

Total Cost Management Framework

A Process for Applying the
Skills and Knowledge of Cost Engineering



A Product of the Technical Board of AACE International

AACE INTERNATIONAL

promoting the planning and management of cost and schedules

ACKNOWLEDGEMENTS

Authors/Key Contributors for the TCM Framework

John K. Hollmann, PE CCE edited and contributed to all sections.⁵ The Technical Board would like to express its gratitude to the following individuals who provided original text, ideas, or otherwise contributed to or helped technically validate the contents (listed in their order of contribution by section).

Author/Key Contributor	TCM Framework Section
Wesley R. Querns, CCE <i>PMO Director, Perot Systems Corporation</i> <i>wesley.querns@chw.edu.</i>	Preface Chapter 1 Introduction Chapter 2 The Total Cost Management Process 9.1 Project Cost Accounting 9.2 Progress and Performance Measurement 10.1 Project Performance Assessment
Gregory D. Githens <i>Catalyst Management Consulting, LLC</i> <i>gdg@catalystpm.com</i>	3.1 Requirements Elicitation and Analysis 3.2 Asset Planning
John R. Schuyler, PE CCE <i>Instructor/Consultant, PetroSkills-OGCI</i> <i>john@maxvalue.com</i>	3.2 Asset Planning 3.3 Investment Decision Making
Larry R. Dysert, CCC <i>Managing Partner, Conquest Consulting Group</i> <i>ldysert@ccg-estimating.com</i>	4.1 Project Implementation
Susan G. Seber, CCE <i>Director, Lean Manufacturing, Eastman Kodak</i> <i>susan.seber@kodak.com</i>	4.1 Project Implementation
Gary Cokins <i>Strategist, SAS Institute Inc.</i> <i>gary.cokins@sas.com</i>	5.1 Asset Cost Accounting 5.2 Asset Performance Measurement 6.1 Asset Performance Assessment 11.4 Quality and Quality Management
Stephen M. Jacobson, CCC <i>Director, Project Mgmt, Hilton Hotels Corp.</i> <i>stephen_jacobson@hilton.com</i>	6.3 Asset Historical Database Management 10.2 Forecasting 10.3 Change Management 10.4 Project Historical Database Management 11.5 Value and Value Improving Practices
Paul E. Makris, PE PSP	6.4 Forensic Performance Assessment
James G. Zack, Jr. <i>Exec. Director, Corporate Claims Mgmt, Fluor</i> <i>jim.zack@fluor.com</i>	6.4 Forensic Performance Assessment
Earl T. Glenwright, Jr. PE PSP <i>Partner, Koevsky-Glenwright Associates</i> <i>earl_csss@yahoo.com</i>	7.1 Project Scope & Execution Strategy Dev. 7.2 Schedule Planning and Development 8.1 Project Control Plan Implementation
Donald F. McDonald, Jr. PE CCE PSP Fellow <i>Fluor Enterprises, Inc.</i>	7.2 Schedule Planning and Development
Bernard A. Pietlock, CCC	7.3 Cost Estimating and Budgeting
Douglas W. Leo, CCC <i>Sr. Project Estimator, Eastman Kodak</i> <i>doug.leo@censeo.us</i>	7.3 Cost Estimating and Budgeting
Sarwar A. Samad, CCE <i>Program Manager, Federal Aviation Admin.</i> <i>ssamad786@hotmail.com</i>	7.4 Resource Planning 7.7 Procurement Planning

⁵ John K. Hollmann, PE CCE, President, Validation Estimating LLC; jhollmann@validest.com

7.4 Resource Planning

7.4.1 Description

Resource planning is the process of ascertaining future resource requirements for an organization or a scope of work. This involves the evaluation and planning of the use of the physical, human, financial, and informational resources required to complete work activities and their tasks. Most activities involve using people (i.e., labor) to perform work. Some activities involve creating an asset using component physical elements or parts (i.e., materials) as well as other items consumed during creation (i.e., consumables). Other tasks involve creating an asset using mainly information inputs (e.g., engineering or software design). Usually, people use tools such as equipment to help them. In some cases automated tools may perform the work with little or no human effort. Therefore, the goal of resource planning in TCM is to ensure that labor, materials, tools, and consumables, which are often limited in availability or limited by density, are invested in a project over time in a way that successfully, if not optimally, achieves project objectives and requirements.

Resource planning begins in the scope and execution plan development process (Section 7.1) during which the work breakdown structure, organizational breakdown structure (OBS), work packages, and execution strategy are developed. The OBS establishes categories of labor resources or responsibilities; this categorization facilitates resource planning because all resources are someone's responsibility as reflected in the OBS. These scope development deliverables are inputs to the schedule planning and development and cost estimating and budgeting processes (Sections 7.2 and 7.3, respectively). Resource estimating (usually a part of cost estimating) determines the activity's resource quantities needed (e.g., hours, tools, materials, etc.) while schedule planning and development determines the work activities to be performed. Resource planning then takes the estimated resource quantities, evaluates resource availability and limitations considering project and business circumstances (e.g., skills, location, resource markets, etc.), and then optimizes how the available resources (which are often limited) will be used in the activities over time. The optimization is performed in an iterative manner using the duration estimating and resource allocation steps of the schedule planning and development process (see Sections 7.2.2.4 and 7.2.2.6).

At the conclusion of the resource planning process, the resource "plan" becomes an inherent part of the project control budget and the resource-loaded schedule. Where appropriate, control budgets include both resource quantities and cost. The estimate and schedule deliverables include documents that describe the resource assumptions, limitations, and other resource considerations incorporated in the baseline project control plan. The resource plan is a key input to the procurement planning process (Section 7.7) that plans for acquisition of the planned resources in alignment with the execution strategy.

From the project control budget and the resource-loaded schedule, planned resource expenditure charts and tables can be developed that are then used as a control baseline against which actual resource use can be measured (Section 9.2) and assessed (Section 10.1). As changes are made to the project scope and/or plans, or performance trends are observed, changes to resource plans can be made through the change management process (Section 10.3).

Resource planning is a critical element of project control planning when the performance of the accounting process for project costs (Section 9.1) is poor as it is for many enterprises. This is because accounting for resource consumption (e.g., time cards, purchase order tracking, etc.) tends to be more detailed and more timely than accounting for costs. Many cost accounting systems report cost data too infrequently (e.g., monthly) and/or too indefinitely (e.g., not at an activity level) to effectively control most projects. This is reflected in the project control saying "control the hours to control the job."

Resource planning is often done at a strategic asset management level (Section 2.3) because the enterprise may have multiple projects competing for key resources (i.e., *portfolio management*). In that case, business management of the enterprise will have to decide on the best allocation of those key (i.e.,

strategic) resources between projects. Any such allocation or constraints will be addressed in the asset planning process (Chapter 3).

7.4.2 Process Map for Resource Planning

At its core, resource planning is an interactive optimization process that works in parallel with the schedule planning and development and cost estimating processes. This process is supported by the study and understanding of the criticality and availability of the various resources, which in turn is supported by historical productivity data and experience with resource issues. Figure 7.2-1 illustrates the process map for resource planning.

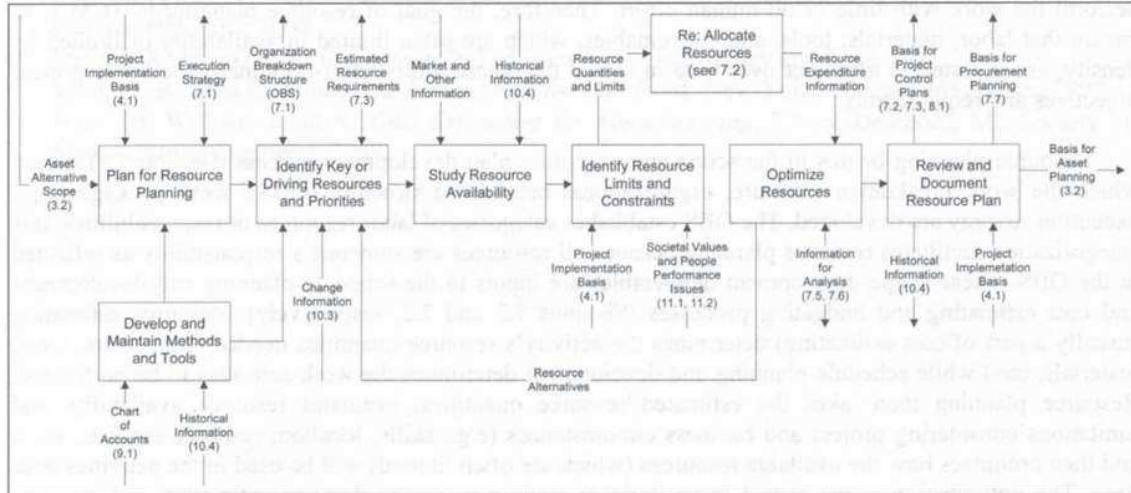


Figure 7.4-1 Process Map for Resource Planning

The following sections briefly describe the steps in the resource planning process.

.1 Plan for Resource Planning

Resource planning is a team effort. The team typically includes the project manager, planners, and other members such as schedulers, estimators, technical personnel (e.g., engineers, programmers), and managers (e.g., construction, programming, etc.). Often a scheduler leads the resource planning effort because the key step of resource allocation is a part of the schedule planning and development process. However, everyone on the project team with resource responsibilities (i.e., per the OBS) should have input to and buy-in for the resource planning aspects of the project control plans. The team and its activities for resource planning must be planned in conjunction with all the other project control planning processes as appropriate for the current phase of scope development. Resource planning tools are also identified that will facilitate the process, and past lessons learned are assessed for relevant guidance.

.2 Identify Key or Driving Resources and Priorities

Based on resource quantity availability and the requirements identified in the cost estimating process and from past project experience, resources are assessed and ranked in terms of how critical they are likely to be to project success. This information helps prioritize subsequent resource planning steps. Feedback from resource optimization may result in reassessment of resource criticality.

.3 Study Resource Availability

Methods for determining resource availability typically include site or field labor surveys, market analyses, and maintaining historical databases. Typically, a few resources will be both critical to success of

a project or activity and highly limited in availability such as a highly specialized worker. For these activities, resource planning may result in additional estimated costs items (e.g., higher wages or labor incentives) and schedule activities (e.g., recruitment, training, etc.).

.4 Identify Resource Limits and Constraints

Resources are rarely in unlimited supply. Therefore, the supply limits must be identified so that thresholds can be set for the resource allocation step (see Section 7.2). Some of the limits may be dependent on market availability while others may be imposed as constraints by enterprise or project system management. There may also be physical constraints on the ability to apply resources (density of workers in a given area).

This step and the procurement planning process as a whole must also consider societal value and people performance issues (see Sections 11.1 and 11.2) that may somehow limit resource usage or performance (e.g., cultural attitudes, motivational issues, etc.).

.5 Optimize Resources

The allocation of resources during schedule development (see Section 7.2) may result in project scheduling challenges, opportunities, or risks that require an iterative evaluation of activity and schedule preferential logic alternatives. To optimize resource usage, the team may reassess which resources are critical and seek ways to obtain those resources (e.g., incentives, training, etc.). Optimization may also consider issues such as when and where material resources will be received as this will affect inventory and material handling costs. Cash flow and interest costs can be improved, and materials damages and losses reduced if orders are not placed too early and hoarding or stockpiling are avoided. Likewise, labor resources should not be mobilized earlier than necessary.

.6 Review and Document Resource Plan

Resource planning outputs (e.g., resource expenditure charts based on resource loaded schedules, recruitment and training plans, etc.) are reviewed by the project team to determine whether they are complete and suitable as a basis for planning, whether they meet project objectives and requirements, and whether they are competitive with industry's best practices and historical approaches.

.7 Develop and Maintain Methods and Tools

Resource planning is facilitated by having a database of historical resource data. These data should include past experiences with resource usage, availability, limitations, and similar information. The collection of historical resource planning data is generally a part of the project performance assessment process (Section 10.1) because resource plans and actual usage are in large part inherent to cost and schedule control records. Development and maintenance of resource planning tools (e.g., checklists, standard procedures, chart of accounts, etc.) is also a step in this process. A standard chart of accounts, along with the WBS/OBS, facilitates resource planning by establishing ways to consistently categorize resource information.

7.4.3 Inputs to Resource Planning

- .1 Project Planning Basis (Objectives, Constraints, and Assumptions).* The enterprise may establish requirements for resource planning such as constraints or limitations on the use of resources (see Section 4.1).
- .2 Changes.* During project execution, changes to the baseline project plans are identified in the change management process (see Section 10.3). Each change goes through the resource planning process so that it can be appropriately integrated into the project control plans.

- .3 *Resource Quantities.* The cost estimating process (see Section 7.3) determines the quantities of labor hours, materials (counts, volumes, weights, etc.), equipment, tools, and consumable usage.
- .4 *Resource Expenditure Information.* The rates or timing of resource expenditures are outputs from the scheduling resource allocation step (see Section 7.2).
- .5 *Organizational Breakdown Structure (OBS).* The OBS, developed during the scope development process (see Section 7.1), documents the project organization and responsibilities for elements of the work in a logical, hierarchical manner. Much of the organization structure (i.e., functional discipline breakdown) may already be reflected in a standard chart of accounts.
- .6 *Execution Strategy.* Plans are developed during scope development (see Section 7.1) that define how the project work will be implemented (i.e., the general approaches through which the work packages and activities will be performed). Elements of the strategy may affect resource planning.
- .7 *Asset Alternative Scope.* If the process is being used in support of strategic asset planning, (see Section 3.2), the scope (usually conceptual) of the investment alternative is the primary process input.
- .8 *Chart of Accounts.* The chart of accounts is a coding structure that allows all cost and resource information on a project to be uniquely identified. The chart of accounts often incorporates standard elements of the OBS (e.g., functional disciplines such as piping) as well as categorization of resource types (e.g., labor, material, etc.). The resource type categorization is sometimes called the *resource breakdown structure (RBS)*. Each stakeholder with accounting, control, and reporting responsibilities may have its own chart of accounts; coordination requires that stakeholders map their accounts with each other so that cost and schedule information can be exchanged.
- .9 *Societal Values and Performance Considerations.* (see Sections 11.1 and 11.2).
- .10 *Historical Project Information.* Past project resource usage, availability, limitations, and similar information is used to support future project resource planning.
- .11 *Information for Analysis.* Resource planning is iterative with the other project planning steps including value analysis and engineering and risk management (see Sections 7.5 and 7.6, respectively). These analytical processes may identify changes in resource plans that will increase value and/or reduce risks.

7.4.4 Outputs from Resource Planning

- .1 *Resource Quantity Availability and Limitations.* The resource allocation step (see Section 7.2.) requires data on thresholds or limits for evaluating resource consumption over time. Examples of limitations include the availability of a particular skill, the total number of available workers with a particular skill set that belong to a local union, and the availability of a major crane or a specialized computer.
- .2 *Basis for Project Control Plans and Plan Implementation.* The resource "plan" is an inherent part of the project control budget and the resource-loaded schedule. Control budgets should include both resource quantities and cost. The estimate and schedule deliverables include documents that describe the resource assumptions, limitations, and other resource considerations incorporated in the baseline project control plans.
- .3 *Basis for Asset Planning.* If the process is being used in support of strategic asset planning (see Section 3.2), the resource plan (usually conceptual) is used to support feasibility analysis.

7.4.5 Key Concepts for Resource Planning

The following concepts and terminology described in this and other sections are particularly important to understanding the resource planning process of TCM:

- .1 *Organization Breakdown Structure (OBS).* (See Section 7.1.2.3).
- .2 *Resources.* In respect to the resource planning process covered in this section, resources include physical and human resources, in particular, labor (e.g., disciplines, trades, etc.), materials (e.g., steel, concrete, etc.), tools (e.g., construction equipment, computers, etc.), and consumables (e.g., welding rods, formwork, office supplies, etc.) used or employed in project activities. From a broader perspective, resources may also include physical space, monetary, and information resources.

- .3 *Resource Allocation.* (See Section 7.2.2.6).
- .4 *Resource Availability, Limitations, and Constraints.* (See Sections 7.4.2.3 and 7.4.2.4).
- .5 *Resource Management.* (See Sections 1.1.2 and 1.4.2).
- .6 *Societal Values.* (See Section 11.1).

Further Readings and Sources

There are many references describing resource planning and related practices for various project types in various industries. Resource planning, as addressed by the process in this section, is generally covered in project planning and scheduling texts, and less often as a subject in itself. Resource management, human resource management, and manufacturing or enterprise resource planning (MRP/ERP) are related but less relevant topics for which text references are not listed here. The following references provide basic information and will lead to more detailed treatments.

- Amos, Scott J. *Skills and Knowledge of Cost Engineering*, 5th ed. Morgantown, WV: AACE International, 2004.
- Callahan, Michael T., Daniel G. Quackenbush, and James E. Rowings. *Construction Project Scheduling*. New York: McGraw Hill, 1992.
- Canter, M. R. *Resource Management for Construction: An Integrated Approach*. Hampshire, London: MacMillan Press Ltd., 1993.
- Fleming, Quentin W. *Project Procurement Management: Contracting, Subcontracting, Teaming*. Tustin, CA: FMC Press, 2003.

7.5.3 Process Map for Value Analysis and Engineering

The VAVE process is a systematic method for identifying and eliminating waste, reducing costs, and improving quality. It involves a series of steps: (1) selection of a project, (2) definition of the project, (3) identification of value engineering opportunities, (4) analysis of value engineering opportunities, (5) development of value engineering proposals, (6) evaluation of value engineering proposals, (7) implementation of value engineering proposals, and (8) monitoring and control of value engineering proposals. The value engineering process is a systematic method for identifying and eliminating waste, reducing costs, and improving quality. The process involves a series of steps: (1) selection of a project, (2) definition of the project, (3) identification of value engineering opportunities, (4) analysis of value engineering opportunities, (5) development of value engineering proposals, (6) evaluation of value engineering proposals, (7) implementation of value engineering proposals, and (8) monitoring and control of value engineering proposals.

7.7 Procurement Planning

7.7.1 Description

Procurement planning is that part of the project control planning process that ensures that information about resources (e.g., labor, material, etc.) as required for project control is identified for, incorporated in, and obtained through the procurement process. The TCM process map does not explicitly include the procurement process. As with engineering, construction, programming, and similar functions involved with project execution, TCM only addresses the project control interface with procurement. The term *procurement* is used here in the broad sense of the collective functions that obtain labor, services, materials, tools, and other resources.

Asset owners usually obtain most of the labor, materials, and other resources used in projects from outside enterprises. These outside enterprises typically include vendors and fabricators for materials and contractors for labor. Even when the asset owner obtains resources from within their own enterprise, the project team's control of the internal resource supplying organization may be limited. In all these cases, procuring needed resources from these suppliers and contractors (and their suppliers in the *supply chain*) requires extra effort to plan and establish agreements. There are also additional concerns with assuring that other parties have acceptable values regarding society, ethics, environment, health and safety, and so on because problems with one party in this regard are likely to affect others with whom they have relationships (see Sections 11.1 and 11.2).

The relationship of suppliers and contractors with the project team, or between suppliers and contractors involved in the project, is defined by contracts, purchase orders, or other legal or procedural documents or agreements. Therefore, in order to institute a project control process, all interfaces of the suppliers and contractors with the project control process must be defined and established in the agreements that we refer to here as *contracts*. Contract clauses that define project control interfaces must be included in the overall project plan.

For project control, suppliers and contractors must be obligated to provide cost, resource, and schedule information as needed to plan the project (i.e., they may develop all or part of the project estimate and schedule), measure progress of the work, support change management, and support historical database needs. Payment methods to the suppliers and contractors and methods for resolving disputes with and between them must also be defined. The goal of procurement planning then is to ensure that labor, materials, tools, and consumables that are obtained from or through suppliers are obtained in a way that optimally achieves project objectives and requirements.

Interface between procurement and project control begins in the scope development process (Section 7.1) where the work breakdown structure, organizational breakdown structure (OBS), work packages and execution strategy are developed. The execution strategy identifies general approaches through which the work packages and activities will be performed, including the role of suppliers and contractors. As regards procurement, the primary execution strategy decisions involve determining the type of contracts to be used for various elements of the work. The decisions are based on a variety of factors such as the status of scope development, the owner's project control capability, perceived risks and *risk allocation* strategies, prevailing purchasing and contracting practices, and so on. Each contract type (e.g., lump sum, unit price, time and materials, cost-plus, etc.) has specific risk and project control interface implications.

For example, lump sum contracts are generally used when scope development is well advanced and design changes are unlikely, and/or when the owner has limited project control capability. Reimbursable or unit price contract types are used more often when the scope is less well developed, new technology is involved, and/or the owner has better project control capability (i.e., better able to measure and assess progress and direct corrective actions).

As was mentioned, suppliers and contractors must be obligated to provide cost, resource, and schedule information as needed for project control. Each supplier and contractor should be required to use a common chart of accounts at the information flow interfaces (i.e., they may use their own accounts internally, but they should use the common accounts for progress reports, billings, etc.). This facilitates project control and cooperation between all parties.

For planning and scheduling, suppliers and contractors generally prepare their own detailed plans and schedules, but any applicable milestones that are required by the overall schedule must be a contracted requirement. For costs, bid, and change order pricing, cost reports, billings, and other submittals should be in accordance with the project WBS/OBS and common chart of accounts (which is made part of the contract) to the level of detail needed to measure and assess the participant's progress and to capture in historical databases. Likewise, estimated and installed labor hour and material quantity information should be reported per the chart of accounts. Also as was mentioned, the owner must establish in the contract requirements for payment methods and timing, change management, and dispute resolution.

At the conclusion of the procurement planning process, all requirements for project control deliverables (e.g., schedule data, cost and progress reports, closeout data, etc.) from the suppliers and contractors and project control procedures they must follow will be incorporated in contracts as appropriate. Likewise, all the project control information (e.g., milestones, chart of accounts, etc.) that is needed by the suppliers and contractors will be incorporated in the contracts as well.

Project procurement planning may be affected by decisions made at a strategic asset management level (Section 2.3) when the enterprise has established relationships with key suppliers and contractors to support project work. In that case, business management of the enterprise will communicate strategic procurement planning requirements to the project team as appropriate (Section 4.1).

Procurement planning is facilitated by having a database of historical procurement data. These data should include past experiences with suppliers and contractors and the contract approaches used. Development and maintenance of procurement planning tools (e.g., checklists, standard procedures, contract terms, etc.) is also a step in the process. A standard chart of accounts, along with the WBS/OBS, facilitates procurement planning by establishing ways for all suppliers to consistently categorize and exchange project control information.

Procurement planning is a team effort. The team includes the project manager or project leader, the project control leads (e.g., estimating, scheduling, etc.), purchasing, contracting and legal personnel, and the managers or coordinators of the work that will be done by vendors, suppliers, and contractor officers. Because much of procurement planning involves issues of information flow between project participants, having an information technology person on the team is often desirable. Generally, the project control leader, in close cooperation with the purchasing and contracting functional leaders, leads the procurement planning effort as covered here. However, everyone on the project team with interface roles with suppliers or contractors should have input to and buy-in for the procurement planning aspects of the project control plans.

7.7.2 Process Map for Procurement Planning

At its core, procurement planning involves studying the capabilities of various resource providers and alternate procurement approaches, and establishing project control requirements for the relationships established. Historical information including lessons learned is a valuable asset in determining the best approaches. Figure 7.7-1 illustrates the process map for procurement planning.

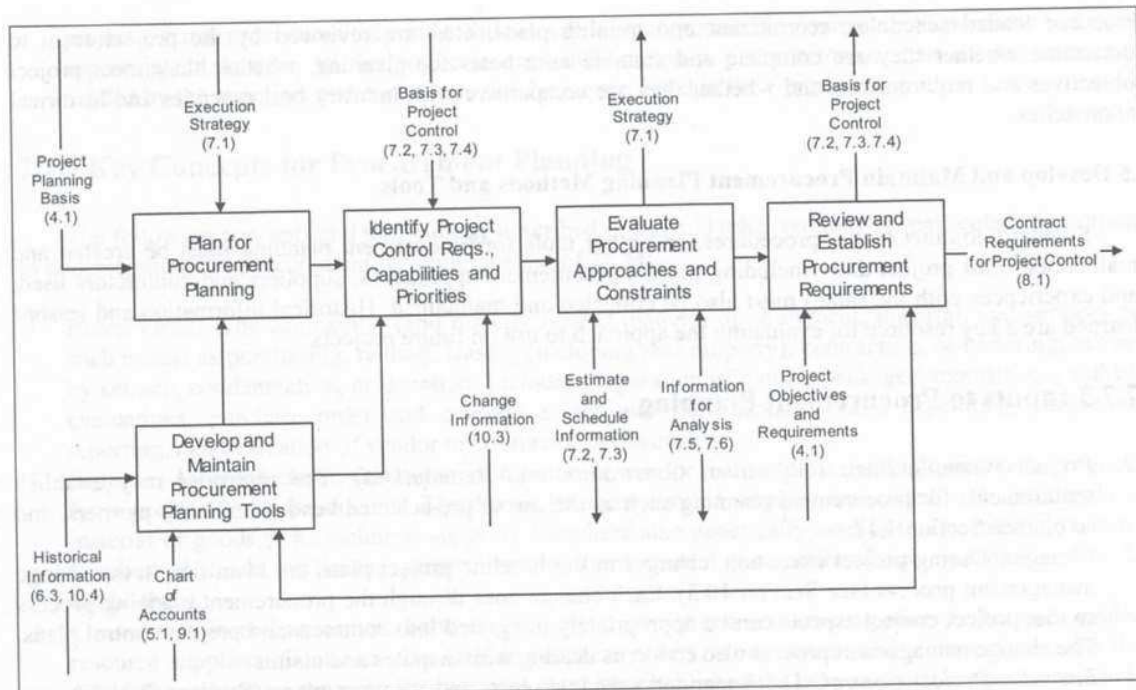


Figure 7.7.1 Process Map for Procurement Planning

The following sections briefly describe the steps in the procurement planning process.

.1 Plan for Procurement Planning

The procurement planning process requires activities and resources, so the work to be performed during the process needs to be planned. The project team identifies procurement planning tools that will facilitate the process, and the team assesses past project experience for lessons learned. Project requirements and initial execution strategies must also be considered.

.2 Identify Project Control Requirements, Capabilities, and Priorities

Based on initial overall project control plans (estimates and schedules), the initial execution strategy, and the scope of proposed changes, basic supplier, and contractor project control requirements are identified and prioritized. In addition, the project control capabilities of the project team need to be prioritized and evaluated.

.3 Evaluate Procurement Approaches and Constraints

Various approaches for establishing contract project control requirements for the various project suppliers and contractors need to be evaluated for their affect on project control plans and execution strategy. The affect of various procurement approaches on estimated cost and schedule (e.g., when to procure) also are evaluated. Opportunities to increase project value, reduce risks, and effectively allocate risks should also be assessed. The project control capabilities of the project team, suppliers, and contractors need to be considered.

.4 Review and Establish Procurement Requirements

The project team must review selected requirements for project control deliverables from the suppliers and contractors, and the project control procedures that they must follow. Likewise, all the project control information needed by the suppliers and contractors must be reviewed. The review ensures that project objectives and requirements are met. Resource planning outputs (e.g., resource expenditure charts based on

resource loaded schedules, recruitment and training plans, etc.) are reviewed by the project team to determine whether they are complete and suitable as a basis for planning, whether they meet project objectives and requirements, and whether they are competitive with industry best practices and historical approaches.

.5 Develop and Maintain Procurement Planning Methods and Tools

Standard contract terms, procedures, and other tools for procurement planning must be created and maintained. Past project data (including project procurement approaches, suppliers and contractors used, and experiences with the same) must also be collected and maintained. Historical information and lessons learned are a key resource for evaluating the approach to use on future projects.

7.7.3 Inputs to Procurement Planning

- .1 *Project Planning Basis (Objectives, Constraints, and Assumptions)*. The enterprise may establish requirements for procurement planning such as the use of pre-selected vendors, alliance partners, and so on (see Section 4.1).
- .2 *Changes*. During project execution, changes to the baseline project plans are identified in the change management process (see Section 10.3). Each change goes through the procurement planning process so that project control aspects can be appropriately integrated into contracts and project control plans. The change management process also concerns dealing with disputes and claims.
- .3 *Basis for Project Control*. The integrated schedule, cost, and resource plans (Sections 7.2, 7.2, and 7.4) define the project control basis and requirements for the project.
- .4 *Estimate and Schedule Information*. As alternate procurement approaches and requirements are assessed, the estimate and schedule effects are evaluated. The results of the evaluation support the procurement assessment. In addition, cost and schedule information provided by suppliers and contractors during the project control and procurement process is input for evaluation.
- .5 *Execution Strategy*. Scope and execution strategy development (see Section 7.1) define how the project work will be implemented (i.e., the general approaches through which the work packages and activities will be performed). The strategy will generally specify the general contractual approaches to be used; however, it does not include the specific tactics, which are developed in procurement planning.
- .6 *Chart of Accounts*. Coding structures that support the accounting and cost/schedule integration processes (see Sections 5.1 and 9.1) are provided. Each supplier will generally have its own chart of accounts; therefore, coordination requires that suppliers and contractors *map* their accounts to the one that is contractually required so that cost and schedule information can be exchanged.
- .7 *Historical Project Information*. Past project procurement approaches, suppliers used, lessons learned, claims experience, and similar information is used to support future project procurement planning.
- .8 *Information for Analysis*. Procurement planning is iterative with the other project planning steps including value analysis and engineering and risk management (see Sections 7.5 and 7.6, respectively). These analytical processes may identify changes in procurement plans that will increase value and/or reduce risks.

7.7.4 Outputs from Procurement Planning

- .1 *Basis for Project Control*. Procurement requirements, as they affect the integrated schedule, cost, and resource plans (Sections 7.2, 7.3, and 7.4), are integrated into the project control basis.
- .2 *Estimate and Schedule Information*. The results of procurement approach and requirements assessment are inputs to the planning and scheduling and estimating and budgeting processes (Sections 7.2 and 7.3).
- .3 *Execution Strategy*. The results of procurement approach assessment are inputs to execution strategy development (Section 7.1).
- .4 *Contract Requirements for Project Control*. All requirements for project control deliverables (e.g., schedule files, cost and progress reports, closeout data, etc.) from the suppliers and contractors and

project control procedures they must follow will be incorporated in contracts and purchase orders as appropriate. Likewise, all the project control information (e.g., milestones, chart of accounts, etc.) needed by the suppliers and contractors will be incorporated in the contracts as well.

7.7.5 Key Concepts for Procurement Planning

The following concepts and terminology described in this and other sections are particularly important to understanding the procurement planning process of TCM:

- .1 *Procurement.* The acquisition (and directly related matters) of equipment, material, and services by such means as purchasing, renting, leasing (including real property), contracting, or bartering, but not by seizure, condemnation, or donation. Includes preparation of inquiry packages, requisitions, and bid evaluations; purchase order and contract award and documentation; and expediting, inspection, reporting, and evaluation of vendor or contractor performance.
- .2 *Supplier.* A manufacturer, fabricator, distributor, or vendor that supplies materials, products, or goods for a project or for production. There may be some limited services associated with the supply of material or goods (e.g., technical support). Suppliers also generically applies to any internal resource suppliers that are not in the project team's direct control (i.e., with whom agreements must be established).
- .3 *Contract.* A formal agreement between the project owner and resource suppliers or between project resource suppliers. Contracts also include purchase orders, work orders, and similar documents that establish working agreements. Procurement planning established the project control requirements to be incorporated in the contracts.
- .4 *Contractor.* A business entity that enters into a contract(s) to provide services to another party. There may be some materials, products, or goods associated with the contracted service (e.g., construction services often include the provision of materials of construction).

Further Readings and Sources

There are many references describing procurement and contracting practices for various project types in various industries. However, procurement planning, as addressed by the process in this section, is generally covered in project management and control texts. The following references provide basic information and will lead to more detailed treatments.

- Amos, Scott, J. *Skills and Knowledge of Cost Engineering*, 5th ed. Morgantown, WV: AACE International, 2004.
- Fleming, Quentin W. *Project Procurement Management: Contracting, Subcontracting, Teaming*. Tustin, CA: FMC Press, 2003.
- Gransberg, Douglas D. and Keith Molenaar, Editors. *Professional Practice Guide (PPG) #10: Project Delivery Methods*. Morgantown, WV: AACE International, 2001.
- Heinze, Kurt. *Cost Management of Capital Projects*. New York: Marcel Dekker, 1996.
- Stukhart, George. *Construction Materials Management*. New York: Marcel Dekker, 1995.
- Zack Jr., James G., Editor. *Professional Practice Guide (PPG) #1: Contracts and Claims*. Morgantown, WV: AACE International, 2000.