

Introduction

Owners are demanding that designers and builders relate more strongly to their financial and economic objectives and demonstrate more effective cost management in the delivery of projects. Regardless of industry, location, or financial situation, owners expect their design and construction team to manage project costs in an accurate and responsive manner. Architects, as leaders and managers of the design process, are also expected to take a leadership role in the cost management process.

Owners expect that an accurately defined budget will be prepared early in a project and, subsequently, that the project will be completed to required scope, quality, and performance, all within that budget. Owners invariably consider cost to be a high-priority issue and often a differentiating aspect of perceived success or failure, regardless of the quality or other attributes of the built facility. Often, meeting a budget is necessary to financially justify a project.

During the past decade, organizations including the American Institute of Architects (AIA), A/E/C Systems, Georgia Institute of Technology, Pennsylvania State University, The Design-Build Institute of America, and the U.S. General Services Administration have supported the development of method-

ology, seminars, and other educational programs on this subject. Numerous papers, workbooks, and several textbooks have been written on the subject of cost estimating and cost management. Furthermore, organizations including The Construction Specifications Institute, The American Society for Testing and Materials (ASTM), The National Institute of Standards and Technology (NIST), and The National Institute of Building Sciences (NIBS) have cooperated on efforts to define and describe cost-estimating and document-management formats.

This book, *The Architect's Essentials of Cost Management*, reviews, collects, and expands on these efforts to present an organized approach to cost management for architects and designers, in the following format:

- ▶ Chapter 1 introduces the topic.
- ▶ Chapter 2 discusses building economics, which include components that make up construction cost, major factors influencing cost, and new industry trends to consider.
- ▶ Chapter 3 deals with cost-estimating methodology and presents suggested formats, probable cost drivers, basic estimating principles, and recommended estimating methods, as well as advanced techniques associated with life-cycle costing and value management.
- ▶ Chapter 4 summarizes available cost-estimating tools, both in published form and through computer systems; how to develop and maintain cost data files; how to work with cost indexes; and offers some suggestions on dealing with computer-assisted estimating.
- ▶ Chapter 5 suggests a cost management methodology, with a focus on the essentials to be

applied. Subjects include budgeting and cost planning, cost management during design and construction, and the potential impacts of alternate delivery methods on cost management.

What in fact are the essentials of cost management? The methodology is not complex in concept; in practice it is very simple, comprising only three steps:

1. Accurately define scope, user/owner expectations, and budget from the outset.
2. Assure that scope, user/owner expectations, and budget are all in alignment.
3. Maintain a balance and alignment through completion of the project.

Graphically, this relationship is depicted in Figure 1.1.

Experience has clearly shown that projects must start right to have a reasonable chance of finishing right. That said, for numerous reasons, it seems to be extremely difficult to invest the time and effort required to start projects correctly. Typically, this is not one person's fault per se; it is simply a result of the impatience that is common to our industry.

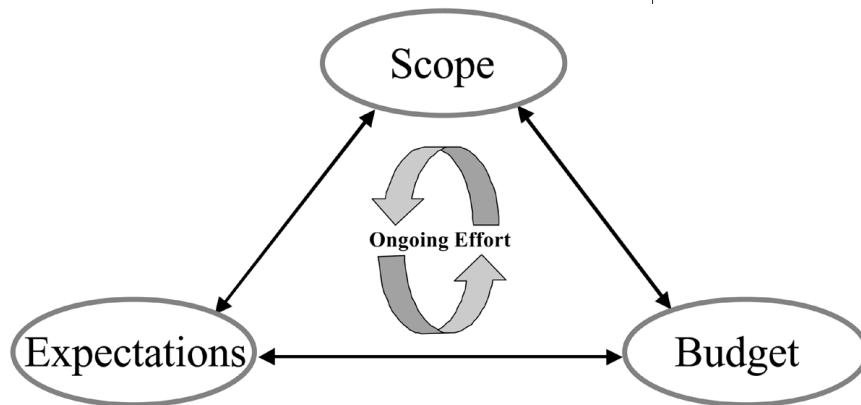


Figure 1.1 Relationship of scope, expectations, and budget.

There is often a rush to get a project started, to commit funds, to gain a leg on the competition, and to commit resources.

Alignment problems are caused by disconnects among scope, expectations, and budget. One lesson we have learned over the past several decades is that it is extremely difficult, time-consuming, and contentious to try to design our way out of alignment problems. The message is simple: *The design process should not be a solution for alignment problems.*

Initial alignment problems usually result from incomplete or ineffective planning and programming, from inconsistencies in requirements, or from significantly flawed conceptual approaches. To solve these problems, planning and programming level solutions are required. When alignment problems surface during the design process, that is the time to recognize that the project will likely require replanning and reprogramming, not just redesign. This is not just semantics, but a clear statement that design should follow adequate planning and programming.

Terminology

In our industry, there are few absolute rights and wrongs in use of terms and accepted standards, and definitions vary considerably. However, to facilitate clear communication it is important to use basic definitions and terminology consistently. To that end, in this book, we will apply the following definitions:

- ▶ *Scope.* Essentially, scope defines the “how much” portion of the process, to include the measurable and quantifiable aspects of the facility: measures of program, building geometry, and facility performance.

- ▶ *Expectations.* A working definition of this term is difficult to achieve, as it is subject to judgment. That said, essentially, we can define expectations as the “how good” component of the process, the resulting quality and performance the client anticipates. These expectations include aesthetics, quality, systems performance, facility performance, project delivery, and external requirements.
- ▶ *Budget.* Budget addresses the “what will it cost” portion of the process. A comprehensive budget, especially from the owner’s point of view, should include not only the initial procurement, but also the total owning costs of the facility, which are composed of initial costs, future onetime costs, facility annual costs, and functional use costs.

Figure 1.2 assigns these definitions to a hierarchy. Keep in mind that these definitions may vary from project to project and that consistency is more important than precision.

Cost Management Considerations

Implementing a successful cost management methodology requires utilizing appropriate standards, concentrating efforts for maximum effectiveness, and being consistent. Some key considerations in this regard presented in this book are:

- ▶ *Instituting standard formats.* A standard format is essential to effectively communicate information from project phase to phase and from project to project. The most common format, MasterFormat, is based on trades/crafts and materials, and works well for prescriptive speci-

SCOPE	EXPECTATIONS	BUDGET
<ul style="list-style-type: none"> • Program <ul style="list-style-type: none"> - Functional Space Program - Blocking & Stacking - Public Space - Efficiency • Geometric Drivers <ul style="list-style-type: none"> - Wall Area Ratio - Degree of Articulation • Volume Drivers <ul style="list-style-type: none"> - Clear Ceiling Height - Plenum Height - Interstitial Needs - Atria - Light Shelves • Facility Parameters <ul style="list-style-type: none"> - HVAC SF/Ton - Watts/SF - Plumbing Fixtures - Ductwork POUNDAGE - Steel Pounds/SF - Etc. 	<ul style="list-style-type: none"> • Aesthetics <ul style="list-style-type: none"> - Form & Massing - Image - Community Requirements - Design Issues • Quality <ul style="list-style-type: none"> - Systems - Materials - Workmanship • Project Delivery <ul style="list-style-type: none"> - Phasing & Scheduling - Continued Occupancy - Delivery System • Systems Performance <ul style="list-style-type: none"> - Functional Space Elements - Building Management - Maintainability - Energy Consumption - Sustainability • Facility Performance <ul style="list-style-type: none"> - Live Loads - Expandability - Flexibility - Security & Safety - Access & Egress - Adjacencies - Natural Light • External Requirements <ul style="list-style-type: none"> - Codes - Standards & Criteria 	<ul style="list-style-type: none"> • Initial Costs <ul style="list-style-type: none"> - Site Acquisition - Fees - Construction - Inflation and Market Conditions - Contingencies - Other Costs • Future One-Time Costs <ul style="list-style-type: none"> - Replacements - Alterations - Salvage - Other One-Time Costs • Facility Annual Costs <ul style="list-style-type: none"> - Operations - Maintenance - Financing - Taxes - Insurance - Security - Other Annual Costs • Functional Use Costs <ul style="list-style-type: none"> - Staffing - Materials - Denial of Use - Other Functional Use Costs

Figure I.2 Hierarchy of scope, expectations, and budget.

fications. But MasterFormat is less useful for comparing competing design alternatives and tracking historical data. Instead, UNIFORMAT, a system originally developed in the 1970s and updated in the last few years, is an elemental or systems-based format that is more effective when dealing with the issues of design phase cost management. Therefore, UNIFORMAT is strongly encouraged in this book for use as a primary format. (Chapter 3 presents a detailed discussion of recommended formats.)

► *Focusing on cost drivers.* It is critical to concentrate on the true cost drivers for any project; there

simply is not enough time to “sweat all the details” from a cost perspective. Often, relatively minor decisions can cause substantial ripple effects or may force other decisions not anticipated. Effective cost management requires having a “big picture” focus, using Pareto’s “20 percent – 80 percent” principle of cost distribution, as presented in Figure 1.3. (Vilfredo Pareto, an Italian economist of the late nineteenth and early twentieth centuries, developed the principle of The Maldistribution of Costs, which essentially stated that in any item made up of a large number of components, a very small number would contain the vast majority of cost.) This rule is a common thread in cost management approaches.

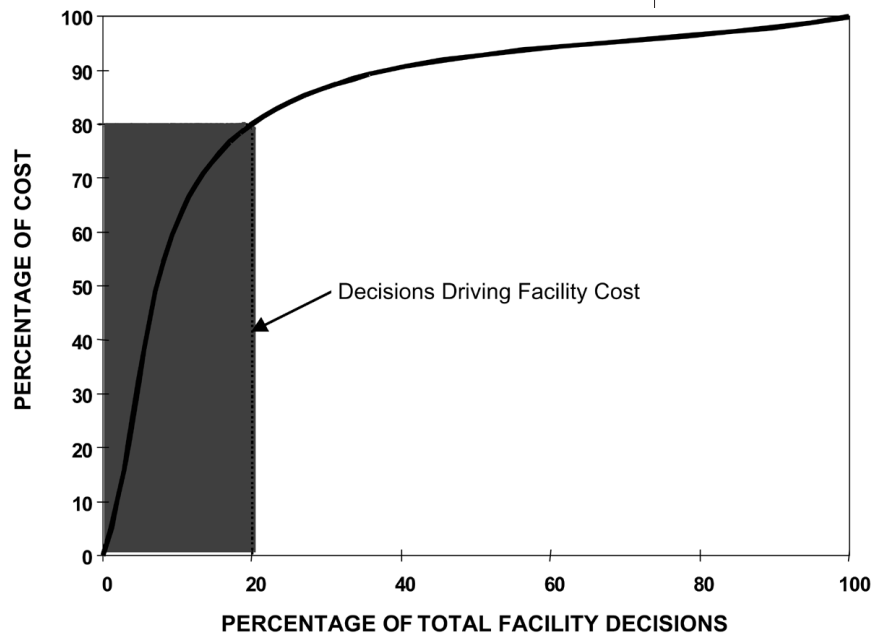


Figure 1.3 Pareto’s principle of cost distribution.

- ▶ *Emphasizing early design process.* Effective cost management requires focusing on the planning, programming, and early design decision-making process where change can usually be accommodated without major disruption to the project. Often, by the design development phase, significant change causes major disruption. This is not to imply that cost management during design development or during the preparation of construction documents is not important, but that the level of focus should be substantially narrowed by design development; otherwise, the cost to implement change will be prohibitive. Figure 1.4 diagrams the relationship between time and change; this will be further emphasized in Chapter 5, where cost management philosophy is discussed.
- ▶ *Paying attention to the relationship between quality and cost.* The relationship between quality and cost is not linear. If it were, decisions would be much simpler to make, in that increases or decreases in cost would follow comparable increases or decreases in quality: a 25 percent

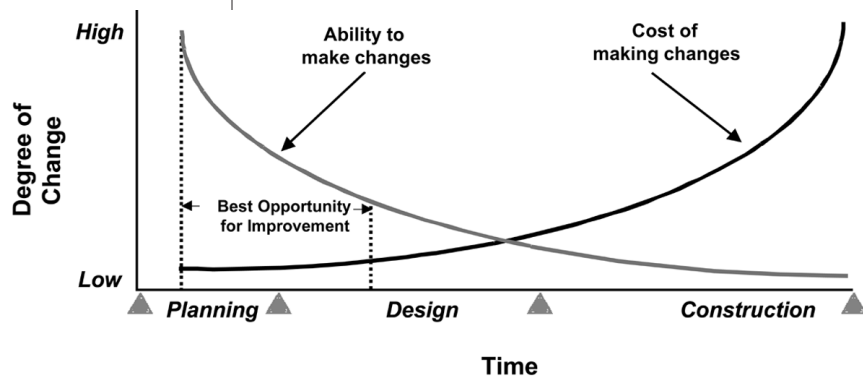


Figure 1.4 Relationship between time and change.

increase in quality or performance would always be accompanied by a 25 percent increase in price. Unfortunately, the fact is that building systems and components can exhibit sharp skews, where modest increases in quality can result in substantial increases in cost. When confronted with these selections, great care should be taken to select an appropriate level of quality. Unnecessary added quality might come at a prohibitive cost.

- ▶ *Considering life-cycle costs.* Because spending more initially might result in beneficial payback over the life of the project, future cost implications should also be considered. Likewise, an unnecessary investment in quality or performance may have an extremely poor payback. For any system there is probably a “best” life-cycle choice, that is, there likely is a system choice with superior economic performance. This relationship is presented in Figure 1.5. Chapter 3 describes life-cycle costing and value engineering and demonstrates how they can be useful tools in the overall cost management process. Emphasizing life-cycle costs, as opposed to initial costs, is an important aspect of this book.
- ▶ *Identifying and managing risks.* Every project decision contains risk; but from a cost perspective, some decisions are much riskier than others, requiring sharper focus on contingency planning and identifying alternate approaches that help to mitigate the inherent risk. Figure 1.6 provides a simplistic comparison of how single-point estimates can have significantly different risks. Later, in Chapter 3, risk management is

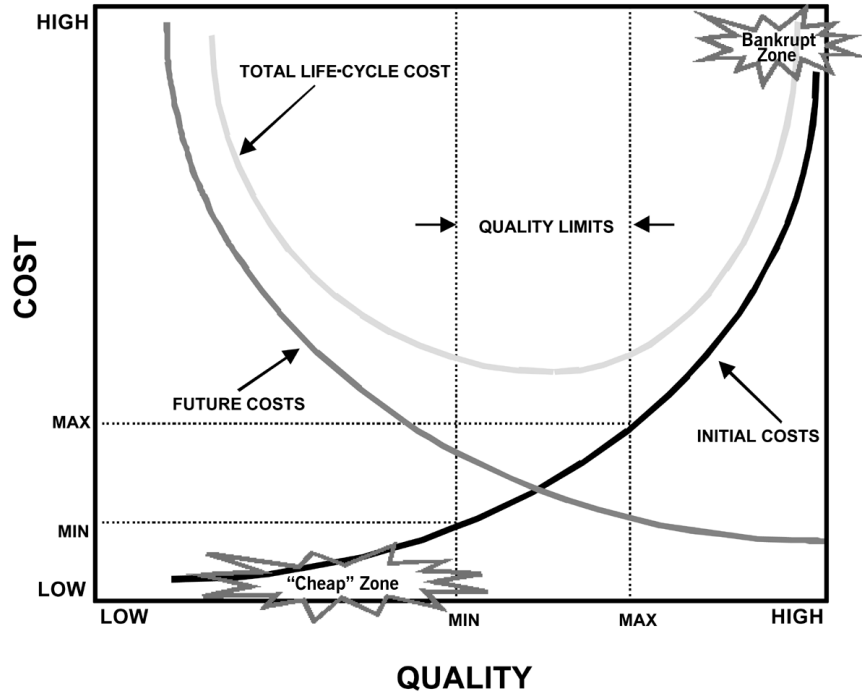


Figure 1.5 Relationship between quality and cost.

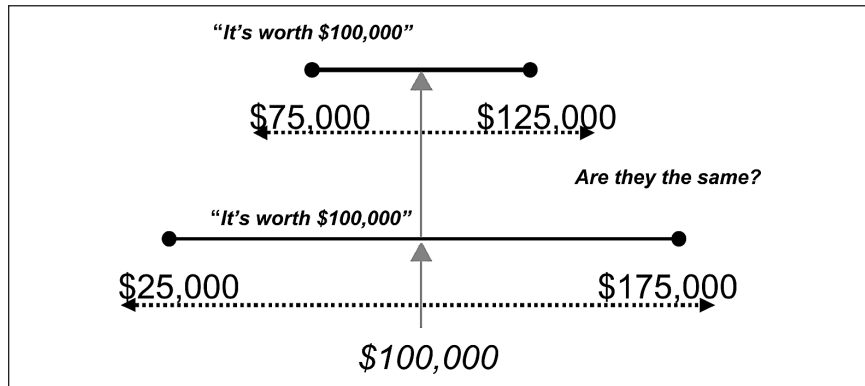


Figure 1.6 Single-point estimate comparisons.

discussed in greater detail, to provide guidance for how to identify significant risks and to determine potential cost implications. Many of the “20–80” decisions are risk-related; therefore, accurate and sensitive cost management should be responsive to risk issues.

- ▶ *Using historical cost information wisely.* Historical cost information can be obtained from a variety of sources: experienced staff, published cost data, information from other organizations, and owner-provided cost data. Early cost estimates may be largely based on historical cost, while later estimates may be priced in detail from a complete quantity survey. Regardless of where cost information comes from, great care should be taken to ensure that sources are reliable and that “comparables” are in fact comparable. It is extremely important to clearly understand the technical basis, market conditions, timeframe, and exclusions/inclusions associated with historical cost information. A factor as seemingly straightforward as “method of measurement” can be a source of dramatic error if it is not interpreted in a consistent manner. Though experience proves that establishing budgets and enacting controls solely on the basis of historical costs can lead to severe project problems, there is no rational excuse for not maintaining accurate historical data on “in-house” projects. To help with that endeavor, this book will present methods and techniques for gathering and storing historical project information.
- ▶ *Estimating costs effectively.* There is no substitute for sound cost estimating, whether provided from internal sources or outside consultants or

constructors. Furthermore, the accuracy of any estimate is only as good as the information on which it is based; this is also true of the assumptions that invariably must be made from those estimates, especially for early-stage estimates. Experience dictates taking these steps to improve the accuracy and validity of estimates: (1) clearly document the estimate; (2) promote a clear understanding among all parties of anticipated level of detail and format; (3) assure buy-in by all parties involved in the estimate; (4) properly evaluate market factors, contingencies, and major risks; and (5) allow adequate time both in terms of the calendar and level of effort required to prepare an accurate estimate. Chapters 3 and 5 describe a methodology and techniques for including estimating into the overall cost management process.

Cost Management Methodology

Cost estimating is a tool; cost management is the application of that tool within an overall project management structure. Effective cost management enables all involved in a project to respond to project challenges and to understand the interrelationships that result from various decisions about costs. Effective cost management is achievable for most organizations if they have a clear objective to align scope, user/owner expectations, and budget from the outset and over time. Here are the basic steps necessary to implement and maintain a cost management process, as differentiated from simple, reactive cost estimating:

1. *Develop the proper budget.* A proper budget is one that is connected to scope and expectations. This requires the conversion of the facility program to a “Cost Plan” prior to initiating design. This effort entails converting program requirements to facility requirements and assuring that user/owner expectations of quality and performance are reflected in specific facility materials and systems assumptions that drive the Cost Plan. The Cost Plan is the basis of a design-to-cost approach and connects the budget to a specific program, user expectations, and scope. This approach may represent a substantial change for designers. Preparing cost plans is discussed in Chapters 3 and 5.
2. *Use the Cost Plan to apportion the overall budget by major components and disciplines.* Ensure that each participant in the design process has a clear understanding of his or her respective budget and the key parameters for measuring the individual’s discipline.
3. *During design development, monitor individual technical decisions for their effect on project cost.* Decisions affecting cost typically are made incrementally as the design evolves; therefore, *as these decisions are made*, their consequences (economic and otherwise) should be clearly understood by the designers, builders, and owner/user staff. Update the Cost Plan periodically to reflect these changes between milestone estimates. At major milestones, prepare new estimates and modify the baseline Cost Plan accordingly.
4. *During the process, make intelligent trade-offs as necessary between aspects of scope, quality, and performance to maintain the project within the overall budget.* Track critical measures and parameters

of scope and user/owner expectations as indicators of progress. Deviations from planned amounts may indicate potential cost problems. Adjust contingencies relative to current design development and outstanding risks. As an integral part of the process, select the particular delivery method to be utilized for construction. Continue this process through the design phase, preparing milestone estimates to fully update the Cost Plan.

5. *Use benchmarking as a technique for comparing and contrasting the project with other projects already constructed.*
6. *Use life-cycle costing and economic analysis as tools for determining long-term costs, operations sustainability, and, potentially, functional staffing.* Owners expect their designer, consultants, and builders to be fully aware of economic consequences. These issues are discussed in Chapters 3 and 5.
7. *Consider value management/engineering as another important tool for improving the cost management process.* Too often in the past, value management has been applied too late, and with insufficient sensitivity to issues that drive the project and are important to the owner. Chapters 3 and 5 present techniques that have been successfully applied to formal value management sessions involving the design team, owner staff, constructor staff, and outside expertise as necessary. These sessions, which provide creative input and a comprehensive review of all decisions, become progressively more detailed as the design develops, culminating in a prebid constructibility review.
8. *Throughout construction, review and assess changes, and address potential schedule/cost issues. Once construction is complete, assess the project for performance*

relative to expectations, catalog historical data, and benchmark the project against comparable projects.

Applying these techniques will help to assure that scope, expectations, and budget remain aligned throughout the life of the project and that owner demands for more effective cost management will be satisfied.