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Measuring the Value of Work Accomplishment
Part One: Fidelity in Measuring Accomplishment Value

Author's Note: This is the first in a series of articles on practical applications of the Earned Value Analysis concept. We will address common issues and misunderstandings about EVA and provide examples of very simple and practical uses of this extremely valuable tool.

Long before the structured, computer-based project planning systems (PERT and CPM) came on the scene in the late 1950's, project mangers struggled with the task of measuring work accomplishment. This measurement was needed for several reasons. One reason was the need to measure performance, which required a comparison of accomplishment against a plan. Another was to provide a basis for progress payments.

The performance data was needed so we could avoid surprises and make decisions. Without performance measurements (which depend on measuring accomplishment) we cannot determine how well a project is proceeding or forecast the end conditions. Therefore, a common occurrence would be to believe that a project was on time and within budget until the schedule and budget were exceeded. And even then, no one knew how extensive the overruns might be until the project was completed.

Where contracts involved progress payments, a similar situation existed. A plan of effort over time would be produced, which was used as a basis for periodic payments to the contractor. Without the measurement of what was actually accomplished, periodic payments were made to the contractor according to the planned effort. However, most projects run into some kind of problems that delay the work. Whether these be technical problems, weather delays, labor strikes, contract disputes, design changes, etc., the work is often accomplished at a lesser pace than in the plan. But, if there is no formal measurement of the work accomplished, the contractor ends up getting paid according to the original plan (an overpayment) or gets into a dispute with the client.

Therefore, the need for formal methods of measuring work accomplishment was soundly established many decades ago, and such methods have helped to address problems such as those above.

Earned Value Analysis

With the advent of computer-based project management systems, the industry, spurred by such U.S. government agencies as the Department of Energy and Department of Defense, developed a formal approach toward the analysis of schedule and cost variance, which we commonly refer to as ***Earned Value Analysis***. This would include DOE's ***Performance Measurement System*** and DOD's ***Cost/Schedule Control Systems Criteria***.

While many people assume that EV systems are only for major government-type contracts, this is not so. A key element of any EV system is a method of measuring the work accomplishment. Such EV measurements are useful (I might rather say "essential") for any kind of project, if the project manager is to maintain control of the project, make practical decisions based on knowing what is going on, and avoid surprises when the project is late and over expended. This would apply to any size project as well as any type of project in any industry. It would also apply to internal projects as well as projects being performed for an external client.

This series of articles will address some of the common issues and misconceptions regarding the application of Earned Value Analysis, and suggest some simple, practical ways to use this most important project control process. We promise a pragmatic treatment of this often intimidating and misunderstood subject.

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Measuring Accomplishment Value

Accomplishment Value is my generic term for that which we often refer to as ***Earned Value*** or ***Budgeted Cost of Work Performed (BCWP)***. I use it because it says exactly what it is ... the value of the work that has been performed. I like Earned Value too ... much better than BCWP. In fact, in a system that I developed at the General Electric Company, I chose to coin the term EVWP (Earned Value of the Work Performed), rather than BCWP, because that says exactly what it is.

However, jargon aside, a major issue is maintaining the fidelity of these EV measurements. How do we make sure that the people who are reporting the accomplishment values are using genuine figures and not pulling the wool over our eyes? The one thing that is worse than not having any accomplishment value measurement at all is to have values that are false. In this latter case, we are led to believe that there is validity to the distorted data. Under the guise of a structured system, we have merely produced a very precise error, made further harmful by the misconception of infallibility by having been produced by the *computer*.

This concern, regarding the means of obtaining objective measurements rather than subjective measurements was raised in a recent e-mail that I received. I would like to share that query with you as well as my response to the question.

A Query

A French student, working on his dissertation on project management, at a university in England, recently sent me a query on earned value. In his note, he said:

" If I want my system to calculate the budgeted cost of work performed, once I have the BAC, I need the actual percent of work complete. Where from do the managers get that figure? Will it be crazy and far from reality if in my system the manager inputs that figure? Therefore I have to assume that he is accurate as far as this datum is not revealed by the system. Which sources does he use to get that information? What I mean is if the % complete is exogenous in my system... will it be wrong? "

The student is already proving himself to be a good project manager by raising these perceptive concerns. He is correct in the basic equation, that requires both %C (percent complete) and BAC budget at completion) to calculate the BCWP (budgeted cost of work performed, or earned value). And, of course, if the %C is erroneous, or picked out of the thin air, then the EV is also wrong.

He asks: how do we minimize the possibility of such errors" (deliberate or otherwise). He asks: can the data be trusted if it comes from outside of the project control system (from sources that might arbitrarily pick %C values).

Solutions

First, if people want to deceive the system, they can always find a way. However, there are a few ways that we can either make it easier to calculate %C or make it more difficult to falsify %C. These are all aimed at moving the source of the EV data closer to the internal system (which addresses his stated concern).

1. Use weight factors. For instance, if the task is to produce an engineering drawing, then you could say that the drawing is 25%C when the backgrounds are complete; 70%C when issued for approval; 90%C when issued with approval: and 100%C when all holds are removed.
2. Use milestones. This is similar to the above. Tasks that involve multiple steps are given a fixed %C when an interim milestone is reached.
3. Use the 0%C - 100%C method. A task is considered to be 0%C until it is finished. This will always produce a lower EV than actual, but motivates the task owner to complete the task (or lie about completion) to get credit for the BCWP.

4. An alternate to the above is the 0-50-100 method. A task is 0%C until started. Then it is 50%C until completed. This makes things simple. There are three task states: not started, in progress, and completed. Each state has a set %C. No calculation or estimate is necessary.
5. The problem with all of the above methods is that there can be a lag in calculated earned value over the real amount of the work accomplished. To counter this problem, we can apply a method that uses a subjective stipulation of %C combined with stepped limits. In this method, we specify fixed %C values associated with specific stages (or phases, gates, milestones, etc.) of the task or work package. We then allow the voluntary reporting of %C up to the specified limit of that stage. This allows some partial credit for accomplishment but prevents abuse of the system by overly optimistic (or deceptive) managers.
6. Use the measured (quantified) progress method. This can be applied to tasks that contain quantifiable results. It might be feet of pipe, miles of road, tons of concrete, lines of code, meters of cable, etc. If a task (or work package) consists of stringing five sets of telephone cable a distance of 500 meters, and the current status is one cable completed and one cable strung 250 meters, then you could say that the task is 30%C.
7. Base %C on percent of applied hours used. There are two conditions that complicate this approach. First, you must be periodically updating the estimated hours so that the BAC hours are the sum of the hours spent plus an up to date estimate-to-complete (ETC). Second, this will cause the ACWP (actual cost) to be equal to the BCWP, thus preventing an accurate calculation of Cost Variance (unless your system can hold two BAC's ... baseline and current). So you can see that this is certainly not a preferred method, but is better than nothing when you are having trouble getting good %C figures. The equation is BCWP = Hours Spent / Hours Spent + ETC. Also note that we violate the rule that the BAC is fixed. In this case, we update the BAC every time the sum of the Hours Spent + ETC changes. Here is an example: A task is budgeted at 200 hours. After spending 80 hours (40% of the original estimate) the worker estimates that it will take another 160 hours to complete it. The new BAC is 80 + 160 = 240 hours. The %C is 80 / 240 or 33%. Recognizing that 80 hours have been spent, we can note that 40% of the budgeted cost has been spent to do 33% of the re-estimated work.

Level of Detail

A key to obtaining good EV figures is to push the collection of %C data down to the lowest levels. This does not necessarily mean that actual cost data need also to be collected at the lowest level. Let me explain. An EV system is almost always built upon a Work Breakdown Structure (WBS). The WBS will subdivide the project into smaller and smaller segments, based on a logical grouping of project elements. Eventually, the WBS will arrive at a group of tasks associated with a project deliverable, belonging to an accountable function. The most common term given to this juncture is *cost account*, although we will also see *control point* or *work package*. It is at this point that we most often compare BCWS, BCWP and ACWP for schedule and cost variance (earned value analysis).

The issue is that these cost accounts will consist of several tasks, each with their own weight (based on budgeted cost or hours). In order to obtain an accurate, weighted %C, it is necessary to determine the %C on a task by task basis, or to create fixed %C values based on accomplishment of specific tasks within the cost account.

This may sound like a lot of detail work, but it is not. It is easier (and more accurate) to get down to this detail, and it is easier to actually do it than it is to describe the process. In fact, when utilizing any of the popular project management software packages, you will find that they are designed to input data at the most detailed (task) level, and then to roll up the data to any of the parent levels.

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Future Articles

In this initial article, we have addressed the issue of obtaining valid measurements of the work actually accomplished. In the coming series of articles on Earned Value, we will address some other application issues on this topic. This will include:

1. Can I use EVA if I don't collect actual cost data?
2. Forecasting based on EV measurements.
3. What if the project work scope changes? Does it invalidate the EVA?

Further Reading:

1. For an easy to follow narrative on EVA, you might enjoy *"The Education of Justin Thyme, Project Manager"*, Harvey A. Levine, posted at Scitor Corporation's website (http://www.scitor.com).
2. For a good review of the workings and application of EVA, try *"Earned Value Project Management"*, Quentin W. Fleming & Joel M. Koppelman, Project Management Institute, 1996
3. For an in-depth coverage of this topic, see: *"Cost/Schedule Control Systems Criteria: The Management Guide to C/SCSC"*, Quentin W. Fleming, Probus Publishing Co., 1988

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