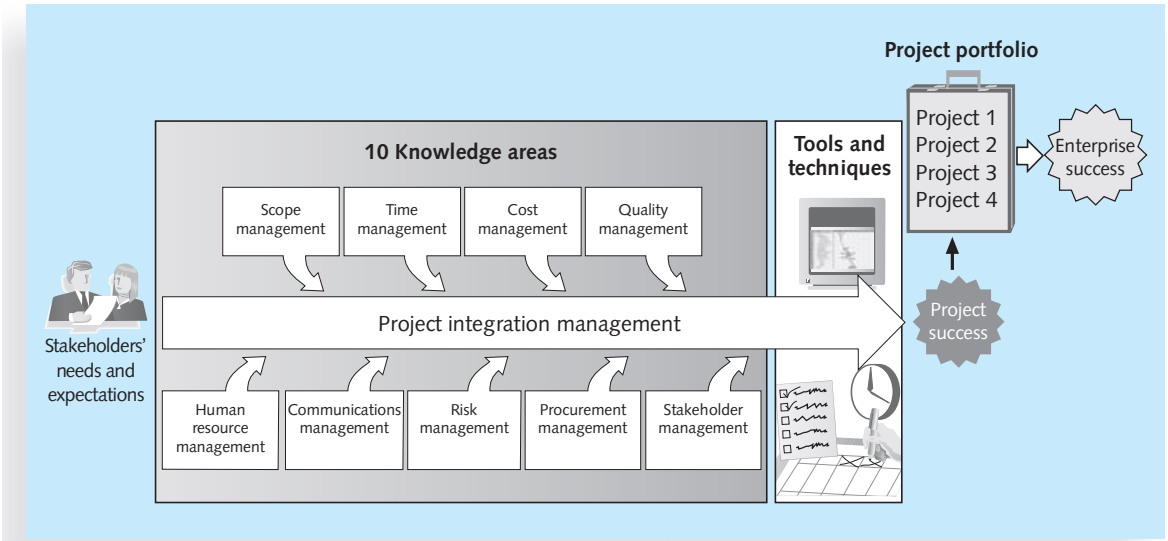


FIGURE 1-2 Project Management Framework

Figure 1-2 illustrates a framework to help you understand project management. Key elements of this framework include the project stakeholders, project management knowledge areas, project management tools and techniques, and the contribution of successful projects to the enterprise.

1.3a Project Stakeholders

Stakeholders are the people involved in or affected by project activities, and include the project sponsor, project team, support staff, customers, users, suppliers, and even opponents of the project. These stakeholders often have very different needs and expectations. A familiar example of a project is building a new house. There are several stakeholders in a home construction project.

- The project sponsors would be the potential new homeowners who would be paying for the house. They could be on a very tight budget, so would expect the contractor to provide a realistic idea of what type of home they could afford given their budget constraints. They would also need a realistic idea of when they could move in. Regardless of budget, they would expect the contractor to provide accurate estimates for the building costs. The new homeowners would have to make important decisions to keep the costs of the house within their budget. Can they afford to finish the basement right away? If they can afford to finish the basement, will it affect the projected move-in date? In this example, the project sponsors are also the customers and users of the product, which is the house.
- The house may require financing by a bank or other financial institution like a credit union, which will secure a legal interest (lien) in the property and

the finished home. This institution is an example of a legal stakeholder who must be informed of any changes to the plans or schedule because the project is part of a legal contract.

- The project manager in this example would normally be the general contractor responsible for building the house. The project manager needs to work with all the project stakeholders to meet their needs and expectations.
- The project team for building the house would include several construction workers, electricians, and carpenters. These stakeholders would need to know exactly what work they must do and when they need to do it. They would need to know if the required materials and equipment will be at the construction site or if they are expected to provide the materials and equipment. Their work would need to be coordinated because many interrelated factors are involved. For example, the carpenter cannot put in kitchen cabinets until the walls are completed.
- Support staff might include the buyers' employers, the general contractor's administrative assistant, and people who support other stakeholders. The buyers' employers might expect their employees to complete their work but allow some flexibility so they can visit the building site or take phone calls related to building the house. The contractor's administrative assistant would support the project by coordinating meetings between the buyers, the contractor, suppliers, and other parties.
- Building a house requires many suppliers. The suppliers would provide the wood, windows, flooring, appliances, and other materials. Suppliers would expect exact details on the items they need to provide, and where and when to deliver those items.
- A project might have opponents. In this example, a neighbor might oppose the project because the workers make so much noise that she cannot concentrate on her work at home, or the noise might wake her sleeping children. She might interrupt the workers to voice her complaints or even file a formal complaint. Or, the neighborhood might have association rules concerning new home design and construction. If the homeowners do not follow these rules, they might have to halt construction due to legal issues. Even without such complaints, the home must comply with certain building codes and other restrictions; these considerations may also result in changes to the project's requirements, making the local government a stakeholder in the project.

As you can see from this example, projects have many different stakeholders, and they often have different interests. Stakeholders' needs and expectations are important in the beginning and throughout the life of a project. Successful project managers develop good relationships with project stakeholders to understand and meet their needs and expectations.

1.3b Project Management Knowledge Areas

Project management knowledge areas describe the key competencies that project managers must develop. The center of Figure 1-2 shows the 10 knowledge areas of project management.

1. Project scope management involves defining and managing all the work required to complete the project successfully.
2. Project time management includes estimating how long it will take to complete the work, developing an acceptable project schedule, and ensuring timely completion of the project.
3. Project cost management consists of preparing and managing the budget for the project.
4. Project quality management ensures that the project will satisfy the stated or implied needs for which it was undertaken.
5. Project human resource management is concerned with making effective use of the people involved with the project.
6. Project communications management involves generating, collecting, disseminating, and storing project information.
7. Project risk management includes identifying, analyzing, and responding to risks related to the project.
8. Project procurement management involves acquiring or procuring goods and services for a project from outside the performing organization.
9. Project stakeholder management includes identifying and analyzing stakeholder needs while managing and controlling their engagement throughout the life of the project.
10. Project integration management is an overarching function that affects and is affected by all of the other knowledge areas.

Project managers must have knowledge and skills in all 10 of these areas. This text includes an entire chapter on each of these knowledge areas because all of them are crucial to project success.

1.3c Project Management Tools and Techniques

Thomas Carlyle, a famous historian and author, stated, "Man is a tool-using animal. Without tools he is nothing, with tools he is all." As the world continues to become more complex, it is even more important for people to develop and use tools, especially for managing important projects. **Project management tools and techniques** assist project managers and their teams in carrying out work in all 10 knowledge areas. For example, some popular time-management tools and techniques include Gantt charts, project network diagrams, and critical path analysis. Table 1-1 lists some commonly used tools and techniques by knowledge area. You will learn more about these and other tools and techniques throughout this text.

A survey of 753 project and program managers was conducted to rate several project management tools. Respondents rated tools on a scale of 1–5 (low to high) based on the extent of their use and the potential of the tools to help improve project success. "Super tools" were defined as those that had high use and high potential for improving project success. These super tools included software for task scheduling (such as project management software), scope statements, requirement analyses, and lessons-learned reports. Tools that are already used extensively and have been found to improve project performance include progress reports, kick-off meetings, Gantt charts, and change requests.

These super tools appear in column 3 of Table 1-1.[14] Note that project stakeholder management was not a separate knowledge area at the time of this survey. Of course, different tools can be more effective in different situations. It is crucial for project managers and their team members to determine which tools will be most useful for their particular projects.

TABLE 1-1 Common project management tools and techniques by knowledge area

Knowledge Area/Category	Tools and Techniques	Super Tools
Integration management	Project selection methods Project management methodologies Stakeholder analyses Work requests Project charters Project management plans Change control boards Project review meetings	Project management software Change requests Lessons-learned reports
Scope management	Statements of work Scope management plans Scope verification techniques Scope change controls	Scope statements Work breakdown structures Requirements analyses
Time management	Project network diagrams Critical path analysis Crashing Fast tracking Schedule performance measurements	Gantt charts
Cost management	Project budgets Net present value Return on investment Payback analysis Earned value management Project portfolio management Cost estimates Cost management plans Cost baselines	
Quality management	Quality metrics Checklists Quality control charts Pareto diagrams Fishbone diagrams Maturity models Statistical methods Test plans	
Human resource management	Motivation techniques Empathic listening Responsibility assignment matrices Project organizational charts Resource histograms Team building exercises	

(continued)

TABLE 1-1 Common project management tools and techniques by knowledge area (*continued*)

Knowledge Area/Category	Tools and Techniques	Super Tools
Communications management	Communications management plans Conflict management Communications media selection Status reports Virtual communications Templates Project websites	Kick-off meetings Progress reports
Risk management	Risk management plans Risk registers Probability/impact matrices Risk rankings	
Procurement management	Make-or-buy analyses Contracts Requests for proposals or quotes Source selections Supplier evaluation matrices	

WHAT WENT RIGHT?

Follow-up studies by the Standish Group (publisher of the annual CHAOS study; see "What Went Wrong?") have shown some improvement in the success rates of IT projects:

- The number of successful IT projects more than doubled, from 16 percent in 1994 to 39 percent in 2012.
- The number of failed projects decreased from 31 percent in 1994 to 18 percent in 2012.

"This year's results represent a high watermark for success rates in the history of CHAOS research. The increase in success is a result of several factors, including looking at the entire project environment of processes, methods, skills, costs, tools, decisions, optimization, internal and external influences, and team chemistry. Advances in the understanding of the skills needed to be a good executive sponsor have proved to be very valuable for increasing success rates. Increases in project management as a profession and trained project management professionals can be tied directly to increases in success rates."[15]

The 2013 CHAOS study also compared small projects (under $1 million) with large projects (over $10 million). Not surprisingly, the success rate for small projects was much higher than for large projects—76 percent versus 10 percent. It is easier to manage smaller projects, and researchers suggest that organizations strive to break large projects into a sequence of smaller ones in a process they call optimization.[16]

Despite its advantages, project management is not a silver bullet that guarantees success on all projects. Project management is a very broad, often complex discipline. What works on one project may not work on another, so it is essential for project

managers to continue to develop their knowledge and skills in managing projects. It is also important to learn from the mistakes and successes of others.

1.3d Project Success

How do you define the success or failure of a project? The list that follows outlines a few common criteria for measuring the success of a project, illustrating each with an example of upgrading 500 desktop computers within three months for $300,000:

1. *The project met scope, time, and cost goals.* If all 500 computers were upgraded and met other scope requirements, the work was completed in three months or less, and the cost was $300,000 or less, you could consider the project successful. The Standish Group studies used this definition of success, but several people question this simple definition of project success and the methods used for collecting the data. (Search for articles by Robert L. Glass to read more about this debate.)
2. *The project satisfied the customer/sponsor.* Even if the project met initial scope, time, and cost goals, the users of the computers or their managers might not be satisfied. Perhaps the project manager or team members never returned calls or were rude. Perhaps users had their daily work disrupted during the upgrades or had to work extra hours due to the upgrades. If the customers were not happy with important aspects of the project, it would be deemed a failure. Conversely, a project might not meet initial scope, time, and cost goals, but the customer could still be very satisfied. Perhaps the project team took longer and spent more money than planned, but they were very polite and helped the users and managers solve several work-related problems. Many organizations implement a customer satisfaction rating system to measure project success instead of tracking only scope, time, and cost performance.
3. *The results of the project met its main objective, such as making or saving a certain amount of money, providing a good return on investment, or simply making the sponsors happy.* Even if the project cost more than estimated, it took longer to complete, and the project team was hard to work with, the project would be successful if users were happy with the upgraded computers, based on this criterion. As another example, suppose that the sponsor approved the upgrade project to provide a good return on investment by speeding up work and therefore generating more profits. If those goals were met, the sponsor would deem the project a success, regardless of other factors involved.

Why do some IT projects succeed and others fail? Table 1-2 summarizes the results of the 2013 CHAOS study. The factors that contribute most to the success of IT projects are listed in order of importance. Executive support is the most important factor, followed by user involvement. A few of the top success factors relate to good scope management, such as having clear business objectives and optimizing scope. Project management expertise continues to be a key success factor. In fact, experienced project managers, who can often help influence all of these factors to improve the probability of project success, led 97 percent of successful projects, based on an earlier CHAOS study in 2001.

TABLE 1-2 What helps projects succeed?

1. Executive support
2. User involvement
3. Clear business objectives
4. Emotional maturity
5. Optimizing scope
6. Agile process
7. Project management expertise
8. Skilled resources
9. Execution
10. Tools and infrastructure

Source: The Standish Group, "CHAOS Manifesto 2013: Think Big, Act Small" (2013).

A 2011 U.S. government report listed the top three reasons why federal technology projects succeed:

1. Adequate funding
2. Staff expertise
3. Engagement from all stakeholders

Notice that the CHAOS study list does not include adequate funding. Most nongovernment companies must either find adequate funds for important projects or cancel projects if they cannot be funded or get an adequate return. Government projects often require that funds be allocated a year or more before they even start, and estimates often fall short. "The government has struggled when acquiring technology thanks to the convoluted nature of the federal contracting process and the shortage of qualified contracting officers and technical personnel. Critics argue that federal agencies get little return for the $80 billion the government spends annually on IT. . . . 'History has shown that government IT projects frequently face challenges of meeting cost, schedule or performance goals,' said Sen. Susan Collins (R-Maine) in a statement."[17]

It is interesting to compare success factors for IT projects in the United States with those in other countries. A 2004 study summarizes the results of a survey of 247 information systems project practitioners in mainland China. One of the study's key findings was that relationship management is viewed as a top success factor for information systems in China, while it is not mentioned in U.S. studies. The study also suggested that having competent team members is less important in China than in the United States. The Chinese, like the Americans, included top management support, user involvement, and a competent project manager as vital to project success.[18]

It is also important to look beyond individual project success rates and focus on how organizations as a whole can improve project performance. Research comparing companies that excel in project delivery—the "winners"—from those that do not found four significant best practices:

1. *Use an integrated toolbox.* Companies that consistently succeed in managing projects clearly define what needs to be done in a project, by whom, when,

and how. They use an integrated toolbox, including project management tools, methods, and techniques. They carefully select tools, align them with project and business goals, link them to metrics, and provide them to project managers to deliver positive results.

2. *Grow project leaders.* The winners know that strong project managers—referred to as project leaders—are crucial to project success. They also know that a good project leader needs to be a business leader as well, with strong interpersonal and intrapersonal skills. Companies that excel in project management often grow or develop their project leaders internally, providing them with career opportunities, training, and mentoring.
3. *Develop a streamlined project delivery process.* Winning companies have examined every step in the project delivery process, analyzed fluctuations in workloads, searched for ways to reduce variation, and eliminated bottlenecks to create a repeatable delivery process. All projects go through clear stages and clearly define key milestones. All project leaders use a shared road map, focusing on key business aspects of their projects while integrating goals across all parts of the organization.
4. *Measure project health using metrics.* Companies that excel in project delivery use performance metrics to quantify progress. They focus on a handful of important measurements and apply them to all projects. Metrics often include customer satisfaction, return on investment, and percentage of schedule buffer consumed.[19]

Project managers play an important role in making projects, and therefore organizations, successful. Project managers work with the project sponsors, the project team, and other stakeholders to meet project goals. They also work with sponsors to define success for particular projects. Good project managers do not assume that their definition of success is the same as the sponsors'. They take the time to understand their sponsors' expectations and then track project performance based on important success criteria.

1.4 PROGRAM AND PROJECT PORTFOLIO MANAGEMENT

As mentioned earlier, about one-quarter of the world's gross domestic product is spent on projects. Projects make up a significant portion of work in most business organizations or enterprises, and managing those projects successfully is crucial to enterprise success. Two important concepts that help projects meet enterprise goals are the use of programs and project portfolio management.

1.4a Programs

A **program** is "a group of related projects, subprograms, and program activities managed in a coordinated way to obtain benefits and control not available from managing them individually."[20] As you can imagine, it is often more economical to group projects together to help streamline management, staffing, purchasing, and other work. The following are examples of common programs in the IT field.

- *Infrastructure*: An IT department often has a program for IT infrastructure projects. This program could encompass several projects, such as providing more wireless Internet access, upgrading hardware and software, enhancing computer security, and developing and maintaining corporate standards for IT.
- *Applications development*: This program could include several projects, such as updating an enterprise resource planning (ERP) system, purchasing a new off-the-shelf billing system, or developing a new capability for a customer relationship management system.
- *User support*: In addition to the many operational tasks related to user support, many IT departments have several projects to support users. For example, a project might provide a better e-mail system or develop technical training for users.

A **program manager** provides leadership and direction for the project managers heading the projects within a program. Program managers also coordinate the efforts of project teams, functional groups, suppliers, and operations staff supporting the projects to ensure that products and processes are implemented to maximize benefits. Program managers are responsible for more than the delivery of project results; they are change agents responsible for the success of products and processes developed by those projects. For example, the NASA International Space Station Program is led by a program manager who oversees all U.S. projects involved with the station and is accountable for achieving their objectives, funding, and contribution to scientific knowledge.

Program managers often have review meetings with all their project managers to share important information and coordinate important aspects of each project. Many program managers worked as project managers earlier in their careers, and they enjoy sharing their wisdom and expertise with their project managers. Effective program managers recognize that managing a program is much more complex than managing a single project. They recognize that technical and project management skills are not enough—program managers must also possess strong business knowledge, leadership capabilities, and communication skills.

1.4b Project Portfolio Management

In many organizations, project managers also support an emerging business strategy of **project portfolio management** or **portfolio management**, as called in this text, in which organizations group and manage projects and programs as a portfolio of investments that contribute to the entire enterprise's success. Portfolio managers help their organizations make wise investment decisions by helping to select and analyze projects from a strategic perspective. Portfolio managers may or may not have previous experience as project or program managers. It is most important that they have strong financial and analytical skills and understand how projects and programs can contribute to meeting strategic goals.

FIGURE 1-3 Project management compared to project portfolio management

Figure 1-3 illustrates the differences between project management and project portfolio management. Notice that the main distinction is a focus on meeting tactical or strategic goals. Tactical goals are generally more specific and short-term than strategic goals, which emphasize long-term goals for an organization. Individual projects often address tactical goals, whereas portfolio management addresses strategic goals. Project management addresses questions like "Are we carrying out projects well?", "Are projects on time and on budget?", and "Do project stakeholders know what they should be doing?"

Portfolio management addresses questions like "Are we working on the right projects?", "Are we investing in the right areas?", and "Do we have the right resources to be competitive?" Pacific Edge Software's product manager, Eric Burke, defines project portfolio management as "the continuous process of selecting and managing the optimum set of project initiatives that deliver maximum business value."[21]

Many organizations use a more disciplined approach to portfolio management by developing guidelines and software tools to assist in it. The Project Management Institute (described later in this chapter) first published the *Organizational Project Management Maturity Model (OPM3) Knowledge Foundation* in 2003.[22] OPM3 describes the importance not only of managing individual projects or programs well but the importance of following organizational project management to align projects, programs, and portfolios with strategic goals. OPM3 is a standard that organizations can use to measure their organizational project management maturity against a comprehensive set of best practices.

BEST PRACTICE

A **best practice** is "an optimal way recognized by industry to achieve a stated goal or objective."[23] Rosabeth Moss Kanter, a professor at Harvard Business School and well-known author and consultant, says that visionary leaders know "the best practice secret: Stretching to learn from the best of the best in any sector can make a big vision more likely to succeed."[24] Kanter also emphasizes the need to have measurable standards for best practices. An organization can measure performance against its own past, against peers, and, even better, against potential. Kanter suggests that organizations need to continue to reach for higher standards. She suggests the following exercise regimen for business leaders who want to adapt best practices in an intelligent way to help their own organizations:

- Reach high. Stretch. Raise standards and aspirations. Find the best of the best and then use it as inspiration for reaching full potential.
- Help everyone in your organization become a professional. Empower people to manage themselves through benchmarks and standards based on best practice exchange.
- Look everywhere. Go far afield. Think of the whole world as your laboratory for learning.

Robert Butrick, author of *The Project Workout*, wrote an article on best practices in project management for the *Ultimate Business Library's Best Practice* book. He suggests that organizations need to follow basic principles of project management, including these two mentioned earlier in this chapter:

- Make sure your projects are driven by your strategy. Be able to demonstrate how each project you undertake fits your business strategy, and screen out unwanted projects as soon as possible.
- Engage your stakeholders. Ignoring stakeholders often leads to project failure. Be sure to engage stakeholders at all stages of a project, and encourage teamwork and commitment at all times.[25]

As you can imagine, project portfolio management is not an easy task. Figure 1-4 illustrates one approach for project portfolio management in which one large portfolio exists for the entire organization. This allows top management to view and manage all projects at an enterprise level. Sections of the portfolio are then broken down to improve the management of projects in each sector. For example, a company might have the main portfolio categories shown in the left part of Figure 1-4—marketing, materials, IT, and human resources (HR)—and divide each of those categories further to address its unique concerns. The right part of this figure shows how the IT projects could be categorized in more detail to assist in their management. In this example, there are three basic IT project portfolio categories:

- *Venture*: Projects in this category help transform the business. For example, the large retail chain described in the opening case might have an IT project to

provide kiosks in stores and similar functionality on the Internet where customers and suppliers could quickly provide feedback on products or services. This project could help transform the business by developing closer partnerships with customers and suppliers.

- *Growth*: Projects in this category would help the company increase its revenues. For example, a company might have an IT project to provide information on its corporate website in a new language, such as Chinese or Japanese. This capability could help the company grow its business in those countries.
- *Core*: Projects in this category must be accomplished to run the business. For example, an IT project to provide computers for new employees would fall under this category.

In Figure 1-4, the costs of Core IT projects are nondiscretionary, which means that the company has no choice in whether to fund them. Core IT Projects must be funded for the company to stay in business. Projects in the Venture or Growth category are discretionary costs because the company can use its own discretion or judgment in deciding whether to fund them; these projects are not critical to the company fulfilling its mission. The arrow in the center of Figure 1-4 indicates that the risks and value of projects normally increase as you move from Core to Growth to Venture projects. In addition, timeliness becomes increasingly important; growth and venture projects, more than core projects, must be done within a certain time frame to be effective. However, some core projects can also be high risk, have high value, and require good timing. As you can see, many factors are involved in portfolio management.

Many organizations use specialized software to organize and analyze all types of project data into project portfolios. **Enterprise project management software** or **project and portfolio management software** integrates information from multiple projects to show the

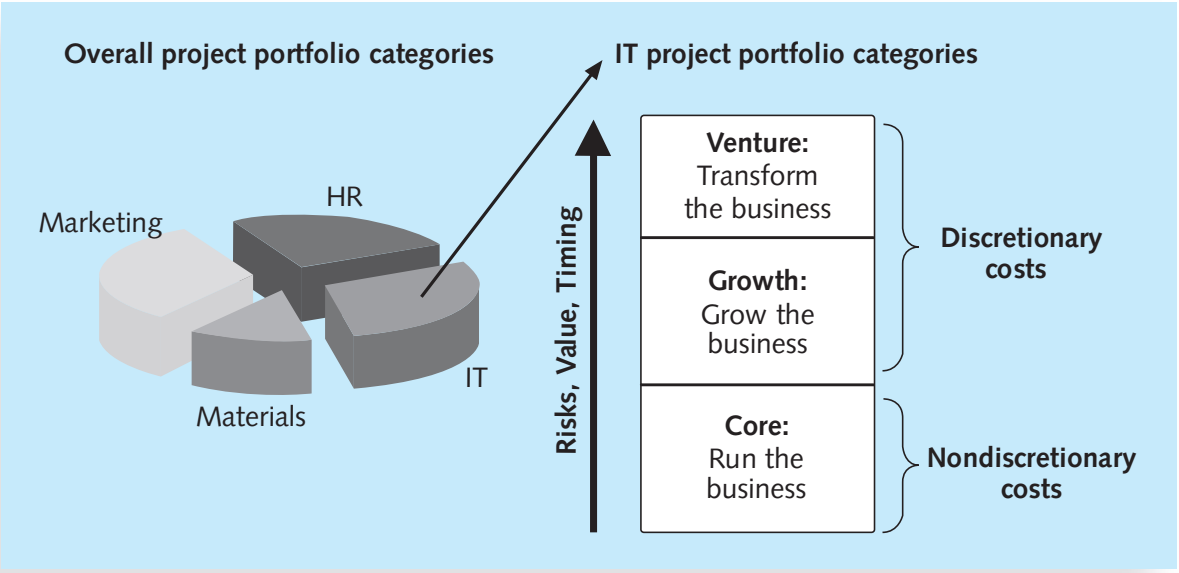


FIGURE 1-4 Sample project portfolio approach

Source: Microsoft, "PPM Solution Guide" (October 2013).

FIGURE 1-5 Microsoft project portfolio management capabilities

status of active, approved, and future projects across an entire organization. It also helps organizations prioritize project portfolio investment to deliver results with the best business value. In 2014, Capterra published an infographic listing the top 20 project management software tools. Microsoft Project continues to lead the market with over 880,000 customers and 22 million users.[26] Figure 1-5 summarizes the capabilities of the Microsoft Project Portfolio Management solution.

1.5 THE ROLE OF THE PROJECT MANAGER

You have already read that project managers must work closely with the other stakeholders on a project, especially the sponsor and project team. They are also more effective if they are familiar with the 10 project management knowledge areas and the various tools and techniques related to project management. Experienced project managers help projects succeed. But what do project managers do, exactly? What skills do they really need to do a good job? The next section provides brief answers to these questions, and the rest of this book gives more insight into the role of the project manager. Even if you never become a project manager, you will probably be part of a project team, and it is important for team members to help their project managers.

1.5a Project Manager Job Description

A project manager can have many different job descriptions, which can vary tremendously based on the organization and the project. In fact, PMI includes a page on their website to

answer the question, "Who are project managers?" In addition to saying that project managers are organized, passionate, and goal-oriented individuals who drive business results by leading projects, PMI emphasizes that they are also change agents who work well under pressure and enjoy challenging work environments.

Project management jobs can be found in every country and every industry. Sites like indeed.com listed hundreds of thousands of job openings in 2015. Monster.com has a job category for project management, and their site says that project managers "smoothly link management, clients and staff to keep projects rolling. To be successful in a project management job, you'll need people skills, business acumen and technical competence."[27] Here are a few edited postings:

- *Project manager for a consulting firm*: Plans, schedules, and controls activities to fulfill identified objectives applying technical, theoretical, and managerial skills to satisfy project requirements. Coordinates and integrates team and individual efforts and builds positive professional relationships with clients and associates.
- *Project manager for a computer systems firm*: Works independently within established practices to assist in the development and implementation process of projects involving departmental, vendor relationships, and/or cross-functional teams. Coordinates with internal/external clients to gather business requirements and coordinate project plans. Monitor projects from initiation through delivery ensuring completion of the project on schedule.
- *IT project manager for a nonprofit consulting firm*: Responsibilities include business analysis, requirements gathering, project planning, budget estimating, development, testing, and implementation. Responsible for working with various resource providers to ensure development is completed in a timely, high-quality, and cost-effective manner.

The job description for a project manager can vary by industry and by organization, but most project managers perform similar tasks regardless of these differences. In fact, project management is a skill needed in every major IT field, from database administrator to network specialist to technical writer. Because demand for project managers is high, some organizations have hired new college graduates to fill positions normally held by experienced professionals. For example, Boom Lab, a consulting company, is growing quickly by finding, training, and placing talented people as project coordinators. As new project coordinators gain experience and credentials, they often continue their careers by managing larger projects, becoming program managers, or transitioning into other management positions.

1.5b Suggested Skills for Project Managers

Project managers need to have a wide variety of skills and be able to decide which skills are more important in different situations. *A Guide to the Project Management Body of Knowledge*—the *PMBOK® Guide*—recommends that the project management team understand and use expertise in the following areas:

- The Project Management Body of Knowledge
- Application area knowledge, standards, and regulations

- Project environment knowledge
- General management knowledge and skills
- Soft skills or human relations skills

This chapter introduced the 10 project management knowledge areas, as well as some general tools and techniques project managers use. The following section focuses on the IT application area, including skills required in the project environment, general management, and soft skills. Note that the *PMBOK® Guide, Fifth Edition* describes three dimensions of project management competency: project management knowledge (knowing about project management), performance competency (being able to apply project management knowledge), and personal competency (attitudes and personality characteristics). Consult PMI's website at *www.pmi.org* for further information on skills for project managers and PMI's Career Framework for Practitioners.

The project environment differs from organization to organization and project to project, but some skills will help in almost all project environments. These skills include understanding change and understanding how organizations work within their social, political, and physical environments. Project managers must be comfortable leading and handling change, because most projects introduce changes in organizations and involve changes within the projects themselves. Project managers need to understand the organization in which they work and how that organization develops products and provides services. The skills and behavior needed to manage a project for a Fortune 100 company in the United States may differ greatly from those needed to manage a government project in Poland. Chapter 2, The Project Management and Information Technology Context, provides detailed information on these topics.

Project managers should also possess general management knowledge and skills. They should understand important topics related to financial management, accounting, procurement, sales, marketing, contracts, manufacturing, distribution, logistics, the supply chain, strategic planning, tactical planning, operations management, organizational structures and behavior, personnel administration, compensation, benefits, career paths, and health and safety practices. On some projects, it will be critical for the project manager to have a lot of experience in one or several of these general management areas. On other projects, the project manager can delegate detailed responsibility for some of these areas to a team member, support staff, or even a supplier. Even so, the project manager must be intelligent and experienced enough to know which of these areas are most important and who is qualified to do the work. The project manager must make all key project decisions and take responsibility for them.

Achieving high performance on projects requires soft skills, otherwise called human relations skills. Some of these soft skills include effective communication, influencing the organization to get things done, leadership, motivation, negotiation, conflict management, and problem solving. Why do project managers need good soft skills? One reason is that to understand, navigate, and meet stakeholders' needs and expectations, project managers need to lead, communicate, negotiate, solve problems, and influence the organization at large. They need to be able to listen actively to what others are saying, help develop new approaches for solving problems, and then persuade others to work toward achieving project goals. Project managers must lead their project teams by providing vision, delegating work, creating an energetic and positive

environment, and setting an example of appropriate and effective behavior. Project managers must focus on teamwork skills to employ people effectively. They need to be able to motivate different types of people and develop *esprit de corps* within the project team and with other project stakeholders. Because most projects involve changes and trade-offs between competing goals, it is important for project managers to have strong coping skills as well. Project managers need to be able to cope with criticism and constant change. Project managers must be flexible, creative, and sometimes patient in working toward project goals; they must also be persistent in making project needs known.

Finally, project managers, especially those managing IT projects, must be able to make effective use of technology as it relates to the specific project. Making effective use of technology often includes special product knowledge or experience with a particular industry.

Project managers must make many decisions and deal with people in a wide variety of disciplines, so it helps tremendously to have a project manager who is confident in using the special tools or technologies that are the most effective in particular settings. Project managers do not normally have to be experts on any specific technology, but they have to know enough to build a strong team and ask the right questions to keep things on track. For example, project managers for large IT projects do not have to be experts in the field of IT, but they must have working knowledge of various technologies and understand how the project would enhance the business. Many companies have found good business managers can be very good IT project managers because they focus on meeting business needs and rely on key project members to handle the technical details.

A 2013 survey by CIO.com listed seven skills project managers need in order to be effective and successful in leading IT projects:

1. Be highly organized.
2. Take charge and know how to lead.
3. Be an effective communicator.
4. Know how and when to negotiate.
5. Be detail-oriented.
6. Recognize and solve problems quickly.
7. Possess the necessary technical skills.[28]

All project managers should continue to develop their knowledge and experience in project management, general management, soft skills, and the industries they support. IT project managers must be willing to develop more than their technical skills to be productive team members and successful project managers. Everyone, no matter how technical they are, should develop business and soft skills.

1.5c Importance of People Skills and Leadership Skills

Project management experts from various industries were asked to identify the 10 most important skills and competencies for effective project managers. Table 1-3 shows the results.

TABLE 1-3 Ten most important skills and competencies for project managers

1. People skills
2. Leadership
3. Listening
4. Integrity, ethical behavior, consistency
5. Strength at building trust
6. Verbal communication
7. Strength at building teams
8. Conflict resolution, conflict management
9. Critical thinking, problem solving
10. Understanding and balancing of priorities

Source: Jennifer Krahn, "Effective Project Leadership: A Combination of Project Manager Skills and Competencies in Context," *PMI Research Conference Proceedings* (July 2006).

Respondents were also asked what skills and competencies were most important in various project situations:

- *Large projects*: Leadership, relevant experience, planning, people skills, verbal communication, and team-building skills were most important.
- *High-uncertainty projects*: Risk management, expectation management, leadership, people skills, and planning skills were most important.
- *Innovative projects*: Leadership, people skills, vision- and goal-setting, self-confidence, expectations management, and listening skills were most important.[29]

Notice that a few skills and competencies not cited in the top 10 list were mentioned when people thought about the context of a project. To be most effective, project managers require a changing mix of skills and competencies depending on the project being delivered.

Also notice the general emphasis on people and leadership skills. As mentioned earlier, all project managers, especially those working on technical projects, need to demonstrate leadership and management skills. *Leadership* and *management* are terms often used interchangeably, although there are differences. Generally, a **leader** focuses on long-term goals and big-picture objectives while inspiring people to reach those goals. A **manager** often deals with the day-to-day details of meeting specific goals. Some people say: "Managers do things right, and leaders do the right things." "Leaders determine the vision, and managers achieve the vision." "You lead people and manage things."

However, project managers often take on the role of both leader and manager. Good project managers know that people make or break projects, so they must set a good example to lead their team to success. They are aware of the greater needs of their stakeholders and organizations, so they are visionary in guiding their current projects and in suggesting future ones. As mentioned earlier, companies that excel in project management grow project "leaders," emphasizing development of business and communication skills. Yet, good project managers must also focus on getting the job done by paying attention to the details and daily operations of each task. Instead of thinking of leaders and managers as specific

people, it is better to think of people as having leadership skills, such as being visionary and inspiring, and management skills, such as being organized and effective. Therefore, the best project managers have leadership and management characteristics; they are visionary yet focused on the bottom line. Above all else, good project managers focus on achieving positive results!

1.5d Careers for IT Project Managers

As shown earlier, the IT industry continues to grow, and the need for people to lead IT projects has remained solid. In fact, every IT worker needs some skills in project management.

Computerworld's 2014 annual forecast survey supports this career projection. Forty-three percent of the 194 respondents said that they expect their IT budgets to increase, and overall IT budgets are expected to increase by 4.3 percent. The top five priorities include spending on:

1. security technologies,
2. cloud computing,
3. business analytics,
4. application development,
5. wireless/mobile.[30]

IT executives listed the "ten hottest skills" they planned to hire for in 2015. Programming and application development remained in first place, mainly due to the increased need for programmers with mobile development expertise and experience building secure applications. Project management skills continue to make the list, as these skills are crucial to prioritizing business needs and implementing effective solutions. Table 1-4 shows the results of the latest survey, as well as the percentage of respondents who listed the skill as being in demand. Even if you choose to stay in a technical role, you still need project management knowledge and skills to help your team and your organization succeed.

TABLE 1-4 Ten hottest IT skills

Skill	Percentage of Respondents
Programming and application development	48
Project management	35
Help desk/technical support	30
Security/compliance governance	28
Web development	28
Database administration	26
Business intelligence/analytics	24
Mobile application and device management	24
Networking	22
Big data	20

Source: Mary K. Pratt, "10 Hottest IT Skills for 2015," *Computerworld*, November 18, 2014.

1.6 THE PROJECT MANAGEMENT PROFESSION

The project management profession is growing at a very rapid pace. To understand this line of work, it is helpful to briefly review the history of project management, learn about the Project Management Institute (PMI) and some of its services (such as certification), and examine the growth in project management software.

1.6a History of Project Management

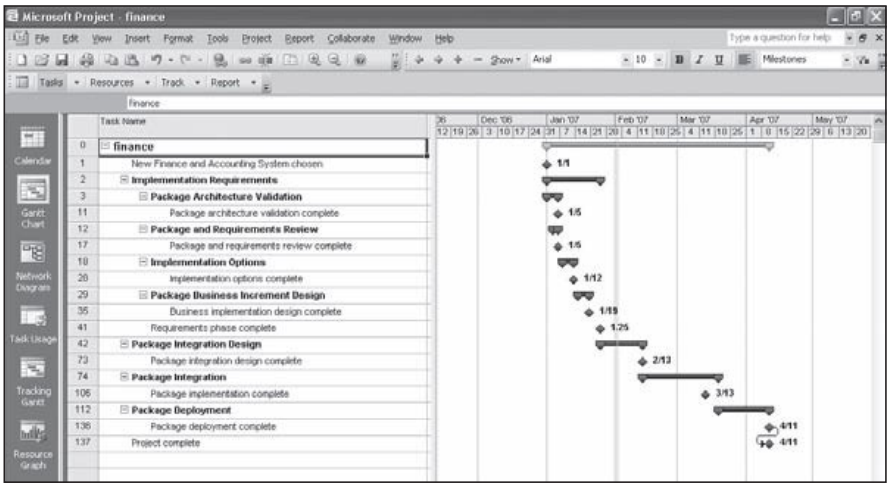
Most people think that project management is a 20th century invention. But Mark Kozak-Holland, certified PMP and author of books that mine history for insight about project management, says that's wrong. He notes that major historical projects closely resemble today's project management best practices. About his 2011 book *The History of Project Management*, he said, "The general perception of most people is that project management started in the mid-20th century, or started earlier with Henry Gantt and his charts. . . . Yet, how were all the great projects of the past delivered? Think about the Giza Pyramid, the Parthenon, the Coliseum, the Gothic Cathedrals of Medieval Europe, the great voyages of exploration, the Taj Mahal, and the mega projects of the industrial revolutions. Was project management used on these projects? Were the concepts of project management even understood? Can we connect modern and ancient project management?" Kozak-Holland's answer to these questions is "yes." You can see the PMBOK process groups and techniques from the knowledge areas in all of these historical projects. Project management has been around since 2550 B.C.E.[31]

Although people have worked on projects for centuries, most agree that the modern concept of project management began with the Manhattan Project, which the U.S. military led to develop the atomic bomb in World War II. The Manhattan Project involved many people with different skills at several different locations. It also clearly separated the overall management of the project's mission, schedule, and budget under General Leslie R. Groves and the technical management of the project under the lead scientist, Dr. Robert Oppenheimer. The Manhattan Project lasted about three years and cost almost $2 billion in 1946.

In developing the project, the military realized that scientists and other technical specialists often did not have the desire or the necessary skills to manage large projects. For example, after being asked several times for each team member's responsibilities at the new Los Alamos laboratory in 1943, Dr. Oppenheimer tossed the project organization chart at his director and said, "Here's your damn organization chart."[32] Project management was recognized as a distinct discipline requiring people with special skills and, more importantly, the desire to lead project teams.

In 1917, long before the Manhattan project, Henry Gantt developed the famous Gantt chart for scheduling work in factories. A **Gantt chart** is a standard format for displaying project schedule information by listing project activities and their corresponding start and finish dates in calendar form. Initially, managers drew Gantt charts by hand to show project tasks and schedule information. This tool provided a standard format for planning and reviewing all the work on early military projects.

Today's project managers still use the Gantt chart as the primary tool to communicate project schedule information, but with the aid of computers, it is no longer necessary to draw the charts by hand, and they are easier to share and disseminate to project stakeholders. Figure 1-6 displays a Gantt chart created with Project 2013, the most widely used project management software today. You will learn more about using Project 2013 in Appendix A.



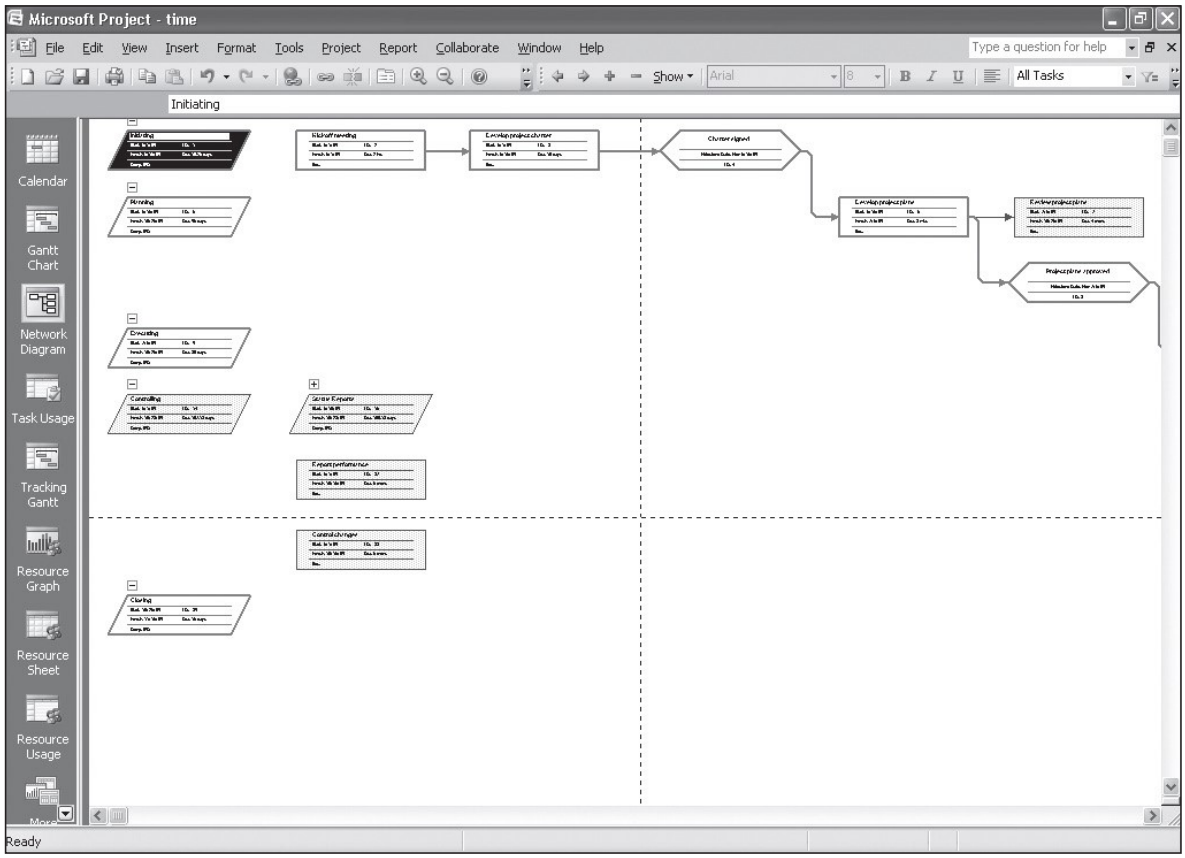
Used with permission from Microsoft Corporation

FIGURE 1-6 Sample Gantt chart created with project 2013

During the Cold War years of the 1950s and '60s, the military continued to play an important role in refining several project management techniques. Members of the U.S. Navy Polaris missile/submarine project first used network diagrams in 1958. These diagrams helped managers model the relationships among project tasks, which allowed them to create schedules that were more realistic. Figure 1-7 displays a network diagram created using Project 2013. Note that the diagram includes arrows that show which tasks are related and the sequence in which team members must perform the tasks. The concept of determining relationships among tasks is essential in helping to improve project scheduling. This concept allows you to find and monitor the **critical path**—the longest path through a network diagram that determines the earliest completion of a project. It shows you which tasks affect the target completion date of a project, and it can change as work proceeds and more information becomes available. You will learn more about Gantt charts, network diagrams, critical path analysis, and other time management concepts in Chapter 6, Project Time Management.

By the 1970s, the U.S. military and its civilian suppliers had developed software to assist in managing large projects. Early project management software was very expensive to purchase, and it ran exclusively on mainframe computers. For example, Artemis was an early project management software product that helped managers analyze complex schedules for designing aircraft. A full-time employee was often required to run the complicated software, and expensive pen plotters were used to draw network diagrams and Gantt charts.

As computer hardware became smaller and more affordable and software companies developed graphical, easy-to-use interfaces, project management software became less expensive and more widely used. This made it possible—and affordable—for many industries worldwide to use project management software on all types and sizes of projects. New software makes basic tools such as Gantt charts and network diagrams inexpensive, easy to create, and available for anyone to update. See the section later in this chapter on project management software for more information.

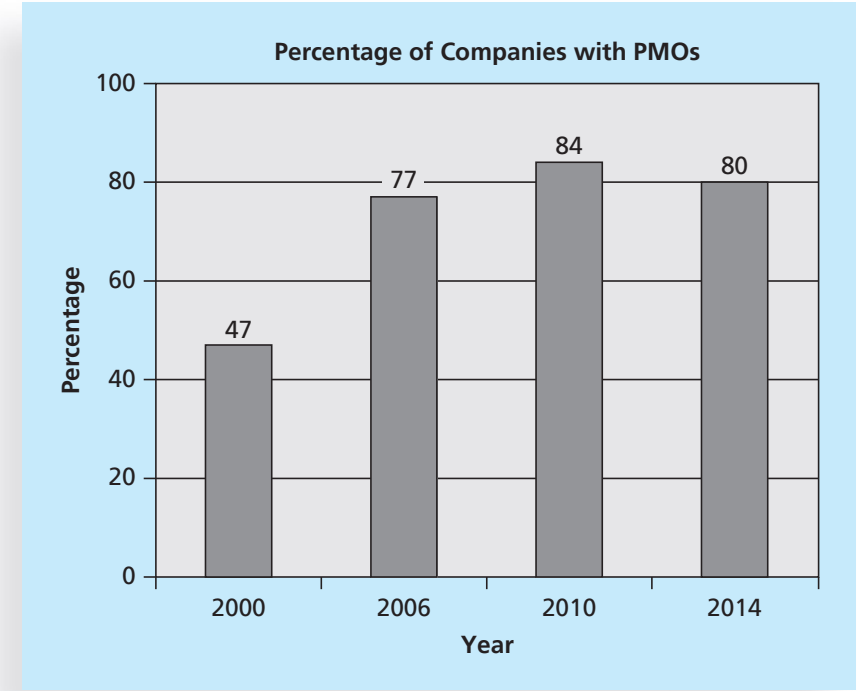


Used with permission from Microsoft Corporation

FIGURE 1-7 Sample network diagram created with project 2013

In the 1990s, many companies began creating Project Management Offices to help them handle the increasing number and complexity of projects. A **Project Management Office (PMO)** is an organizational group responsible for coordinating the project management function throughout an organization. A 2014 study found that 80 percent of U.S. companies reported having PMOs. Figure 1-8 shows the percentage of companies with PMOs based on past surveys.[33] For large organizations, 90 percent reported having PMOs in 2014, while 61 percent of small organizations did. The percentage of large organizations with PMOs was about the same in 2010, but only 48 percent of small organizations had PMOs in 2010. This increase shows the growing importance of using standard project management processes in organizations of all sizes.

There are different ways to structure a PMO, and they can have various roles and responsibilities. Organizations continue to modify their PMOs to ensure they add value to their unique situations. For some organizations with very mature project management processes and experienced managers, a small PMO focusing on organizing all project data might be all that is needed. For an organization new to project management, a larger PMO might be needed focusing on training and standards. PM Solutions identified three key factors that are playing major roles in the growth of PMOs:



Source: PM Solutions, "The State of the PMO 2010" (2010).

FIGURE 1-8 Growth in the Number of Project Management Offices

1. The growing strategic value of the PMO
2. The increased role of the PMO in training
3. The ever-present challenge of resource management

Below are possible goals of a PMO:

- Collect, organize, and integrate project data for the entire organization.
- Ensure that the organization's approaches for project management include accepted and validated best practices.
- Audit project documentation and offer feedback on project managers' approaches and compliance with standards.
- Develop and maintain templates, tools, and standards for project documents and project methodologies to be used.
- Develop or coordinate training in various project management topics.
- Provide a formal career path for project managers.
- Provide project management consulting services.
- Provide a structure or department that project managers belong to while they are assigned to a project or are between projects.

By the end of the 20th century, people in virtually every industry around the globe began to investigate and apply different aspects of project management to their projects. The sophistication and effectiveness with which project management tools are being

applied and used today is enabling companies to do business, use resources, and respond to market requirements with greater speed and accuracy.

Many colleges, universities, and companies around the world now offer courses related to different aspects of project management. You can even earn bachelor's, master's, and doctoral degrees in project management. In late 2014, a *gradschools.com* search for "project management" found 370 campus and online accredited graduate, certificate, and doctoral programs from all types of institutions. PMI reported in 2015 that formal education programs in project management continue to grow, especially in China and India, where many infrastructure projects are needed. "In China, for example, the 104 institutions offering project management programs receive more than 20,000 applications each year." As projects become more global and teams are no longer stationed in the same city or even country, students are learning a common project management language no matter where they seek their education.[34]

The problems organizations have in managing projects, increasing education in project management, and the belief that it can make a difference continue to contribute to the growth of this field.

1.6b The Project Management Institute

Although many professional societies suffer from declining membership, the **Project Management Institute (PMI)**, an international professional society for project managers founded in 1969, has continued to attract and retain members, reporting more than 449,000 members worldwide by late 2014. Because so many people work on projects in different industries across the globe (51 million total according to PMI), PMI has created communities of practice that enable members to share ideas about project management in their particular application areas, such as information systems. PMI also has communities

GLOBAL ISSUES

Based on a survey of more than 1,000 project management leaders across a variety of experience levels and industries, several global dynamics are forcing organizations to rethink their practices:

- Talent development for project and program managers is a top concern. Seventy percent of organizations have a career path for project and program management, but most are still informal and not documented.
- Basic project management techniques are core competencies. Seventy percent of organizations said that they always or often use basic practices like change management and risk management on their projects.
- Organizations want to use more agile approaches to project management. One-quarter of survey respondents said they now use agile techniques, and agile project management was the most requested article topic.
- Benefits realization of projects is a key metric. Organizations know that they need to align projects and programs with the organization's business strategy.[35]

PMI STUDENT MEMBERSHIP

As a student, you can join PMI for a reduced fee ($32 versus $139 in 2015). Consult PMI's website (*www.pmi.org*) for more information. With student membership, you can network with other project management students by joining a local PMI chapter. Many welcome students to attend free events, including talks and job networking. You can volunteer your services to help develop your skills and serve your community. You can also qualify for the Certified Associate in Project Management (CAPM) certification with just a bachelor's degree and a course in project management.

for aerospace/defense, financial services, government, healthcare, and agile techniques, to name a few. Note that there are other project management professional societies, such as the International Project Management Association (IPMA) and the Association for Project Management (APM).

1.6c Project Management Certification

Professional certification is an important factor in recognizing and ensuring quality in a profession. PMI provides certification as a **Project Management Professional (PMP)**—someone who has documented sufficient project experience and education, agreed to follow the PMI code of professional conduct, and demonstrated knowledge of project management by passing a comprehensive examination. Note that you do not need work experience to qualify for CompTIA's Project+ certification or PMI's CAPM certification, so college graduates just entering the workforce can earn these certifications and become more marketable.

The number of people earning PMP certification continues to increase. In 1993, there were about 1,000 certified project management professionals. At the end of April 2015, there were 658,523 active PMPs.[36] Figure 1-9 shows the rapid growth in the number of people earning project management professional certification from 1993 to 2014.

Several studies show that organizations supporting technical certification programs tend to operate in more complex IT environments and are more efficient than organizations that do not support certification. Likewise, organizations that support PMP certification see the value of investing in programs to improve their employees' knowledge in project management. Many employers today require specific certifications to ensure that their workers have current skills, and job seekers find that they often have an advantage when they earn and maintain marketable certifications. Global Knowledge listed PMP certification as number 5 in their list of top-paying certifications for 2014.[37]

As IT projects become more complex and global in nature, the need for people with demonstrated knowledge and skills in project management will continue. Just as passing the CPA exam is a standard for accountants, passing the PMP exam is becoming a standard for project managers. Some companies require that all project managers be PMP certified. Project management certification is also enabling professionals in the field to share a common base of knowledge. For example, any person with PMP certification can list, describe, and use the 10 project management knowledge areas. Sharing a common base of knowledge is important because it helps advance the theory and practice of project management. PMI also offers additional certifications, including agile techniques, scheduling, risk, and program management.

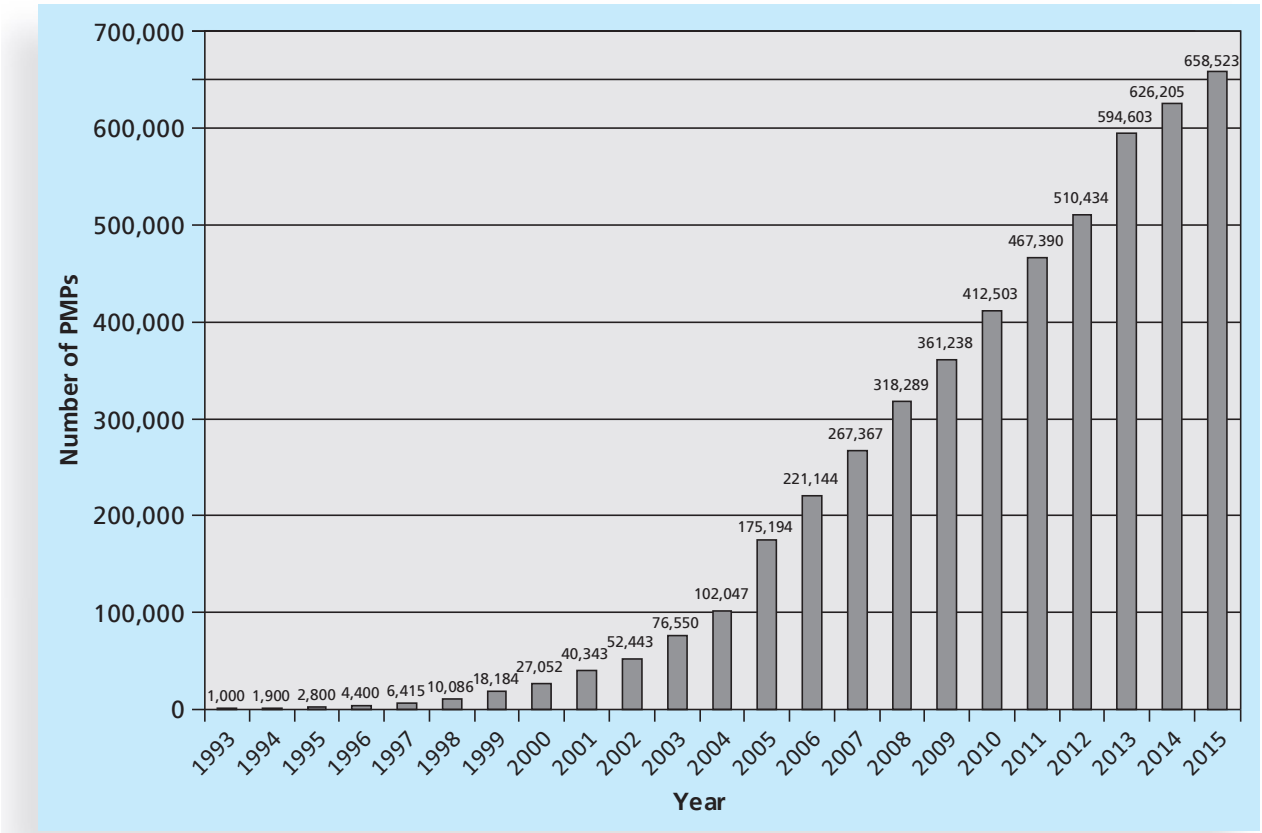


FIGURE 1-9 Growth in PMP Certification, 1993–2014

1.6d Ethics in Project Management

Ethics, loosely defined, is a set of principles that guides decision making based on personal values of what is considered right and wrong. Making ethical decisions is an important part of project managers' personal and professional lives because it generates trust and respect with other people. Project managers often face ethical dilemmas. If project managers can make more money by taking bribes, should they? No! Should project managers accept subpar work to meet a deadline? No! Ethics guide us in making these types of decisions.

PMI approved a Code of Ethics and Professional Conduct that took effect in January 2007. This code applies not only to PMPs but to all PMI members who hold a PMI certification, apply for a PMI certification, or serve PMI in a volunteer capacity.

It is vital for project management practitioners to conduct their work in an ethical manner. Even if you are not affiliated with PMI, these guidelines can help you conduct your work in an ethical manner, which helps the profession earn the confidence of the public, employers, employees, and all project stakeholders. The PMI Code of Ethics and Professional Conduct includes short chapters addressing vision and applicability, responsibility, respect, fairness, and honesty. A few excerpts from this document include the following:

"As practitioners in the global project management community:

2.2.1 We make decisions and take actions based on the best interests of society, public safety, and the environment.
2.2.2 We accept only those assignments that are consistent with our background, experience, skills, and qualifications.
2.2.3 We fulfill the commitments that we undertake—we do what we say we will do.
3.2.1 We inform ourselves about the norms and customs of others and avoid engaging in behaviors they might consider disrespectful.
3.2.2 We listen to others' points of view, seeking to understand them.
3.2.3 We approach directly those persons with whom we have a conflict or disagreement.
4.2.1 We demonstrate transparency in our decision-making process.
4.2.2 We constantly reexamine our impartiality and objectivity, taking corrective action as appropriate.
4.3.1 We proactively and fully disclose any real or potential conflicts of interest to appropriate stakeholders.
5.2.1 We earnestly seek to understand the truth.
5.2.2 We are truthful in our communications and in our conduct."[38]

In addition, PMI added a new series of questions to the PMP certification exam in March 2002 and continues to include this topic to emphasize the importance of ethics and professional responsibility.

1.6e Project Management Software

Unlike the tale of the cobbler who neglected to make shoes for his own children, the project management and software development communities have definitely responded to the need to provide more software to help manage projects. As mentioned earlier, Microsoft Project continues to lead the market with over 880,000 customers and 22 million users. See Appendix A for details on the various configurations available for Microsoft Project and detailed instructions for using Project Professional 2013, the product available for a free trial. TopTenReviews.com has a category for online project management software and listed Clarizen, GeniusProject, and AtTask as the top three products in 2014. There are also several smartphone and tablet apps for project management. There are enough options that deciding which project management software to use has become a project in itself. This section summarizes the basic types of project management software available and provides references for finding more information.

Many people still use basic productivity software such as Microsoft Word and Excel to perform many project management functions, including determining project scope, time, and cost, assigning resources, and preparing project documentation. People often use productivity software instead of specialized project management software because they

MICROSOFT PROJECT 2013

Appendix A includes a *Guide to Using Microsoft Project 2013*, which will help you develop hands-on skills for using this popular project management software.

already have it and know how to use it. However, hundreds of project management software tools provide specific functionality for managing projects and performing portfolio management. These software tools can be divided into three general categories based on functionality and price:

- *Low-end tools*: These tools provide basic project management features and generally cost less than $200 per user. Smartphone and tablet apps are available for much less, but they often have limited functionality. Low-end tools are often recommended for small projects and single users. Most of these tools allow users to create Gantt charts, which cannot be done easily using current productivity software.
- *Midrange tools*: A step up from low-end tools, midrange tools are designed to handle larger projects, multiple users, and multiple projects. All of these tools can produce Gantt charts and network diagrams, and can assist in critical path analysis, resource allocation, project tracking, and status reporting. Prices range from about $200 to $1,000 per user, or less per month for online tools. Several tools require additional server software for using workgroup features.
- *High-end tools*: These tools are sometimes referred to as enterprise project management software. They provide robust capabilities to handle very large projects and dispersed workgroups, and they have enterprise and portfolio management functions that summarize and combine individual project information to provide an enterprise view of all projects. These products are generally licensed on a per-user basis, can be integrated with enterprise database management software, and are accessible via the Internet.

Several free or open-source tools are also available. For example, Basecamp, Trello, and Asana offer free online tools that may work for some projects and offer paid products to meet more complex needs. Most companies, including Microsoft, offer free trials of their project management software. ProjectLibre, LibrePlan, and OpenProject are all free open-source project management tools. Remember, however, that open-source tools are developed, managed, and maintained by volunteers and may not be well supported.

There are many reasons to study project management, particularly as it relates to IT projects. The number of IT projects continues to grow in almost every industry the complexity of these projects continues to increase, and the profession of project management continues to expand and mature. As more people study and work in this important field, the success rate of IT projects should continue to improve.

CASE WRAP-UP

Anne Roberts worked with the VPs and the CEO to form teams to help identify potential IT projects that would support their business strategies. They formed a project team to implement a portfolio project management software tool across the organization. They formed another team to develop project-based reward systems for all employees. They also authorized funds for a project to educate all employees in project management, to help people earn PMP and related certifications, and to develop a mentoring program. Anne had successfully convinced everyone that effectively managing projects was crucial to their company's future.