Chapter 1

Introduction to the Challenge of Cost and Value Management in Projects

The past 30 years have witnessed a dramatic increase in the number and variety of organizations engaged in project-based work. In addition to "traditional" project-oriented industries, like construction, aerospace, and pharmaceuticals, service industries as diverse as finance, utilities, telecommunications, and insurance are beginning to embrace project-based ventures.

This paradigm shift is due to growing recognition that projects and their effective management can provide organizations with a significant competitive edge through cost reduction, enhanced responsiveness, and overall value to customers. Consequently, a number of organizations have adopted many of the well-known techniques of project management, and professional project management organizations have witnessed marked increases in membership.

Despite this enormous interest in projects and project management practices, success rates in many industries are at alarmingly low levels. In addition, bad news about high-profile projects continues to dominate the headlines—in both the public and private sectors. Consider these recent examples:

> **London's Costs for 2012 Soar.** A British parliamentary committee criticized the spiraling costs of the 2012 London Olympics and called for greater transparency on finances. In November, Olympics Minister Tessa Jowell said infrastructure costs had risen by $1.8 billion from the $4.7 billion figure quoted in the bid. Some British lawmakers have speculated the total cost could reach more than $15.9 billion.[1]

> **Lockheed Gets Navy Warning Shot.** The Navy on Friday said it ordered Lockheed to stop work on the new coastal-waters warship because of big cost overruns. Construction on the first ship will continue, but the second Lockheed Martin ship is on hold and subject to a 90-day stop-work order. The Navy didn't disclose the size of the cost increase, but the Lockheed Martin ship now is expected to cost $320 million or more. The ships are supposed to cost $220 million each once they are in production. The Navy acknowledged last year that the lead ships for each of two designs was more likely to cost on the order of $300 million each.[2]

Clearly, something is going wrong.

1.1 IMPORTANCE OF COST AND VALUE MANAGEMENT IN PROJECTS

The key features that define project success are twofold: managing costs to achieve efficiencies, and creating and enhancing value. These two elements enable project stakeholders to understand the activities and resources required to meet project goals, as well as the expenditures necessary to complete the project to the satisfaction of the customer.

Unfortunately, in the field of project management today, significant cost and schedule overruns are the norm, rather than the exception. In fact, recent research that examined the success rates of information technology (IT) projects indicates that the majority of these projects neither met their cost objectives nor delivered the promised value. For example:

- In a study of 300 large companies, consulting firm Peat Marwick found that 65 percent of hardware and/or software development projects were significantly behind schedule, were over budget, or failed to deliver value in terms of expected performance.[3]
- In a report on the current state of IT project implementation, the Standish Group predicted that out of a total of 300,000 projects that cost over $350 billion, approximately 43 percent will overshoot their initial cost estimates, while 63 percent will fall behind schedule and perform at only two-thirds of their expected capability.[4] In other words, these projects will meet neither their cost nor their value objectives.

Why do these problems persist, despite the fact that tools for cost efficiency and value enhancement are widely used, and their benefits are well understood? One key answer is the lack of an integrated cost and value management framework.

Before we explore this integration of cost and value, a brief discussion of their concepts in relationship to projects is worthwhile. Both require well-defined and structured management processes, commonly referred to as cost and value management. Project cost management focuses on issues such as cost estimation and budgeting, cash flow management, and cost control. On the other hand, the emphasis of value management is on optimizing project value—given cost, time, and resource constraints—while meeting performance requirements such as functionality and quality.

Cost and value management remains a critical but often underrepresented issue for a couple of reasons. First, in this book, we define value as the relationship between meeting or exceeding the expectations of project stakeholders, as well as the resources expended to meet or exceed those expectations. This definition clearly implies that project cost and value are inextricably linked, to the point where any attempt to enhance project value without a thorough understanding of its impact on cost and associated trade-offs is meaningless.

Second, project value is a multidimensional concept. Different project stakeholders with different vested interests have different perceptions about what constitutes value to them. For example, the expectations of top management often leave IT project teams scrambling to complete projects as quickly as possible. Internal customers, however, may request additional features that will delay completion. Each stakeholder sees value in the finished project; however, the measures they use to determine value can actually conflict. And yet, despite these differences, the one constant in any attempt to enhance project value is its cost ramifications.

The inability to clearly understand this complex relationship between project cost and value is one of the primary reasons why it is an underrepresented issue. The following case example illustrates this point.

Case Study: Boston's Central Artery/Tunnel Project

The Central Artery highway in Boston was first opened in 1959 with considerable fanfare. Hailed as a technical marvel and model of proactive urban planning, the elevated six-lane highway was designed through the middle of

the city and was intended to handle a traffic volume of 75,000 vehicles a day. However, by the early 1980s, the highway was overburdened by a daily volume of over 200,000 vehicles. Consequently, the city of Boston experienced some of the worst traffic congestion in the country, with bumper-to-bumper traffic that lasted for over 10 hours every day. The traffic woes of the Central Artery highway were further exasperated by an accident rate that was over four times the national average. Clearly, the Central Artery had not only become inadequate to handle the city of Boston's growing traffic volume, but had also become one of the most dangerous stretches of highway in the country.

To alleviate the problem, the City of Boston, under the supervision of the Massachusetts Turnpike Authority and with the help of Federal and State funding, came up with the Central Artery/Tunnel (CA/T) project, more commonly referred to in the Boston area as the ''Big Dig.'' The two main features of the CA/T project are (1) an eight- to ten-lane underground expressway replacing the old elevated roadway, with a 14-lane, two-bridge crossing of the Charles River; and (2) extension of I-90 by building a tunnel that runs beneath South Boston and the harbor to Logan Airport. The CA/T project that began in the city in the early 1980s has been a work in progress for nearly 20 years.

From the outset, the CA/T project faced enormous technical and logistic challenges. First, the project involved construction of eight miles of highway with a total of 161 lane miles, with almost half them to be constructed underground. The project at its peak required 5,000 workers, excavation of 16 million cubic yards of soil, and 3.8 million cubic yards of concrete. Second, all of these construction activities had to be performed without disrupting existing traffic patterns, the current highway system, and its traffic flows.

The project began in 1983 with an original completion date of 1998 and a budget of $2.5 billion. However, neither the original budget nor the completion date has been met, and both have been revised upward frequently. For example, the original budget of $2.5 billion was adjusted to $6.44 billion in 1992, and $14.63 billion in 2003.

Because of the soaring cost projections and schedule overruns, the CA/T project has been source of considerable controversy. The situation was so bad that in 2000 a Federal audit of the project declared the Big Dig officially bankrupt. One of the audit's significant conclusions was that the out-of-control costs were due primarily to management's failure to hold contractors accountable for bids or mistakes. In fact, the public dissatisfaction over the delays and rising costs was so intense that the project manager of CA/T project had to resign. After more than 14 years of construction, the CA/T project was officially declared completed in the spring of 2006, in spite of the fact that some finishing work still remained. All of the tunnels and bridges and their connections and ramps to surface roads were opened to the public.

Unfortunately, the story does not end there. On July 10, 2006, the bolts holding four sections of cement ceiling panels (weighing 12 tons) failed, causing a section to collapse onto traffic below, where it tragically killed a commuter. Subsequent analysis of ceiling bolts in the rest of the tunnels showed 242 others already showing signs of stress, which led to a lengthy shutdown of the entire tunnel system for inspection and repairs.

Coupled with the March 2006 demand by the Massachusetts Attorney General for $108 million in refunds from contractors for ''shoddy work'' (including substandard concrete throughout the tunnel system), this event highlights the cloud under which the most expensive highway project in American history operates. Most recently, the State of Massachusetts formally assumed control of the Boston CA/T from the Turnpike Authority, and a concerted effort to pinpoint the causes of the Big Dig's poor cost estimation and control has begun.

In the final analysis, the Big Dig was certainly a technological marvel. It will undoubtedly provide enhanced value to its users through significant reduction in traffic congestion, carbon monoxide emissions, and improving the ''green'' reputation of the city. From a public relations and cost perspective, however, the project is currently viewed as a disaster.

Today, the taxpaying public continues to justifiably ask the fundamental question: ''Where is the value in a project that has gone on for many years past its due date—and threatens to continue disrupting the lives of commuters in the Boston area?'' The Massachusetts Turnpike Authority (MTA) believes that the answers lie in poor cost management and lack of adequate oversight from project managers.[5]

This book was written to explore the dynamic relationship between project value and cost, as well as the mechanisms used to achieve integration between them. Our goals are fourfold: first, to provide practicing managers with a thorough understanding of the various dimensions of cost and value in projects, the factors that impact them, and the most effective managerial approaches for achieving cost efficiency and value optimization. Unlike most project management books, which deal with this topic from a tactical perspective, this book takes a strategic approach.

Second, the book thoroughly covers the various elements of value management from a project perspective, including planning, engineering, and analysis. In addition, we examine various project management decision areas that have the potential to enhance value, along with relevant managerial approaches that can be used to optimize that value. Third, we provide an integrated framework for managing cost and value that can be useful to practicing project managers. Finally, this book contains a good

deal of prescriptive advice on how to avoid common pitfalls in managing cost and value in projects.

We'll begin by exploring the essential features of effective cost and value management.

1.2 KEYS TO EFFECTIVE PROJECT COST MANAGEMENT

Effective project cost management is an extremely complex process that begins very early during a project life cycle, and long before its actual start. Among the factors that influence success is a reasonable and accurate system for estimating costs. Table 1.1, drawn from Rodney Turner's work,[6] highlights some of the most important considerations when creating a cost estimation system.

Table 1.1 Keys to effective cost estimation

1. A clear, complete, and unambiguous definition of the project and the scope of work involved
2. A thorough assessment of the potential risks involved, with well-thought-out action plans to minimize their possible impact
3. A well-trained and competent project manager
4. A thorough understanding, by all stakeholders, of the various types of costs that are likely to be incurred throughout the life of the project
5. A project organizational culture where there is a free flow of communication, so that all project participants clearly understand their responsibilities
6. A well-defined project work structure where work packages are broken down into manageable sizes
7. Meaningful budgets, where each work package is allocated its appropriate share of the total budget, commensurate to the work involved
8. An accounting system and coding scheme that are well aligned with the work breakdown structure and are compatible with the organization's management information system
9. A cost accounting system that will accumulate costs and allocate them to their relevant cost accounts as and when they are incurred
10. A prioritized and detailed work schedule, drawn from the work breakdown structure, which assigns and tracks the progress of individual tasks
11. Effective management of well-motivated staff, to ensure that progress meets or beats the work schedule

Table 1.1 Continued

12. A mechanism for comparing actual and planned expenditures for individual tasks, with the results extrapolated to cover the entire project
13. The ability to bring critical tasks that are late back on schedule, including providing for additional resources or taking other prompt remedial measures
14. Adequate and effective supervision to ensure that all activities are done right the first time
15. Supervision of staff time sheets so that only legitimate times are booked to various cost codes
16. Proper drafting of specifications and contracts
17. Discreet investigation to confirm that the customer is of sound financial standing, with sufficient funds to make all contracted payments
18. Similar investigation, though not necessarily as discreet, of all significant suppliers and subcontractors (especially those new to the contractor's experience)
19. Effective use of competitive tendering for all purchases and subcontractors to ensure the lowest cost commensurate with quality and to avoid committing to costs that exceed estimates and budgets
20. Proper consideration and control of modifications and contract variations, including charging all justifiable claims for price increases to the customer
21. Avoidance of all nonessential changes, especially those for which the project customer will not pay
22. Proper control of payments to suppliers and subcontractors to ensure that all invoices and claims for progress payments are neither overpaid nor paid too soon
23. Recovery of all incidental expenses allowed for in the contract charging structure (for example, expensive telephone calls, special printing and stationery, travel, and accommodation)
24. Proper invoicing to the customer, ensuring that claims for progress payments or cost reimbursements are made at the appropriate times and at the correct levels, so that disputes that could delay payments do not arise
25. Effective credit control to prevent payments from the customer from becoming long overdue
26. Internal security audits to help prevent losses through theft or fraud
27. Regular cost and progress reports to senior management, highlighting potential schedule or budget overruns in time for corrective action to be taken
28. Cost-effective design, perhaps using value engineering
29. Prompt action to close off accounts at the end of the project, to prevent unauthorized time bookings and other items from being charged to the project

While this list is not all-inclusive, its elements do have a significant influence over the effectiveness of cost management for projects large and small. Of more immediate interest is the sheer complexity and breadth of an effective cost estimation system, suggesting that organizations intent on controlling their costs need to recognize that there is no such thing as a simple, quick fix. Rather, downstream project cost management rests heavily on the care and accuracy of detailed estimation occurring early in the project. As the old saying suggests, "We can't fix what we can't see." Taken one step further, we can't control what we did not plan for!

1.3 ESSENTIAL FEATURES OF PROJECT VALUE MANAGEMENT

"Project value" refers to the relationship between the needs of different project stakeholders and the resources used to satisfy them. What constitutes project value, however, can be hard to pin down, because different stakeholders have different views. The challenge of value management is to understand and reconcile these differences.

Essentially, value management focuses on enhancing project value, given cost and time constraints, without any negative impact on the project facility's functionality, reliability, or quality. Effective project value management includes the following key features:

1. *Careful analysis and identification of project needs and scope*—The first step in effective value management lies in a clear project definition and scope analysis.
2. *Thorough planning of the project and subsequent work*—Effective planning helps to ensure that the project is developed to maximum cost efficiency with no unnecessary steps or wasted effort.
3. *Identification of key areas of opportunities that can influence project value*—The project team's goal is to enhance positive features of the project while keeping control of costs. Carefully weighing the cost/benefit analysis for a project is the key to enhancing value.
4. *Development of alternatives for exploiting the identified opportunities for improving project value*—Multiple paths may be available for enhancing value, some of which are more cost effective than others.

5. *Evaluation of alternatives; development of proposals and action plans*—Performing a clear trade-off analysis can help create alternatives and select the best choices for improving value.
6. *Use of a performance monitoring system for tracking project value*—The project team must have the means to accurately monitor the project, gain timely and actionable information, and make "on-line" decisions and choices among alternatives.
7. *Ensure a free flow of communication that cuts across organizational boundaries*—To effectively manage for value, a cross-functional mindset must prevail throughout the organization, so that ideas, alternatives, and creative solutions have the widest possible arena for exploitation.

In the remainder of this chapter, we will present an overview of the various topics that are discussed in this book.

1.4 ORGANIZATION OF THE BOOK

The book's key content and order of chapters are presented below, with Figure 1.1 providing the model for organization. We deliberately organized the book to resemble a project activity network, to illustrate the chronological sequencing of critical cost and value management activities, as well as the manner in which they must be integrated. This approach enables us to provide guidance regarding the important elements in these activities, and to offer some suggestions for a reasonable order in which to address them. Our ultimate aim is to propose an integrated framework by which project managers can incorporate cost and value thinking into their management style.

The opening chapter has explained the importance of this topic, reviewed the book's organization, and provided examples of the nature and scope of the problem, as well as its impact on the larger economy. Chapter 2 focuses on why it is critical to identify the needs and scope of a project at the earliest possible stage. This enables a project activities framework to be developed and project performance to be monitored—both of which ensure that promised value is delivered. An accurate definition of project scope and needs also sets the stage for identifying resources and approximate costs for successful project completion. Finally, needs assessment can alert project stakeholders, very early in

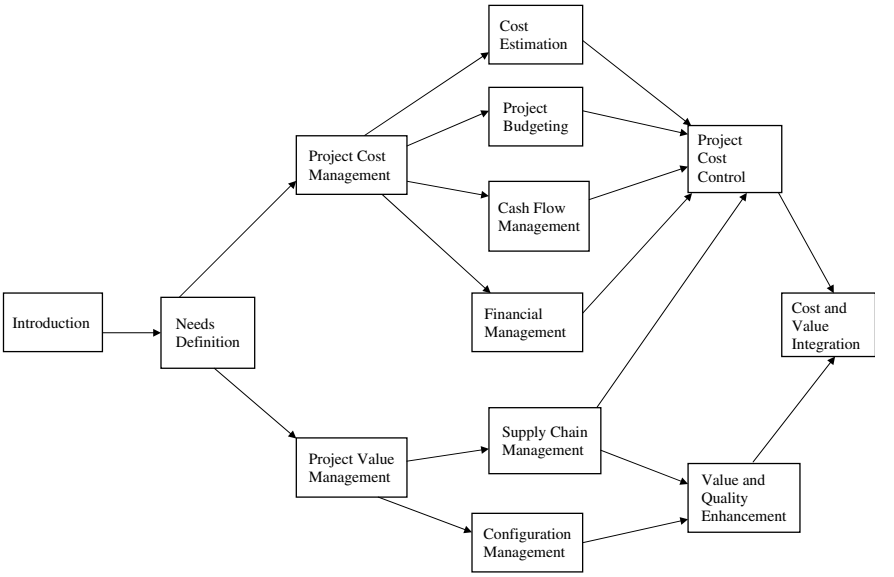

Figure 1.1 Cost and value management framework

the project life cycle, that the project as assigned may not meet needs and should be modified or canceled.

The next three chapters explore the topic of project cost management. Although the actual steps involved in the cost management process will depend on the nature of the project, the most commonly used sequence consists of cost estimation, budgeting, and cost control.

Chapter 3 covers cost estimation, which is important for a number of reasons. Estimation creates a standard against which actual expenditures can be compared, which in turn provides the basis for cost control. In addition, comparing cost estimates with estimates of return provides the basis for assessing project feasibility. When cost estimates are considered along with projected returns, they facilitate decision-making relating to project financing and funding. Cost estimates also provide mechanisms for managing cash flow during the course of a project, and for revising project activity duration—and they provide a framework for allocating resources as the project progresses. For example, as activity times are estimated on the basis of work content and resource availability, cost estimates for crashing project activities will help determine overall project acceleration costs. All of this is merely scratching the surface—we examine cost estimation in much greater detail throughout the course of the chapter.

Any discussion of project cost management must also include forecasting, which takes place at the front end of the project environment. Forecasting is the primary mechanism for ensuring that the project is on course, or for changing its direction if conditions in the project environment change. The context of our discussion relates to accurately forecasting activity times, as well as the relationship between project time/cost (also know as an S-curve), as they both have cost implications. Various approaches to forecasting—as well as some techniques that can be useful for forecasting activity times and the project S-curve—are found in the appendix to Chapter 3.

In Chapter 4, we discuss various concepts and approaches relating to project budgeting, which involves a combination of cost estimation, analysis, repetitive work, and, to a certain extent, intuition. An effective project budget is essentially a plan that integrates the allocation of resources, the project schedule, and the project's goals. Meaningful budgets require intense communication among all interested stakeholders, make use of multiple sources of data, and are developed concurrently with the project schedule to ensure that all milestones can be met.

When it comes to project cost control, a frequently made mistake is to compare the predicted rate of expenditures over time with the actual costs incurred. Without factoring in some measure of the work completed for expenditures incurred, any comparison for the purposes of cost control will lead to erroneous conclusions. The earned value management (EVM) method solves this problem. In essence, EVM requires that not merely the planned expenditure and actual cost incurred are measured, but also the *value of the work actually accomplished at the cost rates set out in the original budget*. In addition, the information EVM provides about the efficiency with which budgeted money is used relative to realized value makes it possible to create forecasts about the estimated cost and schedule to project completion. The topic of project cost control, along with the concepts of EVM and S-curves, are examined in detail in Chapter 5.

In the next two chapters, we discuss two other topics that can have a direct influence on overall project costs: cash flow management and financial management. Cash flow management is a vital process that is inextricably linked to the project cost management process—without it, effective cost management cannot be achieved. Simply defined, cash flow is the net difference between the flows of money in and out of the project. Cash flow management is important from the perspectives of both the project sponsor and its contractors. The sponsor must have access to funds

to pay the contractor, and must be able to keep track of expenses and project progress. The contractor, on the other hand, should accurately monitor costs as they are incurred, bill the sponsor at the appropriate time, and have appropriate control systems to ensure that payments are received without excessive delays. The topic of managing cash flow is the focus of Chapter 6.

Project financing and its management is a vast subject area that cannot be examined in a single chapter. However, Chapter 7 covers some very important elements relating to the features and sources of project financing, and includes some key issues to consider in managing project finances. These are important elements of the overall project strategy—the ways in which a project is funded and its finances are managed have a significant impact on project cost, cash flow, and, most importantly, success. Sometimes, these outlays can be enormous and extremely risky: Boeing, for example, routinely commits well over $1 billion dollars in nonrecoverable R&D expenses for new project ventures. If the parent organization borrows the finances needed for the project, the money has to be repaid—regardless of success or failure.

The next series of chapters deal with how to manage and enhance value in projects. The topics include value management, change control and configuration management, project supply chain management, and quality management.

Chapter 8 explores the topic of value management in projects. Value management (VM) is a management style that focuses on enhancing overall business performance through innovation, skills development, and people motivation, and by creating synergies. Value management encompasses all value-enhancing techniques, including *value planning, value engineering*, and *value analysis.* In this chapter, we discuss issues such as the relationship between value management and value engineering, value planning, and value analysis, the difference between value and cost management, and various VM techniques.

The essence of configuration management (CM) is to gain the continual agreement of stakeholders regarding configuration and functionality of the project's end product throughout the project's lifecycle. By doing so, value to the project's stakeholders is enhanced. Specifically, configuration management is the process by which the configuration of individual components manages the functionality of those components, as well as the functionality of the total product. Configuration management is also used to manage the work methods by which each component is made and

built in to the product. We will learn about CM and its various features in Chapter 9.

Chapter 10 covers supply chain management (SCM), a process that attempts to fully integrate the network of all organizations and their related activities in an efficient manner. The focus of SCM is to add value to the product or service at each stage of the chain, so that it meets or exceeds customer expectations. (For this reason, supply chains are often referred to as "value" chains.) While it has enjoyed great popularity elsewhere, SCM is only recently gaining ground among many project organizations. Consequently, project organizations not employing supply chain processes are continually plagued by problems of poor quality, low profit margins, and schedule and cost overruns. The reality is that project organizations with their multitude of suppliers have an urgent need to adopt SCM-related practices. To that end, we discuss the unique nature of project supply chains in this chapter, as well as some strategies for applying SCM-related concepts and techniques to projects.

The concept of "quality" is multidimensional. What constitutes quality, and how quality is defined, may vary among different customer groups. For example, among piano buyers, performing artists who have the knowledge and sophistication to evaluate the subtle differences between the piano's tone and feel are more likely to buy a piano such as the Steinway Grand. Less sophisticated consumers, who are generally more interested in consistent quality, will more likely buy a Yamaha or Baldwin upright piano.[7] In our chapter on value management, the concept of project quality is dealt with indirectly under the umbrella term of "value." Similarly, the quality dimensions of performance and functionality are addressed in the material on configuration management. However, given the uniqueness of a project-based environment, the role of quality and its contribution in enhancing the overall value of projects takes on added importance. We examine the various aspects of a project's quality and quality management in Chapter 11.

The final chapter is organized in a capstone format that provides an integrated framework incorporating the entire scope of this book. Our discussion focuses on the required processes that should be in place to effectively manage cost, time, value, and risk aspects of a project. For example, we explore how risk management approaches can be used to protect project value from inevitable uncertainties.

As we have said, one of the greatest challenges facing project managers today is the need to develop a better understanding of the roles that cost

and value management play in successful project implementation. Project management texts touch the surface of these duties, but it is a rare work that gives them their due. This is a pity, particularly given the numerous projects that fail due to the inability of project teams and organizations to effectively manage these twin requirements.

Readers will find that we offer a sequential methodology for addressing cost and value management. First, it is necessary to effectively plan for them. Just as we plan for a project's development through sophisticated means such as work breakdown structures and network diagrams, we must include effective cost and value planning in our project management repertoire. Second, cost and value must be controlled on an ongoing basis. Projects, as we know, do not succeed or fail solely on the basis of sound planning—project execution requires us to apply those plans in a meaningful way. Likewise, cost and value management include a definite "control" process to monitor the ongoing status of cost and value and make necessary corrections. Finally, good project management also requires an evaluation stage, in which we analyze what went right and what went wrong. For cost and value management, the analysis component is equally critical. It is only through critical analysis that we learn. It is only through learning that we improve.

We believe that this book comes at an opportune time in the advancement of project management knowledge and processes. In recent years, projects have become one of the key means by which organizations add to their bottom lines—making it critical to master project-based skills, including cost and value management. Proficiency in these two areas will confer an important advantage on organizations competing with each other for profits, market share, and technical innovations. We hope that readers find much of "value" for themselves and their organizations in these pages.

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