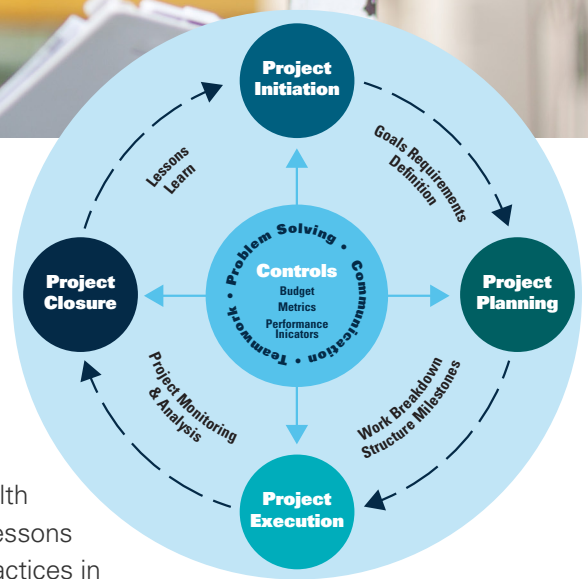




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# **STRONG PROJECT CONTROLS ARE CRITICAL TO YOUR SUCCESS**

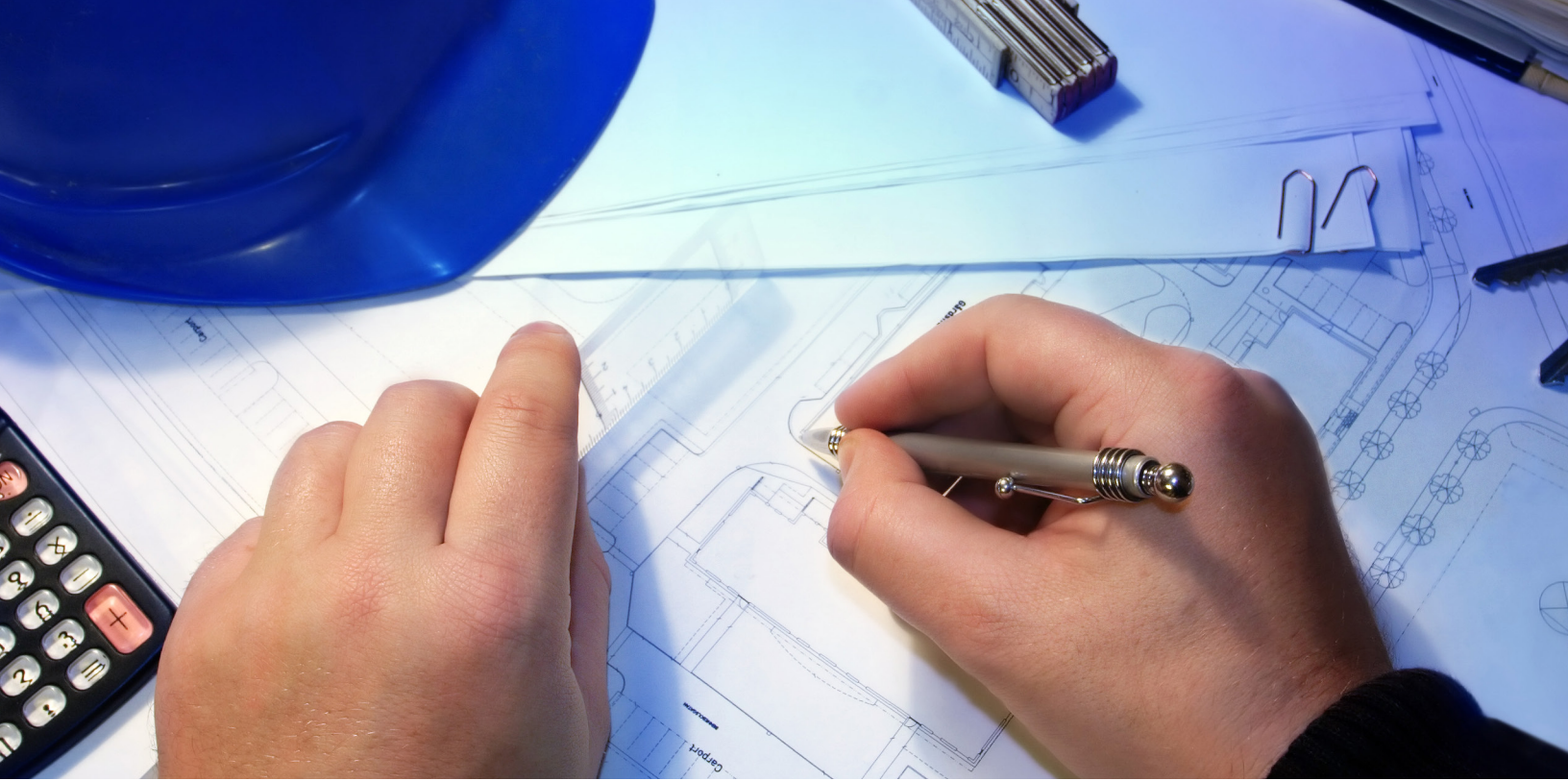
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The hallmark of a high performing organization is the cultivation, use, and continuous improvement of their processes used to monitor and evaluate performance. As such, many organizations continue to struggle to reach a high level of performance in delivering projects, not because they don't have project management processes, but because these processes fail to identify, track and act upon project data which indicate project health – both good and bad. Additionally, these organizations fail to use lessons learned from one project to improve their project management practices in subsequent projects.

During my naval career, I was involved in the construction and delivery of two new nuclear-powered fast attack submarines, the USS Missouri (SSN 780) and the USS Illinois (SSN 786). Both of these machines were constructed over a prolonged period and with extensive Work Breakdown Schedules (WBS). Both were delivered early and within budget because Key Performance Indicators (KPIs) were effectively used to signal the Project Manager's (PM) and stakeholders' action. By appropriately responding to KPIs, the PMs were effective in managing resource allocation to meet most milestones on time or early, enabling project success. Contrast this with a project that has a poor WBS and/or doesn't effectively use metrics and KPIs. This project will struggle because metrics or KPIs are not available to signal a need for a change. A poor WBS means resources are not closely coupled to tasks and costs, and stakeholders are unable to monitor project progress. This project will likely result in missed project milestones and significant stakeholder dissatisfaction. But this disappointment can be avoided!

Projects generate a multitude of data, yet in many underperforming organizations the data isn't distilled into metrics which can then be collated into KPIs. KPIs in sum provide stakeholders a method for early indication of emerging project issues, as well as successes. Furthermore, even when used project metrics and resultant KPIs are not sufficiently broad or are misunderstood, this can hamstring the organization's



ability to implement actions that address project weaknesses or that can capitalize on successes. Another problem is that many PMs and stakeholders don't recognize the differences between lagging KPIs and leading KPIs – those that record what has been done versus those that try to anticipate the future. Understanding and tracking essential project KPIs will help your PMs reach and maintain a higher level in project performance. Stakeholders that require their PMs to report both KPIs and resulting actions enable effective project oversight and consistency in project success.

Before we get to specific KPIs, all PMs should understand the scope of their project, have a list of all of the activities that must be accomplished to complete the project, and should assign both cost and duration to each of these activities. This is the project's WBS. The WBS is segmented by milestones, which are important pre-defined points in the project used as "sign posts" to indicate an important event or decision point.

The WBS should be broken down into sufficiently small elements or activities which are logical, manageable, independent, measurable, and resourced:

**Logical** means that completion of embedded tasks implies the completion of the top-tier activity.

**Manageable** implies the right number of activities are included; too many activities render a WBS unwieldy in reporting and difficult to oversee; too few activities results in lack of visibility on key enabling sub activities, which go un-tracked. Manageable implies the "Goldilocks" principle is met. The Goldilocks principle states that something must fall within certain margins, as opposed to reaching extremes.

**Independent** means the activity is self-contained and does not bleed over into another WBS activity.

**Measurable** means that the activity's work can be tracked in both time and cost.

**Resourced** means that the activity has defined, and specifically identified, materials and personnel.



The importance of an effective WBS cannot be overstated. The WBS must account for everything that must be accomplished to deliver 100% of the scope in the project; *if not done, once discovered the PM will have to ask for additional funds or time (or both) to perform the missing scope activities.* The WBS is the bedrock that effective projects are set upon – PMs that get this right enable consistent project success. Success however is not guaranteed unless data from the WBS is collected, segregated, and formed into project metrics and KPIs, and then effectively acted upon.

The summation of WBS activity costs plus contingencies is the Project Budget – before anything is spent on the project this is the Budget at Completion (BAC); as actual costs are realized during execution, this is the Estimate at Completion (EAC). The project's critical path is the sequence of WBS activities that represents the longest path to complete the project. The summation of the critical path activity durations is the overall project duration.

Basic Metrics (these should be used on every project):

**Planned Value (PV)** is the approved value of the work to be completed in a given time. Alternatively, it's the summation of the estimated costs of all project activities scheduled as of the reporting date.

$$PV = (\text{Planned \% Complete}) \times BAC$$

**Earned Value (EV)** is the budgeted cost of project work completed as of the reporting date.

$$EV = (\text{Actual \% Complete}) \times BAC$$

**Actual Cost (AC)** is the actual cost of project work completed as of the reporting date. AC is the summation of what has been spent as of the reporting date.

In short, Earned Value is the value of work actually completed, Planned Value is the value of work that should have been earned had the schedule been precisely executed, and Actual Cost is what has been spent to date. Top-level activities in the WBS should be tracked, and depending on the complexity of



the WBS, all individual sub-activity PV's, EV's, and AC's may also need to be tracked and activity KPI's reported. All Critical Path activities and near-critical path activities should be included in what is tracked and reported; what gets tracked should also meet the Goldilocks principle.

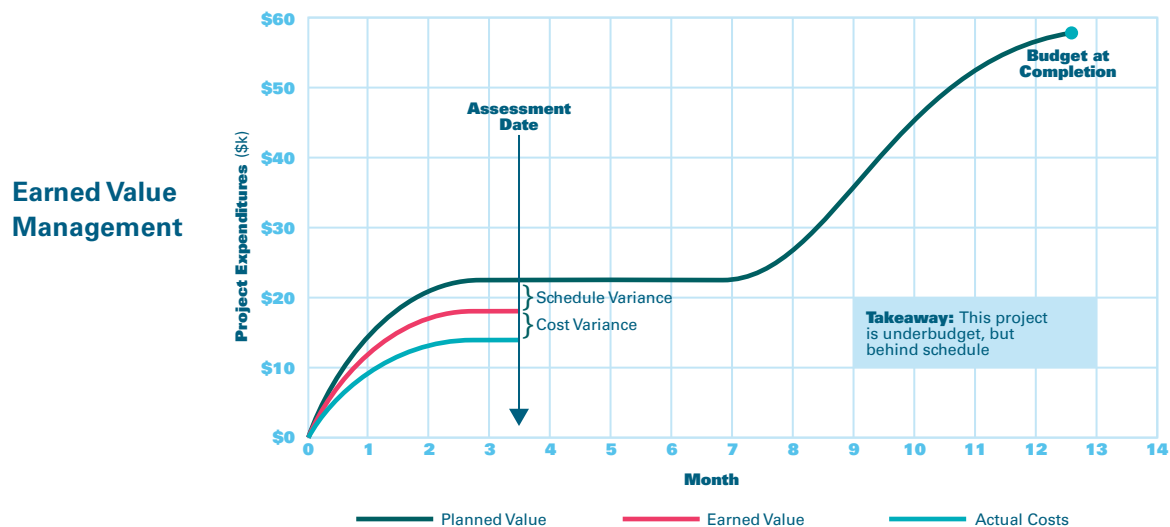
From these basic metrics, high performing PM's will then track variances, specifically Cost Variance (CV) and Schedule Variance (SV). Variances are the PM's and Stakeholder's signal that corrective actions are needed.

**Cost Variance (CV)** is a measure of cost performance; it will tell you how the project is performing against the project's budget via a surplus or deficit and will signal that corrective actions may be warranted.

$CV = EV - AC$  A negative CV indicates the project is spending more than budgeted.

**Schedule Variance (SV)** is a measure of how far ahead or behind schedule the project is.

$SV = EV - PV$  A negative SV indicates the project is behind schedule.





**Here is a numerical example to illustrate:**

The project is to pick several apple orchards totaling 375 acres. The PM has been given an all-inclusive budget of \$500 per acre and a three-week fixed duration. The morning of the 8th day the owner asked the PM for a project update. At the end of the 8th day, the PMs team has picked 132 acres. After adding up the project expenses, the total is \$55,678.00.

**The PM reports the following project metrics:**

$$BAC = 375 \times \$500 = \$187,500$$

$$\text{Planned \% Complete} = \frac{8 \text{ days}}{21 \text{ days}} = 38.11\% \quad PV = 38.11\% \times \$187,500 = \$71,450.63$$

$$\text{Actual \% Complete} = \frac{132 \text{ acres}}{375 \text{ acres}} = 35.20\% \quad EV = 35.20\% \times \$187,500 = \$66,000.00$$

$$CV = EV - AC = \$66,000.00 - \$55,678.00 = \$10,322.00$$

$$SV = EV - PV = \$66,000.00 - \$71,450.63 = -\$5,450.63$$

Both CV and SV must be determined and acted upon. CV tracks cost deviation from budget, but it does not measure the discrepancy between work scheduled and work accomplished. SV tracks deviation in work accomplished and work planned, but it does not track actual costs associated with the work.

So, what are Key Performance Indicators? A KPI is a quantifiable measure used to evaluate the success of an organization in meeting objectives for performance. Effective KPIs are Simple, Measurable, Actionable, Timely and Visible. Assuming Quality as a given, successful projects, in the most basic sense, are those that deliver on time and on budget. To this end, Cost Performance Index (CPI) and

Schedule Performance Index (SPI) are effective project KPIs because they signal project distress (less than 1.0) or success (greater than 1.0) in a simple way.

$$\text{CPI} = \frac{\text{EV}}{\text{AC}} \quad \begin{array}{l} \text{CPI} > 1.0 \text{ the project is performing well against the budget;} \\ \text{CPI} < 1.0 \text{ budgetary corrective actions are called for as the project is over budget.} \end{array}$$

$$\text{SPI} = \frac{\text{EV}}{\text{PV}} \quad \begin{array}{l} \text{SPI} > 1.0 \text{ the project is performing well against the schedule;} \\ \text{SPI} < 1.0 \text{ work accomplishment corrective actions are called for as the project is behind.} \end{array}$$

**Continuing the example above:**

$$\text{CPI} = \frac{\text{EV}}{\text{AC}} = \frac{\$66,000.00}{\$55,678.00} = 1.19$$

$$\text{SPI} = \frac{\text{EV}}{\text{PV}} = \frac{\$66,000.00}{\$71,450.63} = 0.92$$

$$\text{EAC}_{(8\text{th Day})} = \frac{\text{BAC}}{\text{CPI}} = \frac{\$187,500}{1.19} = \$158,176.14$$

After 8 days, the project is underbudget but behind schedule. To catch up, the PM has authorized overtime until back on schedule; based on CPI and EAC, the project can afford more resource effort.

Other KPIs that may be useful dependent on the project (this table is by no means all-inclusive of good KPIs):

KPI	EXPLANATION	EQUATION
<b>Estimate at Completion (EAC)</b>	Total project cost at present rate of performance	$\text{EAC} = \frac{\text{BAC}}{\text{CPI}}$
<b>Estimate to Complete (ETC)</b>	Amount to spend at present performance to complete the project	$\text{ETC} = \text{EAC} - \text{AC}$
<b>Percentage of Overdue Project Tasks</b>	General indicator of project progress health	$\frac{\# \text{ of Overdue Tasks}}{\# \text{ of Completed Tasks}}$
<b>Percentage of Missed Milestones</b>	Missing key progress points is an indicator of project distress	$\frac{\# \text{ of Missed Milestone}}{\# \text{ of Scheduled Milestones to Date}}$
<b>Planned Hours of Work vs Actual Hours of Work</b>	Simple comparison of resource utilization	
<b>Rework Percentage</b>	Indicator of workforce skill and potential quality problems	$\frac{\# \text{ of Tasks Reworked}}{\# \text{ of Tasks Reported Complete}}$
<b>Number of Schedule Adjustments</b>	Constantly shifting the schedule indicates project issues	
<b>Supervision and Management (SM) Percentage</b>	> ~12% is an indication of a top-heavy project	$\frac{\text{SM Hours to Date}}{\text{Completed Tasks (in hours)}}$

High performing PMs use a multitude of KPIs to get a broad view of project performance to prevent focusing on one KPI to the detriment of other indicators. For example, singling out CV and/or CPI and acting on these without considering others will lead to actions that affect these KPIs to the likely detriment of the overall project. Additionally, focusing solely on numerical KPIs could lead to ignoring other important project attributes such as customer satisfaction.

Whatever the mix of KPIs selected for a given project, these should be visible and reviewed by business leaders above the PM. Due to proximity to the project, the PMs judgment is easily clouded by:

- Thinking s/he can turn it around before problems are noticed by stakeholders.
- Personal connections with subcontractors responsible for deteriorating KPIs.
- Other factors that cause people to keep bad news to themselves.

Effective project management requires that the project have structure and discipline. Structure is provided by precisely defined project requirements, a work breakdown structure that is effective, and by using project metrics and KPIs to institute change within the project to keep it on course.

Consider the projects that you are contemplating or actively working on. Are KPIs identified and effectively used? Is the WBS structured to enable effective management? CAI can help. We are a global company with a unique combination of in-depth technical knowledge and broad understanding of today's leading manufacturing facilities, equipment, and capital project execution and management methods. Our team has worked extensively with grassroots sites, large companies, and startups in delivering projects.

**To learn more about our Project Management program, email  
Jessie Porter, Senior Program Manager at [jess.porter@cagents.com](mailto:jess.porter@cagents.com)**





## Jessie Porter

Jess is a seasoned executive and US Naval Commander with over 15 years of executive level experience leading diverse teams with a broad range of responsibility. He successfully commanded, operated, and maintained a multi-billion-dollar nuclear submarine in environmental extremes ranging from the Arctic Ocean to the South Pacific. He was selected for promotion to Captain, and he served on the front line with distinction on seven operational deployments, new construction, and modernizations of submarines.

Jess has coordinated all aspects of construction projects from submarines, to pharmaceutical industry laboratories and facilities and very large commercial data centers. He specializes in the 'art of execution'.