

**HAROLD KERZNER**

# **PROJECT MANAGEMENT**

**TWELFTH EDITION**

**A SYSTEMS APPROACH TO PLANNING,  
SCHEDULING, AND CONTROLLING**

**WILEY**

# PROJECT

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# MANAGEMENT



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# MANAGEMENT

*A Systems Approach to  
Planning, Scheduling, and  
Controlling*

T W E L F T H   E D I T I O N

H A R O L D   K E R Z N E R ,   P h . D .

WILEY



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*To  
my wife,  
Jo Ellyn,  
for her more than thirty years  
of unending love, devotion,  
and encouragement to continue  
my writing of project  
management books*



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Project management has evolved from a management philosophy restricted to a few functional areas and regarded as something nice to have to an enterprise project management system affecting every functional unit of the company. Simply stated, project management has evolved into a business process rather than merely a project management process. More and more companies are now regarding project management as being mandatory for the survival of the firm. Organizations that were opponents of project management are now advocates. Management educators of the past, who preached that project management could not work and would be just another fad, are now staunch supporters. Project management is here to stay. Colleges and universities are now offering undergraduate and graduate degrees in project management.

This book is addressed not only to those undergraduate and graduate students who wish to improve upon their project management skills but also to those functional managers and upper-level executives who serve as project sponsors and must provide continuous support for projects. During the past several years, management's knowledge and understanding of project management has matured to the point where almost every company is using project management in one form or another. These companies have come to the realization that project management and productivity are related, and that we are now managing our business as though it is a series of projects. Project management coursework is now consuming more of training budgets than ever before.

General reference is provided in the text to engineers. However, the reader should not consider project management as strictly engineering-related. The engineering examples are the result of the fact that project management first appeared in the engineering disciplines, and we should be willing to learn from their mistakes. Project management now resides in every profession, including

information systems, healthcare, consulting, pharmaceutical, banks, and government agencies.

The text can be used for both undergraduate and graduate courses in business, information systems, and engineering. The structure of the text is based upon my belief that project management is much more behavioral than quantitative since projects are managed by people rather than tools. The first seven chapters are part of the basic core of knowledge necessary to understand project management, specifically topics related to PMI's "Talent Triangle." Chapters 8 through 10 deal with the support functions and describe factors for predicting success and management support. It may seem strange that ten chapters on organizational behavior and structuring are needed prior to the "hard-core" chapters of planning, scheduling, and controlling. These first ten chapters are needed to understand the cultural environment for all projects and systems. These chapters are necessary for the reader to understand the difficulties in achieving cross-functional cooperation on projects where team members are working on multiple projects concurrently and why the people involved, all of whom may have different backgrounds, cannot simply be forged into a cohesive work unit without friction. Chapters 11 through 20 are more of the quantitative chapters on planning, scheduling, cost control, estimating, contracting (and procurement), and quality. Chapter 21 focuses on some of the more advanced topics.

The changes that were made in the twelfth edition include:

- Updated section on the Introduction to Project Management
- Updated section on Competing Constraints
- New section on the Talent Triangle
- New section on Entry-Level Project Management
- New section on Technology-Based Projects
- Updated section on the Many Faces of Project Success
- New section on Converting Methodologies to Frameworks
- New section on the Causes of Project Failure
- New section on Degrees of Project Success and Failure
- Updated section on Knowledge Management and Data Warehouses
- Updated section on Project Management Intellectual Property
- New section on Benefits Harvesting and Cultural Change
- New section on Transformational Project Management Leadership
- Updated section on Managing Mega Projects
- Updated section on Agile Project Management
- New section on Agile and Adaptive Project Management Cultures
- Updated section on Multinational Project Management Sponsorship
- New section on Preparing a Project Business Case
- Updated section on Validating the Project's Assumptions
- Updated section on Validating the Project's Objectives
- New section on Life-Cycle Milestones
- New section on the Project Management Office
- New section on Project Portfolio Management

- Updated section on Best Practices
- Updated section on Resource Leveling Issues

The text contains case studies, multiple choice questions, and discussion questions. There is also a separate companion book of cases (*Project Management Case Studies*, fifth edition) that provides additional real-world examples. Some of the new case studies include in the case book are:

Case Study	Description
Disney (A) Imagineering Project Management	Discusses some of the different skill sets needed to be an Imagineering PM
Disney (B) Imagineering in Action: The Haunted Mansion	Discusses the challenges with evolving scope on a project
Disney (C) Theme Parks and Enterprise Environmental Factors	Discusses how important an understanding of the enterprise environmental factors are and how they can impact project success
Disney (D) The Globalization of Disney	Discusses the challenges facing the use of project management on a global scale
Disney (E) Hong Kong Ocean Park: Competing Against Disney	Discusses how one company competed against Disney by expanding the project's scope
Olympics (A) Managing Olympic Projects	Discusses how the enterprise environmental factors impact Olympic projects
Olympics (B) Olympics, Project Management and PMI's Code of Ethics and Professional Responsibility	Discusses the complexity of abiding by PMI's Code of Conduct and Professional Responsibility on some Olympic projects
Olympics (C) Feeding the Olympic Athletes	Discusses the complexities (including quality control) for feeding 23,000 Olympians, coaches and staff members
Olympics (D) Health and Safety Risks at Olympic Events	Discusses the health and safety risks when of allowing athletes to compete in environments that have known health risks
Tradeoffs (A), (B)	Discusses how the introduction of competing constraints mandated additional tradeoffs and the challenges the company faced
The Project Management Audit	Discusses the need for occasional audits on a project and what happens executives are displeased with the results
The Executive Director	Discusses how a newly appointed executive director in a government agency played the political game to prevent being blamed for any wrong-doing

The twelfth edition text, the *PMBOK® Guide* and the book of cases are ideal as self-study tools for the Project Management Institute's PMP® Certification Exam. Because of this, there are tables of cross references at the end of each chapter in the textbook detailing the sections from the book of cases and the Guide to the Project Management Body of Knowledge (*PMBOK® Guide*) that apply to that

chapter's content. The left-hand margin of the pages in the text has side bars that identify the cross-listing of the material on that page to the appropriate section(s) of the *PMBOK® Guide*. At the end of most of the chapters is a section on study tips for the PMP® exam.

This textbook is currently used in the college market, in the reference market, and for studying for the PMP® Certification Exam. Therefore, to satisfy the needs of all markets, a compromise had to be reached on how much of the text would be aligned to the *PMBOK® Guide* and how much new material would be included without doubling the size of the text. Some colleges and universities use the textbook to teach project management fundamentals without reference to the *PMBOK® Guide*. The text does not contain all of the material necessary to support each section or process in the *PMBOK® Guide*. Therefore, to study for the PMP® Certification Exam, the *PMBOK® Guide* must also be used together with this text. The text covers material for almost all of the *PMBOK® Guide* knowledge areas but not necessarily in the depth that appears in the *PMBOK® Guide*.

An instructor's manual is available only to college and university faculty members by contacting your local Wiley sales representative or by visiting the Wiley website at [www.wiley.com/kerzner](http://www.wiley.com/kerzner). Access to the instructor's material and supporting material can be provided only through John Wiley & Sons Publishers, not the author.

One-, two-, and three-day seminars on project management and the PMP® Certification Training using the text are offered by contacting Lori Milhaven, Executive Vice President, the International Institute for Learning, at 800-325-1533, extension 5121 (e-mail address: [lori.milhaven@iil.com](mailto:lori.milhaven@iil.com)).

The problems and case studies at the ends of the chapters cover a variety of industries. Almost all of the case studies are real-world situations taken from my consulting practice or from research. Feedback from my colleagues who are using the text has provided me with fruitful criticism, most of which has been incorporated into the twelfth edition.

The majority of the articles on project management that have become classics have been referenced in the textbook throughout the first eleven chapters. These articles were the basis for many of the modern developments in project management and are therefore identified throughout the text.

Many colleagues provided valuable criticism. In particular, I am indebted to those industrial/government training managers whose dedication and commitment to quality project management education and training have led to valuable changes in this and previous editions. In particular, I wish to thank Frank Saladis, PMP, for his constructive comments, recommendations, and assistance with the mapping of the text to the *PMBOK® Guide* as well as recommended changes to many of the chapters. I am indebted to Dr. Edmund Conrow, PMP, for more than a decade of assistance with the preparation of the risk management chapters in all of my texts. I am also indebted to Dr. Rene Rendon for his review and recommendations for changes to the chapter on Contract Management.

To the management team and employees of the International Institute for Learning, thank you all for twenty-five years of never-ending encouragement, support, and assistance with all of my project management research and writings.

Harold Kerzner  
*The International Institute for Learning*  
2017







# Overview

## 1.0 INTRODUCTION

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In the United States, the roots of project management date back to the Department of Defense (DOD) and heavy construction companies during the 1960s. Early use of project management focused on the completion of unique, or sometimes repetitive, projects with a heavy focus on compliance to budgets and schedules. To maintain standardization and control in the way that projects were managed, DOD established policies and procedures for gate reviews and the way that status should be reported.

In the early years, project management was seen as a part-time job rather than as a career path position. In many companies, project management existed in only a small portion of the business, which made it difficult for some projects to get total company support.

Executives began realizing the complexities of resource control and effective project staffing. In addition, the rapid rate of change in both technology and the marketplace had created enormous strains on existing organizational forms. The traditional structure, which was highly bureaucratic, showed that it could not respond rapidly enough to a changing environment. Thus, the traditional structure was replaced by project management, or other temporary management structures, that were highly organic and could respond very rapidly as situations developed inside and outside the company. The organic nature of project management practices today allow project managers to customize the project management tools and processes to adapt to a variety of different environments.

The acceptance of project management was not easy. Many executives were not willing to accept change and were inflexible when it came to adapting to a different environment and flexible organizational structures. The project management approach required a departure from the traditional business organizational form, which was basically vertical and which emphasized a strong superior-subordinate relationship. Many executives had very strong beliefs as to how a company should be run and refused to recognize or admit that project management could benefit their company.

Unfavorable economic conditions forced executives to reconsider the value that project management could bring to a firm. Some of the unfavorable conditions included the recessions of the late 1970s and early 1990s, the housing crisis that began in 2008, the European economy downturn in 2013 and 2014, and the world economic slowdown in 2015. These unfavorable conditions emphasized the need for better control of existing resources, the creation of a portfolio of projects that would maximize the value brought to the firm, and a higher percentage of project successes. It soon became apparent that project management could satisfy all of these needs and that project management is a necessity in both bad and good economic conditions. Today, the concept behind project management is being applied in such diverse industries and organizations as defense, construction, pharmaceuticals, chemicals, banking, hospitals, accounting, advertising, law, state and local governments, and the United Nations.

Almost all of today's executives are convinced that project management can and does work well. Project management is now being applied to all facets of a business rather than just parts of the business. Projects are now being aligned with corporate or strategic objectives. Simply stated, "Why work on a project that is not aligned to strategic objectives with the goal of creating business value?" In some companies such as IBM, Microsoft, and Hewlett-Packard, project management is recognized as a strategic competency necessary for the survival of the firm. This recognition of the importance of project management today permeates almost all industries and companies of all sizes.

## 1.1 UNDERSTANDING PROJECT MANAGEMENT

### **PMBOK® Guide, 6th Edition**

Chapter 1 Introduction to the *PMBOK® Guide*

1.2.1 Projects

1.2.1 The Importance of Project Management

1.2.4.5 Project Management Process Groups

In order to understand project management, one must begin with the definition of a project. A project can be considered to be any series of activities and tasks that:

- Have a specific objective, with a focus on the creation of business value, to be completed within certain specifications
- Have defined start and end dates
- Have funding limits (if applicable)
- Consume human and nonhuman resources (i.e., money, people, equipment)
- Are multifunctional (i.e., cut across several functional lines)

The result or outcome of the project can be unique or repetitive, and must be achieved within a finite period of time. Because companies have very limited resources, care must be taken that the right mix of projects is approved. Given this, another outcome of a project is that it provides business value to the company as opposed to being a "pet" project for the personal whims of one person.

Project management is the application of knowledge, skills, and tools necessary to achieve the project's requirements. The knowledge, skills, and tools are usually grouped into activities or processes. PMI's *PMBOK® Guide* identifies five process groups. Some of the activities within these groups include:

- Project initiation
  - Selection of the best project given resource limits
  - Recognizing the benefits of the project

- Preparation of the documents to sanction the project
- Assigning of the project manager
- Project planning
  - Definition of the work requirements
  - Definition of the quality and quantity of work
  - Definition of the resources needed
  - Scheduling the activities
  - Evaluation of the various risks
- Project execution
  - Negotiating for the project team members
  - Directing and managing the work
  - Working with the team members to help them improve
- Project monitoring and control
  - Tracking progress
  - Comparing actual outcome to predicted outcome
  - Analyzing variances and impacts
  - Making adjustments
- Project closure
  - Verifying that all of the work has been accomplished
  - Contractual closure of the contract
  - Financial closure of the charge numbers
  - Administrative closure of the paperwork

Successful project management can then be defined as achieving a continuous stream of project objectives within time, within cost, at the desired performance/technology level, while utilizing the assigned resources effectively and efficiently, and having the results accepted by the customer and/or stakeholders. Because each project is inherently different and each customer can have different requirements, the activities included within the process groups may change from project to project. The *PMBOK® Guide* identifies industry-accepted activity regarded as best practices for each process group and these best practices can be structured to create a project management methodology that can be applied and customized to a variety of projects.

The potential benefits from effective project management are:

- Clear identification of functional responsibilities to ensure that all activities are accounted for, regardless of personnel turnover
- Minimizing the need for continuous reporting
- Identification of time limits for scheduling
- Identification of a methodology for trade-off analysis
- Measurement of accomplishment against plans
- Early identification of problems so that corrective action may follow
- Improved estimating capability for future planning
- Knowing when objectives cannot be met or will be exceeded

Unfortunately, the benefits cannot be achieved without overcoming obstacles such as project complexity, customer's special requirements and scope changes, organizational restructuring, project risks, changes in technology, and forward planning and pricing.

Project management is designed to make better use of existing resources by getting work to flow horizontally as well as vertically within the company. This approach does not really destroy the vertical, bureaucratic flow of work but simply requires that line organizations talk to one another horizontally so that horizontal and vertical work flow will be accomplished more smoothly throughout the organization and in a concurrent manner. The vertical flow of work is still the responsibility of the line managers. The horizontal flow of work is the responsibility of the project managers, and their primary effort is to communicate and coordinate activities horizontally between the line organizations.

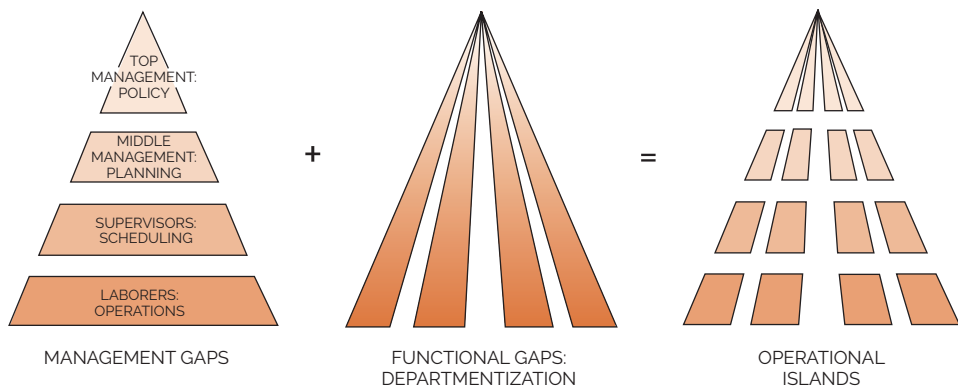
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3.4 Project Management Competence

Figure 1–1 shows how many companies are structured. There are always “class or prestige” gaps between various levels of management. There are also functional gaps between working units of the organization. If we superimpose the management gaps on top of the functional gaps, we find that companies are made up of small operational islands that refuse to communicate with one another for fear that giving up information may strengthen their opponents. The project manager’s responsibility is to get these islands to communicate crossfunctionally toward common goals and objectives.

The project manager may require a difference set of skills when working with each of the islands. The *PMBOK® Guide* identifies a talent triangle composed of technical project management, leadership and strategic and business management skills. In today’s environment, strategic and business management skills are getting more attention because project managers are seen as managing part of a business rather than merely a project and, as such, are expected to make both project and business decisions.

The following is an overview definition of project management:

Project management is the planning, organizing, directing, and controlling of company resources for a relatively short-term objective that has been established to complete specific goals and objectives. Furthermore, project management utilizes the systems approach to management by having functional personnel (the vertical hierarchy) assigned to a specific project (the horizontal hierarchy).



**FIGURE 1–1.** Organizational gaps.

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2.4 Organizational Systems

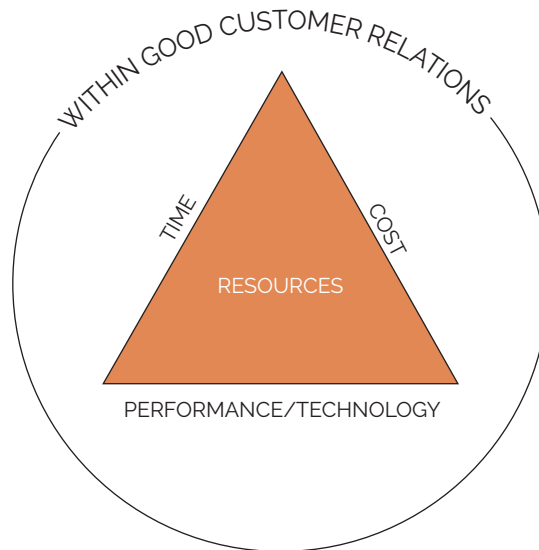
The preceding definition requires further comment. Classical management is usually considered to have five functions or principles:

- Planning
- Organizing
- Staffing
- Controlling
- Directing

You will notice that, in the definition, the staffing function has been omitted. This was intentional because the project manager does not staff the project. Staffing is a line responsibility. The project manager has the right to request specific resources, but the final decision as to what resources will be committed rests with the line managers.

We should also comment on what is meant by a “relatively” short-term project. Not all industries have the same definition for a short-term project. In engineering, the project might be for six months or two years; in construction, three to five years; in nuclear components, ten years; and in insurance, two weeks. Long-term projects, which consume resources full-time, are usually set up as a separate division (if large enough) or simply as a line organization.

Figure 1–2 is a pictorial representation of traditional project management the way it was understood in the past. The objective of the figure is to show that project management is designed to manage or control company resources on a given activity, within time, within cost, and within performance. Time, cost, and performance were considered as the



**FIGURE 1–2.** Overview of project management.

only constraints on the project. If the project is to be accomplished for an outside customer, then the project had a fourth constraint: good customer relations. Customers can be internal or external to the parent organization. The reader should immediately realize that it is possible to manage a project within time, cost, and performance and then also alienate the customer to such a degree that no further business will be forthcoming. Executives often select project managers based on who the customer is and what kind of customer relations will be necessary.

Projects exist to produce deliverables. The person ultimately assigned as the project manager may very well be assigned based upon the size, nature, and scope of the deliverables. Deliverables are outputs, or the end result of either the completion of the project or the end of a life-cycle phase of the project. Deliverables are measurable, tangible outputs and can take such form as:

- **Hardware Deliverables:** These are hardware items, such as a table, a prototype, or a piece of equipment.
- **Software Deliverables:** These items are similar to hardware deliverables but are usually paper products, such as reports, studies, handouts, or documentation. Some companies do not differentiate between hardware and software deliverables.
- **Interim Deliverables:** These items can be either hardware or software deliverables and progressively evolve as the project proceeds. An example is a series of interim reports leading up to the final report.

## 1.2 DEFINING PROJECT SUCCESS

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#### 1.2.6.4 Project Success Measures

In the previous section, we defined project success as the completion of an activity within the constraints of time, cost, and performance. This was the definition used for the past thirty to forty years or so. More recently, the definition of project success has been modified to include completion:

- Within the allocated time period
- Within the budgeted cost
- At the proper performance or specification level
- With acceptance by the customer/user
- With minimum or mutually agreed upon scope changes
- Without disturbing the main work flow of the organization
- Without changing the corporate culture

The last three elements require further explanation. Very few projects are completed within the original scope of the project. Scope changes are inevitable and have the potential to destroy not only the morale on a project, but the entire project. Scope changes *must* be held to a minimum and those that are required *must* be approved by both the project manager and the customer/user.

Project managers must be willing to manage (and make concessions/trade-offs, if necessary) such that the company's main work flow is not altered. Most project managers

view themselves as self-employed entrepreneurs after project go-ahead and would like to divorce their project from the operations of the parent organization. This is not always possible. The project manager must be willing to manage within the guidelines, policies, procedures, rules, and directives of the parent organization.

All corporations have corporate cultures, and even though each project may be inherently different, the project manager should not expect his assigned personnel to deviate from cultural norms. If the company has a standard of openness and honesty when dealing with customers, then this cultural value should remain in place for all projects, regardless of who the customer/user is or how strong the project manager's desire for success is.

Excellence in project management is defined as a continuous stream of successfully managed projects. Any project can be driven to success through formal authority and strong executive meddling. But in order for a continuous stream of successful projects to occur, there must exist a strong corporate commitment to project management, and this commitment *must be visible*.

### 1.3 TRADE-OFFS AND COMPETING CONSTRAINTS

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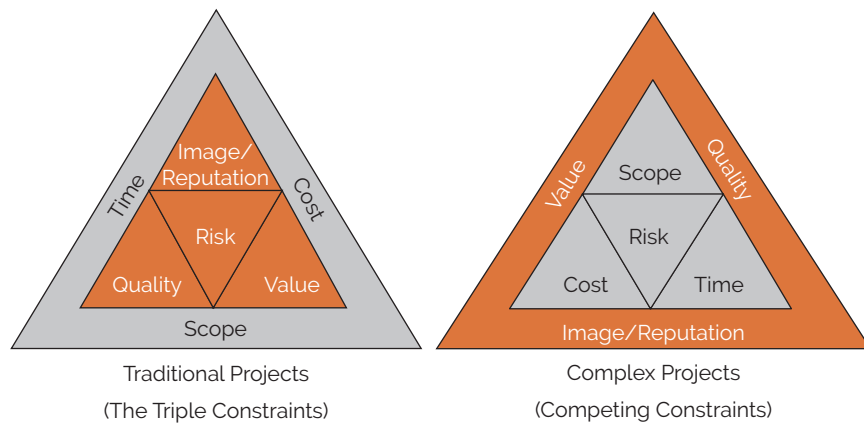
Although many projects are completed successfully, at least in the eyes of the stakeholders, the final criteria from which success is measured may be different from the initial criteria because of trade-offs. Trade-offs are situations where one aspect of a project may be sacrificed to gain an advantage with another aspect. As an example, additional time and money may be needed to make further improvements in the quality of the project's deliverables.

The first triangle shown in Figure 1–2 is referred to as the triple constraints on a project, namely time, cost, and performance, where performance can be scope, quality, or technology. These are considered to be the primary constraints and are often considered to be the criteria for a project against which success is measured.

Today, we realize that there can be multiple constraints on a project and, rather than use the terminology of the triple constraints, we focus our attention on competing constraints. Sometimes the constraints are referred to as primary and secondary constraints. There may be secondary factors such as risk, customer relations, image, and reputation that may cause us to deviate from our original success criteria of time, cost, and performance. These changes can occur any time during the life of a project and can then cause trade-offs in the triple constraints, thus requiring that changes be made to the success criteria. In an ideal situation, we would perform trade-offs on any or all of the competing constraints such that acceptable success criteria would still be met.

As an example, let's assume that a project was initiated using the success criteria of the triple constraints as shown in Figure 1–3. For simplicity's sake, a triangle was used for the competing constraints in Figure 1–3. However, there can be significantly more than three competing constraints in which some geometric shape other than a triangle might work best. Partway through the project, the environment changes, a new senior management team is brought in with their own agenda, or a corporate crisis occurs such





**FIGURE 1-3.** Competing constraints.

that the credibility of the corporation is at stake. In such a case, the competing constraints shown on the right in Figure 1-3 can be more important than the original triple constraints.

Secondary factors are also considered to be constraints and may be more important than the primary constraints. For example, years ago, in Disneyland and Disneyworld, the project managers designing and building the attractions at the theme parks had six constraints: time, cost, scope, safety, aesthetic value, and quality.

At Disney, the last three constraints of safety, aesthetic value, and quality were considered locked-in constraints that could not be altered during trade-offs. All trade-offs were made on time, cost, and scope. Some constraints simply cannot change while others may have flexibility.

Not all constraints are equal in importance. For example, in the initiation phase of a project, scope may be the critical factor and all trade-offs are made on time and cost. During the execution phase of the project, time and cost may become more important and then trade-offs will be made on scope. A more detailed discussion of trade-offs can be found in Chapter 16.

When managing a project according to the triple constraints of time, cost, and scope, we perform a juggling act and often find a way to meet all three constraints, each of which usually carries an equal degree of importance. When the number of constraints increases to five or six constraints, it may be difficult, if not impossible, to meet all of the constraints and a prioritization of constraints may be necessary.

The prioritization of constraints can change over the life of the project based upon the needs of the project manager, the client, and the stakeholders. Changing the priorities of the constraints can lead to scope changes and play havoc with the requirements and baselines. There must be a valid reason for changing the prioritization of the constraints after project go-ahead.

## 1.4 THE ENTRY-LEVEL PROJECT MANAGER

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Too often, people desire a project management position without fully understanding what the job entails. Some people believe that they will be given a vast amount of authority, they will make any and all decisions on the project, they will have control of a small empire of workers which they personally hired, and they will interface with executives within and outside of their firm.

In reality, project management may be a lot different than some believe. Most project managers have very little real authority. The real authority may rest with the project sponsor and functional management. Some people argue that project management is actually leadership without authority.

Project managers may not have any say in staffing the project and may not even be able to fire poorly performing workers. Project staff is most commonly provided by the functional managers and only the functional managers can remove the workers. Projects managers may have no input into the wage and salary program for the employees assigned to the project. Employees assigned to the project may be working on several other projects at the same time, and the project manager may not be able to get these employees to satisfy his/her project's requirements in a timely manner. Project managers may not be allowed to communicate with personnel external to the company. This may be done by the internal project sponsor.

Today's project managers are expected to have at least a cursory understanding of the company's business model as well as the company's business processes that support project management. Project managers are now expected to make both project- and business-related decisions when necessary.

Some people believe that project managers make any and all decisions on a project. This is certainly not true. In today's high-technology environments, project managers cannot be experts in all areas. Their expertise may not be in any of the knowledge areas of the project. This is quite common when a project manager is asked to manage a technology-based project, as discussed in Section 1.5. They must therefore rely upon the governance committee and team members for support in project decision making.

The project manager may have no say or input on the imposed constraints or boundary conditions for the project. These factors may have been made by the client or the sales force during competitive bidding activities and the project manager is told that he/she must live with these conditions. It is not uncommon for the sales force to agree to unrealistic budgets and schedules just to win a contract and then tell the project manager, "This is all the time and money we could get from the client. Live with it."

Finally, the new project manager cannot take for granted that he or she fully understands the role of the participants. Because each project will be different, the roles of the players and the accompanying interface can change. This is discussed in Sections 1.6–1.10.

The characteristics of a project can change from company to company. It is important for the newly appointed or entry-level project managers to have a good understanding of what the job entails before accepting the position.