Successful PROJECT MANAGEMENT

SEVENTH EDITION

JACK GIDO . JIM CLEMENTS . ROSE BAKER

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To my wonderful family: my wife, Rosemary; our sons, Steve and Jeff; our "daughters," Teresa and Wendy; and our grandchildren, Matthew, Alex, Allison, Meghan, and Sophie.

J.G.

To my wonderful wife, Beth, and our four incredible children—Tyler, Hannah, Maggie, and Grace. I love you all very much.

J.P.C.

To my immensely supportive family: my late husband, Frank; son, Dan; daughter, Francie; and my friends who have helped me achieve my professional goals.

R.B.

Brief Contents

Contents

Preface

There are those who make things happen,
those who let things happen, and
those who wonder what happened.

We hope that *Successful Project Management* will help you have an enjoyable, exciting, and successful experience as you grow through future project endeavors, and that it will be the catalyst for enabling you to ***make things happen!***

Best wishes for enjoyment, satisfaction, and success in all that you do.

Jack Gido
Jim Clements
Rose Baker

Our Approach

Project management is more than merely parceling out work assignments to individuals and hoping that they will somehow accomplish a desired result. In fact, projects that could have been successful often fail because of such take-it-for-granted approaches. Individuals need hard information and real skills to work successfully in a project environment and to accomplish project objectives. *Successful Project Management* is written to equip its users with both—by explaining concepts and techniques and by using numerous examples to show how they can be skillfully applied.

Although the focus of the book is squarely on the practical things readers absolutely need to know to thrive in project environments, the book does not forsake objective learning; it simply challenges readers to think critically about project management principles and to apply them within the context of the real world. We capture lessons learned from years of managing projects, teaching project management, and writing extensively about it.

Successful Project Management is intended for students as well as for working professionals and volunteers. The book is designed to present the essential skills readers need to make effective contributions and to have an immediate impact on the accomplishment of projects in which they are involved. It prepares students with marketable and transferable skills and sends them into the workforce ready to apply project management knowledge and skills. The book also supports employer talent development and lifelong learning programs to develop and train employees to work effectively in multifunctional teams and apply project management tools and techniques to successfully accomplish project objectives.

Successful Project Management is written for everyone involved in projects, not just project managers. Projects with good or even great project managers still may not succeed, as the best efforts of all involved are essential. All the

people on the project team must have the knowledge and skills to work effectively together in a project environment. People do not become project managers by reading books; they become project managers by first being effective project team members. This book provides the foundation individuals need to be effective members of project teams and thereby boosts everyone's potential to rise to the challenge of managing teams and projects.

The book is written in an easy-to-understand, straightforward style with a minimum of technical terms. Readers acquire project management terminology gradually as they read the text. The mathematics is purposely kept simple. The text does not use complex mathematical theories or algorithms to describe scheduling techniques and does not include highly technical projects as examples. An overtly technical approach can create a barrier to learning for individuals who lack deep understanding of advanced mathematics or technical backgrounds. Separate appendixes are provided for those readers who want more in-depth coverage of probability considerations and time-cost trade-offs. Our book includes a broad range of easily understood examples based on projects encountered in everyday situations. For example, real-world applications include conducting a market survey, building an information system, and organizing a community festival.

Enhancements to the Seventh Edition

MINDTAP

The seventh edition introduces a brand new MindTap product. For each chapter, this all-digital version of the book enhances learning with an engagement video and discussion, a quiz with rich feedback, Microsoft® Project 2016 tutorial videos, and animations that highlight some of the cases in the end-of-chapter material. If you're interested in all these features, talk to your Cengage learning consultant.

Based on the excellent and supportive comments we received from our reviewers, we are pleased to incorporate the following enhancements in the seventh edition of *Successful Project Management:*

- Revised the chapter concepts and contents to support the Project Management Knowledge Areas of the Project Management Institute's *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, Sixth Edition, as shown in the table on the following page.
- Provided animated videos of selected case studies. Each case study animation includes embedded questions at intervals during the video for students to answer as well as discussion questions at the end of the video.
- Replaced all Real World Project Management vignettes (two in each chapter) with more up-to-date vignettes that discuss a variety of applications and industry sectors, both North American and International.
- Enhanced and updated the Microsoft Project Appendixes in Chapters 4 through 7 based on Microsoft® Project 2016, including all new figures of screen captures.
- Updated **tutorial videos** for using Microsoft® Project 2016, available within the MindTap.
- Made minor edits in the chapters to support the Project Management Knowledge Areas of *A Guide to the Project Management Body of Knowledge*

Chapter	PMBOK® Project Management Knowledge Areas									
	Integration	Scope	Schedule	Cost	Quality	Resource	Communications	Risk	Procurement	Stakeholder
1. Project Management Concepts	✓									✓
2. Identifying and Selecting Projects	✓								✓	
3. Developing Project Proposals									✓	
4. Defining Scope, Quality, Responsibility, and Activity Sequence	✓	✓	✓		✓	✓				
5. Developing the Schedule	✓		✓			✓				
6. Resource Utilization			✓			✓				
7. Determining Costs, Budget, and Earned Value	✓			✓						
8. Managing Risk								✓		
9. Closing the Project	✓								✓	
10. The Project Manager	✓					✓				✓
11. The Project Team						✓				
12. Project Communication and Documentation	✓					✓	✓			✓
13. Project Management Organizational Structures	✓					✓				

(PMBOK® Guide) and to provide consistency of concepts and terminology among the chapters.

- Updated Appendix B, Project Management Websites.
- Updated Appendix C, Project Management Associations around the Globe.

Distinctive Features

Successful Project Management has many distinctive features to enhance learning and build skills.

Supports *PMBOK® Guide*—Concepts in the chapters support the project management knowledge areas of the Project Management Institute's *A Guide to the Project Management Body of Knowledge (PMBOK® Guide).*

Learning Outcomes—The beginning of each chapter identifies specific outcomes the learner should be able to accomplish after studying the material.

Real-World Vignettes—Each chapter contains two real-world vignettes that illustrate the topics in the chapter. These vignettes not only reinforce chapter concepts but also draw readers into the discussion and pique their interest in applications of project management.

Examples and Applications—Specific relevant real-world examples and applications are incorporated throughout this text to reinforce the concepts presented.

Reinforce Your Learning Questions—Brief questions appear alongside the text to ensure that learners retain key concepts and that the fundamentals are not ignored. These in-the-margin questions "pop up" throughout the text to provide positive reinforcement and to help learners to gauge their comprehension of the material.

Critical Success Factors—Each chapter contains a concise list of the important factors that project managers and team members need to know to help make their projects successful.

Chapter Outlines—Each chapter opens with an outline of the key topics that will be covered. These outlines clarify expectations and allow readers to see the flow of information at a glance.

Graphics and Templates—Numerous exhibits and templates appear in the text to illustrate the application of important concepts and project management tools.

Chapter Summaries—At the end of each chapter is a concise summary of the material presented in the chapter—a final distillation of core concepts.

Review Questions and Problems—Each chapter has a set of questions and problems that test and apply chapter concepts, support the learning outcomes, and reinforce understanding and retention.

Internet Exercises—Each chapter has a set of exercises to invite learners to research and review information about real-world applications of various project management topics and summarize their findings.

Case Studies—End-of-chapter case studies provide critical-thinking scenarios for either individual or group analysis. Variety in case format ensures that all learners can relate to the scenarios presented. The cases are fun and are intended to spark interesting debates. By fostering discussion of various viewpoints, the cases provide opportunities for participants to expand their thinking about how to operate successfully when differing views arise in the work environment. Thus students gain valuable insight into what teamwork is all about.

Case Study Animations—Animated videos are provided of selected case studies. Each case study includes embedded questions at intervals during the animation for students to answer as well as discussion questions at the end of the video.

Microsoft® Project 2016—Examples of how to use and apply Microsoft® Project 2016 are included in appendixes in Chapters 4–7. Detailed instructions and a number of sample screen displays are included.

Tutorial Videos—The book's MindTap includes a series of brief videos that illustrate how to use Microsoft® Project 2016. The videos align with the material in the Microsoft® Project 2016 appendixes in Chapters 4–7 of the book.

Project Management Information Systems—A comprehensive appendix discusses the use of project management information systems as a tool to plan, track, and manage projects. Common features of project management information systems are discussed, along with selection criteria.

Project Management Websites— An appendix of project management websites is provided as a good resource for additional information, applications, tools, and research about project management. The book's companion website includes links to each of the project management websites listed.

Project Management Associations—A list of project management associations around the globe is provided in an appendix for individuals who want to contact these organizations about professional development, access to periodicals and other publications, or career opportunities. The book's companion website includes links to each of the project management associations listed.

Organization and Content

Successful Project Management comprises 13 chapters plus appendixes with an opening foundation chapter on project management concepts and the remaining 12 chapters divided into three parts:

- Part 1, Initiating a Project, discusses identifying and selecting projects, and developing project proposals.
- Part 2, Planning, Performing, and Controlling the Project, covers defining scope, quality, responsibility, and activity sequence; developing the schedule; resource utilization; determining costs, budget, and earned value; managing risk; and closing the project.
- Part 3, People: The Key to Project Success, discusses the project manager; the project team; project communication and documentation; and project management organizational structures.

Chapter 1, Project Management Concepts, is a foundation chapter that discusses the definition of a project and its attributes; managing a project within the constraints of scope, quality, schedule, budget, resources, risks, and customer satisfaction; the project life cycle of initiating, planning, performing, and closing a project, as well as monitoring and controlling the project and managing changes; the definition of project management and the steps of the project management process; stakeholder engagement; implications of global project management; project management associations; and the benefits of project management. The concepts in this chapter support two *PMBOK® Guide* project management knowledge areas: project integration and stakeholder management.

Part 1, Initiating a Project, discusses identifying and selecting projects, and developing project proposals. It includes two chapters:

- Chapter 2, Identifying and Selecting Projects, covers how projects are identified, selected, authorized, and outsourced. The project charter is also discussed. The concepts in this chapter support two *PMBOK® Guide* project management knowledge areas: project integration and procurement management.

- Chapter 3, Developing Project Proposals, deals with building effective relationships with customers and partners; proposal marketing strategies; decision making to go forward with a proposal; creating winning proposals; proposal preparation and contents, including simplified project proposals; pricing considerations; customer evaluation of proposals; types of contracts; and measuring success of proposal efforts. The concepts in this chapter support the *PMBOK® Guide* project management knowledge area of project procurement management.

Part 2, Planning, Performing, and Controlling the Project, covers project management techniques and tools. It includes six chapters:

- Chapter 4, Defining Scope, Quality, Responsibility, and Activity Sequence, discusses clearly defining the project objective; preparing a project scope document; the importance of planning for quality; creating a work breakdown structure; assigning responsibilities for work elements; and defining specific activities and creating a network diagram. The concepts in this chapter support five *PMBOK® Guide* project management knowledge areas: project integration, scope, quality, resource, and schedule management.
- Chapter 5, Developing the Schedule, deals with estimating the resources and durations for activities; developing a schedule that indicates the earliest and latest start and finish times for each activity; and determining slack and identifying the critical path of activities. It also explains the project control process, including monitoring and controlling progress; the effects of actual performance; updating the schedule; approaches to controlling the schedule; and agile project management. This chapter also includes an appendix on using probabilistic activity durations. The concepts in this chapter support three *PMBOK® Guide* project management knowledge areas: project integration, resource, and schedule management.
- Chapter 6, Resource Utilization, addresses taking resource constraints into account when developing a network plan and project schedule; preparing a resource requirements plan; leveling the use of resources within the required time frame for a project; and determining the shortest project schedule when the number of available resources is limited. The concepts in this chapter support two *PMBOK® Guide* project management knowledge areas: project resource and schedule management.
- Chapter 7, Determining Costs, Budget, and Earned Value, covers estimating the costs of activities; creating a time-phased budget; cumulating actual costs; determining the earned value of work actually performed; analyzing cost performance; estimating project cost at completion; approaches to controlling costs; and managing cash flow. This chapter also includes an appendix on time-cost trade-off. The concepts in this chapter support two *PMBOK® Guide* project management knowledge areas: project integration and cost management.
- Chapter 8, Managing Risk, includes identifying and categorizing risks and their potential impact; assessing the likelihood of occurrence and degree of impact; prioritizing risks; preparing risk response plans; creating a risk assessment matrix; and controlling and monitoring risks. The concepts in this chapter support the *PMBOK® Guide* project management knowledge area of project risk management.

- Chapters 4–8 include several continuing multichapter integrated examples and case studies that apply the concepts and tools discussed in the chapters. The examples and case studies are introduced in Chapter 4 and continue and build through Chapters 5, 6, 7, and 8. Chapters 4 through 7 also include appendixes on Microsoft Project that illustrate how to use and apply Microsoft Project to one of the multichapter integrated examples.
- The last chapter in Part 2 is Chapter 9, Closing the Project. It discusses what actions should be taken when closing a project; conducting a postproject evaluation; the importance of documenting and communicating lessons learned; organizing and archiving project documents; obtaining feedback from customers; and early termination of projects. The concepts in this chapter support two *PMBOK® Guide* project management knowledge areas of project integration and procurement management.

Part 3, People: The Key to Project Success, focuses on the importance of the people involved in a project. It includes four chapters:

- Chapter 10, The Project Manager, discusses the responsibilities of the project manager; the skills needed to manage projects successfully; ways to develop project manager competence; approaches to effective delegation; and how the project manager can manage and control changes to the project. The concepts in this chapter support three *PMBOK® Guide* project management knowledge areas: project integration, resource, and stakeholder management.
- Chapter 11, The Project Team, covers the development and growth of teams; the project kickoff meeting; effective teams including characteristics of effective project teams, barriers to team effectiveness, effective team members, team building, and valuing team diversity; ethical behavior; sources of conflict during the project and approaches to handling conflict; problem solving, including brainstorming; and effective time management. The concepts in this chapter support the *PMBOK® Guide* project management knowledge area of project resource management.
- Chapter 12, Project Communication and Documentation, addresses the importance of effective verbal and written communication, including suggestions for enhancing personal communication; effective listening; types of project meetings and suggestions for productive meetings; project presentations and suggestions for effective presentations; project reports and suggestions for preparing useful reports; controlling changes to project documents; creating a project communication plan; and collaborative communication tools. The concepts in this chapter support four *PMBOK® Guide* project management knowledge areas: project communications, integration, resource, and stakeholder management.
- Chapter 13, Project Management Organizational Structures, explains the characteristics, advantages, and disadvantages of the functional, autonomous project and matrix organizational structures and discusses the role of the project management office. The concepts in this chapter support two *PMBOK® Guide* project management knowledge areas: project integration and resource management.

Appendix A, Project Management Information Systems, discusses the common features of project management information systems; criteria for selecting a project management information system; and advantages of and concerns about using such systems. Appendix B provides a list of websites that are good resources for additional information, applications, tools, and research about project management. Appendix C is a list of project management associations around the globe. Appendix D is a list of common project management acronyms. The book also includes answers to the Reinforce Your Learning questions for each chapter, and a Glossary of project management terms used in the book.

Support Materials

This edition of *Successful Project Management* provides a support package that will encourage student success and increase instructor effectiveness.

The comprehensive **Instructor Manual** includes sample syllabi, learning objectives and outcomes for each chapter, suggested teaching methods for each chapter, lecture outlines, and answers to the end-of-chapter questions and case studies.

The **Test Bank** includes true/false, multiple-choice, and problem-solving exercises for each chapter. ***Cognero***, an online, fully customizable version of the *Test Bank*, provides instructors with all the tools they need to create, author/edit, and deliver multiple types of tests. Instructors can import questions directly from the *Test Bank*, create their own questions, or edit existing questions.

Instructor Companion Site. In addition to the supplements above, a comprehensive set of instructor support materials, including the Instructor Manual, PowerPoint® slides, and a link to the trial version of Microsoft® Project 2016, is available for *Successful Project Management* on the book's companion website at www.cengagebrain.com. These support materials are designed to guide the instructor and minimize class preparation time.

Student Companion Site. The Student Companion Site includes student PowerPoint® slides, Internet exercises from the text, website links, a link to the trial version of Microsoft® Project 2016, flashcards, and a glossary. The companion site can be found at www.cengagebrain.com. On the home page, students can use the search box to insert the ISBN of the title (from the back cover of their book). This will take them to the product page, where free companion resources can be found.

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Jack Gido was most recently Director of Economic & Workforce Development and Director of PennTAP, the Pennsylvania Technical Assistance Program at Penn State University. In this position, he directed the program, obtained funding, and provided leadership for a statewide staff who provided technology assistance and workforce development to Pennsylvania business and industry to improve their global competitiveness. Jack has 20 years of industrial management experience, including the management of productivity improvement and technology development projects. He has an M.B.A. from the University of Pittsburgh and a B.S. in Electrical Engineering from Penn State University. Jack is a member of the Project Management Institute and former President of the Upstate New York Chapter and teaches courses on project management.

Jim Clements currently serves as the 15th President of Clemson University. Prior to becoming President at Clemson University, Jim served as President of West Virginia University. Previously he was Provost and Vice President for Academic Affairs, Vice President for Economic and Community Outreach, Chair of the Computer and Information Sciences Department, and the Robert W. Deutsch Distinguished Professor of Information Technology at Towson University. He holds a Ph.D. in Operations Analysis from the University of Maryland, Baltimore County, an M.S. in Computer Science from the Johns Hopkins University, and a B.S. and M.S. in Computer Science from the University of Maryland, Baltimore County. He is the author of more than 75 research publications. During the past 25 years, Dr. Clements has served as a consultant for a number of public and private organizations. He is also a four-time winner of the Faculty Member of the Year Award given by students at Towson University.

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Successful Project Management

CHAPTER 1

Project Management Concepts

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Concepts in this chapter support the following Project Management Knowledge Areas of *A Guide to the Project Management Body of Knowledge (PMBOK® Guide):*

Project Integration Management

Project Stakeholder Management

REAL WORLD PROJECT MANAGEMENT

Managing Culture for Project Success

Consider the word, Culture. It brings to mind many ideas related to culture in the workplace, cultures in different companies, or cultures in countries. Culture is a way of thinking that distinguishes one group of people from other groups of people. An organization's culture of innovation is the support for new ideas, risk, and failure. Behavior and attitudes are influenced by culture. Actions such as assertiveness, collectivism, or humane orientation can be defined for different cultures and influence

how a project manager makes decisions related to managing a project and project team members.

What impact do you think cultural practices have on project success?

Drew is a project manager for a firm with project teams in four countries, Austria, Canada, Finland, and South Korea. Each of the teams interacts with Drew and the team at the corporate headquarters through online video, phone calls, e-mails, and, at times, on location meetings.

As part of the company's professional development, Drew attended a training session on understanding diversity and culture to learn about corporate innovation culture and its relationship with assertiveness, collectivism, and humane orientation. One of the modules in the program indicated that cross-cultural management can be influenced by managerial practices and other organizational factors. Innovation activities often include championing programs, incentives for initiating new ideas, and monetary and nonmonetary rewards. The training materials described companies with a high innovation culture also had workers who showed high levels of analytical behaviors and a high problem-solving orientation. Drew hoped to inspire the teams and have more support for an innovation culture in order to increase the efficiency for solving problems or preventing problems in the teams' projects.

As a result of the training, a survey was implemented to learn more about the teams in each of the countries related to assertiveness, collectivism, and humane orientation, the three factors most related to changes in corporate innovation culture.

Drew had learned about each during the training. Assertiveness had been found to be linked to encouragement for taking initiatives and rewards for performance. Collectivists expressed pride, loyalty, and cohesiveness with others in their group or organization. Those with a humane orientation encouraged or rewarded others for their fairness, generosity, care, and kindness.

The findings of the survey indicated that the teams in the four countries were different from each other. The team from Austria had the highest scores in assertiveness and the team from Finland had the lowest. The team from South Korea had the highest score for collectivism and the team from Finland had the lowest. The team from Canada had the highest humane orientation score and the team from Austria had the lowest.

Drew made decisions about what to do based upon the scores. More empowerment of individual champions and additional monetary and nonmonetary incentives were given to the Austrian team as a means to stimulate the corporate innovation culture because such practices are viewed favorably by those with more assertiveness in their social relationships. Providing material rewards are not fully compatible with cultures low in assertiveness; therefore, Drew provided nonmonetary rewards to the team from Finland. Drew applied more empowerment to the group for the team from Korea due to their high scores for in-group collectivism to reinforce the

team's success rather than individual success. The same empowerment procedures were followed for the team from Canada as the team from Korea because high levels of humane orientation do not value self-enhancement, power, and materials possessions as much as low humane orientation. Additional feedback from the teams helped Drew find that enhancing analysis and practices is more appropriate to organizations with high in-group collectivism, high assertiveness, and low humane orientation.

From her work, it was learned that corporate culture should be compatible with national cultural practices to increase the potential for project success. The success factors that Drew experienced are successes that you as a project manager can experience. The skills that Drew applied are ones that you will learn throughout this book.

Based on information from Unger, B. B., Rank, J. J., & Gemünden, H. H. (2014). Corporate innovation culture and dimensions of project portfolio success: The moderating role of national culture. *Project Management Journal, 45*(6), 38–57.

This chapter presents an overview of project management concepts. You will become familiar with the

- Definition of a project and its attributes
- Key constraints within which a project must be managed
- Life cycle of a project
- Definition of project management
- Elements of the project management process
- Identification and engagement of stakeholders
- Implications of global project management
- Project Management Institute
- Benefits of project management

LEARNING OUTCOMES

After studying this chapter, the learner should be able to:

- Define what a project is
- List and discuss the attributes of a project
- Explain what is meant by project objective
- Define what is meant by project deliverable
- Provide examples of projects
- Discuss project constraints
- Describe the phases of the project life cycle
- Define and apply project management
- Discuss the steps of the planning process
- Identify the three elements of the executing process
- Create a stakeholder register
- Discuss stakeholder engagement
- Discuss some implications of global project management
- Discuss the Project Management Institute
- List benefits of project management techniques

Project Attributes

A **project** is an endeavor to accomplish a specific objective through a unique set of interrelated activities and the effective utilization of resources. The following attributes help define a project:

- A project has a clear **objective** that establishes what is to be accomplished. It is the tangible end product that the project team must produce and deliver. The project objective is usually defined in terms of *end product* or *deliverable, schedule,* and *budget.* It requires completing the project work scope and producing all the deliverables within a certain time and budget. For example, the objective of a project might be to introduce a new portable food preparation appliance in 10 months and within a budget of $2 million.

  The project objective may also include a statement of the expected *benefits* or *outcomes* that will be achieved from implementing the project. It is why the project is being done. For example, a project with the objective to develop a new product may have an expected outcome to sell a certain number of units of that new product within a year, or to increase market share by a specific percent. The project objective might be to expand market share by 3 percent by introducing a new portable food preparation appliance within 10 months with a budget of $2 million. In this case, the outcome of increased market share would not be known until some time period has elapsed after the new product development project is completed. Another example is a project with an objective to put on an event to raise funds for a particular cause, such as diabetes research, but the expected benefit of the event is to raise a certain amount of money, such as $20,000. In this case, the completion of the project—holding the fund-raising event—enables the benefit to be achieved.
- A project is carried out through a set of *interdependent activities* (also referred to as *tasks*)—that is, a number of nonrepetitive activities that need to be accomplished in a certain sequence in order to achieve the project objective.
- A project utilizes various *resources* to carry out the activities. Such resources can include different people, organizations, equipment, materials, and facilities. For example, a project to perform a complex series of surgical operations may involve doctors with special expertise, nurses, anesthesiologists, surgical instruments, monitoring equipment, prosthetic devices or transplant organs, and special operating facilities.
- A project has a *specific time frame* or *finite life span.* It has a start time and a date by which the objective must be accomplished. For example, the refurbishing of an elementary school might have to be completed between June 20 and August 20.
- A project may be a *unique* or *one-time* endeavor. Some projects, such as designing and building a space station, are unique because they have never been attempted before. Other projects, such as developing a new product, building a house, or planning a wedding, are unique because of the customization they require. For example, a wedding can be a simple, informal occasion, with a few friends in a chapel, or a spectacular event, staged for royalty.
- A project has a **sponsor** or **customer**. The sponsor/customer is the entity that provides the funds necessary to accomplish the project. It can be a person, an organization, or a partnership of two or more people or organizations. When a contractor builds an addition to a house, the homeowner is

the customer who is funding or paying for the project. When a company receives funds from a government agency to develop a robotic device for handling radioactive material, the sponsor is the government agency. When a company's board of directors provides funds for a team of its employees to upgrade the firm's management information system, the board is the sponsor of the project. In this last case, the term *customer* may take on a broader definition, including not only the project sponsor (the company's management) but also other *stakeholders*, such as the people who will be the end users of the information system. The person managing the project and the project team must successfully accomplish the project objective to satisfy the project sponsor as well as the users of the project's end product—an upgraded information system.

- Finally, a project involves a *degree of uncertainty*. Before a project is started, a plan is prepared based on certain assumptions and estimates. It is important to document these assumptions because they will influence the development of the project work scope, schedule, and budget. A project is based on a unique set of interdependent activities and estimates of how long each activity should take, various resources and assumptions about the availability and capability of those resources, and estimates of the costs associated with the resources. This combination of assumptions and estimates causes uncertainty that the project objective will be completely accomplished. For example, the project scope may be accomplished by the target completion date, but the final cost may be much higher than anticipated because of low initial estimates for the cost of certain resources. As the project proceeds, some of the assumptions will be refined or replaced with factual or updated information. For example, once the conceptual design of a company's annual report is finalized, the amount of time and costs needed to complete the detailed design and produce the final document can be better estimated.

Reinforce Your Learning

1. What are some attributes of a project?

The following are some examples of projects:

Staging a theatrical production
Developing and introducing a new product
Developing a set of apps for mobile business transactions
Planning a wedding
Modernizing a factory
Designing and implementing a computer system
Converting a basement to a family room
Organizing and hosting a conference
Designing and producing a brochure
Executing an environmental cleanup of a contaminated site
Holding a high school reunion
Building a shopping mall
Performing a series of surgeries on an accident victim
Organizing a community festival
Consolidating two manufacturing plants
Rebuilding a town after a natural disaster

Reinforce Your Learning

2. Identify three projects in which you have been involved during your lifetime.

Hosting a dinner for 20 relatives

Designing a business internship program for high school students

Building a tree house

Balancing Project Constraints

The successful accomplishment of the project objective could be constrained by many factors, including *scope, quality, schedule, budget, resources, risks, customer satisfaction*, and *stakeholder support*.

The project **scope** is all the work that must be done in order to produce all the project *deliverables* (the tangible product or items to be provided), satisfy the customer that the deliverables meet the requirements and acceptance criteria, and accomplish the project objective. For example, the project scope might be all of the work involved in clearing the land, building a house, and landscaping to the specifications agreed upon by the contractor and the buyer. Or a project to install new high-speed specialized automation equipment in a factory might include designing the equipment, building it, installing it, testing it to make sure it meets acceptance criteria, training workers to operate and maintain the equipment, and providing all the technical and operating documentation for the equipment.

Quality expectations must be defined from the onset of the project. The project work scope must be accomplished in a quality manner and meet specifications. For example, in a house-building project, the customer expects the workmanship to be of the highest quality and all materials to meet specifications. Completing the work scope but leaving windows that are difficult to open and close, faucets that leak, or a landscape full of rocks will result in an unsatisfied customer and perhaps a payment or legal dispute. Mechanisms such as standards, inspections, audits, and so forth must be put in place to assure quality expectations are being met throughout the project and not just checked or inspected at the end of the project, when it might be costly to correct. All project deliverables should have quantitative acceptance criteria.

The **schedule** for a project is the timetable that specifies when each activity should start and finish. The project objective usually states the time by which the project scope must be completed in terms of a specific date agreed upon by the sponsor and the organization performing the project. The project schedule indicates the dates when specific activities must be started and finished in order to meet the project completion date (for example, when a new bridge is to be open to traffic or when a new product must be launched at an industry exposition).

The **budget** of a project is the amount the sponsor or customer has agreed to pay for acceptable project deliverables. The project budget is based on estimated costs associated with the quantities of various resources that will be used to perform the project. It might include the salaries of people who will work on the project, materials and supplies, equipment, rental of facilities, and the fees of subcontractors or consultants who will perform some of the project tasks. For example, for a wedding project, the budget might include estimated costs for flowers, gown, tuxedo, caterer, cake, limousine rental, videographer, reception facility, and so on.

Various **resources** are needed to perform the project activities, produce the project deliverables, and accomplish the project objective. Resources include people, materials, equipment, facilities, and so forth. Human resources include

people with specific expertise or skills. Certain quantities of each type of resource with specific expertise are required at specific periods of time during the project. Similarly, particular equipment may be required during a certain portion of a project, such as equipment needed to excavate the land before construction can start on a new office building. The resource requirements for a project must be aligned with the types and quantities of resources available at the time periods when they are required.

There could be **risks** that adversely affect accomplishing the project objective. For example, designing an information system using the newest technology may pose a risk that the new technology may not work as expected. Or there may be a risk that a new pharmaceutical product may not receive regulatory approval. A risk management plan must be developed that identifies and assesses potential risks and their likelihood of occurrence and potential impact, and delineates responses for dealing with risks if they do occur.

Ultimately, the responsibility of the project manager is to make sure the **customer is satisfied**. This goes beyond just completing the project scope within budget and on schedule or asking if the customer or sponsor is satisfied at the end of the project. It means not only meeting the customer's expectations but also developing and maintaining an excellent working relationship throughout the project. It requires ongoing communication with the customer or sponsor to keep the customer informed and to determine whether expectations have changed. Regularly scheduled meetings or progress reports, phone discussions, and e-mail are examples of ways to accomplish such communication. Customer satisfaction requires involving the sponsor as a partner in the successful outcome of the project through active participation during the project. The project manager must continually be aware of the degree of the customer's satisfaction. By maintaining regular communication with the customer or sponsor, the project manager demonstrates genuine concern about the customer's expectations; it also prevents unpleasant surprises later.

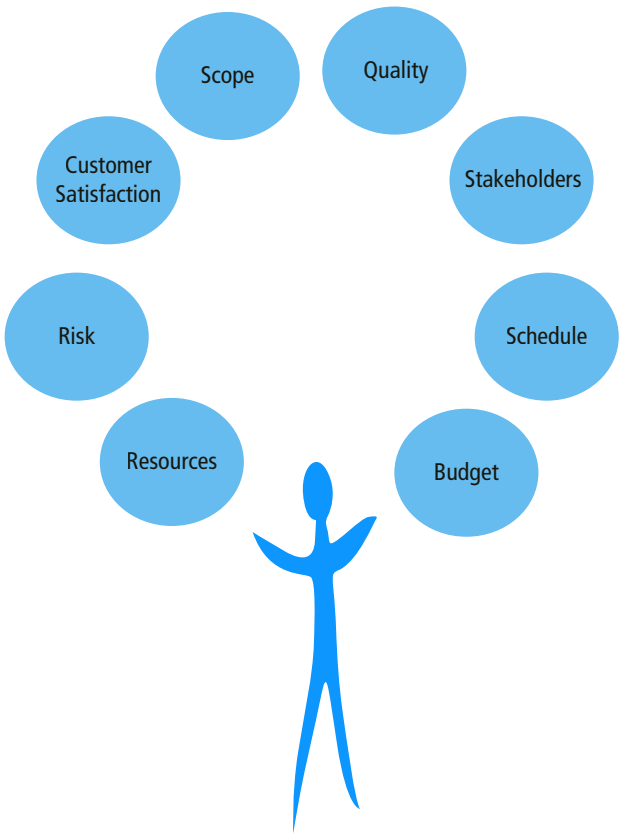
The project manager and team need to build relationships with, and engage, the various **stakeholders** who may influence or may be affected by the project, in order to gain their support. See the section on stakeholder engagement later in this chapter for further discussion.

Successfully completing the project requires finishing the scope of work within budget and a certain time frame while managing resource utilization, meeting quality specifications, and managing risks—and this must all be done while assuring customer or sponsor satisfaction and dealing with stakeholders' issues and concerns and gaining their support. During the project, it is sometimes challenging to balance or juggle these factors, which often constrain one another and could jeopardize accomplishing the project objective. See Figure 1.1. To help ensure the achievement of the project objective, *it is important to develop a plan before starting the project work*, rather than jumping in and starting without a plan. Lack of a plan decreases the chances of successfully accomplishing the full project scope within budget and on schedule.

Once a project is started, unforeseen circumstances may jeopardize the achievement of the project objective with respect to scope, budget, or schedule. They include:

- The cost of some of the materials is more than originally estimated.
- Inclement weather causes a delay.

FIGURE 1.1 **Factors Constraining Project Success**



- Additional redesign and modifications to a new sophisticated medical instrument are required to get it to meet performance specifications and government testing requirements.
- Delivery of a critical component for an aviation control system is delayed several months.
- Environmental contaminants are discovered when excavating for a new building.
- A key project team member with unique technical knowledge decides to retire, which creates a gap in critical expertise.

Any of the above examples could affect the balance of scope, quality, schedule, budget, resources, risks, customer satisfaction, and stakeholder support (or impact these factors individually), jeopardizing successful accomplishment of the project objective. The challenge for the project manager is to not only continually balance these factors throughout the performance of the project but also prevent, anticipate, or overcome such circumstances if and when they occur. *Good planning and communication* are essential to prevent problems from occurring or to minimize their impact on the achievement of the project objective when they do occur. The project manager needs to be proactive in planning