Customize your Independent Estimate at Completion (IEAC) Formula

Bill Mendelsohn

We all understand the value of having multiple IEACs to validate a project's LRE. For one, a range of estimates is always preferable to a point estimate. Additionally, as DOD practitioners know, this is a requirement for the header of Format 1 of the Contract Performance Report, now described in data item DI-MGMT-81861. Having a variety of IEACs in our portfolio also contributes to more robust Monte Carlo modeling.

As a refresher, IEACs typically consist of taking BCWR or Work Remaining, dividing it by an efficiency factor and adding it to ACWP. The most basic IEAC is ACWP + BCWR / CPI which can be mathematically simplified to BAC / CPI. This IEAC does an excellent job passing the common sense test. CPI is a meaningful metric on its own. A CPI of .90 means we're providing 90 cents of value for every dollar we spend. This IEAC is also easily explainable, "Boss, if we continue to perform at our current cost efficiency our IEAC will be $2M over our reported LRE". The well-known deficiency with this simple IEAC is that it assumes that we'll continue operating at the same efficiency, when studies show that overruns tend to get worse. Thus we use a series of efficiency factors relying on composites typically involving SPI. Examples are CPI x SPI or .5CPI + .5SPI and countless variations. The studies by David Christensen previously cited in The Measurable News and elsewhere have found the ideal IEAC may depend on which phase a project is in. His papers detail the reasons for this, but for our purposes we accept that there is value in having multiple IEACs to provide range estimates and comparison points. These composite efficiency factors are useful, but meaningless. As many Earned Schedule (ES) enthusiasts will tell you, SPI is already close to meaningless, but by the time you start multiplying SPI by CPI and weighting it the results are beyond meaningless. However, anything that offers a more accurate IEAC is useful. Still not convinced? I bet if you look at your worst programs where the LRE kept growing and growing and simply took ACWP + BCWR / (CPI * SPI) and added .95 to the denominator for ACWP + BCWR / (CPI x SPI x .95) you'd arrive at a more accurate IEAC than the standard formulas provided.

Why .95? I pulled it out of the air to illustrate that there's nothing magical about efficiency factors using weighted CPI and SPI. Is .75CPI + .25SPI somehow meaningful or more pure because the weights add to 1.0, even if multiplying by some made up factor like .95 is more accurate? Where estimates are concerned, I'll trade purity for accuracy any day.

I'm not advocating we all start adding .95 to our existing efficiency factors. What I'm driving at is identifying a new efficiency factor, let's call it ***e***, to add to our IEAC portfolio. Here's how I calculated the ***e*** for a selected a group of like projects. First, I only selected projects with suspect or optimistic LREs. I selected products where the Variance at Completion (VAC) was more optimistic (higher) than the cumulative Cost Variance (CV). I call this the Keenu metric and we're interested in negative Keenus because that is where the project is projecting to improve the existing overrun, which rarely happens. For example, you have a problem if you project a VAC of -$2.5M and a cumulative CV of -$4.0M. Our Keenu in this example is -$1.5M = -$4M – (-$2.5M) ; a negative Keenu is an indicator you may have an overly optimistic LRE. The LRE is stating that not only are we not going to maintain this same level of inefficiency, somehow we're going to get more efficient in the future. I don't typically perform IEAC analyses on programs with a good Keenu. Why bother? We have better uses for our time than fixing the unbroken.

Next, I took the standard IEAC composite formula of ACWP + BCWR / (CPI x SPI) to solve for ***e***. First I added ***e***, ACWP + BCWR / (CPI x SPI x ***e***). This is the formula we'll use to calculate IEACe after we determine our e constant. To do this, we solve for e where e = BCWRold / (CPIold x SPIold x ETCfinal) on a selection of projects that are now complete. For the variables labeled 'old', go back to some point in time of the closed projects and plug in the numbers at that point in time. I used data from when the sample projects were around 50% complete. The ETCfinal will be the real or final LRE of the closed project minus the ACWP of the point in time you chose. This will give the ETC that the program would have used if they had a crystal ball (and were honest).

Let's say you look at a project that finished with a VAC of -$75M and LRE of $550M. You want to know what ***e*** would have predicted that a year ago. The numbers from a year ago were:

CV = -$50M, VAC = -$30M, Keenu = -$20M, CPI=.85, SPI =.83 ACWP=$340M, BCWR=$135M, ETCfinal $210M (or final LRE of $550M, minus 1 year ago ACWP of $340M).

e = BCWR / (CPI x SPI x ETC) or 0.91 = $135M / (.85 x .83 x $210)

Our ***e*** would be .91, so to demonstrate this ***e*** would have provided the crystal ball perfect IEAC if we used it a year ago we just plug it back in ACWP + BCWR / (CPI x SPI x e) or $340M + $135M / (.85 x .83 x .91) = IEAC = $550M (rounded).

I then applied this to my portfolio to arrive at an average e constant to apply to future projects with bad Keenu metrics. Statistically, this IEACe formula had a higher Pearson's correlation when compared to 4 other traditional IEAC types for the same projects. The difference wasn't statistically significant from the other IEACs, but that's OK. I'm not recommending abandoning any of the existing IEAC, just adding one to our IEAC portfolio.

Given that the purpose of the IEAC efficiency factor is to come up with the most accurate estimate, isn't a good efficiency factor more important than pretending that some composite like .70CPI3 months + .30SPI3 months means something? I encourage you to calculate the ***e*** on your programs and test the theory.

About the Author

Bill is currently the Director of Earned Value and Project Management at ITT Excelis, Mission Systems, 655 Space Center Drive, Colorado Springs, Colorado. During his career, he has worked in project and program management, EVM compliance, procurement, subcontracts, budget analysis, pricing, and program control. He has used EVM from the perspectives of analysis, administration, control account manager, and ensuring compliance. Bill earned a Master's in Contract Management, and obtained certifications as a PMI PMP, an AACE EVP, and a Lean Six sigma Black Belt.