TECHNICAL ARTICLE

Are Today's Project Cost Professionals a Bunch of Bean Counters?

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ABSTRACT: This article features 10 key considerations and a top 20 skills list that, when implemented, is generally viewed as forming a supporting structure that will enable the exercise of creative, proactive, project cost control. The author believes that even with the best of skills, there can be an inadequate or poor project cost performance if there is not the structure and organization to allow project cost excellence to develop and flourish.

KEY WORDS: Construction, earned value, labor productivity, and project cost control

This article features 10 key considerations and a top 20 skills list that, when implemented, is generally viewed as forming a supporting structure that will enable the exercise of creative, proactive, project cost control.

10 KEY CONSIDERATIONS

The 10 key considerations include the following.

Key 1—The Supporting Structure—The author of this article believes that even with the best of skills, there can be an inadequate or poor project cost performance if there is not the structure and organization to allow project cost excellence to develop and flourish.

Key 2—The Bean-Counter Syndrome

The practice, known as the bean-counter syndrome, is common but unacceptable in an effective, cohesive, project team. It results in poor cost trending. It has two major contributing factors.

First, the cost engineer can be directly responsible for this problem. This can be the case if the individual does not possess the essential analytical skills needed and/or good people/communication skills. Without these, the result is little dynamic cost trending and a lot of reporting only. Add to this, the accounting of costs after the fact. There is little or no proactive effort. Hence the term, bean-counter.

However, effective cost accounting is important because past experiences provides the platform for analysis and forward projection.

The second contributing factor to the bean-counter syndrome can be that the project manager does not want an aggressive, creative, analytical function for the cost engineer. Therefore, the cost engineer's work is regulated to a retroactive, recordkeeping, function.

Key 3—Research and Experience

Extensive experience and research by the author and by others during the 1990s clearly showed that many of the leading companies and their cost professionals lacked creative and proactive project cost skills. Project benchmarking and seminar programs, carried out during the 1990's with many of the world's leading companies, consistently showed a level around 60 percent for effective cost accounting. The Construction Industry Institute's (CII) research during the same period showed a similar result, with levels of effective cost accounting in a range of 55 to 58 percent. CII's research also projected that an effective cost accounting level of 80 percent was needed to reduce project costs and/or to meet financial budgets.

Has poor cost trending continued into the 21st Century? Is the norm of cost reporting and cost accounting still the bean-counter syndrome? Is there little creative and proactive project cost control?

The author's experience over the prior four years suggests that nothing has changed! During this period, the author worked with over 200 senior individuals from leading companies and found a significant lack of proactive cost control capability.

Interested professionals and individual companies need to look at their own businesses and ask if poor cost trending is the norm? The author has developed a list of 20 top cost control skills and techniques for the proactive control of project costs. He believes that these skills, if used consistently, will lead to a cost capability of 80 percent.

These skills and techniques have been developed for the full execution of engineering, procurement, and construction (EPC) of plant projects.

As you continue to read this article, check out the list and see if you and/or your company programs have these skills.

Key 4—Cost Control Defined

Effective cost control is a process that identifies all cost risks at all times. It focuses on potential hazards, evaluating the affect of such hazards and, where possible, proposes actions to alleviate the situation. It provides constant surveillance of developing project conditions to effectively and economically create a no surprises condition, except for force majeure situations.

Accurate and timely cost forecasts are the key deliverables. Project performance and progress measurement is essential as cost forecasting depends on knowing the true status of the work at any one time.

Key 5—Change is a Vital Ethic and it is Always Present

Changes in the project cost and schedule baselines is as much a political problem, as it is a technical problem. Even with high-quality trend analysis, changing approved baselines requires the understanding, support, and commitment of all parties to the project. This is especially true for the client or customer.

This support and commitment can only be achieved when both the project manager and the project control analysts have competence, credibility, and effective communication channels with project parties.

It is recommended that when current baselines are no longer realistic, revised baseline targets should be developed. There can be endless discussions about the definition of realistic, but the setting of programs to unrealistic or impossible baselines is to be avoided. Otherwise, it leads to reduced project credibility and poor morale.

Key 6—Project Manager Responsibility for Project Cost Control

The project manager is directly responsible for creating an environment that

will enable project control to be properly exercised. The project manager must be a cost leader, actively encouraging project cost consciousness at all project levels.

Key 7—Establishing Project Cost Consciousness

Effective project control requires the timely evaluation of potential cost and schedule hazards and presentation of any problems, along with recommended solutions, to project management. The cost/schedule specialist must be a skilled professional and also be able to effectively communicate at both upper management and lower working levels.

Key 8—A Cost Effective Program

All project control programs must live up to their own principles and be cost effective. Because of the ease of use of modern computer programs, many companies over control and over report. This also occurs because of the ever-present tendency, as projects become larger or more complex, to create additional levels of control, reporting, and personnel. Yet, more is not necessarily better.

Key 9—Business Decision Making

The initial step is to ensure that key decisions makers—the project manager, the engineering manager(s), the procurement/contract manager, and the construction manager—base their decisions on sound business practice, with adequate cost/schedule analysis and in conjunction with technical considerations. When these people are not motivated by a solid business ethic, then cost overruns and schedule delays become both commonplace and inevitable.

Key 10—Pareto's Law or the 80-20 Rule

Vilfredo Pareto's Law, a statistical probability, demonstrated that most of the wealth of a nation is concentrated in a small percent of the population. In the project business, this law became the 80-20 rule, where we learned that 80 percent of the costs are most probably to be found in 20 percent of the items. Concentrate on these high cost items as it is impossible to track/evaluate all costs.

THE TOP 20 SKILLS

Creative, Proactive Project Cost Control—the Top 20 Skills

This list of top 20 is not all-inclusive; other lower skills/techniques would also be required; and, of course, the top 20 would not all be required on a small, routine project.

The following skills and techniques are divided into major categories, including overall, engineering, procurement, and construction.

CATEGORY ONE
OVERALL

Focus—Remember Pareto's Rule; work "by exception"

Skill 1—Weekly Project Trend Report

Cost trending is the cornerstone of effective project control. The technique constantly identifies change and variation and all should be entered on a weekly trend report.

There is a high risk of design change on projects starting from a basic design package. Also, on reimbursable-type projects, the risk of design change is higher than on lump sum projects. It is vital that, those responsible for cost management and change control, ensure that communication channels are properly developed with all engineers. This is needed to constantly provide an accurate assessment of the developing design.

General design specifications and equipment specifications should be monitored for conflict, preference (that adds cost) and gold plating. Changes to the project execution plan—whether they are contractual, environmental, regulatory, or schedule oriented—should be included as well. Potential and approved trends should be reported, and preparation of related cost estimates should be routine.

The deliverables of effective cost trending are accurate cost and schedule forecasts. These forecasts generally consider the following common conditions and associated cost impacts.

- Current trends of time and money; positive and negative.
- Scope deviations, changes, and claims.
- Changes in project conditions.
- Changes to the project execution plan.
- Rundown/usage of contingency.
- Failure to meet contractual conditions.
- Engineering and construction progress/productivity.
- Subcontractor $-hour performance.
- Equipment/material bid experience (under and over budget).
- Actual versus planned commitment levels.
- Cost escalation factors.
- Currency exchange rates. And,
- Effect of changes in governmental and environmental regulations.

Skill 2—The Weekly Trend Meeting

Of the many meetings conducted during the execution of a project, the weekly trend meeting is probably one of the most important.

This is not a decision-making meeting, but is a communication meeting where information on change and variation is gathered and shared by key technical/services specialists.

The project manager leads the meeting and the project cost manager/engineer usually serves as secretary. All current and potential influences, changes, extras, and trends are reviewed and discussed.

The key meeting objective is the common sharing, gathering, communicating, and coordinating of all project influences that are developing at the time.

Skill 3—Contingency Evaluation and Rundown; Monthly

All too often, project managers treat contingency as a slush fund. When there is a cost increase, the contingency is immediately tapped, so the cost forecast can remain unchanged. There needs to be a structured program for managing contingency. As the project advances, funds should then be expended and cost risks reduced.

On many projects, contingency is the single largest cost item. It should be an item that is constantly and carefully evaluated with a good risk analysis program. Depending on the project size ($ of project), it can be a computer program or a proven manual technique.

In reality, the following items are always two key concerns.

- Are commitments, as they are entered in, (i.e., purchase orders and third party contracts), in line with the estimated amounts; and,
- Are the expenditures, (i.e., paying the bills), meeting the original committed amounts.

It is common for there to be supplemental purchase orders. For multiple reasons, the original purchase or contract price is exceeded. The budget for that item is also exceeded. This can be especially true of construction subcontracts. Such

equipment/material cost additions would come from the design-development allowance.

As risk reduces with project execution, the contingency should be reduced, accordingly. Contingency is essentially to be used for unknowns, and these unknowns only become known when commitments are made. It is then that the cost reality and validity of the estimate and project budget becomes apparent.

Over the project experience of the author, he has successfully used a relatively simple manual method of contingency evaluation. His technique is based on making allowances for remaining commitments and expenditures, by major accounts. The allowances are based on the experience of many conceptual estimates/budgets.

Skill 4—Earned Value System (EVS) for Performance Measurement

An earned value system (EVS) program is the most effective system for measuring the progress and productivity of the work. It is also the most expensive because the measurement is at the unit-quantity level, and this results in very detailed measurement and reporting and requires considerable resources.

The terms achieved value, accomplished value, or physical quantity measurement, can also be used. A project's budget is expressed in quantities, hours, and dollars, and earned value is keyed to the project budget.

With an EVS program, project budgets are determined by the quantity take-offs to a code of accounts, from completed drawings/documents for engineering and construction drawings and equipment lists for field work. This constant take-off, feeding in accurate quantities into the budget, ensures a correct budget (hours per quantity) for performance measurement. The information is also fed into the trending program.

This program is only used for direct work, both engineering and construction labor. Indirect and supervisory accounts are generally tracked with cost/hourly expenditure curves.

Skill 5—The Fast Track Trapezoidal Program

A fast track trapezoidal program independently develops the construction schedule and direct labor worker-hours. When correctly used, it has a high probability result and provides a real check of the project schedule and estimate.

The technique can be used at an early stage of engineering and requires a preliminary plot plan and equipment list. (The author notes that he has used this program consistently during feasibility studies and with excellent results). It is based on the fast track data base, plot area, labor density (sq. ft. per worker) and construction complexity (direct hours per sq. ft.). The historical data base is extensive and proven for process plant projects and covers many industries. The probability of the calculations can exceed 90 percent, often higher than that of the conceptual estimate.

CATEGORY 2 ENGINEERING

Focus: The greatest proportion of project changes (in-scope and out-of-scope) will usually occur during the engineering design phase. These changes can affect either all or many phases of the work. Some of the possible areas affected include the following.

- Reducing engineering productivity.
- Increasing material and equipment costs.
- Changing contracting arrangements; low scope definition or high risk of change.
- Adding engineering and construction hours. And,
- Requiring more field resources, etc.

Skill 6—Evaluation of Design or Development Allowance; Monthly

An evaluation of a design or development allowance, identified as a separate line item in the estimate, is not part of contingency. It is a known condition that is very common on fast-track projects. It represents funds that will be used to cover design changes, which often occur after an equipment purchase has been made. This can result in additional costs to the original purchase price.

The fast-track approach requires early placement of all critical equipment, even before the design has been completed. As the design advances to completion, changes can and do occur to the already-committed equipment. The value of design allowance for conceptual estimates is approximately listed as follows.

- 8-10 percent of the total estimated equipment cost; and
- 10-15 percent of major equipment categories; e.g., large compressors, and pressure vessels.

This cost allowance would also be part of the equipment bid tab evaluations, especially for major, complex equipment.

Skill 7—Engineering Tracking Curves; Critical Work

Engineering tracking curves (critical work) covers both cost and schedule risks. Typically, these curves would be used to monitor high production categories, such as concrete foundation drawings and piping isometrics. Both disciplines use a high proportion of engineering labor hours and are usually critical to the project schedule.

This technique can be used for any significant element of work. During critical periods, the frequency of monitoring would be increased from monthly to bi-weekly or even weekly if necessary. If process design is critical to the project schedule, these curves would also be developed for the P&IDs.

The curves, showing actual versus planned, would cover the following.

- production of number of drawings over time; and
- hours per drawing versus the estimate/budget.

Skill 8—Hourly Rate Profile for Total Engineering

An hourly rate profile is a curve over time, showing estimated versus actual; $ per hour. Engineering productivity can be good and hours under-run, but engineering costs over-run because of the rate being higher than what was budgeted.

Skill 9—Engineering Change Log; Weekly

An engineering change log would be a sub routine of the trending program and would be maintained by the lead design personnel. It would contain all changes from the frozen or fixed scope that was the technical basis for the funding estimate, as envisioned by the designers. It is probable that some of these changes are already covered by the approved estimate/budget. Double-dipping is to be avoided.

CATEGORY THREE PROCUREMENT

Focus—The project purchasing strategy should specify a proposed split of domestic and international purchasing.

In the control budget, escalation rates

and design allowances should be established by a prime account. The use and coordination of overseas purchasing offices and/or agents should be specified. Project conditions such as schedule acceleration, purchasing preferences, and special owner requirements, need to be evaluated for their cost impact.

The following items should be considered when planning for procurement cost management.

- Optimize commercial terms by taking advantage of cash discounts for quantity and by making prompt payments.
- On large projects, maximize discount terms by ordering similar items on a single purchase order.
- Minimize import duties and taxes by requesting special waivers from host countries, or by reclassifying items to lower duty categories.
- Minimize freight charges by careful selection of carriers. And,
- Biased bidding—After evaluating potential contract quantity increases, make a sensitivity analysis of unit price bids to verify that an apparent low bidder is, in fact, still lowest.

Skill 10—Cost Forecasts of Major Purchase Orders

The purchase order commitment register may be voluminous. For this reason, it is recommended that the major cost purchase orders be segregated and reviewed each month for a final cost forecast. Design allowances for fast-track projects are of particular importance, and currency fluctuations, escalation, and delivery conditions should all be carefully considered.

Skill 11—Monthly Purchasing Experience Report

A monthly purchasing experience report shows actual commitments versus estimated commitments of major equipment/material accounts and of the total purchasing effort. Of major interest would be the following questions on purchasing.

- Are we on budget, at this reporting period ?; or
- Are we losing or gaining?

CATEGORY FOUR CONSTRUCTION

Direct Hire Focus—The ability to effectively control and forecast construction costs starts with the quality of the field budget. Too often, a lack of care and attention to construction work begins as early as the project control estimate.

This lack of care and attention becomes particularly evident in the field indirects estimate. Factors are applied to direct-labor costs instead of developing quantity takeoffs. This requires drafting layouts for temporary facilities, developing a detailed organization for the field staff, and preparing detailed construction equipment lists, as well as time-frame schedules.

Many projects experience overruns in field indirects because of a poor estimate, rather than a lack of control or poor site management. Establishing detailed (quantity) estimates for small tools, consumables, and field office expenses is a difficult task, normally accomplished by a unit or factored basis method.

The major elements for controlling construction costs are early identification of quantity variances, labor productivity and craft rates, and continuous evaluation of field indirects. A quantity field budget, showing clearly defined units of work, is essential.

Subcontract Focus—Much of the reporting is the direct responsibility of subcontractors, with some expert analysis being carried out by the general contractor. It must be recognized that many subcontractors do not use experienced project control personnel and often do not operate with detailed control systems. The key to success, therefore, is to develop a simple, practical method of control and to require that subcontractors include adequate personnel costs in their bids to use the system.

Effective subcontract control is based on the following essentials.

- Good contractual documents and agreements.
- An adequate system for documenting changes and amendments.
- An acceptable scheduling system (critical path method or bar chart).
- An effective progress measurement system.
- An effective cost trending and forecasting system. And,
- An adequate performance measurement system.

Most of these elements should be identified in the bid documentation.

Skill 12—Construction Pre-Planning; Direct Cost Involvement

Failure by cost personnel to be involved in construction pre-planning can lead to failure to identify major cost risks. Current studies by the Construction Industry Institute (CII) have shown that construction pre-planning is one of the most important elements for project success and that it is also one of the most neglected programs of current industry practice.

Pre-planning for construction at the early stages of a project is absolutely essential. At an early stage, detailed planning is restricted by lack of scope definition. However, there are areas where pre-planning can be reasonably definite, such as work accessibility, traffic patterns, laydown areas, rigging studies, preassembly and modularization, material selection, temporary facilities, and overall personnel resources.

Skill 13—Extra Work Report

An extra work report would be a sub routine of the trending program. Because of the volatile nature of conditions at a construction site, change is a constant companion. A field trending system that reflects costs due to changes and extra work is therefore essential. The system would typically capture the following items.

- specification changes;
- design errors;
- field errors;
- supplier errors;
- owner changes; and,
- changed or unusual site conditions.

A procedure should be developed to cover extra work initiation, approval and authorization, reporting, and closeout.

Skill 14—Construction Work Tracking Curves; Critical Work

Construction work tracking curves (critical work) covers both cost and schedule risks. Typically, these curves would be used to monitor high production categories, such as earthwork, concrete foundations, and piping. These disciplines use a high proportion of labor hours and are usually critical to the project schedule.

This technique can be used for any significant element of work. During critical periods, the frequency of monitoring would be increased from monthly to bi-weekly or even weekly if necessary.

The curves, showing actual versus planned, would cover the following:

- Production of work units/quantities over time; and
- Hours per work unit/quantity versus the estimate/budget.

Skill 15—Monthly Subcontract Cost Report

On international work, subcontracting of construction is the norm; very little or no work is carried out on a direct-hire basis. The monthly subcontract cost report should list all subcontracts, showing the budget, original contract price, and should include allowances for changes, extras, future claims, and a total forecast.

The emphasis should be on major subcontracts. The first step in cost control is evaluating the contractual documents and the contract agreement. The cost engineer should look for contractual anomalies, pricing discrepancies, and conditions that might lead to future cost risk.

Careful consideration should be given to schedule commitments, warehousing agreements, laydown and material handling requirements, and whether previously stated commitments can be maintained during execution of the subcontract. It is particularly important that a review of associated interface work by others, job-site areas, free-issue material supplies, and services be made, since these items often provide the source for major claims.

A log should be maintained of all engineering and contractual changes that have taken place in the agreement. All changes and appropriate cost trends of such changes should be recorded. These potential cost deviations should be estimated as definitively as possible for use in future negotiations with the subcontractor.

Skill 16—Subcontract Performance ($) Report

The subcontract performance report is an assessment of the subcontractor's financial performance, in $ per hour for their labor installation. Any material costs are deleted from the analysis. Actual earnings rate is then compared to an independent unit rate assessment of what the rate should be. If there is a loss and the sub is in financial difficulties, the risk of future subcontractor negative action with schedule delays, claims, and contract default becomes very real.

When this technique is used properly, it provides an early warning of potential problems and allows time to consider alternative solutions. This technique can only be used on lump sum and unit price contracts.

Skill 17—Back-Charge Register

Back-charges result from poor vendor and contractor workmanship, schedule delays, lack of resources, failure to clean-up and etc. The charges can be significant.

Accurate records and supporting documentation are essential. It should be noted that these charges/costs are certain to be challenged by the offenders, so that full recovery is unlikely, often falling in the range of 30-60 percent. The offenders take the position that the costs are much higher than they should be because of the general contractor's higher costs and lower productivity. There is some truth in such assertions, so negotiation of these costs can result in agreement to accept a lower number.

Skill 18—Labor Productivity Profile

A labor productivity profile only covers direct labor. Development of this profile prior to the start of construction is a great tool to plan productivity levels on an incremental (monthly) and cumulative basis throughout the construction period, establish labor levels, and forecast the final productivity level and associated cost at the 40 percent completion point of construction. This technique uses the EVS of quantity and worker-hour measurement.

Skill 19—Hourly Rate Profile for Construction Direct Labor

The hourly rate profile for construction direct labor shows a curve over time. It shows estimated versus actual $ per hour. The assessment of the final rate together with the projected productivity rate and associated direct worker-hours results in a total direct labor cost forecast. Constant tracking of this cost will allow a significant cost risk to be assessed; the total direct labor cost can be 20 percent of the total project cost.

Skill 20—Construction Indirects Tracking Curves

Construction indirects tracking curve accounts are not quantity based, so they fall outside the EVS program. The work covers field staff, construction equipment, field office expenses, temporary facilities, indirect labor, and general support services. These are major cost centers. The use of $ expenditure curves to track actual costs versus estimated costs (over time) can enable the cost risk to be assessed incrementally and in total. If further detail is necessary, curves could be developed for hours and hourly rates, separately and also for individual accounts.

The bottom line for a successful project control program is no surprises. With the exercise of the top 20 skills, as outlines in this article, this objective can be achieved and can lead to lower project costs or, at the very least, cost containment. ◆

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