

Earned Value Management

The CPI Stability Myth



There is undoubtedly the equivalent of an ‘urban myth’ still in circulation within the general project management community, arising from US Defence based research from the 1990s, that the Earned Value (EV), Cost Performance Index (CPI)¹ stabilizes at the 20% completion stage and the final outcome will be within 10% of this value and usually worse. This myth has been extended by some authors to all projects in all industries; and I would suggest that this is demonstrably false in at least some circumstances.

If CPI stability was an incontrovertible ‘fact’ for all projects, there would be no need for active management of the project after 20% completion!

Newer research suggests CPI stability is not automatic. Earned Value is a very useful project management control tool mandated by many Government agencies in the USA, UK, Australia, and elsewhere. However, the migration of the EV toolset from carefully controlled major defence projects in the USA to the general PM business community is definitely creating issues with the concept of stability.

Studies by David S. Christensen and other researchers (Payne 1990; Christensen and Payne 1992; Christensen and Heise 1993; Christensen 1999) into USA Department of Defense acquisition contracts reported that the cumulative CPI would not change by more than 0.10 from its value at the 20% completion point. Christensen and Templin² pointed out in clear terms that *“these rules of thumb are statistical statements about the mean cost performance of defense contracts”* (p. 115).

Therefore, when a project cannot be considered statistically homogeneous with the projects used in the DoD studies, applicability of the rules based on the DoD experience must be limited. The DoD research established ‘CPI stability’ on a large number of major US military projects. Although it should be noted, there are different views on whether this DoD CPI stability rule can be generalized to other projects. Newer research has found CPI stability is not a ‘given’ and it rarely exists on small commercial projects³.

¹ For more on *the calculation of CPI* see: https://mosaicprojects.com.au/WhitePapers/WP1081_Earned_Value.pdf

² Christensen, D. S., and Templin, C. (2002). *EAC evaluation methods: Do they still work?*. Acquisition Rev. Q., pp105–116.

³ Henderson, K., and Zwikael, O. (2008). *Does project performance stability exist? A re-examination of CPI and evaluation of SPI(t) stability*. Crosstalk J. Defense Software Eng., 7–13

Statistical Stability

From one perspective, a progressive improvement in the stability of the CPI is to be expected⁴. This is for two reasons, both driven by the fact CPI is a cumulative calculation (it is the sum of all complete and in-progress work packages):

1. The sample size is increasing, which improves the reliability of the calculation. At the 5% stage there are likely only 6% or 7% of the total work packages included in the CPI calculation (the rest have not started); by the 50% stage this is likely to exceed 60% of the work packages either started or complete. At the 50% stage errors and anomalies in a few work packages will be far less influential.
2. Completed work packages (the WP is closed) are innately stable – there is no further possibility of change. At the 5% stage maybe 1% of the work packages will be closed, by the 50% stage this may be as high as 40% closed and not subject to further change.

CPI Stability

Identifying what underlying factors cause stability in the CPI measure as evidenced by the DoD research, to determine if the factors are desirable and then find ways to improve project management practice in other industries so that the desirable factors are encouraged is ongoing. It appears that:

- When CPI stability is shown to be established, the 'CPI Stability' is a strong indicator of other important (but much harder to measure) factors such as, a good quality plan, stable management, stable requirements, an efficient management system, effective project culture, etc.
- Conversely, where CPI is unstable, significant changes in the underlying project can be reasonably assumed to be occurring, either at the management level, in the project planning, or at the requirements/scope level. These changes may be beneficial or detrimental but are undoubtedly a risk that warrants the attention of senior management.

If these assumptions are correct, it would also be useful to develop an understanding of the usefulness of CPI instability as a risk indicator (ie, what level of instability indicates a 'project at risk').

Conclusions: CPI Stability

The cost performance index (CPI) is a leading indicator of future performance and has been shown to be one of the most accurate predictors of future cost outcomes, but there are limitations:

- As the project progresses, the To Complete Performance Index (TCPI) gives a better indication of the potential for a contractor to recover (assuming cost overruns)⁵
- Generalisation of the 20% stability rule has been shown to be inappropriate.

Where CPI stability is demonstrated and cost performance is acceptable, this is a likely indicator of other desirable management features, but this does not apply to projects with a negative cost performance.

⁴ Kim, B.-C. 2015. *Probabilistic Evaluation of Cost Performance Stability in Earned Value Management*. ASCE Journal of Management in Engineering.

⁵ For more on the **TCPI** see: https://www.mosaicprojects.com.au/WhitePapers/WP1097_TCPI_in_EVM.pdf



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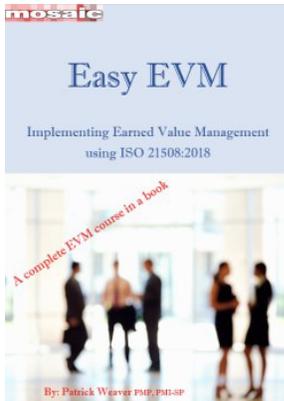
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EVM Resources

Easy EVM - Implementing Earned Value Management using ISO 21508:2018



Easy EVM is a self-paced course-in-a-book, supported by Mosaic Project Services Pty Ltd. The purpose of this 'course-in-a-book' is to provide practical guidance to people, and organizations, involved in either implementing an earned value management system, or using information created by an earned value management system. It provides guidance on concepts, responsibilities, integration, and processes, for the implementation and use of earned value management based on ISO 21508: *Earned Value Management in Project and Programme Management*. The book is divided into five sections, each section includes guidance on an aspect of EVM, references, and a set of 20 questions; with the answers in Section 6.

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