The Value Earned with Earned Value
Joseph A. Griffin, Graduate Faculty
College of Professional Studies, Northeastern University

Abstract

This paper provides the reader insight into the full value that can be gained when Earned Value is deployed to report project performance. A four-phase framework is offered as a lens through which to apply and interpret earned value data in a meaningful and informative manner. The paper briefly discusses the origins of Earned Value, the purpose and over of the key formulae, and then discusses the four-phase framework: 1) identify what’s important, 2) create a reporting schedule, 3) create actionable results, and 4) create a culture of accountability through reporting. Finally, some of the primary limitations of earned value are surveyed.

Introduction

Some project environments require earned value; some project environments aren’t well suited, given their scope and nature, for earned value, but these are the outside edges of the spectrum. For most project environments, earned value is an excellent means of gaining a strong understanding about how projects are performing. This paper seeks to present the value that can be earned when Earned Value is utilized effectively.

Earned Value is a rich tool for project managers looking to understand and forecast project performance. Knowing the formulae is simply not enough. To reap the full benefits, one needs to be able to skillfully apply and interpret the results in a meaningful way. This paper provides a four-phase framework for how earned value can be implemented in a holistic manner, allowing its full value to be earned.

Background of Earned Value

Earned Value arose from a need to answer what sounds like simple question, “What did we get for the costs we incurred?” If a project manager or sponsor waits until the project is completed, she can easily review the deliverables and the final costs to answer this question. Maybe it is an easy question, after all. At that point, it can be an easy question, but waiting until the end of a project to review the cost incurred is not a good idea. Rather, the project manager would want to review the performance throughout the project. At specific points, the project manager will want to report progress to key stakeholders, and in the middle of the project, this question—what did we get for the costs we incurred—can be a bit more difficult to answer.

EVM was developed during the 1950s and 1960s within the context of the Department of Defense, as military projects grew in complexity. A means was needed to measure performance in a reliable manner, and EVM emerged as the tool of choice. The critical point held within the history is not what the specific history is, but that EVM emerged as a tool well suited to track costs and progress in highly complex projects and project environments. The rich history of EVM within this context provides a sense of confidence in the ability of the EVM to provide value to the project manager and sponsor who wants to have a clear understanding of ‘what did we get for the costs we incurred.’

Purpose & Overview of Earned Value

The purpose of EVM is most easily understood through the use of a simple example. Assume you are the project manager on a residential construction project that has a budget of $200,000. The construction project is slated to take 5 months to complete. At the end of month two, you meet with the project sponsor who wants to understand your project progress and performance. At the end of month two, you view the expense sheets and see that you have expended $100,000. So here is the data in summary:

- Project Overview:
  - Total Budget: $200,000
  - Baseline Schedule: 5 months

© 2013, Joseph A. Griffin

Originally published as a part of 2013 PMI Global Congress Proceedings – New Orleans, Louisiana
• Current Status:
  o End of month two
  o Actual Cost to date: $100,000

![Cost Timeline in Months](image)

**Figure 1 – Cost Timeline in Months**

Now the question, “What does this mean?” With the information at hand, a few conclusions might be drawn. First, if it is assumed that the costs would be accrued at an even amount each month ($40,000 per month), it could mean that you are over budget. You should have expended $80,000 by the end of month two, and you have spent $100,000.

It could also mean that you are ahead of schedule. After all, you have spent half your budget when you are 40 percent through the slated duration of your project. You should have accomplished $80,000 worth of work, and you have now accomplished $100,000, which should have been expended mid way through month three. It is also possible that you are under budget or behind schedule.

The problem with both of these conclusions—ahead of schedule or over budget—is that they cannot be known with any certainty without some additional information. Namely, you must know what the value of the work actually performed is. If you know what the value of the work completed to date actually is, you will know whether you are ahead of schedule, over budget, or right on target. Without knowing the value of the work completed, you are left to speculate.

A few basic inputs and formulae allow one to apply earned value to a given project context. Table 1 provides a summary of the key inputs and formulae.

**Table 1: Earned Value Terms and Formulae**

<table>
<thead>
<tr>
<th>Acronym:</th>
<th>Full Title:</th>
<th>Formula:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAC or TV</td>
<td>Budget at Completion or Total Value</td>
<td>No formula needed</td>
<td>The amount budgeted to be spent at completion of project</td>
</tr>
<tr>
<td>AC</td>
<td>Actual Cost</td>
<td>No formula needed</td>
<td>The actual cost incurred at reporting date</td>
</tr>
<tr>
<td>EV</td>
<td>Earned Value</td>
<td>No formula needed</td>
<td>The cost budgeted for the work that was actually completed during the reporting period</td>
</tr>
<tr>
<td>PV</td>
<td>Planned Value</td>
<td>No formula needed</td>
<td>The cost budgeted for the work scheduled for completion during the reporting period</td>
</tr>
<tr>
<td>CV</td>
<td>Cost Variance</td>
<td>EV – AC</td>
<td>The difference between the earned value and the actual cost incurred; a negative result indicates unfavorable performance, meaning the value earned cost more than budgeted</td>
</tr>
<tr>
<td>CPI</td>
<td>Cost Performance Index</td>
<td>EV / AC</td>
<td>Ratio of earned value to actual cost; a number less than one indicates poor performance; while a number greater than one indicates favorable performance</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------</td>
<td>---------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>SV</td>
<td>Schedule Variance</td>
<td>EV – PV</td>
<td>The difference between the earned value and the planned value; a negative result indicates that you are not earning value at the rate that you had planned to earn value, thus a negative value is unfavorable</td>
</tr>
<tr>
<td>SPI</td>
<td>Schedule Performance Index</td>
<td>EV / PV</td>
<td>The ratio of earned value to planned value; a number less than one indicates an unfavorable relationship between these values, meaning you are not earning value at the rate planned</td>
</tr>
<tr>
<td>ETC</td>
<td>Estimate to Completion</td>
<td>(BAC – EV) / CPI</td>
<td>The estimate to completion forecasts future cost based on past performance. If the CPI is unfavorable (less than 1), then a higher ETC can be expected, as past performance was unfavorable</td>
</tr>
<tr>
<td>EAC</td>
<td>Estimate at Completion</td>
<td>AC + ETC</td>
<td>By adding ETC to AC, the estimate needed to complete the project based on past performance is calculated</td>
</tr>
<tr>
<td>TCI</td>
<td>To Complete Index</td>
<td>(BAC – EV) / (EAC – AC)</td>
<td>TCI provides a ratio of performance that must be attained if you wish to accomplish the project with the original budget. For instance, a result of greater than tells you the efficiencies you must achieve in terms of cost to maintain your original budget</td>
</tr>
</tbody>
</table>

Most of the inputs for performing the earned value calculations can be taken directly from project status reports or the project management software one may use. However, some may have trouble determining how to calculate earned value (EV). As stated above, EV is the cost budgeted for the work that was actually completed during the reporting period. The key to determining earned value is twofold. First, it must be determined how much of a task is actually completed. Second, you must determine the amount that was budgeted for the work you have completed.

Let’s say that you were laying 100 ft. of sewer line at a cost of $20 per ft. The total planned value would be $2,000 for this activity. At the time to prepare your report, 25 ft. of pipe has been installed. Therefore, the cost budgeted for the work that was actually completed can be calculated by multiplying $20 times the number of feet installed, which is 25, producing a value of $500. If you were to then look at the actual cost expended, you might see that it was in fact $500, or it might be different. For instance, if you encountered some unexpected rock formations, it might have required special equipment, which was not considered in the original cost estimate, thus creating a variance between the earned value and the actual cost incurred. Therefore to determine the earned value, one must first determine the completion level of a given task, and then determine what should have been spent to accomplish that level of work for the given task. In this example, the question is not how much was spent, but how much value was earned. Using the planned cost per foot ($20) and the amount installed (25 ft.), one can determine that the earned value was $500. Often times, the calculation is not this simply, and you must determine a means of calculating percentage complete to determine earned value.

In summary, it can be simply stated that EVM is a project performance measurement and forecasting tool. Through a few rather straightforward formulae (shown above), one can gain insight into past project performance, the current project position, and forecast future performance and outcomes, given performance remains constant.
This is accomplished through revealing the relationship that exists between the scope of work and the planned schedule and costs. By applying the formulae associated with EVM, the user compares the value earned of the actual work performed with the planned work and schedule, which provides insight into the true performance of the project.

Leveraging Earned Value Through Reporting: A Four-Phase Reporting Framework

Now that we have established a baseline of understanding about the components of EVM and the insights it can provide from the formulae listed above, one needs to determine how to truly leverage EVM within their project environment. Namely, how do we leverage these values in a way that allows us to report in a meaningful way, ensuring we are earning full value from earned value. To do this, one needs to follow four straightforward steps once they have a solid understanding the terms and formulae listed above.

Phase 1: Identify what’s important

Projects are unique by nature. Different projects have different pressures, and these pressures are experienced at different levels. Of course, all projects are constrained. The triple constraint is well known to all project managers—scope, schedule, and cost. However, most projects have some flexibility either by design or necessity. For instance, a project might have a hard due date to meet an external compliance standard. The scope is fixed, as the compliance standard must be met, and the schedule is hard, but the project manager may have flexibility in terms of cost or resources to ensure the company remains compliant by the specified due date. This is not always the case, but it is sometimes, and a good project manager will understand where the give points are in a given project. Not because she wants to perform poorly and push boundaries, but because she wants to be sure to succeed on the most critical measures of success. Therefore, at the beginning of a project, the project manager must understand what are the most critical factors for success. Is it schedule, scope, cost, quality? What should be the lens through which the performance of the project is interpreted?

Identifying what is important is basic stakeholder management. It means talking with the sponsor, the client, the project team, and other key stakeholders to ensure that the project manager has a firm grasp on the key success factors. Often times, a simply question can be asked: “In your opinion, what are the three top success factors for this project?” The answers can range from the predictable—to deliver the full scope on budget and on time—to the less predictable—to enter a new market, to develop a stronger relationship with this client. Now you might be thinking that you can see how Earned Value can provide insight into the more predictable success factors, but the connection with the less predictable questions may not be so obvious, but true nonetheless.

Earned Value can help you develop a stronger relationship with a client. From the personal to the professional, good relationships are built on trust and communication. Trust has been called the currency of relationships. Earned Value can build trust between business partners because it creates a transparent means of communicating results in an informative and helpful manner. It tells each partner what the performance has been, where they currently stand in the present, and what needs to be focused on in the future. Rather than using it to hide performance from clients or sponsors, EVM can create a constructive dialogue between partners who are hoping for a successful outcome by allowing everyone to focus on where the problems are occurring, rather than talking around or past one another in an attempt to avoid the performance elephant that is often sitting in the room.

The point with this example is that you have to determine what is truly important, and even when people give the more predictable response to the suggested question—to deliver the full scope on budget and on time—other reasons can often be lurking in the background. Therefore, when someone gives you the predictable response, ask a simple follow-up, “Why?” Knowing why will help you identify what is important.

This is one of the most important ways that you get the full value from earned value—you must first understand what is important, and then you must determine how earned value can contribute to determining if you are successful. This requires some up front thinking and investigation, but it can be critical to a project’s success, and even more critical to a project manager’s success. An old German proverb speaks to this point, “Go slow now; go...
fast later.” By going a bit slower to determine what true success is you can move faster later towards the true goal. Therefore, you must first determine what is truly important.

The key value earned by earned value in this phase is that you can use earned value to showcase project performance in terms of the true measures of project success.

**Phase 2: Create a reporting schedule**

Once you know what is important, creating a reporting schedule is next. Now many companies and/or project types have predetermined reporting points. Maybe there is weekly, bi-weekly, monthly or quarterly reporting dates to various stakeholder groups. However, some work in environments that are less formal, and the project manager may have a larger degree of latitude or freedom. Regardless of the environment, the project manager needs to create a schedule for when reporting will be done.

The most obvious conclusion from this last statement is that the project manager will determine when key stakeholders will be brought together to report on the key information that is gained from your EVM analysis, and this was one intended meaning of that last sentence. But I would argue that there is a second schedule that needs to be created in the project manager’s mind—a schedule for when informal reporting will be done.

In many environments, meetings exist merely to publically announce the decisions that have already been made. Now, a value statement is not being made about these environments. But their existence to some level within every organization is undeniable. Some may like these environments; others may not. My guess is that if you keep ending up on the wrong side of decisions at meetings, then you weren’t aware of this environment existing when in fact it actually does. A good project manager will have some awareness of the presence of this culture within his or her project environment, and he or she will leverage it successfully. Now, the obvious question, how does earned value do this?

By using earned value metrics for reporting within your project, you will gain insights into your project that simply aren’t available otherwise. You will know how your project compares against other projects whose data you have access to, you will know exactly where the variances exist by diving down to the work package level (more on this later), and you will have solid indications of what needs to be focused on to bring the project back within control. It will also provide a reliable means to validate your performance. One of the benefits of using EVM is that it allows projects that are dissimilar in scope and scale to be compared with one another.

Creating a reporting schedule, formal and informal, that allows you to leverage these benefits is a key step to gaining the full value that Earned Value has to offer.

**Phase 3: Create actionable results**

You have decided what is truly important, and you have an idea of when you will share the results, formally and informally. But before you share the results, you need to determine what the results actually mean in specific terms. Said another way, all this analysis must lead to actionable results.

Of course, if all the metrics point to being on target, then the actionable result may be ‘keep up the good work’. But often times, results will not necessarily be favorable. Our Cost Performance Index may be less than 1, indicating unfavorable cost performance. If it is outside an acceptable range of performance, then we must diagnose the root cause of the variance, and create recommendations that will address the root issues that lead to unfavorable performance. This brings us to a key means of leveraging the full value of earned value—linking earned value with a root cause analysis.

Let’s assume that the project has a CPI of 0.75. This would indicate that for every dollar spent, $.75 of value is being earned, which is not a good return on investment. If your current CPI was .75, and you had a Budget at Completion (BAC) of $200,000 and your current EV was $75,000, then you could assume that you would need to spend $166,666 to complete the project (ETC). So the first step is to try to determine what is causing your poor cost performance. Was it an isolated incident or is it a systemic issue that will continue to plague the project. One way to
determine this is through a root cause analysis. Because this paper is not primarily about root cause analysis, only an introductory overview will be provided of the process, showing you how these two tools—EVM and Root Cause Analysis—can be used to the benefit of the other.

Different authors and trainers provide different steps for performing a root cause analysis. I follow a six-step process:

1. Identify symptom(s)
2. Determine rate of recurrence
3. Determine root cause of symptom(s)
4. Succinctly state root cause(s)
5. Develop alternative solution(s)
6. Implement solution(s)

Identify Symptoms:

The process begins by identifying the symptoms. By symptoms, it is the meant those factors that lead you to believe there is a problem. In the context of Earned Value, this would mean a CPI or SPI or CV or SV is outside an acceptable performance range. If this symptom presents, then the root cause needs to be identified. What this implies is that there is a regular time of reviewing Earned Value data, allowing for deviations to be identified as early as possible.

Additionally, many companies have a range of acceptable performance. For instance, a CPI of .99 may not immediately require a complete investigation into the cause, but a CPI of .95 or .90 may. As the project manager is reviewing reports, he or she should watch for trends, beginning to identify symptoms as early as possible.

Determine Rate of Recurrence:

This point of the process relates to the previous paragraph. The project manager must be reviewing data to determine if the symptoms have persisted throughout the project or a certain phase of the project, or if it is the initial occurrence of the symptom. Knowing this will provide insight into where to look for the root cause. For instance, if the project has been progressing on target, and then an unacceptable variance occurs, then this would point to some change in the dynamics of the project since the last reporting period. If, however, the project manager sees a trending, unacceptable variance that has persisted throughout the project, then it might point to a more systematic issue being present. The rate of recurrence provides some insight into the type of problem one may encounter.

Determine Root Cause of Symptom(s):

Once the symptom has been identified and the rate of recurrence is understood, the project manager must turn his or her attention to understanding what the root cause is. There are a number of tools that will help with this (fishbone diagram, structured brainstorming sessions, interviews, etc.), but the earned value data will provide a shortcut.

If the CPI is outside an acceptable range, say .85, then the project manager can begin delving into the values that are used to calculate the CPI to understand the source of the variance. For instance, if you are building a house, and you have a CPI of .85, you can begin looking at the CPI at different levels within the Work Breakdown Structure (WBS). Let’s say, you have the following simple, partial WBS for a construction project:

Table 2: Smith Construction Project WBS

<table>
<thead>
<tr>
<th>Code</th>
<th>Deliverable</th>
<th>CPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Site Prep</td>
<td>0.96</td>
</tr>
<tr>
<td>1.1</td>
<td>Site Survey</td>
<td>0.95</td>
</tr>
<tr>
<td>1.2</td>
<td>Site Grading</td>
<td>0.95</td>
</tr>
</tbody>
</table>
The CPI of .85 will reflect the summation of all costs and value earned to date, which, in this example, would include all deliverables shown in Table 2. Through your software, you can look at the CPI for each line item of the WBS, so that you know how each deliverable contributes to the summative CPI of .85. Therefore, you would see that the CPI associated with 1.0 Site Prep is 0.96, meaning that there is some unfavorable performance, but this is not the portion of the project where there should be the greatest level of concern. However, the CPI associated with 2.0 Foundation is 0.79, indicating very unfavorable cost performance. This shows the project manager that he or she should spend the majority of their investigation looking into this portion of the project’s performance to understand why there is an unfavorable CPI. This is one of the great values of EV—the ability to pinpoint the area of poor cost or schedule performance.

But it also brings us to a weakness of Earned Value. Earned Value doesn’t tell the project manager why the variance exists; it only tells him or her that it does in fact exist. At this point, the project manager must investigate the cause of the variance, and there are a few options: incorrect estimates, scope creep, unexpected difficulties, and others. The project manager must apply good judgment to understanding why the variance exists.

Succinctly State Root Cause(s):

After the root cause has been identified, it is key to succinctly state the root cause in a clear and unambiguous manner. The reason is that sometimes the root cause might be more of an inference or presumption rather than based on evidence. By stating it clearly, it forces all to both vocalize their views and creates a basis of shared agreement for moving forward. Without this, you might have different stakeholders looking to address the symptoms from different angles, leading to more confusion and unfavorable performance. Creating shared agreement is a key to moving forward.

Develop Alternative Solution(s):

After the root cause has been identified and agreed to, the time comes to develop some recommendations or solutions to address the poor performance. The types of solutions presented will depend upon the type of root cause identified. Briefly, there are three basic types of solutions that might be proposed: people solutions, product solutions, or process solutions. People solutions are needed when it is the people in the position that created the issue, either they were poorly trained or misunderstood the project needs, and their performance needs to be addressed. Product solutions are needed when the problem is somehow rooted in the deliverables being produced. For instance, a design flaw was uncovered in the foundation specs, which led to the increased cost to address the flaw. Process solutions are required, when it is the processes producing the problems. It could be processes related to the production of the deliverables, or it could be processes related to the managing of the project, such as poor estimating techniques, insufficient risk analysis, or a range of other process related activities. By using this or similar lens for developing solutions, it provides people with a means of framing solutions. Additionally, this lens can be used when seeking to identify the root cause, as well.

Implement Solution(s):

Finally, we arrive at the step that most people get to too quickly: implementing the solution. At this point, you simply implement the solution you have developed. As you implement it, you pay particular attention to any unintended consequence and implications to the project or deliverables. When there is a ‘fix’ that will have a major impact on the deliverables or the processes, it is important to keep key stakeholders in the loop, managing their expectations in an effective and proactive means.
By combining your Earned Value analysis with a root cause analysis, you can leverage the benefits of each tool to create actionable results that benefit the project’s performance in a favorable manner, gaining full value from earned value.

**Phase 4: Create a culture of accountability through reporting**

“Once upon a time…” Anyone remotely familiar with English literature recognizes this phrase as a cue, a cue to suspend belief, to expect the unimaginable, to not be surprised by frogs that turn into princes with a kiss or horses that talk or any other fantastical imagination we may soon hear. The reason is because we are about to hear a fairy tale, a tale of fantasy and imagination. When I talk about creating a culture of accountability through reporting, I want you to think of reporting as storytelling. But I am not talking about these types of stories, rather I am asking that we use earned value and storytelling techniques to reimagine the way that we report project performance.

Too often, when we have the EV data, we think giving the data is the report. We tell people the CPI is X, the SPI is Y, and the like. We sometimes do this without providing sufficient context for this data. The context is especially important when the values are outside an acceptable performance level.

When we write or present reports, earned value provides the story arc for our report, as it tells us where we have been, where we are, and where we are going, in terms of performance. We then fill in those three points with relevant details that support the ‘story’ or progress of the project. Doing this, we can create compelling reports that are memorable, informative, and effective. We can do all this while creating a culture of accountability, where project managers and team members know they will be held accountable for the performance of their projects, but they will have the opportunity to tell the ‘story’ of their project as a means of interpreting what might be otherwise considered raw, cold data.

When we do this, we show that we can do more than simply rattle off statistics. We can use the data to inform our understanding of the project’s actual performance, and we can use that understanding to develop solutions that will provide a path forward that is informed by actual performance data rather than conjecture and opinion. Using this four-phase framework allows us to leverage the full benefits of earned value.

**Limitations of EVM**

Earned value is not without its limitations. A few have been stated earlier, but it important to make clear that there are some limitations or shortcomings. First, earned value does not tell you how to correct variances. This was covered as part of the root cause analysis. The EV metrics reveal that a variance exists, and it can pinpoint the location of the variance, but it does not provide corrective action. The project manager and team must determine what led to the variance and how it can be corrected.

Second, earned value data can be manipulated. If reports don’t contain sufficient supporting data that is verified, someone can massage the numbers so that the results look favorable. Of course, eventually the truth would come out, but someone might be tempted to manipulate the data on a given report, thinking they can make up the difference during the next reporting period. Therefore, it is critical to create a process where this is less likely to occur. Rules are not the best way to accomplish this. The best way to avoid this is to create an environment that encourages people to report unfavorable performance early so that corrective action can be taken early. This requires sponsors to put a proverbial plaque on their desk that reads ‘Bad news is welcome here’. Without this type of culture, people will always be tempted to hide poor performance.

Third, earned value relies on accurate data. A process must be in place to capture accurate and relevant data. If the data inputted into the formulae is not reflective of reality, then the results will mislead management, possibly leading to poorer performance. Therefore, great care must be taken to be sure that accurate data is being captured and analyzed.

Fourth, quality is not directly considered as part of the earned value metrics. Therefore, you must not only rely on earned value to measure project performance, you must see it as one tool that can provide quite a bit of insight, but not all the information required to ensure the project is performing well. You must create a reasonable and
appropriate quality plan that performs quality control in a way that is verifiable and reliable, which supplements the earned value data.

These limitations by no means should preclude one from using EV, but one should remain cognizant of the limitations to ensure that realistic expectations are placed on the value that earned value can deliver.

**Recommended Steps to Implementing EVM**

Implementing Earned Value is no mean undertaking. One must consider a range of logistical questions—who will train our staff, how do we collect the data needed, who is responsible for all the activities, what program do we use to calculate the metrics, how do we structure reports, how do we ensure that the data accurately reflects project status—and there are cultural questions—will the project teams be receptive to this methodology, what reporting system or methodology will we migrate from, how will we educate sponsors. The complications are heightened in project environments that are subject to ANSI/EIA-748. The requirements are extensive and seemingly complex.

Most of us, however, are in project environments where we are not subject to such standards. We simply want to better understand how our projects are performing. The best advice is to start small. Initiate a pilot project, using earned value on a couple smaller projects. Ensure that your team understands how to apply it, gather the data, interpret the results, and communicate effectively. This will give you time to identify both the visible (current processes) and invisible (cultural) barriers. You can build a case for rolling out the methodology using your own data and results, rather than relying only on a paper such as this one. Nothing will be more convincing to those key stakeholders that evidence from their context. I would also recommend that if no one on your team has experience with Earned Value that you hire someone to help you set it up initially. This can ensure that you don’t re-create the wheel, but leverage the knowledge and experience of others.
Bibliography


