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INTERNATIONAL
RECOMMENDED
PRACTICE

46R-11

**REQUIRED SKILLS AND KNOWLEDGE
OF COST ESTIMATING**

SAMPLE

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REQUIRED SKILLS AND KNOWLEDGE OF COST ESTIMATING

TCM Framework: General Reference
7.3 – Cost Estimating and Budgeting

Rev. January 16, 2013 (Ed. Rev. May 16, 2023)

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1. INTRODUCTION

This recommended practice (RP) is intended to serve as a guideline, not a standard. As a recommended practice of AACE International, the intent of the guideline is to define the required skills and knowledge to perform project cost estimating. It serves as the foundation of the skills and knowledge of an AACE Certified Estimating Professional™ (CEP™).

Project cost estimating requires knowledge of all elements of cost from project conception to completion. This includes: direct material and labor costs, indirect costs, general administration costs, profit, finance cost, owner's costs and startup costs. This may also include operations and maintenance costs for selection of project alternatives.

The RP highlights the necessary skills and knowledge of a cost estimator from a high level viewpoint. It identifies competencies for a project cost estimator. Detailed skills, knowledge and methodology, are excluded from this recommended practice. These skills and knowledge are applicable to the cost estimating profession across all industries and types of projects.

This RP is aligned with RP 11R-88, *Required Skills and Knowledge of Cost Engineering* and the *Total Cost Management Framework*.

2. RECOMMENDED PRACTICE

A cost estimate is a compilation of all the probable costs of the elements of a project or effort included within an agreed upon scope.

Cost estimating is the predictive process used to quantify cost, and price the resources required by the scope of an investment option, activity, or project. Cost estimating is a process used to predict uncertain future costs. In that regard, a goal of cost estimating is to minimize the uncertainty of the estimate given the level and quality of scope definition. The outcome of cost estimating typically includes both an expected cost and a probabilistic cost distribution. As a predictive process, historical reference cost data (where applicable) improve the reliability of cost estimating. Cost estimating, by providing the basis for budgets, also shares a goal with cost control of maximizing the probability of the actual cost outcome being the same as predicted.

The cost estimating process is commonly applied during each phase of the asset or project life cycle as the asset or project scope is defined, modified, and refined. As the level of scope definition increases, the estimating methods used become more definitive and produce estimates with increasingly narrow probabilistic cost distributions. The specific estimating tools and techniques used vary widely depending upon the industry, organization, the life cycle phase, the type of asset or project, and the level of definition of scope information available. The analysis, development, and maintenance of estimating tools and techniques are steps that are considered part of the estimating process.

The cost estimating process is typically performed concurrent to or iteratively with the asset and project planning and evaluation processes described in the *TCM Framework*. Because costs are often dependent on time duration, while resource requirements identified in cost estimating may affect the schedule, the estimation of the time duration of activities must be considered concurrently with costs. Iterative approaches are used to enable the team to remain current with cost as the project/product scope matures. This is a direct input into the organization's decision process which systematically evaluates and refines a scope until it satisfies all of the organization's requirements.

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Estimating is a predictive process which requires judgment and experience although some aspects of estimating lend themselves to semi-automation (e.g., quantity take-off tools, estimating software tools, determinations of quantities by computer-aided design tools, and so on). While these tools increase efficiency they are not a substitute for experience and judgment.

Effective cost estimating requires an understanding of the work being planned. In some industries, such as engineering and construction, cost estimating is a recognized discipline because of the specialized knowledge required. In all industries, many individuals contribute to the performance of the estimating process.

The cost estimating process includes: planning for the estimate, quantifying scope, applying cost to the scope, pricing of the project, reviewing, validating, and documenting the estimate.

Project cost estimators predict the cost of a project for a defined scope, to be completed at a defined location and point of time in the future. Cost estimators assist in the economic evaluation of potential projects by supporting the development of project budgets, project resource requirements, and value engineering. They also support project control by providing input to the cost control baseline. Estimators collect and analyze data on all of the factors that can affect project costs such as: materials, equipment, labor, location, duration of the project, and other project requirements. A professional cost estimator practitioner must be able to articulate the meaning of the terms cost estimating and total cost management (TCM).

Cost estimators may have different perspectives depending on their particular situation. The following are two possible scenarios:

1. When working for an owner organization, cost estimators are involved directly in supporting the economic evaluation of a potential program or project. They will establish the baseline estimate for budgetary purposes and financing. This includes not only the scope of work to be completed by various contractors, but also the costs for all other portions of the project that may be the owner's responsibility. The owner estimator reviews and validates contractor estimates; prepares conceptual estimates in early phases (before contractors are involved); validates estimates prepared by joint venture (JV) partners; and prepares operating and abandonment cost estimates.
2. When working for a contracting organization, cost estimators determine the probable cost of the contractor's defined scope of work plus the contractor's profit. This typically constitutes the contractor's bid, tender or proposal. The owner will typically compare various contractor bids for possible project award.

2.1. What is the Career Progression for a Cost Estimator?

Typically, most cost estimators begin as junior estimator with a limited focus depending upon the industry they are employed in. For example, in construction, they may develop their skills around a specific trade or discipline of work (e.g., civil, structural, architectural, mechanical, electrical, etc.). As the estimator practitioner develops their skills, they progress to a senior estimator position and may be considered subject matter experts (SME's) in multiple areas of estimating (e.g., multiple disciplines of work, quantity takeoff, pricing, bidding and analysis, change orders, life cycle analysis, value engineering, etc.). After mastering many areas within the estimating fields, the seasoned estimator may become the chief estimator of the estimating department or organization. Chief estimators may have company management duties such as: developing estimating standards and guidelines, training, and other management roles.

2.2. What are the Differences Between an Owner Estimator, Engineering Consultant Estimator and a Construction Contractor Estimator?

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The roles and duties of the owner, engineering consultant, and construction contractor estimators may vary throughout the phases of a project. We will use facilities projects to describe the differences, but similar variations will exist for other industries.

2.2.1. Owner Estimator

The owner estimator typically has the duty to develop and oversee an owner's full cost portfolio for a given year of spending requirements. The owner's estimating staff may include a full discipline of estimator support (civil, structural, architectural, mechanical, and electrical, etc.) but may depend on the size of the owner organization. The owner estimator position typically requires experience in multiple disciplines. The owner estimator may be involved in planning phases of programs or projects consisting of conceptual, budget and definitive estimating, as well as, value engineering, change control, claims avoidance/reconciliation and risk modeling/management.

During the bidding cycle of construction projects, the owner estimator will be called upon to update the owner's estimate with addenda details, collect and evaluate contractor bids, assess the lowest responsive and responsible bidder, evaluate bids, and support owner decision making. During construction implementation activity, the owner estimator will be engaged in change control, change order processing, negotiations, claims avoidance and cost trending. After construction is completed the owner estimator will be asked to reconcile definitive estimates to actual construction costs and provide lessons learned to the owner organization.

After the project is complete the owner estimator collects project data and develops historical databases that can support estimating for future projects. The goal of the owner estimator is to determine the appropriate capital budget for the project to be successful. Typically, bids will only comprise a portion of the overall owner's estimate. The owner's estimate forms the basis for project funding requirements, and includes both project capital and expense costs.

2.2.2. Engineering Consultant Estimator

The engineering consultant estimator may have similar duties and responsibilities as the owner estimator because they are often tasked with preparing the facility estimate on behalf of the owner. Typically, the cost estimate prepared by the engineering consultant estimator will exclude owner costs associated with the overall project funding. If the owner contracts with an engineering firm to prepare the facility estimate, the owner has ultimate responsibility to condition the engineer's estimate and include all owner related costs and expenses to support full project funding.

2.2.3. Construction Contractor Estimator

The construction contractor's estimating roles and duties traditionally cover the "hard bidding" aspects of cost estimating. A prime construction contractor estimator typically provides the estimate for the portion of construction activity that they will self-perform. They may receive bids from their preferred subcontractors for the remaining portion of the work. The construction contractor estimator's duties often consist of compiling the multiple bids into a one overall bid package that will ultimately be considered by the project owner. This may include responsibility to review subcontractor quotes, ascertain their compliance with scope, and incorporate prime contractor carrying charges and profit markups. These estimators also keep estimates (bids) for historical purposes to potentially be used for conceptual pricing on future prospect work or to use as competitive data on future bid proposals.

3. COST ESTIMATING PROCESS MAP

TCM Framework Fig 7.3.1 (Figure 1) illustrates the process map for cost estimating and budgeting that shows the basic work flow process of the development of a cost estimate. This includes: planning for the estimate, quantifying scope, applying cost to the scope, pricing of the project, reviewing, validating, and documenting the estimate.

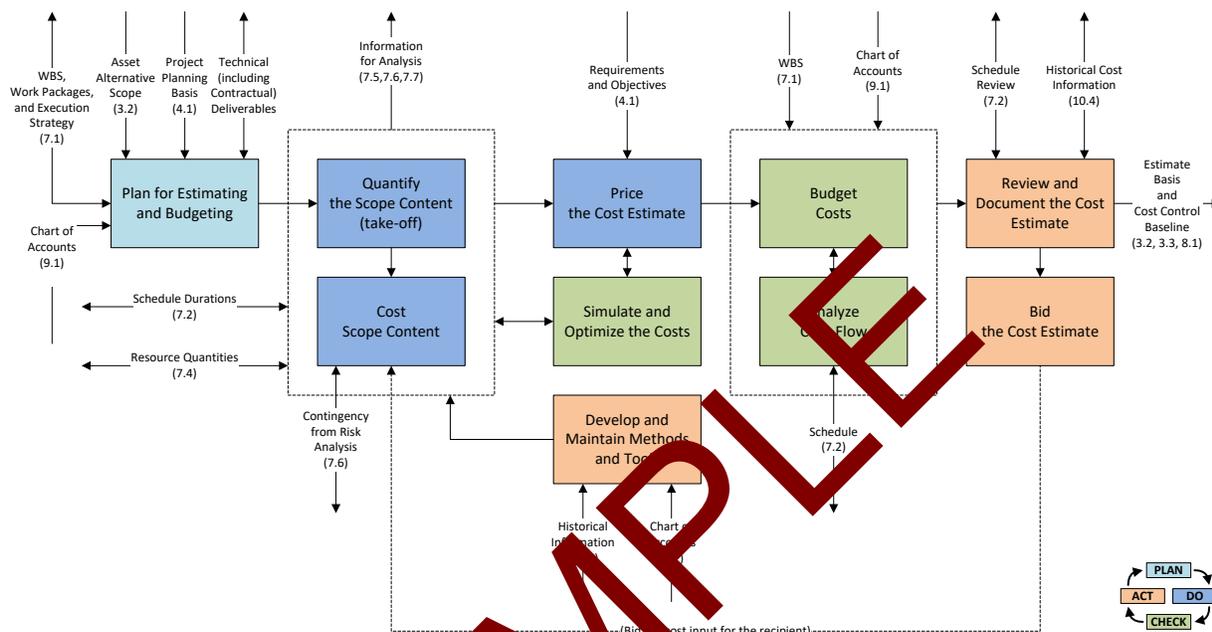


Figure 1 – Process Map for Cost Estimating and Budgeting (TCM 7.3.1)

4. COMPETENCY MODEL

Figure 2 illustrates the hierarchical structure of the skills and knowledge competency model for a cost estimator. The first level of the structure differentiates between general supporting knowledge used in more than one practice or process, and specific practice knowledge used in particular functions or process steps. Succeeding levels further break down the content to whatever level is appropriate for each skills and knowledge area. The location of a skill or knowledge element in the level of the outline does not reflect on its relative importance.

The structure is organized in accordance with the plan, do, check, and assess (PDCA) process model that serves as the basis for the TCM Framework through which all the skills and knowledge of cost engineering are applied. TCM is not structured by a practitioner’s work function. For example, cost estimators will not find all of their required skills and knowledge under one heading. The required skills and knowledge of a cost estimator will include elements of supporting knowledge, as well as elements of planning, measuring, and assessing that are appropriate to the estimating function.