Growth and new developments in project management continue to accelerate in our society, in practice, and in our research publications. Beyond the attention previously (and still) paid to project management, program management, project portfolios, project maturity, project management offices (PMOs), Agile, and other such project issues, we are now seeing attention also directed to mega-projects, organizational project management, project governance, strategic projects, benefit realization, the duties of the project sponsor, the meaning of executive commitment, and other such issues. Projects are getting much more sophisticated and complex, involving multiple organizations and billions of dollars. And even though our knowledge of how to successfully execute standard projects has resulted in much better success rates in practice, the rates of success for less traditional projects, such as strategic and multiorganizational projects, are still poor. Part of the reason for this is just now becoming clear that projects are only the middle portion of a set of activities involving the recognition of a need, the selection of a project to meet it, designing a governance structure for the project, executing the project, and the tasks needed to ensure the benefits of the project are realized. These activities are now also being focused on and we hope to thereby see better success rates for our strategic and more complex projects.

The past several decades have been marked by rapid growth in the use of project management as a means by which organizations achieve their objectives. In the past, most projects were external to the organization—building a new skyscraper, designing a commercial ad campaign, launching a rocket—but the growth in the use of projects lately has primarily been in the area of projects internal to organizations: developing a new product, opening a new branch, implementing a new enterprise software system, improving the services provided to customers, and achieving strategic objectives. As exhilarating as outside projects are, successfully executing internal projects is even more satisfying in that the organization has substantially improved its ability to execute more efficiently, effectively, or quickly, resulting in an agency or business that can even better contribute to society and simultaneously enhancing its own competitive strength. Fundamentally, project management provides an organization with powerful tools that improve its ability to plan, implement, and control its activities as well as the ways in which it utilizes its people and resources.

In this introductory chapter to project management, we begin by defining precisely what a project is. Both the objectives and characteristics of projects are also discussed to help further define them. Next, we address the emergence of project management, the forces that have fostered project management, and recent trends in project management. Following this, we describe the project life cycle. Finally, the chapter concludes with an overview of the structure of the remainder of the text. In later chapters, we will get into the newer topics of benefit realization, mega-projects, project governance, and other such issues.
1.1 The Definition of a “Project”

Formally, a project may be defined as “A temporary endeavor undertaken to create a unique product, service, or result” (PMBOK®, Project Management Institute, 2013, p. 417). Consistent with this definition, there is a rich variety of projects to be found in our society. Although some may argue that the construction of the Tower of Babel or the Egyptian pyramids were some of the first “projects,” it is probable that cavemen formed a project to gather the raw material for mammoth stew. It is certainly true that the construction of Boulder Dam and Edison’s invention of the light bulb were projects by any sensible definition. Modern project management, however, is usually said to have begun with the Manhattan Project. In its early days, project management was used mainly for very large, complex research and development (R&D) projects like the development of the Atlas Intercontinental Ballistic Missile and similar military weapon systems. Massive construction programs were also organized as projects, including the construction of dams, ships, refineries, and freeways.

As the techniques of project management were developed, mostly by the military, the use of project organization began to spread. Private construction firms found that organizing work on the basis of projects or a project-based organization was helpful on smaller projects, such as the building of a warehouse or an apartment complex. Automobile companies used project organization to develop new automobile models. Both General Electric and Pratt & Whitney used project organization to develop new jet aircraft engines for airlines, as well as the Air Force. Project management has even been used to develop new models of shoes and ships. More recently, the use of project management by international organizations, and especially organizations producing services rather than products, has grown rapidly. Advertising campaigns, global mergers, and capital acquisitions are often handled as projects, and the methods have spread to the nonprofit sector. Weddings, SCOUT-O-RAMAS, fund drives, election campaigns, parties, and recitals have all made use of project management. Most striking has been the widespread adoption of project management techniques for the development of computer software.

To add to our vocabulary in discussions of project management, it is sometimes useful to make a distinction among terms such as project, program, task, and work packages. The military, the source of most of these terms, generally uses the term program to refer to an exceptionally large, long-range objective that is broken down into a set of projects. These projects are divided further into tasks, which are, in turn, split into work packages that are themselves composed of work units. Of course, exceptions to this hierarchical nomenclature abound. For example, the Manhattan Project was a huge “program,” but a “task force” was created to investigate the many potential futures of a large steel company. In the broadest sense, a project is a specific, finite task to be accomplished. Whether large- or small-scale or whether long- or short-run is not particularly relevant. What is relevant is that the project be seen as a unit. There are, however, some objectives that all projects share and some attributes that characterize projects.

Three Project Objectives: The “Triple Constraint” or “Iron Triangle”

While multimillion-dollar, 5-year projects capture public attention, the overwhelming majority of all projects are comparatively small—though nonetheless important to doer and user alike. They involve outcomes, or deliverables, such as a new floor for a professional basketball arena, a new insurance policy to protect against a specific casualty loss, a new website, a new casing for a four-wheel-drive minivan transmission, a new industrial floor cleanser, the installation of a new method for peer review of patient care in
a hospital, even the development of new software to help manage projects. The list could be extended almost without limit. These undertakings have much in common with their larger counterparts. Importantly, they have the same general objectives—specified deliverables (also commonly known as scope\(^1\)), a specific deadline (time), and budget (cost). We refer to these as “direct” project objectives or goals.

There is a tendency to think of a project solely in terms of its outcome—that is, its scope. But the time at which the outcome is available is itself a part of the outcome, as is the cost entailed in achieving the outcome. The completion of a building on time and on budget is quite a different outcome from the completion of the same physical structure a year late or 20 percent over budget, or both.

Indeed, even the concept of scope is perhaps more complex than is apparent. In particular, it is important to recognize that the expectations of the client are an inherent part of the project specifications, which unfortunately tend to evolve over time. To consider the client’s desires as different from the project specifications is to court conflict between client and project team. All too often projects begin with the client specifying a desired outcome. Then the project team designs and implements the project. Then the client views the result of the team’s ideas. In following this approach, differences between the client’s expectations and the project team’s designs commonly develop as a project proceeds due to both changing expectations on the client’s part as they learn new information and limitations on the team’s part about what they can deliver. As a result, meeting the client’s latest desires may not be well reflected by the initially specified scope of the project. The expectations of client and project team therefore need to be continuously realigned and integrated throughout the entire project, but they frequently are not. As a result, we believe in making an effort upfront and throughout the project to ensure that the nebulous elements of the client’s evolving expectations and desires are identified and realigned with the client’s latest scope (though possibly at additional cost). We discuss these issues in more detail in the coming chapters.

The three direct project objectives are shown in Figure 1.1, with the specified project objectives on the axes. This illustration implies that there is some “function” that relates them, one to another—and so there is! Although the functions vary from project to project, and from time to time for a given project, we will refer to these relationships, or trade-offs, throughout this book. The two primary tasks of the project manager (the “PM”) are to manage these trade-offs and to anticipate and address risks to the project. In addition to the direct project goals, organizations often have a unique set of ancillary project objectives/goals that are often unarticulated but nevertheless important to the success of the project.

Ancillary goals include improving the organization’s project management competency and methods, developing individuals’ managerial experience through project management, gaining a foothold in a new market, and similar goals. In a more basic sense, those with a stake in the project (the PM, project team, senior management, the client, and other project stakeholders) have an interest in making

\(^1\)The term “scope” is typically used when differentiating between what is included and what is excluded in something, but in project management the term has come to mean the specified deliverables. The Project Management Institute’s Project Management Body of Knowledge (PMBOK\(^\circ\)) defines Scope as follows: “The sum of the products, services, and results to be provided as a project.” We will refer to the PMBOK guide frequently throughout this book and use the icon seen here in the margin to draw the student’s attention to this important reference (see the PMI reference in the “Bibliography” section). If particular PMBOK figures, tables, sections, or chapters are relevant to the discussion, we note this under the icon as, for example, Section 3.2.
The project a success. Shenhar et al. (1997) have concluded that project success has four dimensions: (1) project efficiency, (2) impact on the customer, (3) the business impact on the organization, and (4) opening new opportunities for the future. The first two are clearly part of what we have defined as the project’s direct objectives; the last two are typical of what are frequently unspecified ancillary goals.

One other crucial, but unstated, trade-off that a PM must consider is the health of the project team as well as the rest of the organization. The PM cannot burn out the team in an attempt to achieve the direct objectives, nor destroy the organization’s functional departments in an attempt to meet the project’s goals. Another factor in making project trade-offs is the project’s environment, that is, those things or persons outside the project, and often outside the sponsoring organization, that affect the project or are affected by it. Examples of this environment might be environmental groups, trade unions, competitive firms, and the like. We will deal with these issues in more detail in Chapter 12.

From the early days of project management, the direct project objectives of time, cost, and scope (as generally agreed to by the client and the organization actually doing the project) have been accepted as the primary determinants of project success or failure. In the past 25 years or so, other direct and ancillary objectives have been suggested. These did not replace the traditional time, cost, and scope, but were added as also relevant. For the most part, however, Chapters 1 through 11 will focus mainly on the traditional direct objectives.

Characteristics of Projects

There are three characteristics that all projects share and a number of other characteristics that are common to projects but not universal. We begin our discussion with the three universal characteristics and then direct our attention to several of the common characteristics.

The first universal characteristic of projects is that every project is unique. Though the desired end results may have been achieved elsewhere, every project has some unique elements. No two construction or R&D projects are precisely alike. Though it is clear that construction projects are usually more routine than R&D projects, some degree of customization is a characteristic of projects. In addition to the presence of risk, as noted earlier, this characteristic means that projects, by their nature, cannot be completely reduced to routine. The PM’s importance is emphasized because, as a devotee of management by exception, the PM will find there are a great many exceptions to manage by.
The second universal characteristic is that a project is a one-time occurrence with a well-defined and specific set of desired end results. (We discuss poorly defined, or “quasi-” projects a bit later.) These end results are referred to as the “scope,” or sometimes required “performance,” of the project. The project can be divided into subtasks that must be accomplished in order to achieve the project goals. The project is complex enough that the subtasks require careful coordination and control in terms of timing, precedence, cost, and scope. Often, the project itself must be coordinated with other projects being carried out by the same parent organization.

The third universal characteristic of projects is that they have a finite duration. There is a clear date when the project is launched and a corresponding due date or deadline. Furthermore, like organic entities and their growth curve, projects have life cycles. Often starting with a slow beginning and progressing to a buildup of size, then peaking, beginning a decline, and finally must be closed by some due date. (Also like organic entities, they often resist closure.) Some projects end by being phased into the normal, ongoing operations of the parent organization. The life cycle is discussed further in Section 1.3, where an important exception to the usual description of the growth curve is mentioned. There are several different ways in which to view project life cycles. These will be discussed in more detail later.

**Interdependencies**

While not universally true, projects often interact with other projects being carried out simultaneously by their parent organization. Typically, these interactions take the form of competition for scarce resources between projects, and much of Chapter 9 is devoted to dealing with these issues. While such interproject interactions are common, projects

---

**Project Management in Practice**

**A Unique Method for Traveler-Tracking at Copenhagen Airport**

IT University of Copenhagen, Denmark, was working with Copenhagen Airport to improve both the efficiency and effectiveness of the management of their airport through a new approach: traveler-tracking, but without invading people’s privacy. The 3-year project focused on a unique, low-cost approach—capturing the Bluetooth signals from passengers’ phones with two electronic readers that cost only $30 each. At the time, not everyone had a smartphone that emits signals, of course, but about 7 percent of the passengers did, enough to provide a random sample for tracking. To ensure travelers’ privacy, a crucial stakeholder in this project, they collected only a portion of each signal and deleted the addresses. They also informed the public about the project on the airport’s website and on-site as well. To encourage positive traveler response to the project, they provided alerts to passengers willing to synchronize their Bluetooth to receive information regarding when their plane was boarding and a map to the gate.

Knowing when people were entering and leaving Security allowed the airport to balance the staff at Security so lines didn’t build up, thereby shortening the time passengers must wait, while also reducing over- and understaffing of screeners. In addition, the information allows them to post wait times at the check-in gates. The data also lets the airport to determine which shops and areas are getting the most traffic so they can shift usage of facility space to better serve the travelers and the friends and families accompanying them. Moreover, when construction and rerouting changes traffic flows, they can determine the impact on passengers and take action to reduce the inconvenience.

**Questions**

1. Are the triple constraints of this project clear? What are they?
2. What was unique about this project? What was the main conflict?
3. Why are the travelers themselves a stakeholder in this project, since most of them won’t even know they are being tracked?
4. How widespread do you think this technology will become? What uses will be garnered from it? Do any of them concern you?

always interact with the parent organization’s standard, ongoing operations. Although
the functional departments of an organization (marketing, finance, operations, and
the like) interact with one another in regular, patterned ways, the patterns of interac-
tion between projects and these departments tend to be changeable. Marketing may be
involved at the beginning and end of a project, but not in the middle. Operations may
have major involvement throughout. Finance is often involved at the beginning and
accounting (the controller) at the end, as well as at periodic reporting times. The PM
must keep all these interactions clear and maintain the appropriate interrelationships
with all external groups.

Projects also typically have limited budgets, both for personnel and other resources.
 Often the budget is implied rather than detailed, particularly concerning personnel, but it
is strictly limited. The attempt to obtain additional resources (or any resources) frequently
leads to the next attribute—conflict.

More than most managers, the PM lives in a world characterized by conflict. Projects
compete with functional departments for resources and personnel. More serious, with the
growing proliferation of projects, is the project-versus-project conflict for resources within
multiproject organizations. The members of the project team are in almost constant conflict
for the project’s resources and for leadership roles in solving project problems. The PM
must be expert in conflict resolution, but we will see later that there are helpful types of
conflict. The PM must recognize the difference.

Conventional thinking suggests that different stakeholders (e.g., clients, the parent
organization, the project team, and the public) define success and failure in different ways.
For example, the client wants changes and the parent organization wants profits. Likewise,
the individuals working on projects are often responsible to two bosses at the same time:
a functional manager and the PM. Under such conditions, conflict can arise when the two
bosses have different priorities and objectives.

While the conventional view tends to regard conflict as a rather ubiquitous part of
working on projects, more recently others have challenged this view. For example, John
Mackey, cofounder and co-CEO of Whole Foods Market, suggests in his recent book Con-
scious Capitalism (2013) that satisfying stakeholder needs is not a zero-sum game where
satisfying one stakeholder must come at the expense of another. Rather, Mackey suggests
a better approach that is to identify opportunities to satisfy all stakeholder needs simulta-
neously. One way to accomplish this is to identify ways to align the goals of all stakeholders
with the purpose of the project. As was mentioned earlier, the primary role of the PM is to
manage the trade-offs. However, as Mackey warns, if we look for trade-offs we will always
find trade-offs. On the other hand, if we look for synergies across the stakeholder base,
we can often find them too. The clear lesson for project managers is to not be too quick to
assume trade-offs exist among competing project objectives and stakeholder groups.

Nonprojects and Quasi-Projects

If the characteristics listed earlier define a project, it is appropriate to ask if there are non-
projects. The use of a manufacturing line to produce a flow of standard products is a non-
project. The production of weekly employment reports, the preparation of school lunches,
the delivery of mail, the flight of Delta 1288 from Dallas to Dulles, checking your e-mail
all are nonprojects. While one might argue that each of these activities is, to some degree,
unique, it is not their uniqueness that characterizes them. They are all routine. They are
tasks that are performed over and over again. This is not true of projects. Each project is
a one-time event. Even the construction of a section of interstate highway is a project. No
two miles are alike and constructing them demands constant adaptation to the differences
in terrain and substructure of the earth on which the roadbed is to be laid. Projects cannot
be managed adequately by the managerial routines used for routine work.
In addition to projects and nonprojects, there are also quasi-projects: “Bill, would you look into this?” “Mia, we need to finish this by Friday’s meeting.” “Samir, can you find out about this before we meet with the customer?” Most people would consider that they have just been assigned a project, depending on who “we” and “you” is supposed to include. Yet there may be no specific task identified, no specific budget given, and no specific deadline defined. Are they still projects, and if so, can project management methods be used to manage them? Certainly! The scope, schedule, and budget have been implied rather than carefully delineated by the words “this,” “meet,” and “we” (meaning “you”) or “you” (which

---

**Project Management in Practice**

**The Smart-Grid Revolution Starts in Boulder, Colorado**

Boulder’s utility company, Xcel Energy, decided that it was time to create a roadmap for a 3-year, $100 million “smart-grid” electrical system that would span the entire city. There were no standards, benchmarks, or tested procedures for converting a city from a conventional electric-grid system to a fully integrated smart one, though it was known that if customers can monitor the true cost of their energy, they will automatically reduce their usage, by up to 30 percent in some cases. Of course, the smart grid would also allow Xcel to reroute power around bottlenecks, detect power outages, identify service risks, cut its use of road crews, read customer meters remotely, reduce outages, and identify false alarms more quickly.

Xcel brought in a mass of partners on the project, such as Accenture consulting for engineering, energy industry consultants, leading technologists, business leaders, IT experts, and, of course, Boulder city managers, leaders, and user-citizens. The public and private partners were divided into eight teams, all led by a senior PM working with a PMO. With all these different stakeholders, with different objectives and interests, it was crucial to have steady, reliable communication to keep everyone up to date and the project on track. Security and privacy were high-priority items on the project, and communication with the community was facilitated through town hall meetings, the local media, tours of project sites, and even a touring trailer allowing citizens to get a hands-on demonstration of the smart-grid technology. With the completion of the project, Xcel is now measuring its many benefits and expects it will take a year to collect and analyze all the data across all the seasons. The project partners have also created an industry consortium to establish industry standards for future, larger smart-grid projects. They now see Boulder as a living laboratory from which they can continue to learn and thereby successfully deploy smart grids across the entire country.

**Questions**

1. Are the triple constraints of this project clear? List each of them.

2. Given the range of benefits listed for the new technology, what interdependencies and conflicts do you suspect smart grids will create for utilities?

3. A major portion of this project had to do with carefully managing all the stakeholders. List those mentioned in the article and divide them into the four groups mentioned above. Do any stakeholders fall into more than one of the groups?

4. What conflicts do you suspect might have occurred among all the different stakeholders in this project?

5. Why do you think Xcel agreed to invest $100 million in this risky experiment? What might have been their ancillary goals?

may mean a group or team). In such cases, it is best to try to quickly nail down the scope, schedule, and budget as precisely as possible, but without antagonizing the manager who assigned the project. You may need to ask for additional help or other resources if the work is needed soon—is it needed soon? How accurate/thorough/detailed does it need to be? And other such questions.

One common quasi-project in the information systems area is where the project includes discovery of the scope or requirements of the task itself (and possibly also the budget and deadline). How can you plan a project when you don’t know the scope requirements? In this case, the project is, in fact, determining the scope requirements (and possibly the budget and deadline also). If the entire set of work (including the discovery) has been assigned to you as a project, then the best approach is to set this determination as the first “milestone” in the project, at which point the resources, budget, deadline, capabilities, personnel, and any other matters will be reviewed to determine if they are sufficient to the new project requirements. Alternatively, the customer may be willing to pay for the project on a “cost-plus” basis, and call a halt to the effort when the benefits no longer justify the cost.

Project Management in Practice

The Olympic Torch Relay Project

Getting the Olympic Flame, known as the Olympic Torch Relay, to the Olympic Games is no simple matter. Generally, the Torch Relay has gotten longer and more complex with every Olympic event. In the 1936 Olympics, the torch left from the original site of the Olympics, the Temple of Hera in Olympia, Greece, and traveled through seven countries to reach its final destination at the games in Berlin. For the Beijing 2008 Olympics, the flame traveled 137,000 kilometers (about 85,000 miles)! This increasing length and complexity are driven by the realization of host country citizens that it is a rare opportunity to have the Olympic torch pass through your hometown and the corresponding goal of the Olympic Committee to touch as many lives as possible in a positive way.

As an example, the planning for the 1996 Atlanta Olympic Torch Relay (see figure) took 2 years, cost over $20 million, and involved an 84-day, 42-state campaign using 10,000 runners to carry the torch for 15,000 miles! Accompanying the runners was a 40-vehicle caravan carrying security officers, media personnel, medical personnel, computers, telecommunications gear, clothing, food, and spare lanterns with extra flames in case the original torch went out. The caravan included: 50 cell phones; 120 radios; 30 cars; 10 motorcycles; and clothing for 10,000 runners, 10,000 volunteers, as well as 2,500 escort runners.

The Torch Relay is also a major marketing campaign, primarily for the relay’s sponsors. Thus, accompanying the Atlanta-bound caravan were trucks hawking Olympic memorabilia: t-shirts, sweatshirts, baseball caps, tickets to the soccer matches, and on and on. In addition to retail commercialism, a number of companies were piggybacking on the Torch Relay to further their own commercial interests: IBM, Motorola, BellSouth, Texaco, BMW, Lee, Coca-Cola, and so on. We can only wonder how far and complex the Torch Relay will be in the next Olympics!

Questions

1. Which of the three universal and three common characteristics of projects are displayed in the regular torch relay?
2. Since this is such a regular project—every 4 years since 1936—would you consider it a nonproject, or a quasi-project? Why, or why not?
3. Is the Torch Relay another part of the Olympics themselves, perhaps a subproject?

1.2 Why Project Management?

It is popular to ask “Why can’t they run government the way I run my business?” In the case of project management, however, business and other organizations learned from government, not the other way around. A lion’s share of the credit for the development of the techniques and practices of project management belongs to the military, which faced a series of major tasks that simply were not achievable by traditional organizations operating in traditional ways. NASA’s Apollo space program and, more recently, Boston’s “Big Dig” tunnel and freeways project and the development of Boeing’s 787 “Dreamliner” are a few of the many instances of the application of these specially developed management approaches to extraordinarily complex projects. Following such examples, nonmilitary government sectors, private industry, public service agencies, and volunteer organizations have all used project management to increase their effectiveness. For example, most firms in the computer software business routinely develop their output as projects or groups of projects.

Project management has emerged because the characteristics of our contemporary society demand the development of new methods of management. Of the many forces involved, three are paramount: (1) the exponential expansion of human knowledge; (2) the growing demand for a broad range of complex, sophisticated, customized goods and services; and (3) the evolution of worldwide competitive markets for the production and consumption of goods and services. All three forces combine to mandate the use of teams to solve problems that used to be solvable by individuals. These three forces combine to increase greatly the complexity of goods and services produced plus the complexity of the processes used to produce them. This, in turn, leads to the need for more sophisticated systems to control both outcomes and processes.

The basic purpose for initiating a project is to accomplish specific goals. The reason for organizing the task as a project is to focus the responsibility and authority for the attainment of the goals on an individual or small group. In spite of the fact that the PM often lacks authority at a level consistent with his or her responsibility, the manager is expected to coordinate and integrate all activities needed to reach the project’s goals. In particular, the project form of organization allows the manager to be responsive to (1) the client and the environment, (2) identify and correct problems at an early date, (3) make timely decisions about trade-offs between conflicting project goals, and (4) ensure that managers of the separate tasks that comprise the project do not optimize the performance of their individual tasks at the expense of the total project—that is, that they do not suboptimize.

Actual experience with project management (such as through Six-Sigma projects) indicates that the majority of organizations using it experience better control and better customer relations and apparently an increase in their project’s return on investment (Ibbs and Kwak 1997). A significant proportion of users also report shorter development times, lower costs, higher quality and reliability, and higher profit margins. Other reported advantages include a sharper orientation toward results, better interdepartmental coordination, and higher worker morale.

On the negative side, most organizations report that project management results in greater organizational complexity. Many also report that project organization increases the likelihood that organizational policy will be violated—not a surprising outcome, considering the degree of autonomy required for the PM. A few firms reported higher costs, more management difficulties, and low personnel utilization. As we will see in Chapter 5, the disadvantages of PM stem from exactly the same sources as its advantages. The disadvantages seem to be the price one pays for the advantages. On the whole, the balance weighs in favor of project organization if the work to be done is appropriate for a project.

The tremendous diversity of uses to which project management can be put has had an interesting, and generally unfortunate, side effect. While we assert that all projects are to some extent unique, there is an almost universal tendency for those working on some
specific types of projects to argue “Software (or construction, or R&D, or marketing, or machine maintenance, or . . .) projects are different and you can’t expect us to schedule (or budget, or organize, or manage, or . . .) in the same way that other kinds of projects do.” Disagreement with such pleas for special treatment is central to the philosophy of this book. The fundamental similarities between the processes involved in managing all sorts of projects, be they long or short, product- or service-oriented, parts of all-encompassing programs or stand-alone, are far more pervasive than are their differences.

There are also real limitations on project management. For example, the mere creation of a project may be an admission that the parent organization and its managers cannot accomplish the desired outcomes through the functional organization. Further, conflict seems to be a necessary side effect. As we noted, the PM often lacks the authority-of-position that is consistent with the assigned level of responsibility. Therefore, the PM must depend on the goodwill of managers in the parent organization for some of the necessary resources. Of course, if the goodwill is not forthcoming, the PM may ask senior officials in the parent organization for their assistance. But to use such power often reflects poorly on the skills of the PM, and while it may get cooperation in the instance at hand, it may backfire in the long run.

We return to the subject of the advantages, disadvantages, and limitations of the project form of organization later. For the moment, it is sufficient to point out that project management is difficult even when everything goes well. When things go badly, PMs have been known to turn gray overnight and take to hard drink! The trouble is that project organization is the only feasible way to accomplish certain goals. It is literally not possible to design and build a major weapon system, for example, in a timely and economically acceptable manner, except by project organization. The stronger the emphasis on achievement of results in an organization, the more likely it will be to adopt some form of project management. The stake or risks in using project management may be high, but no more so than in any other form of management; and for projects, it is less so. Tough as it may be, it is all we have—and it works!

All in all, the life of a PM is exciting, rewarding, at times frustrating, and tends to be at the center of things in most organizations. Project management is now being recognized as a “career path” in a growing number of firms, particularly those conducting projects with lives extending more than a year or two. In such organizations, PMs may have to function for several years, and it is important to provide promotion potential for them. It is also common for large firms to put their more promising young managers through a “tour of duty” during which they manage one or more projects (or parts of projects). This serves as a good test of the aspiring manager’s ability to coordinate and manage complex tasks and to achieve results in a politically challenging environment where negotiation skills are required.

**Forces Fostering Project Management**

First, the expansion of knowledge allows an increasing number of academic disciplines to be used in solving problems associated with the development, production, and distribution of goods and services. Second, satisfying the continuing demand for more complex and customized products and services depends on our ability to make product design an integrated and inherent part of our production and distribution systems. Third, worldwide markets force us to include cultural and environmental differences in our managerial decisions about what, where, when, and how to produce and distribute output. The requisite knowledge does not reside in any one individual, no matter how well educated or knowledgeable. Thus, under these conditions, teams are used for making decisions and taking action. This calls for a high level of coordination and cooperation between groups of people not particularly used to such interactions. Largely geared to the mass production of
simpler goods, traditional organizational structures and management systems are simply not adequate to the task, unlike project management.

The organizational response to the forces noted above cannot take the form of an instantaneous transformation from the old to the new. To be successful, the transition must be systematic, but it tends to be slow and tortuous for most enterprises. Accomplishing organizational change is a natural application of project management, and many firms have set up projects to implement their goals for strategic and tactical change.

Another important societal force is the intense competition among institutions, both profit and not-for-profit, fostered by our economic system resulting in organizational “crusades” such as “total quality management,” “Six-Sigma,” and particularly prominent these days: “supply chain management.” The competition that these crusades engenders puts extreme pressure on organizations to make their complex, customized outputs available as quickly as possible. “Time-to-market” is critical. Responses must come faster, decisions must be made sooner, and results must occur more quickly. Imagine the communications problems alone. Information and knowledge are growing explosively, but the time permissible to locate and use the appropriate knowledge is decreasing.

In addition, these forces operate in a society that assumes that technology can do anything. The fact is, this assumption is reasonably true, within the bounds of nature’s fundamental laws. The problem lies not in this assumption so much as in a concomitant assumption that allows society to ignore both the economic and noneconomic costs associated with technological progress until some dramatic event focuses our attention on the costs (e.g., the global financial crisis, the Gulf oil spill). At times, our faith in technology is disturbed by difficulties and threats arising from its careless implementation, as in the case of industrial waste, but on the whole, we seem remarkably tolerant of technological change, such as the overwhelmingly easy acceptance of communication by e-mail and shopping on the Internet.

Finally, the projects we undertake are large and getting larger. The modern advertising company, for example, advanced from blanket print ads to regionally focused television ads to personally focused Internet ads. As each new capability extends our grasp, it serves as the base for new demands that force us to extend our reach even farther. Projects increase in size and complexity because the more we can do, the more we try to do.

The projects that command the most public attention tend to be large, complex, and multiorganizational endeavors. Often, such endeavors are both similar to and different from previous projects with which we may be more or less familiar. Similarities with the past provide a base from which to start, but the differences imbue every project with considerable risk. The complexities and multiorganizational aspects of projects require that many parts be put together so that the project’s objectives—deliverables, time (or schedule), and cost—are met and desired benefits achieved.

In his fascinating book, *Rescuing Prometheus* (Hughes, 1998), technology historian Thomas Hughes examines four large-scale projects that required the use of a nontraditional management style, a nontraditional organizational design, and a nontraditional approach to problem solving in order to achieve their objectives. These huge projects—the Semi-automatic Ground Environment (SAGE) air defense system, the Atlas Intercontinental Ballistic Missile, the Boston Central Artery/Tunnel (better known as “the big dig”), and the Department of Defense Advanced Research Projects Agency’s Internet (ARPANET)—are all characterized by extraordinarily diverse knowledge and information input requirements. The size and technological complexity of these projects required input from a large number of autonomous organizations—governmental, industrial, and academic—that usually did

---

2Six-sigma (see Pyzdek and Keller, 2009) itself involves projects, usually of a process improvement type that involves the use of many project management tools (Chapter 8), teamwork (Chapters 5 and 12), quality tools such as “benchmarking” (Chapter 11), and even audits (Chapter 12).

3Hughes’s term for this is “transdisciplinary” (across disciplines), which is rather more accurate than the usual “interdisciplinary” (between disciplines).
not work cooperatively with other organizations, were sometimes competitors, and could be philosophical and/or political opponents. Further, any actions taken to deal with parts of the total project often had disturbing impacts on many other parts of the system.

Obviously, these projects were not the first complex, large-scale projects carried out in this country or elsewhere. For example, the Manhattan Project—devoted to the development of the atomic bomb—was such a project. The Manhattan Project, however, was the sole and full-time work for a large majority of the individuals and organizations working on it. The organizations contributing to the projects Hughes describes were, for the most part, working on many other tasks. For example, Massachusetts Institute of Technology (MIT), the Pentagon, IBM, Bell Labs (now Lucent Technologies), RAND Corporation, the Massachusetts Department of Highways, and a great many other organizations were all highly involved in one or more of these projects while still carrying on their usual work. The use of multiple organizations (both within and outside of the sponsoring firm) as contributors to a project is no longer remarkable. Transdisciplinary projects are more the rule than the exception.

These revolutions and modifications in the style of management and organization of projects will be reflected throughout this book. We will identify the specific tasks facing top management, project executives, and PMs. We investigate the nature of the projects for which the PM is responsible; the trade-off, risk analysis, and other skills that must be used to manage projects; and the means by which the manager can bring the project to a successful conclusion.

The Project Manager and Project Management Organizations

While managing the trade-offs, the PM is expected to integrate all aspects of the project, ensure that the proper knowledge and resources are available when and where needed, and above all, ensure that the expected results are produced in a timely, cost-effective manner. The complexity of the problems faced by the PM, taken together with the rapid growth in the number of project-oriented organizations, has contributed to the professionalization of project management. In the early days of projects, being a PM was known as the “accidental profession.” There was no training or career path in project management; you just became one by accident. That has now all changed and the role has become “professionalized.”

One of the major international organizations dedicated to this professionalization is the Project Management Institute (PMI®, www.pmi.org), established in the United States of America in 1969. By 1990, the PMI had 7,500 members, and by 2017, it had exploded to 450,000 members in more than 190 countries (see Figure 1.2). This exponential growth is indicative of the rapid growth in the use of projects, but also reflects the importance of the PMI as a force in the development of project management as a profession. Its mission is to foster the growth of project management as well as “building professionalism” in the field through its many worldwide chapters, its meetings and seminars around the globe, and its journals, books, and other publications. However, there are many other project management organizations as well, such as the Association for Project Management (APM; www.apm.org.uk) headquartered in the United Kingdom, which started in the early 1970s and serves all of Europe. As well, there is the International Project Management Association (IPMA; www.ipma.ch) headquartered in Switzerland, which began in 1965 and serves a global constituency.

Another major objective of these organizations is to codify the areas of knowledge required for competent project management. As a result, the APM has its APM Body
of Knowledge, PMI has its project management body of knowledge, PMBOK® (Project Management Institute, 5th edition, 2013), as well as a new 3rd edition of Standard for Program Management and a new 3rd edition of Standard for Portfolio Management. Other groups have similar project management bodies of knowledge, as well as credentials (see the following text), such as PRINCE2 (PRojects IN Controlled Environments) used primarily in the information systems industry and employed extensively by the UK government. Table 1.1 illustrates the difference between the APM BOK and PMBOK®.

All these compilations of knowledge are meant to serve as the fundamental basis for education for PM. To certify that active PM understand and can competently apply these bodies of knowledge, various associations offer credentials certifying to this proficiency. For example, PMI offers a certificate called the Project Management Professional (PMP®) that includes a group of education, experience, and testing requirements to obtain. More recently, PMI has added seven more certificates, including one for advanced program managers, called the Program Management Professional (PgMP®), another for developing PMs, the Certified Associate in Project Management (CAPM®), which has less educational and experience requirements, and five more specialized certificates, including one in Agile project management. (More information on these certificates is contained in the Appendix to this chapter.) As a result of all this activity, the profession has flourished, with the result that many colleges and universities offer education and training in project management, and some offer specialized degree programs in the area.

Although obtaining more education in the field is always desirable, and being certified or credentialed verifies that knowledge to a potential employer, the recipient of such proof must avoid preaching the “body of knowledge” bible excessively lest they find themselves again seeking employment. As one employer stated (Starkweather and Stevens, 2011, p. 37): “It is useful background info, but fresh PMPs® want to ram that knowledge down clients’ throats and clients are not willing to pay for it.” It turns out that although recruiters like to see certification on a resumé, executives are much less interested in it and wish to see performance instead (pp. 36, 38, 39): “There is no correlation between a good PM and certification based on my 15 years of experience,” and “Would like the PMP® program to
TABLE 1.1 Comparison of APM’s BOK (5th ed., ©2006) and PMI’s PMBOK® (5th ed., ©2013)

<table>
<thead>
<tr>
<th>APM’s BOK: This 179-page book consists of 1½ page introductions, definitions, and references for 52 major project management areas of knowledge divided among 7 sections</th>
<th>PMI’s PMBOK®: This 589-page book tries to capture the basic knowledge of project management, consisting of 10 knowledge areas (Chapters 4–13) and 5 process groups: initiating, planning, executing, monitoring/controlling, and closing. It aims to describe the norms, methods, processes, and practices of PM. There are now over 4 million copies of PMBOK in circulation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Section 1: Project Mgt. in Context</strong>—projects, programs, portfolios, sponsors, PMO, project context</td>
<td><strong>Chapter 1: Introduction</strong>—projects, programs, portfolios, role of the project manager, environment, PMBOK</td>
</tr>
<tr>
<td></td>
<td><strong>Chapter 8: Project Quality Management</strong>—plan quality, perform quality assurance, control quality</td>
</tr>
<tr>
<td><strong>Section 2: Planning the Strategy</strong>—success, stakeholders, value, risk, quality, environment, health, safety</td>
<td><strong>Chapter 2: Organizational Influences and Project Life Cycle</strong>—life cycle, routine work, stakeholders, organization</td>
</tr>
<tr>
<td></td>
<td><strong>Chapter 9: Project Human Resource Management</strong>—develop HRM plan, acquire and develop team</td>
</tr>
<tr>
<td><strong>Section 3: Executing the Strategy</strong>—scope, schedule, resources, budgets/cost, changes, earned value, information</td>
<td><strong>Chapter 3: Project Management Processes</strong>—interactions, process groups: initiating, planning, executing, monitor/controlling, closing</td>
</tr>
<tr>
<td></td>
<td><strong>Chapter 10: Project Communications Management</strong>—identify stakeholders, plan communications, distribute information, manage expectations, report performance</td>
</tr>
<tr>
<td><strong>Section 4: Techniques</strong>—requirements, development, estimates, technology, value engr., modeling, testing, configuration management</td>
<td><strong>Chapter 4: Project Integration Management</strong>—charter, plan, execution, monitor/control, change, close</td>
</tr>
<tr>
<td></td>
<td><strong>Chapter 11: Project Risk Management</strong>—identify, qualitative risk analysis (RA), quantitative RA, plan response, monitor/control risks</td>
</tr>
<tr>
<td><strong>Section 5: Business and Commercial</strong>—business case, marketing, sales, financing, procurement, legal</td>
<td><strong>Chapter 5: Project Scope Management</strong>—collect requirements, define scope, create work breakdown structure, verify scope, control scope</td>
</tr>
<tr>
<td></td>
<td><strong>Chapter 12: Project Procurement Management</strong>—plan, conduct, administer, close procurements</td>
</tr>
<tr>
<td><strong>Section 6: Organisation and Governance</strong>—life cycles, implementation, handover, closeout, reviews, org. structure, org. roles, methods, procedures, governance</td>
<td><strong>Chapter 6: Project Time Management</strong>—define activities, sequence, resources, durations, schedule, control schedule</td>
</tr>
<tr>
<td></td>
<td><strong>Chapter 13: Plan Stakeholder Management</strong>—identify stakeholders, analyze stakeholder expectations, develop strategies to engage stakeholders</td>
</tr>
<tr>
<td><strong>Section 7: People and the Profession</strong>—communication, teamwork, leadership, conflicts, negotiation, HRM, behavior, learning, development, professionalism, ethics.</td>
<td><strong>Chapter 7: Project Cost Management</strong>—estimate costs, determine budget, control costs</td>
</tr>
</tbody>
</table>

more rigorously measure understanding of the methodology rather than memorization. I’ve seen very little correlation between having a PMP® and having a deep understanding of how to apply the methodology, how to tailor it for a specific situation.”

Clearly, rapid growth in the number of PMs and the membership in these project management associations were the result, not the cause, of tremendous growth in the number of projects being carried out. The software industry alone has been responsible for a significant percentage of the growth. Another major source of growth has been the need to control project activity in large organizations. As the number of nonroutine activities increases in an organization, there is an increased need in senior management to understand and control the system. Project management, with its schedules, budgets, due dates, risk assessments, statements of expected outcomes, and people who take responsibility, is a way to meet this need. These forces have combined and led to the creation of a project-organized firm. Much more will be said about project-oriented organizations in Chapter 4.
As we note in the coming chapters, the PM's job is not without problems. There is the ever-present frustration of being responsible for outcomes while lacking full authority to command the requisite resources or personnel. There are constant problems of dealing with the stakeholders involved in any project—senior management, client, project team, and public—all of whom seem to speak different languages and have different objectives. There are ceaseless organizational and technical “fires to be fought.” There are vendors who cannot seem to keep “lightning-strike-me-dead” promises about delivery dates. This list of troubles only scratches the surface.

Difficult as the job may be, most PMs take a considerable amount of pleasure and job satisfaction from their occupation. The challenges are many and the risks significant, but so are the rewards of success. Project managers usually enjoy organizational visibility, considerable variety in their day-to-day duties, and often have the prestige associated with work on the enterprise’s high-priority objectives. The profession, however, is not one for the timid. Risk and conflict avoiders do not make happy PMs. Those who can stomach the risks and enjoy practicing the arts of conflict resolution, however, can take substantial monetary and psychological rewards from their work.

Trends in Project Management

Many new developments and interests in project management are being driven by quickly changing global markets, technology, and education. Global competition is putting pressure on prices, response times, and product/service innovation. Computer and telecommunications technologies along with greater education are allowing companies to respond to these pressures, pushing the boundaries of project management into regions where new tools are being developed for types of projects that have never been considered before. In addition, the pressure for more and more products and services has led to initiating more projects, but with faster life cycles. We consider a variety of trends in turn.

Achieving Strategic Goals

There has been a greater push to use projects to achieve more strategic goals and filtering existing major projects to make sure that their objectives support the organization’s strategy and mission. Projects that do not have clear ties to the strategy and mission are terminated and their resources are redirected to those that do.

Achieving Routine Goals

On the other hand, there has also been a push to use project management to accomplish routine departmental tasks that would previously have been handled as a functional effort. This is because lower level management has become aware that projects accomplish their scope objectives within their budget and deadline and hope to employ this new tool to improve management of their functions. As a result, artificial deadlines and budgets are created to accomplish specific, though routine, tasks within the functional departments, a process called “projectizing.” However, as reported by Jared Sandberg (2007) in the Wall Street Journal, there is an important danger with this new tactic. If the deadline isn’t really important and the workers find out it is only artificial (e.g., either by meeting it but getting no appreciation or by missing it but with no penalty), this will destroy the credibility of any future deadlines or budgets, much like “the boy who cried wolf.”

Improving Project Effectiveness

A variety of efforts are being pursued to improve the results of project management, whether strategic or routine. One well-known effort is the creation of a formal Project Management Office in many organizations, which is responsible for the evaluation and improvement of an organization’s project management “maturity,” or skill and experience in managing projects. Other measures to improve project effectiveness are better liaison with the project’s stakeholders, especially
the client, through improved governance procedures, and implementing more innovative risk-sharing win—win contracts.

**Virtual Projects**  With the rapid increase in globalization, many projects now involve global teams with team members operating in different physical geographic locations and different time zones, each bringing a unique set of talents to the project. These are known as virtual projects because the team members may never physically meet before the team is disbanded and another team reconstituted. Advanced telecommunications and computer technologies allow such virtual projects to be created, conduct their work, and complete their project successfully.

**Dynamic and Quasi-Projects**  Led by the demands of the information technology/systems departments, project management is now being extended into areas where the final scope requirements may not be understood, the time deadline unknown, and/or the budget undetermined. When any one or all of the three primary project objectives are ill-defined, we call this a “quasi-project.” Such projects are extremely difficult to manage and are often initiated by setting an artificial due date and budget, and then completed by “de-scoping” the required deliverables as the project progresses, to meet those limits. However, new tools for these kinds of quasi-projects are now being developed—prototyping, Agile project management, and others—to help these teams achieve results that satisfy the customer in spite of all the unknowns. Similarly, when change happens so rapidly that the project is under constant variation, other approaches are developed such as “emergent planning” (also known as “rolling wave”), environmental manipulation, alternate controls, competing experiments, and collaborative leadership (Collyer et al., 2010).

### 1.3 The Project Life Cycle

Most projects go through similar stages on the path from origin to completion. We define these stages, shown in Figure 1.3, as the project’s life cycle. The project is born (its start-up phase) and a manager is selected, the project team and initial resources are assembled, and the work program is organized. Then work gets under way and momentum quickly builds.
Progress is made. This continues until the end is in sight. But completing the final tasks seems to take an inordinate amount of time, partly because there are often a number of parts that must come together and partly because team members “drag their feet” for various reasons and avoid the final steps.

This “stretched-S” pattern of slow–rapid–slow progress toward the project goal is common. Anyone who has watched the construction of a home or building has observed this phenomenon. For the most part, it is a result of the changing levels of resources used during the successive stages of the life cycle. Figure 1.4 shows project effort, usually in terms of person-hours or resources expended per unit of time (or number of people working on the project) plotted against time, where time is broken up into the several phases of project life. Minimal effort is required at the beginning, when the project concept is being developed and subjected to project selection processes. (Later, we will argue that increasing effort in the early stages of the life cycle will improve the chance of project success.) Normally, there is a strong correlation between the life-cycle progress curve of Figure 1.3 and the effort curve of Figure 1.4 because effort usually results in corresponding progress (although not always). Hence the mathematical derivative of the former tends to resemble the latter (Cioffi, personal communication, 2004). Moreover, since the effort curve is generally nonsymmetrical, the progress curve will in general not be symmetrical either.

Activity increases as planning is completed and execution of the project gets underway. This rises to a peak and then begins to taper off as the project nears completion, finally ceasing when evaluation is complete and the project is terminated. While this rise and fall of effort always occurs, there is no particular pattern that seems to typify all projects, nor any reason for the slowdown at the end of the project to resemble the buildup at its beginning. Some projects end without being dragged out, as is shown in Figure 1.5. Others, however, may be like T. S. Eliot’s world, and end “not with a bang but a whimper,” gradually slowing down until one is almost surprised to discover that project activity has ceased. In some cases, the effort may never fall to zero because the project team, or at least a cadre group, may be maintained for the next appropriate project that comes along. The new project will then rise, phoenix-like, from the ashes of the old.

The ever-present goals of meeting scope, time, and cost are the major considerations throughout the project’s life cycle. It was generally thought that scope took precedence early in the project’s life cycle. This is the time when planners focus on finding the specific methods required to meet the project’s scope goals. We refer to these methods as the project’s technology because they require the application of a science or art.
When the major “how” problems are solved, project workers sometimes become pre-
occupied with improving scope, often beyond the levels required by the original specifica-
tions. This search for better scope delays the schedule and pushes up the costs.

At the same time that the technology of the project is defined, the project schedule
is developed and project costs are estimated. Just as it was thought that scope took prece-
dence over schedule and cost early in the life cycle, cost was thought to be of prime impor-
tance during the periods of high activity, and then schedule became paramount during the
final stages, when the client demanded delivery. This conventional wisdom turns out to
be untrue. Recent research indicates that scope and schedule are more important than cost
during all stages. The reality of time–cost–scope trade-offs will be discussed in greater
detail in Chapter 3.

Figure 1.3 presents the conventional view of the project life cycle. There are, how-
ever, many projects that have a life cycle quite different from the S-shaped curve shown in
Figure 1.3, conventional wisdom to the contrary. Remember that Figure 1.3 shows “per-
cent project completion” as a function of “time.” The life-cycle function is essentially
unchanged if, for the horizontal axis, we use “resources” instead. In effect, the life cycle
shows what an economist might call “return on input,” that is, the amount of project com-
pletion resulting from inputs of time or resources. While the S-shaped return curve reflects
reality on many projects, it is seriously misleading for others.

For example, consider your progress toward getting a degree, which is usually spec-
ified, in large part, by the number of credit hours for courses successfully passed. For
smooth progress toward the degree, the life-cycle “curve” would probably resemble a stair
step, each level portion representing a term of study and the step up representing com-
pletion of credit toward the degree. Summer vacation would, of course, be a longer horizontal
stair continuing into the fall term. Passing a crucial licensing exam, such as the Certified
Public Accountant (CPA), the bar exam for attorneys, or even an electrician’s or plumber’s
certification, might appear as a long flat line along the horizontal axis with a spike at the
time of passing the exam; of course, the effort curve of Figure 1.4 would look completely
different.

Another type of life-cycle curve might be the installation of a new technology consist-
ing of multiple parts, where each independent part resulted in different incremental bene-
fits. In these cases, organizations prefer to install those parts resulting in “the biggest bang
for the buck” first, so the resulting life-cycle curve would show great progress at first, and
slightly less next, and continual dwindling off as the remaining parts were installed, essen-
tially concave with “decreasing returns to scale,” as the economists call it. Moreover, there
might even be an “inverse S-curve” representing fast progress at first, a slowdown in the
middle, and then speeding up again at the end.

A particularly important alternative life-cycle shape can be captured by the analogy
of baking a cake. Once the ingredients are mixed, we are instructed to bake the cake in
a 350° (F) oven for 35 minutes. At what point in the baking process do we have “cake?”
Experienced bakers know that the mixture changes from “goop” (a technical term well known to bakers and cooks) to “cake” quite rapidly in the last few minutes of the baking process. The life cycle of this process looks like the stretched-J curve shown in Figure 1.5. A number of actual projects have a similar life cycle, for example, some computer software projects or chemistry and chemical engineering projects. For example, in a software development project, programmers often work independently, developing the major modules of the program. However, the software will not have the desired functionality until the very end of the project when these modules are integrated with one another.

In general, this life cycle often exists for projects in which the output is composed or constructed of several subunits (or subroutines) that have little use in and of themselves, but are quite useful when put together. This life-cycle curve would also be typical for projects where a chemical-type reaction occurs that rapidly transforms the output from useless to useful—from goop to cake. Another example is the preparation of the manuscript for the current edition of this book. A great deal of information must be collected, a great deal of rewriting must be done, and new materials gathered, but there is no visible result until everything is assembled.

Figure 1.3 shows that, as the project nears completion, continued inputs of time or resources result in successively smaller increments of completion—diminishing marginal returns. Figure 1.5 shows the opposite. As these projects near completion, additional inputs result in successively larger increments of progress—increasing marginal returns, obviously

---

**Turning London’s Waste Dump into the 2012 Olympics Stadium**

Back in 2006, the 2012 Olympic Delivery Authority (ODA) chose a river-surrounded, 1-square-mile East London disposal site loaded with discarded appliances, tons of waste, shanties, and soil polluted with petrol, oil, lead, tar, and arsenic as the site for their 2012 Olympic Stadium to seat 80,000 visitors. To meet a mid-2011 completion due date, the ODA project manager Ian Crockford quickly assembled a project team of over 1000, including governmental employees and other stakeholders, such as the London Development Agency as landowner, politicians, utility firms, community councils, miscellaneous local governmental groups, and, of course, the athletes, all of whom wanted a voice in the site design. To clean up the site, the team created a “Soil Hospital” on-site with 60 scientists and technicians who processed and cleaned 800,000 tons of soil. To use the surrounding river for transporting equipment and materials to the site, others on the team dredged 30,000 tons of silt, gravel, garbage, and one car from 2.2 kilometers of the river, which hadn’t seen commercial use in over 35 years.

When they were ready to design the stadium, they referred to plans and schedules for London’s 90,000-seat Wembley Stadium (but that took 10 years to build) and Sydney’s 2000 Olympics 80,000-seat stadium (but that would have stretched halfway across the surrounding rivers on the London site). Moreover, the scope for this stadium was that 25,000 seats would be permanent but the other 55,000 would be temporary, built solely for the 2012 Olympics. To respond, the design team planned a highly compact field of play that was acceptable to everyone, including the athletes. Construction started in May 2008 with the pouring of concrete, but soon they found that the steel-beamed roof as designed would create turbulence on the compact field. The team redesigned a lighter, more flexible roof made, in part, with 52 tons of scrap metal from old keys, knives, and guns confiscated by the London police, fitting with the ODA’s goals of using recycled materials. The entire stadium used only one-quarter the amount of steel used in the 2008 Olympic stadium in Beijing. Construction was completed by the mid-2011 deadline at a price of £486 million, £51 million under budget.

Questions

1. What shape of life cycle did this stadium project have? Compare it with the life cycle of the river dredging portion of the effort. Compare it also with the Olympic Torch Relay project described earlier.

2. Which of the “triple constraints” seems to be uppermost here? Which constraints was Crockford trading between?

3. Were there any ancillary goals for this project? What might they have been?

bounded at 100 percent completion. In Chapter 7, we will see that the distinction between these types of life cycles plays a critical role in developing budgets and schedules for projects. It is not necessary for the PM to estimate the precise shape of the life-cycle curve, but the PM must know which type of project life cycle applies to the project at hand. It is also important to point out that other life-cycle patterns such as a linear life cycle are possible.

There is another comparison between the two types of project life cycles that is instructive. For the stretched-S life cycle in Figure 1.3, percentage of project completion is closely correlated with cost, or the use of resources. In fact, this is the basis for the use of “earned value,” a technique for monitoring project progress that we will describe in more detail in Chapter 10. However, for the stretched-J progress curve in Figure 1.5, the expenditure of resources has little correlation with progress, at least in terms of final benefit.

Risk During the Life Cycle

It would be a great source of comfort if one could predict with certainty, at the start of a project, how the scope, time, and cost goals would be met. In a few cases, routine construction projects, for instance, we can generate reasonably accurate predictions, but often we cannot. There may be considerable uncertainty about our ability to meet project goals due to various risks to the project during its life cycle. The shaded portion of Figure 1.6 illustrates that uncertainty.

Figure 1.6 shows the uncertainty as seen at the beginning of the project. Figure 1.7 shows how the uncertainty decreases as the project moves toward completion. From project start time, \( t_0 \), the band of uncertainty grows until it is quite wide by the estimated end of the project. As the project actually develops, the degree of uncertainty about the final outcome is reduced (e.g., see the estimate made at \( t_1 \)). A later forecast, made at \( t_2 \), reduces the uncertainty further. It is common to make new forecasts about project scope, time, and cost either at fixed intervals in the life of the project or when specific technological milestones are reached. In any event, the more progress made on the project, the less uncertainty there is about achieving the final goal.

Note that the focus in Figures 1.6 and 1.7 is on the uncertainty associated with project cost—precisely, the uncertainty of project cost at specific points in time. However, the same applies to the scope and schedule also, with the result that there is uncertainty in all three of these direct objectives due to risks to each of them during the project. As a result, the uncertainty over time if plotted in three-dimensional space is more of an ellipsoid.
(or partially flattened football) with differing uncertainties in each of scope, cost, and schedule. Dealing with the risk that brings this uncertainty is a major responsibility of the PM. PMBOK® devotes an entire chapter to the subject of risk management.

1.4 The Structure of This Text

This book, a project in itself, has been organized to follow the life cycle of all projects. It begins with the creative idea that launches most projects and ends with closing out the project. This approach is consistent with our belief that it is helpful to understand the entire process of project management in order to understand and manage its parts. Another characteristic of the book also relates to the process of project management: some topics, such as “procurement,” can largely be treated as stand-alone issues, discussed in a single appropriate place in the book, and then dispensed with. Other topics, however, such as “risk” or “planning,” arise throughout the book and are treated wherever they are relevant, which may be quite often. To attempt to treat them in a single section, or chapter, it would be misleading. In addition, although this book is intended primarily for the student who wants to study project management, we feel it can also be of value to the prospective or acting PM and to senior managers who initiate projects and select, work with, or manage PMs. Therefore, our interests often go beyond the issues of primary concern to beginning students.

Most actual projects will not be of the size and complexity addressed in many of our discussions. Though our intent was not to confine our remarks only to large engineering-oriented projects, these are typically the most complex and place the greatest demands on project management. Smaller, simpler projects may therefore not require the depth of tools and techniques we will present, but the student or manager should be aware that such tools exist.

Project management actually begins with the initial concept for the project. We feel that this aspect of project management is so important, yet so universally ignored in books on project management, that we included two appendices covering this area in previous editions of this book. In one paper, we discussed creativity and idea generation. In another, we described some of the techniques of technological forecasting. While our notion about the importance of these subjects is unchanged, the location of the two appendices has been moved from the end of this work to the Internet. The complete text of both appendices now appears in www.wiley.com/college/meredith (along with other items noted in the preface to this edition). One of the major factors making for successful projects is having a clear set
of goals for the project in the beginning, so it is critical that top management makes these
goals completely clear to all involved in the project, including the PM, the team, and the
users of the project.

Before undertaking a journey, it is useful to know what roads are to be traveled. While
each individual chapter begins with a more detailed account of its contents, what follows is
a brief description of chapter contents along with their organization (Figure 1.8) into three
general areas: project initiation, project planning, and project execution.

**Part I: Project Initiation** Following this current introductory chapter, the material
in Part I focuses on the context for initiating the project. We realize that many instructors
(and students) would rather get right to the basics of managing projects and that can be done
by moving directly to Part II of the text. However, we believe that without understanding
the context of the project—why it was selected and approved, what project managers are
responsible for and their many roles (such as leading a team and negotiating for resources),
the importance of the PMO, and where (and why) the project resides in the organization’s
hierarchy—a PM is courting disaster. Chapter 2 covers the initiation of a project, whether
tactical or strategic, and the evaluation and selection of a project from a portfolio of potential
projects. It also covers the governance mechanisms needed for ensuring projects deliver the
benefits to the organization that were intended by the funder of the project, including its
use by the intended final customers of the project. The topics of project success factors;
the meaning of top management commitment to a project; project management “maturity”;
the role of the PMO; and the duties of all the managers involved in running projects, such
as the project owner, the sponsor, and the program manager, are also covered. Chapter 3,
“The Project Manager,” concerns the PM’s roles, responsibilities, and some personal
characteristics a PM should possess. It also discusses problems a PM faces when operating
in a multicultural environment. Next, Chapter 4 covers a subject of critical importance to the
PM that is almost universally ignored in project management texts: the art of negotiating for
resources. The chapter also includes some major sources of interpersonal conflict among
members of the project team. Concluding Part I of the book, Chapter 5 concentrates on
establishing the project organization. Different project organizational forms are described, as well as their respective advantages and disadvantages. The staffing of the project team is also discussed.

**Part II Project Planning**  This part of the text discusses the essentials of planning the project in terms of activities, costs, risks, and schedule. Chapter 6 deals with project activity planning, both traditional and Agile, and presents tools useful in organizing and staffing the various project tasks and assessing and prioritizing risks to the project. It also contains a short discussion of phase-gate management systems and other ways of dealing with the problems that arise when multidisciplinary teams work on complex projects. Because costs and risk are important elements of project planning, the topics of budgeting and risk management, including techniques such as simulation to estimate costs and risks, are addressed next in Chapter 7. Scheduling, a crucial aspect of project planning, is then described in Chapter 8, along with the most common scheduling models such as the Program Evaluation and Review Technique (PERT), and precedence diagramming. Concluding Part II, resource allocation is covered in Chapter 9, where the Critical Path Method (CPM) of applying resources to speed up projects is explained. For single projects, we also discuss how the resource allocation problem can be addressed through resource **leveling** to minimize the cost of the resources.

**Part III: Project Execution**  Finally, we can address how to actually run a project. Chapter 10 examines the information requirements of a project and the need for monitoring critical activities, particularly through the concepts of time and cost variances and “earned value,” and projecting the final cost and time of the project. Chapter 11 then describes the control process in project management. This chapter covers standards for comparison and tools to help the manager keep the project in control. Chapter 12 deals with methods for both ongoing and terminal audits and evaluations of a project, as well as identifying factors associated with project success and failure. Chapter 13 describes the different forms of project closure, such as outright shutdown, integration into the regular organization, or extension into a new project. Each of these forms presents unique problems for the PM to solve. Finally, though the project itself may be closed, there is still the issue of realizing the full benefits from the project’s outputs and the tasks involved with this effort.

With this introduction, let us begin our study, a project in itself, and, we hope, an interesting and productive one.

---

**Summary**

This chapter introduced the subject of project management and discussed its importance in our society. It defined what we mean by a “project,” discussed the need for project management, and described the project life cycle. The final section explained the structure of this text and gave an overview of the material to be described in the coming chapters.

The following specific points were made in the chapter:

- The Project Management Institute (PMI) was founded in 1969 to foster the growth and professionalism of project management.
- Project management is now being recognized as a valuable “career path” in many organizations, as well as a way to gain valuable experience within the organization.
- Project management, initiated by the military, provides managers with powerful planning and control tools.
- The three primary forces behind project management are (1) the growing demand for complex, customized goods and services; (2) the exponential expansion of human knowledge; and (3) the global production–consumption environment.
- The three prime objectives of project management are to meet specified scope within budget (cost) and on schedule (time).
- The two primary tasks of the PM are to manage trade-offs among the three prime objectives and to manage risks.
• Our terminology for size follows in this order: program, project, task, work package, and work unit.
• Projects are characterized by their uniqueness, singular occurrence, desired end results, and finite duration.
• Projects are only the middle portion of a set of activities involving the recognition of a need, the selection of a project to meet it, designing a governance structure for the project, executing the project, and the tasks needed to ensure the benefits of the project are realized.
• Projects often start slowly, build up speed while using considerable resources, and then slow down as completion nears.

Glossary

Deliverables The desired elements of value, outcomes, or results that must be created for a project to be considered complete.

Interdependencies Relations between organizational functions where one function or task is dependent on others.

Life Cycle A standard concept of a product or project wherein it goes through a start-up phase, a building phase, a maturing phase, and a termination phase.

Program Often not distinguished from a project, but frequently meant to encompass a group of projects oriented toward a specific goal.

Project “A temporary endeavor undertaken to create a unique product, service, or result” (Project Management Institute, 2013, p. 417).

Project Management The means, techniques, and concepts used to run a project and achieve its objectives.

Risk The chance that project processes or outcomes will not occur as planned.

Stakeholder Individuals or groups with a special interest in a project, usually the project team, client, senior management, and specific public interest groups that impact or are impacted by the project.

Suboptimize Doing the best within a function or area but at a cost to the larger whole.

Task A subset of a project, consisting of work packages.

Technology The means for accomplishing a task.

Trade-off Taking less on one measure, such as scope, in order to do better on another, such as schedule or cost.

Uncertainty Having only partial or no information about the situation or outcomes, often due to ambiguity or complexity. Greater uncertainty translates into increased risk.

Work Package A sub-element of a task used to assign costs and values.

Questions

Material Review Questions

1. Name and briefly describe the societal forces that have contributed to the need for project management.
2. Describe the life cycle of a project in terms of (1) the degree of project completion and (2) required effort.
3. Describe the limitations of project management.
4. List the main characteristics of a project and briefly describe the important features of each.
5. Name and briefly describe the three primary goals of a project.
6. Discuss the advantages and disadvantages of project management.
7. How do projects, programs, tasks, and work packages differ?
8. How would you define a project?
9. What are some of the interdependencies related to a project?
10. What are some sources of conflict the PM must deal with?
11. Differentiate between direct and ancillary project goals. Would learning a new skill through the project be a direct or ancillary goal? Entering a new market?
12. Describe the characteristics of quasi-projects.

Class Discussion Questions

13. Give several examples of projects found in our society, avoiding those already discussed in the chapter.
14. Describe some situations in which project management would probably not be effective.
15. How does the rate-of-project-progress chart (Fig. 1.3) help a manager make decisions?
16. Expound on the adage, “Projects proceed smoothly until 90 percent complete, and then remain at 90 percent forever.”
17. Would you like to be a PM? Why or why not?
18. Discuss why there are trade-offs among the three prime objectives of project management.
19. Why is the life-cycle curve often “S” shaped?
20. How might project management be used when doing a major schoolwork assignment?
21. Why is there such a pronounced bend in the curve of Figure 1.2?
22. Describe a project whose life cycle would be a straight line from start to finish. Describe a project with an inverse-S life cycle.

23. How does the recognition that projects are only the middle portion of a longer chain of activities help improve the effectiveness of a project?
24. Why do project managers frequently not understand the purpose of the project they are responsible for?

Incidents for Discussion

Blanka Transport, Inc.

After several years of driving long-haul trucks, Joe Blanka founded his own trucking company, Blanka Transport Inc. (BTI), which specialized in less-than-truckload shipments in the midwestern part of the United States. Joe developed a successful method for scheduling BTI’s runs that met or exceeded the delivery expectations of its customers. As a result, BTI shipments were growing at a rate between 15 and 20 percent per year. The growth, however, was not evenly distributed across BTI’s territory. On some routes, capacity was overloaded in one direction and underloaded in the other.

Joe noticed that the imbalance problem was not stable across time. In some months, capacity was short in one direction, and in other months, it was short in another direction. He thought that one way of solving the problem would be through marketing, by offering incentives to customers whose shipments would improve load balance. Another approach to the problem was to analyze and restructure the route–equipment combinations. He also thought that it might be possible to warehouse some less-urgent shipments for short periods in order to help the balance.

Joe’s son, the first member of the Blanka family to attend college, was a senior in engineering school. He had just completed a course in project management, and after briefly describing some of the basic concepts to his father, he suggested that a process improvement project might be a good way to deal with the balance problem. He thought that the Marketing Manager and the Route Manager could serve as project co-managers. He also felt that some of the older, more experienced drivers might be helpful. The objective of the project would be to decrease the size of the route imbalances by 75 percent in a 1-year period.

Questions
Is this a proper approach to the problem? Is this a “project”; if so, what are the three triple constraints? What, if any, helpful suggestions would you make to Joe?

Maladroit Cosmetics Company

The plant manager of the Maladroit Cosmetics Company must replace several of her filling machines that have become obsolete. She is about to take delivery of six machines at a total cost of $4 million. These machines must be installed and fully tested in time to be used on a new production line scheduled to begin operation in 6 months. Because this project is important, the plant manager would like to devote as much time as possible to the job, but she is currently handling several other projects. She thinks she has three basic choices: (1) she can handle the project informally out of her office; (2) she can assign the project to a member of her staff; or (3) the company that manufactures the machines can handle the installation project for a fee close to what the installation would cost Maladroit.

Questions
Would you classify the work of installing the six machines as a project? Why or why not? Explain how the PM might trade off one of the primary objectives for another. What type of life cycle would you envision the machine installation work would follow? Why?

Continuing Integrative Class Project

It often helps in communicating the process, difficulties, and satisfactions of project management if the class can do a team project together during the term of the course. The instructor may have a prechosen project for the class to work on, perhaps in a local organization, or the school itself (where there are many excellent projects: the cafeteria, parking, library, counseling, class scheduling, etc.), but if not, the following project is offered as an alternative.
The project is to prepare a “Student Study Guide” for this course, due (time requirement) on the last day of the course before the final examination. The purpose of the guide is to help the students learn the material of the course, both by preparing the guide and by using it to study for the final examination. The requirements (scope) for the guide are as follows:

- A professional-looking appearance.
- A consistent approach throughout the chapters.
- A copy for every student, as well as the Instructor.
- Presented in hard copy CD, flash memory, or electronic (e.g., web) form (check with your Instructor).
- Everyone in class must participate, with one exception noted further below.
- If subteams are used, they must not be organized to operate independently of each other (e.g., by doing all the work on one of the chapters).
- The project plans can be constructed manually or in Microsoft Project® or another software program (check with your Instructor).

In addition, one student will be appointed as “Historian,” whose job is to monitor and prepare a written report on the progress of the project over its duration. This includes both the tasks to be accomplished and also the attitude and spirit of the PM, the project team and/or subteams, and the various stakeholders in the project (team members, Instructor, future students who may use the Guide) as well as the culture and environment of the project. The main task of the Historian is to compare the reality of the class project to that described in the textbook and point out in the written report similarities and differences that will be recognizable by the PM and team members. The Historian will have no work to do on the project itself, but will need to sit in on meetings, confer with the PM and subteam heads, talk to team members occasionally, confer with the Instructor, and other such activities as needed to properly monitor task progress. The role of this person is especially critical for the class to learn how closely their project followed the typical path of a normal project, what problems arose and how they should have been handled, and so forth. As a result, this person should probably be selected by the Instructor right at the beginning of the course.

There may also be some expenses (budget requirement), such as photocopying costs and travel expenses, that may require assistance from the Instructor. Usually, these costs are minor, but it depends on the project. Of course, in a real project the major cost would be the labor/personnel costs of the team members doing the work, a cost that is essentially “free” here.

In future chapters, we will continue to develop the various elements of the project, such as selecting the PM, organizing the team, scheduling the deliverables, and monitoring progress. However, executing the requisite tasks of the project takes the most time in a real project but is a topic that is outside the scope of this text, which concerns only the generic tasks of project management. (Every project will have different tasks associated with it, many with very technical requirements.) Therefore, it will be necessary to forge ahead and do all the preparatory project elements, particularly in Parts I and II of the book, so that progress on the project tasks can begin right away. It would, of course, be best if the class could read all the material up to Chapter 10, which initiates Part III: Project Execution, where the work begins, before actually starting the project. Unfortunately, the course would be almost over by then and it would be too late to start a project. As a result, the PM and the class will have to skip ahead and read the Continuing Integrative Class Project assignments, at least for Chapters 2–10 now; hopefully, they will discover in retrospect how they could have conducted each of the various elements of the project better.

But for right now, it is most important to cover the project elements in Chapters 2 and 3—what the project will be and who will be the PM, respectively, so the project can get underway ASAP. It is best to do these two elements in the very first class, the first one in consultation with the Instructor and the second one with the Instructor ABSENT from the room but with instructions for where to find him or her once the class has selected the PM, hopefully within 20 minutes but most certainly by the end of the class. Good luck!

Bibliography


Appendix: PMI Certifications

We discuss here only the CAPM® and PMP® certifications. For information on the other credentials, please visit the PMI website at www.pmi.org.

Certified Associate in Project Management (CAPM®)

This is the “entry level” credential, which typically leads to qualifying for the full Project Management Professional (PMP®) credential, although a candidate can maintain their CAPM® certification by retaking the exam every 5 years. It is mainly for project team members with 1500 hours of documented experience or for those who can verify they have taken 23 face-to-face hours of project management classroom education or training. The exam is 3 hours to complete 150 questions and costs $225 ($300 for non-PMI members) to sit for the exam.

Project Management Professional (PMP®)

This is the longstanding standard certification that a person is fully competent in project management and regularly lead and direct project teams. The credential is maintained by gaining 60 PDUs every 3 years. To sit for the exam, a candidate must have a high school education plus 5 years of documented project management experience and can verify they have taken 35 hours of face-to-face project management classroom education or training. Alternatively, a candidate can demonstrate that they have a bachelor’s degree (or global equivalent) plus 3 years of documented project management experience and can verify they have taken 35 hours of project management classroom education or training. The exam is 4 hours to complete 200 questions and costs $405 (or $555 for non-PMI members, based on 2017 rates) to sit for the exam.
