



NAC Executive Insights

Early Project Cost Estimating for Decision-Making on Project Execution

Key Points

1. Ensure estimate technique fits project type and level of scope definition.
2. Use relevant database.
3. Provide for project uncertainties.
4. Perform estimate review.
5. Obtain senior management approval.

Owners make key decisions related to moving a project through the project development phases. Generally, key decisions are made prior to spending significant dollars on project development. The first decision an owner makes is whether a project is worthy of development. The second decision is the approval to commence detailed design. This decision accelerates the spending of money and leads to the selection of the service provider(s). Each decision to proceed to the next phase of development is supported by enhanced scope detail and a cost estimate derived from the more detailed scope. The decision also is influenced by the selected project delivery approach: whether design-bid-build, design-build, or construction manager at risk or some variation of these delivery approaches.

Introduction

Decisions must be made throughout the project development and execution process as more information becomes available. Effective decision-making requires high quality information on which to base a decision. Perhaps one of the most critical project decisions is approval of a project's cost or budget. This decision is most often made prior to the start of detailed design. Typically the project scope is not fully defined and the characteristics describing the project are not one hundred percent clear at the time this decision is made.

To address uncertainties related to scope and other project characteristics, project risks have to be analyzed and assessed for potential impact. In terms of cost estimates, the uncertainties related to the project are quantified in cost and time. The extra dollars and time used to express uncertainty are often called "contingency." Once a project's total cost is determined, it must be reviewed in detail and approved by senior level management. This Executive Insight provides information on the use of early estimating techniques to support decisions regarding whether a project should go forward, be terminated, or be re-worked to enhance key project inputs before starting detailed design.

Ensure Estimate Techniques Fit Project Type and Level of Scope Definition

Several techniques or a combination of techniques are used to support a critical decision concerning moving a project to the execution phase (see Table 1 below from Executive Insight, “Essential Requirements for an Effective Estimating Database”). It is unlikely that a single parameter order of magnitude estimate will be used to estimate the cost of the entire facility. More likely, the level of scope definition must provide sufficient definition of major facility components or systems. Preliminary plans and specifications are needed to support the development of estimates for major components or systems. The facility components or systems would be estimated separately and then combined to provide a total construction cost. Engineering and design costs can be estimated as a percent of construction costs. Unique costs, such as utility connections at the boundary of the facility, would be estimated using approximations of where the connections are made and the distance to where the utilities are located within the facility.

Table 1. Estimating Techniques Supporting Project Development

TYPE	PROJECT PHASE	PURPOSE	BASIS	COMMENT
Order of Magnitude	Front End Planning — Feasibility	Screen for Project Viability	\$ per Key Facility Parameter	Owner Driven
Conceptual — Factored or Ratio	Front End Planning — Detailed Scope	Approval for Project Execution	Major Facility Parameters Defined	Owner Driven with Service Provider Support
Semi-Detailed	Project Execution — Engineering and Design	Basis for Cost and Schedule Control	Combination of Factored/Ratio and Quantity Pricing Based on Preliminary Plans and Specifications	Driven by Service Provider with Owner Input
Detailed	Project Execution — Construction	Basis for Bidding Construction	Quantity Pricing Based on 100 Percent Plans and Specifications	Driven by Service Provider

Use Relevant Database

Since the estimating techniques vary depending on the component or system being estimated, the databases used must be appropriate to support each technique (see Executive Insight, “Scope Development and Estimating Databases”). At a minimum, the factored or ratio type estimate should be used because this technique requires the definition of major facility components (see Table 1 from Executive Insight, “Essential Requirements for an Effective Estimating Database”). In the industrial sector this would include specifying major mechanical equipment. In buildings, this would entail specifying system requirements such as using a concrete structural frame and total square footage plus number of

floors. In infrastructure, one may be specifying the number of lanes and lane width plus pavement structure and depth for a new highway.

Provide for Project Uncertainties

A key element of total project cost is contingency. Contingency is a cost element used to account for uncertainties related to specific project risks and potential variation in cost elements that are considered when developing the estimate.

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Contingency is not a “slush fund.” It is a cost category. Contingency is managed over the project development process including construction. Rigorous techniques are employed to assess project uncertainties and to determine appropriate amounts to cover the risks associated with early estimates. Risk analysis and setting contingency values are the focus of the Executive Insight, “Risk Analysis and Setting Contingency to Estimate the Cost of Project Uncertainties.”

Perform Estimate Review

Every estimate needs a thorough review no matter the project phase. The review process is always important, but perhaps is most critical when the cost estimate is used to set the budget for the project and make a final decision to proceed with project execution. A comprehensive review includes a review of the project scope; the project location characteristics — geotechnical for foundation issues and climate for effect on construction productivity; assumptions; the estimating techniques; and the data sources used to develop the estimate. This review should include a review of risks and other factors that contribute to the evaluation of the needed contingency amount. A final intent of this review is to ensure the entire scope of the facility has been covered and that all costs are properly estimated.

Obtain Senior Management Approval

Once the cost estimate has been thoroughly reviewed and changes made, the total project cost estimate should be reviewed by senior management and approved by the appropriate manager. A board review may be required, depending on the magnitude of the funds involved. This estimate is often described by a range of probable costs to allow some margin for cost growth as a result of later changes to enhance the project’s rate of return or benefit-to-cost ratio.

About the Author

Stu Anderson was elected to the National Academy of Construction in 2010. He retired from Texas A&M University in 2019, where he served as assistant vice chancellor for facilities planning and management.

He also was a tenured professor and held the Zachry Chair in Construction Integration in the Texas A&M College of Engineering. He earned a bachelor's degree in building construction from the University of Washington, a master's of civil engineering from the University of Illinois, and a PhD from The University of at Texas Austin. He was previously with the Fluor Corporation and with Stone & Webster.