Accounting's contribution to operations has been repeatedly validated in many industries. However, in construction, the importance of accounting has yet to receive the recognition it deserves . . . even though the techniques have been part of American industry since World War II.

THE IMPACT OF ACCOUNTING

BY PARVIZ DANESHGARI & MICHELLE T. WILSON

on Job Management & Profitability

During the global struggle between the Allies and the Axis Powers, the war effort was paramount. Millions of lives were at stake, and nations pursued every innovation possible. Along with the advent of aircraft carriers, ballistic missiles, and atomic bombs, there were lesser-known, but equally important, innovations. Countries raced to invent communication devices, intelligence tools, medical techniques – and more efficient production processes.

American manufacturers of war equipment discovered that accounting and statistical process control (SPC) data could reduce production variations and improve the quality of our nation's weaponry. After WWII, many industries adopted this technique to refine their production processes. By controlling variations in many aspects of their work, other industries have been able to compete with international low-cost producers.

The same principle applies to the construction industry. Based on more than 17 years of applied research, we will demonstrate the application of SPC in construction. In addition, we will discuss the essential role of accounting in the collection, analysis, interpretation, and utilization of data for job management – part of a process called *Agile Construction.*

Accounting is a "necessary evil" for most contractors. This is not so for an agile construction company, where the accounting department is a proactive, forward-looking participant in construction operations.

But, why should your accounting department adapt to a new role? Because the market demands it!

Construction Market Shifts

In the 1960s, the construction market was transformed as dollars shifted from industrial to commercial and residential construction. New contractors entered this market more easily because fewer specialized workers were required, compared to other types of construction.

Years later, subcontractors followed the same market trends. For example, in the late 1990s, the electrical construction market shifted from 50% industrial work to more than 50% commercial and residential work.

During the next 20 years, the market for commercial and residential construction will continue to expand. For example, the Energy Information Administration predicts that commercial floor space in 2025 will increase by 52% compared to 2000.[1] Other sources expect the American population to grow another 20-25% by that time.[2]

Low-Cost Providers

Due to this shift into commercial and residential construction, supply-side control is no longer effective (for example, when supply of a resource, such as specialized workers, is limited). So, how can contractors compete as demand continues to shift and rivals flood the market?

Companies can only control market share if they are profitable. And, in a commodity market, contractors can only be profitable if they are low-cost providers. Low-cost providers of construction services deliver quality work at a lower cost through high

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system productivity. In a commodity market, low-cost providers offer profitable market-based pricing – and accounting plays a vital role in this process.

The Accounting Department's Role

Accounting departments can help contractors become low-cost providers by furnishing data on: **1)** estimation accuracy, **2)** operational trends, **3)** productivity, **4)** production, and **5)** the impact of work type and location on productivity and profitability.

To do so, CFMs and other members of senior management must recognize and respond to the differences between after-the-fact measures and trend monitoring, production and productivity, and common cause and special cause variations. We will look at each of these differences and discuss an approach to accounting that promises to streamline operations more quickly than standard reporting.

After-the-Fact Measures & Trend Monitoring

As the central source of reported information, accounting is a critical component of any construction company's operation. However, traditional construction accounting measurements do not provide the necessary context to fully evaluate a job's progress. When accounting information is compiled and reported two weeks or one month after the work occurs, the information arrives far too late for decision makers to recognize or address the immediate needs at the jobsite.

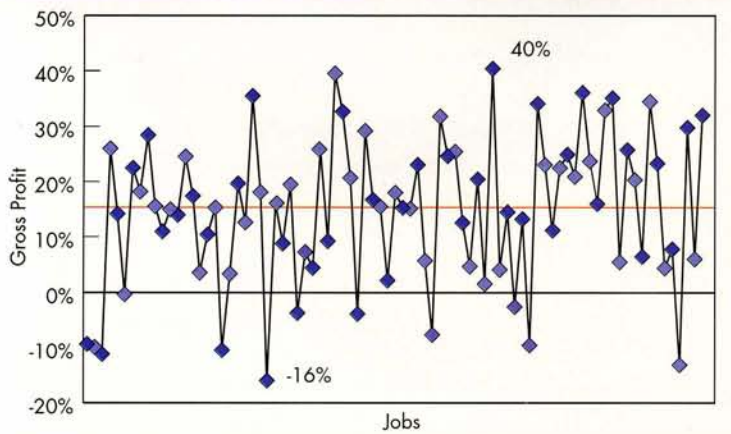
To show how after-the-fact measurements can be misleading, let's say that two jobs closed out 18% more productive than planned. On the surface, 18% seems like a respectable rate. However, the two jobs unfolded in very different ways.

Job 1 gained momentum throughout the project. Managers incorporated lessons learned into the ongoing work, planned effectively, and capitalized on advantages. As a result of their active management, productivity steadily increased throughout the job.

Job 2 also shows 18% more productivity than planned. However, in the beginning of the project, the job was almost 30% more productive than expected, and gradually became less productive as the job progressed. In this case, 18% is a liability because almost half of the early productivity gains were lost. Without correct information, the final profit numbers look good for both jobs, but the reality differs.

The only way to stop a downward trend is to know that it is occurring! This observation of data over a period of time is called *trend monitoring.* With trend monitoring and other aspects of SPC, contractors can recognize and respond to a job's warning signals almost immediately.

Exhibit 1: Deviation in Profitability for ABC Construction



Production & Productivity

In construction, every job is different. Two almost identical jobs can return vastly different profits because of the market, the location, the materials, the schedule, the crew, the owner, the weather, and a myriad of other reasons. Standard, after-the-fact measures of cost and quantities do not begin to address why one job loses 5%, while another makes 30%.

To predict profitability more accurately, contractors must understand the difference between *production* and *productivity.* In construction, production measures construction put in place, while productivity measures how well it was put in place. Ordinary cost-based accounting only measures production, the incurred cost independent of labor's actual value-added activity on the jobsite.

Let's say a contractor measures installed quantities. Without recognizing the labor required for installation, the measurements do not provide the information necessary for either company management or jobsite staff to respond appropriately to jobsite variations.

What Is a Variation?

A variation is a deviation from an expected outcome. It can be described as a lack of uniformity, a

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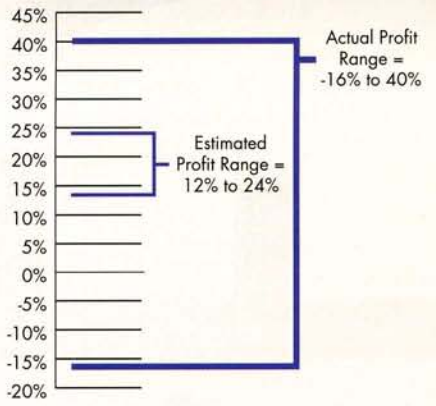
Exhibit 2: Estimated & Actual Profits for ABC Construction



fluctuation, or the difference between one event and another. SPC maintains that variations occur everywhere, in every aspect of every operation.

Why Are Variations a Problem?

Variations prevent consistent, repeatable installation and production. In World War II, too much variation would render a weapon useless, or even dangerous, for a soldier to use. In construction, variations hinder a contractor's ability to bid jobs accurately, build projects productively, and increase profits.

Variations add unanticipated material or handling costs and hamper a project's installation, function, or reliability. The greater the variation, the more severe the uncertainty of a contractor's profitability. (Variations in timing can cause, at a minimum, wasted labor hours – and, in the extreme, liquidated damages.) Exhibit 1 on page 26 shows profitability by job for ABC Construction, an electrical contractor. In this example, profits are very erratic; individual projects vary from a 16% loss to a 40% profit.

The deviation is far too wide to reliably determine, or even approximate, a new job's profitability. In some cases, this potential difference is easily more than the entire net profit of the contractor's previous year! This lack of predictability makes it challenging to manage cash flow, meet financial obligations, or accurately bid for new work.

Common Cause & Special Cause Variations

Common cause variation is evident in the small fluctuations of a project, such as:

1) The material delivery truck generally arrives within the first three hours of the job start, +/- 30 minutes.
2) Job permits should be issued on Wednesday, but this could vary by +/- two days.

Common cause variation is a system level occurrence. Countless factors are regularly present in the construction process and each factor contributes a small amount to the total variation. No cause necessarily contributes more significantly than any other.

Special cause variation occurs outside normal operations when an exceptional occurrence temporarily or sporadically disturbs a process. For example, a misallocation of labor hours to the wrong cost code creates an abnormal increase in productivity. To correct the special cause, the CFM informs the PM, who works with field supervisors to sort out the allocation of hours.

How to Identify Types of Variations

Although a special cause variation generally has an identifiable trigger, contractors too often deal with a special cause variation as if it were a common cause variation, or vice versa. Both of these mistakes are very expensive and sometimes unrecoverable.

Cost-based measurement of the construction progress hides special cause variations. Due to accounting's after-the-fact reporting, it's easy to miss the special cause variations that diminish productivity and profitability. Conversely, a quantity measurement approach (measuring job progress by feet installed or wiring laid) to job production will show an individual cost code's common cause variation as a special cause.

So, what's the solution? CFMs should measure system productivity. Not only will this allow them to accurately measure profits, it will also enable them to help streamline many aspects of a contractor's day-to-day operations.

(For specific operational measurements for GCs and subcontractors, see our article, "The Impact of Job Planning on Profits" in the November/December 2005 issue.)

Accounting Data that Streamlines Operations

Estimating has a two-fold role in any construction company:

1) Pricing the work for the market, and
2) Identifying the probable costs associated with completing the installation.

To better understand the cost of the next project, estimating must have accurate feedback from both accounting and the field to generate accurate future bids.

Sometimes History Doesn't Repeat Itself

Using production averages from one job to anticipate the next job leads to variation, which often leads to unpredictable profits. As many CFMs know, averages and blanket pricing can mask several issues. For example:

- Installing fixtures may be an acceptable loss leader when it accounts for 20% or less of the labor on the job. However, this could seriously undermine a project's profitability when it accounts for 60% of the job or more.
- Cable tray can be installed at a typical rate of production. However, drops and angles necessary on the jobsite, but not evident on job drawings, can significantly slow the rate of installation.

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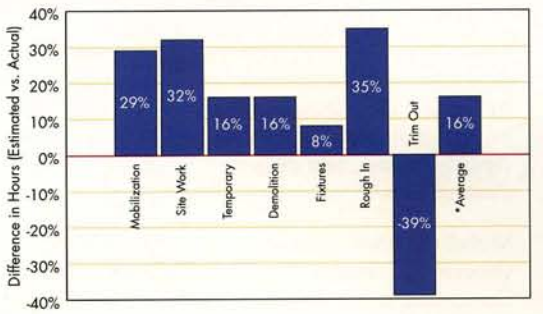
Exhibit 3: Performance to Estimate Breakdown for ABC Construction

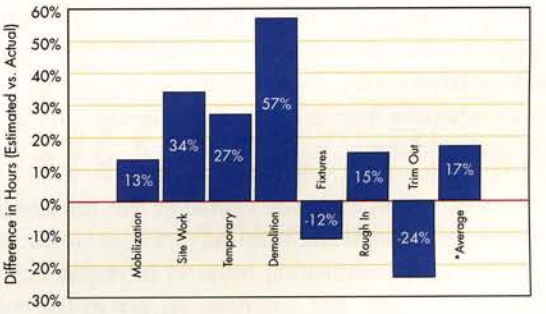
As the result of a cost-code comparison, ABC Construction discovered significant variations in productivity. For example, actual hours were much higher than estimated by 94% and 164% for fixture work on both local and non-local renovations. Demolition hours for local and non-local renovations were also significantly underestimated by 63% and 70%. (In contrast, demolition was consistently overestimated during new construction.) Overall, non-local renovations showed the most substantial variation.

This data underscores the importance of accounting's role in the estimation process. Such feedback by job type and location, segmented by cost code, encourages estimators to bid more accurately and improve their hit ratio. This allows contractors to be low-cost providers and win more jobs. With this approach, accounting is no longer just an overhead expense – it's a revenue generator!

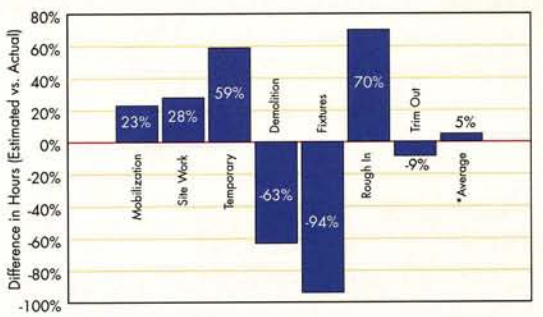
Local Jobs, New Construction



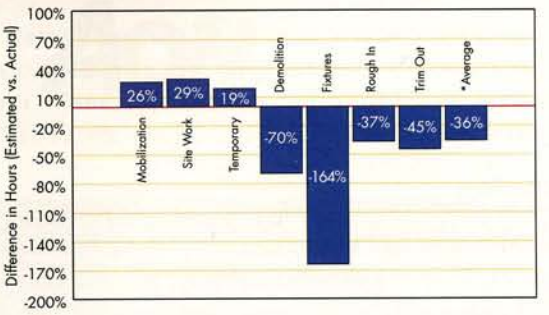
Non-Local Jobs, New Construction



Local Jobs, Renovation



Non-Local Jobs, Renovation



*All averages are weighted.

- A labor cost code of $200,000 on a $500,000 project will have a considerable impact compared to the same $200,000 in labor on a $1,000,000 project.
- Jobs with a certain owner may be fine on a short schedule, but are subject to huge overruns if the schedule expands.

Historical accounting information cannot contribute to accurate estimates if there is any substantial variation between past jobs and future work. But, contractors can recognize impacting factors and estimate with greater accuracy when they analyze each job and its context. Exhibit 2 on page 28 shows ABC Construction's estimated profits. Each estimate predicted a gross profit of 12-24%. The reality, however, was somewhat different. What explains this wide disparity? The variation was primarily caused by productivity differences.

To see fluctuations in estimated and actual profits, accounting data, estimation data, and field productivity information must all be evaluated collectively. Labor is often the most significant source of variation on any jobsite, and as shown in Exhibit 3 on page 29, cost-code comparisons can reveal significant variation in labor productivity, depending on the location and type of work.

ABC's historical estimating procedures for new construction were fairly reliable. However, estimators overcompensated for non-local renovation work, as the actual numbers showed significant variations from the demolition, fixtures, rough in, and trim out estimates.

An agile construction company combines this information to categorically respond and surgically address issues. Just as across-the-board estimating leads to inconsistency, so do sweeping changes. For example, an across-the-board response to ABC's erratic estimations of demolition and fixtures costs would destabilize the predictability of its reasonably accurate estimates in new local construction.

CFMs can use accounting to measure the performance of more than estimating. They can apply this approach to operational areas including project management, jobsite oversight, and procurement.

Conclusion

Increased productivity directly correlates to increased profitability. With correct measures and timely intervention, contractors can recognize and address situations that cause declines in productivity. Productivity measurements, as well as correct recognition of special and common cause variations, enable CFMs to mine accounting data for ways to improve operations. By connecting estimation, project management, and accounting, CFMs can improve job predictability, productivity, bid accuracy, and profits. BP

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Endnotes:

1. *Annual Energy Outlook 2005 with Projections to 2025*, Energy Information Administration, *www.eia.doe.gov/oiaf/aeo*
2. Wellner, Alison Stein, "The Next 25 Years," *American Demographics*, April 1, 2003.