

Recommendation 19: Eliminate the Earned Value Management mandate for software programs using Agile methods.

Problem

DoD established use of EVM as a requirement for periodically measuring linear programs with firm baselines established prior to starting development. EVM is not well suited as a measurement tool in an Agile environment, which is dynamic by design.

Background

DoD's use of EVM originated in the 1967 DoDI 7000.2 *Performance Measurement for Selected Acquisitions*.¹ In simple terms, DoD uses EVM to track contractors' progress against a baseline and provide a mechanism for reporting key metrics. For example, cost performance index (CPI) measures conformance of actual work completed to actual cost incurred, and schedule performance index (SPI) is the ratio of the earned value to the planned value.² The following are examples of key metrics:

- Cost variance
- CPI
- Schedule variance
- SPI
- Budgeted cost of work scheduled
- Actual cost of work performed
- Estimate to complete
- Estimate at completion

EVM, an important management tool for DoD for the last several decades, is also used in commercial industry and advocated for by organizations such as the Project Management Institute (PMI).³ EVM remains the prevailing tool by which DoD measures performance on large contracts. It was originally developed to measure project performance using the waterfall approach. Because threats and technology are now constantly evolving and necessitating rapid responses to changing operational requirements, DoD programs are transitioning to Agile methods to deliver capability more quickly.⁴

In March 2009, the Defense Science Board Task Force on DoD Policies and Procedures for the Acquisition of IT recommended, "The USD(AT&L) should lead an effort in conjunction with the Vice Chairman, Joint Chiefs of Staff, to develop new, streamlined, and agile capabilities (requirements) development and acquisition processes and associated policies for information technology programs."⁵

¹ DoDI 7000.2 was superseded by Earned Value Management Systems, Electronic Industries Alliance Standard 748, current release.

² "The Time Dependence of CPI and SPI for Software Projects," R. D. H. Warburton, Project Management Institute, accessed November 9, 2017, <https://www.pmi.org/learning/library/earned-value-management-cost-index-6427>.

³ Project Management Institute, *The Practice Standard for Earned Value Management—Second Edition* (Newton Square, PA: Project Management Institute, 2011).

⁴ "Agile by the Numbers," Peter Viechnicki and Mahesh Kelkar, Deloitte Insights, accessed November 9, 2017, <https://dupress.deloitte.com/dup-us-en/industry/public-sector/agile-in-government-by-the-numbers.html>.

⁵ Defense Science Board, *Report of the Defense Science Board Task Force on Department of Defense Policies and Procedures for the Acquisition of Information Technology*, OUSD(AT&L), 2009, x, accessed November 27, 2017, <https://www.hsdl.org/?view&did=37450>.

Congress accepted this recommendation, and in the FY 2010 NDAA required the “Secretary of Defense [to] develop and implement a new acquisition process for [IT] systems.” This process included several principles of Agile development, such as early and continual involvement of the user; multiple rapidly executed increments or releases of capability; early, successive prototyping to support an evolutionary approach; and a modular open-systems approach.⁶ Although DoD did not fully implement this new acquisition process for IT systems, Agile continued to gain traction as an effective method for developing capability more quickly with greater responsiveness to user requirements.

As Agile continued to gain popularity, many viewed EVM techniques as too difficult to implement effectively on an Agile project.⁷ The rationale was that EVM cannot easily accommodate fluid requirements and shifting baselines.⁸ By its nature, Agile is intended to provide more current and visible feedback to stakeholders participating in integrated development teams through near real-time performance reporting and frequent releases of working capabilities. To analyze this potential conflict, in July 2014 the Office of Performance Assessments and Root Cause Analysis (PARCA) initiated discussions with various DoD services and agencies to address the possibility of implementing EVM and Agile development practices together on DoD programs. PARCA ultimately started an initiative to explore the joint applicability of Agile and EVM, which resulted in DoD publishing the PARCA Agile and EVM Project Manager’s Desk Guide in March 2016. The desk guide provides a resource for DoD personnel whose work includes programs that apply both Agile and EVM.⁹

Although some argue that EVM and Agile are not compatible, using an Agile approach does not preclude the need for disciplined program management and performance measurement processes. Program managers should select appropriate resources from their toolkit based on program characteristics, and EVM is just one of many tools available. PMI, the Software Engineering Institute at Carnegie Mellon University, the Institute of Electrical and Electronics Engineers, and the GAO have published many best practices for effectively planning and managing major IT acquisitions.¹⁰

The current DoD requirement to use EVM applies to all cost- and incentive-type contracts of \$20 million or more. For cost- and incentive-type contracts of \$100 million or more, the contractor is required to have a certified EVM system. Both of these requirements apply regardless of the development approach (e.g., waterfall, Agile, other).¹¹

⁶ FY 2010 NDAA, Pub. L. No. 111-84, 123 Stat. 2402, Section 804 (b) (2009).

⁷ “Measuring Integrated Progress on Agile Software Development Projects,” Tamara Sulaiman and Hubert Smits, *Methods and Tools*, accessed October 23, 2017, <http://www.methodsandtools.com/archive/archive.php?id=61>.

⁸ *Ibid.*

⁹ OUSD AT&L (PARCA), *Agile and Earned Value Management: A Project Manager’s Desk Guide*, accessed November 9, 2017, <https://www.acq.osd.mil/evm/docs/PARCA%20Agile%20and%20EVM%20PM%20Desk%20Guide.pdf>.

¹⁰ GAO, *DoD Major Automated Information Systems: Improvements Can Be Made in Applying Leading Practices for Managing Risk and Testing*, GAO Report 17-322, accessed November 9, 2017, <http://www.gao.gov/assets/690/683831.pdf>.

¹¹ Earned Value Management System, DFARS 234.2.

Findings

Using EVM and Agile Together

For EVM to work with Agile, users must tailor EVM to integrate into the overall program management approach. Software programs are frequently tasked with implementing fast-changing technology or business solutions (e.g., functional changes needed to achieve future business processes).¹² Agile improves performance visibility, continually adapts to changing priorities, and improves customer engagement and satisfaction by bringing the most valuable products and features to market faster and more predictably.¹³ Agile also complements reengineering of business processes to adopt best business practices from COTS software products through this customer-focused approach. Agile projects inherently require maximum flexibility to adjust the baseline as software development progresses and releases are developed and delivered. By contrast, EVM methods stress the importance of establishing a stable baseline for defined work in the planning phase before the project starts.¹⁴ EVM also assumes linear progress on task execution and completion for schedule and cost-performance measurements.

Coexistence of Agile and EVM requires a tailored approach, which can be costly and time-consuming to develop and support. Implementing tailored EVM can appear to be a contrived solution compared to more modern tools that support the inherent transparency of the Agile development process.

Limited Value of EVM

Given the dynamic nature of Agile, implementing a batch-oriented EVM system has limited value in an Agile environment. By its nature, Agile provides dynamic and ongoing feedback to stakeholders participating on development teams.¹⁵ The opposite is true for EVM techniques, which take a static measurement at a point in time. Legacy accounting and program management tracking systems can only accrue performance data once or twice a month. Today, timekeeping systems are linked to a cost system that updates weekly.¹⁶

An Acquisition Category I project manager interviewed by the Section 809 Panel stated,

*EVM slows me up. It can take up to 9 months for an integrated baseline review [IBR] after which work actually starts ... then add 3 months to get meaningful metrics, and you are a year in before getting any usable performance data.*¹⁷

¹² Business Systems Requirements and Acquisition, DoDI 5000.75 (2017).

¹³ “Embracing Agile,” Darrell K. Rigby, Jeff Sutherland, and Hirotaka Takeuchi, Harvard Business Review, accessed November 9, 2017, <https://hbr.org/2016/05/embracing-agile>.

¹⁴ DoD Defense Contract Management Agency Instruction: Earned Value Management System Compliance Reviews, DCMA-INST 208, Change 1 (2017).

¹⁵ “12 Principles Behind the Agile Manifesto,” Agile Alliance, accessed November 27, 2017, <https://www.agilealliance.org/agile101/12-principles-behind-the-agile-manifesto/>.

¹⁶ “Part 2 – Weekly Earned Value: More trouble than it’s worth?” Humphreys and Associates, accessed November 9, 2017, <https://blog.humphreys-assoc.com/part-2-weekly-earned-value/>.

¹⁷ COL Pat Flanders, meeting with Section 809 Panel staff, May 11, 2017.

This situation is in contrast to an Agile project for which multiple working software releases would be expected during the first year. DoD culture needs to accept a new paradigm of using software tools that provide daily information, rather than mandating the use of EVM.

Another substantial shortcoming of EVM is that it does not measure product quality. A program could perform ahead of schedule and under cost according to EVM metrics, but deliver a capability that is unusable by the customer. Agile mitigates this risk by incorporating end users on integrated teams that frequently produce, test, and release working software. Traditional measurement using EVM provides less value to a program than an Agile process in which the end user continuously verifies that the product meets the requirement.

Monitoring Tools and Agile Metrics

There are many tools available to monitor performance, but no single best approach. Numerous project monitoring and control processes, best practices, and tools exist to track and review the progress and performance of an acquisition program. Each program must determine the right tool suite and metrics for its use. Common metrics used in Agile software development include the following:¹⁸

- Velocity: The amount of work accomplished, expressed as story points per sprint.¹⁹
- Burn-down: Story points remaining in the sprint backlog.
- Cost Per Story Point: Used to track efficiency and estimate cost of future work.
- Delivery Progress: Relative to current product roadmap and goals for each sprint.

Staff from the U.S. Army's Reserve Component Automation System (RCAS) program demonstrated for the Section 809 Panel a suite of leading tools that integrate, review, and report progress in near real-time. RCAS managers use this tool as a key information source when they meet daily to review progress. EVM may be of little or no value when managers can see progress in near real-time. MITRE's recent work on *Acquisition in the Digital Age* reinforces this concept: "Given the dynamic and iterative structure and processes of Agile, implementing an EVM system can pose a significant challenge with little value."²⁰

¹⁸ Will Hayes et al., Software Engineering Institute, *Agile Metrics: Progress Monitoring of Agile Contractors*, CMU/SEI-2013-TN-029, accessed November 27, 2017, https://resources.sei.cmu.edu/asset_files/TechnicalNote/2014_004_001_77799.pdf.

¹⁹ A sprint, also known as an iteration, is the time during which an Agile development team works, usually one week to one month, at the end of which the team delivers working software. Story points are a unit of measure for expressing an estimate of the overall effort that will be required to fully implement a product feature or any other piece of work.

²⁰ Pete Modigliani and Su Chang, The MITRE Corporation, *Defense Agile Acquisition Guide: Tailoring DoD IT Acquisition Program Structures and Processes to Rapidly Delivery Capabilities*, 48, accessed November 27, 2017, <http://www.acqnotes.com/Attachments/MITRE-Defense-Agile-Acquisition-Guide.pdf>.

Conclusions

PMs should have the option to choose the project monitoring and control methods best suited for their acquisition programs. The drivers for deciding which methods to use include the benefits of each tool, technique, and metric and how they contribute to overall program success.

Overall conclusions include the following:

- Agile and EVM can be tailored to work together, but with near real-time tools available, it is questionable whether the tailoring effort yields a commensurate benefit to Agile projects.
- Using EVM with Agile can require requests for waivers and/or deviations to meet current DFARS requirements.²¹
- EVM has been required on most large software programs but has not prevented cost, schedule, or performance issues.²²
- PMs should choose the proper project monitoring and control approaches for their acquisition programs, rather than be mandated to use EVM.

Implementation

Legislative Branch

- There are no statutory changes required.

Executive Branch

- Eliminate the mandate for using EVM at any dollar value when Agile methods are used for software development or integration contracts. Continue to require EVM for non-Agile programs.
- Allow the PEO to approve appropriate project monitoring and control methods for all Agile software development or integration programs. Selected project monitoring and control methods, which may include EVM, should provide faith in the quality of data and track the following at a minimum:
 - Schedule accomplishment vs. plan
 - Cost accomplishment vs. plan
 - Estimate to complete
- Revise DFARS Subpart 234.201, DoDI 5000.02 Table 8, and OMB Circular A-11 to reflect the above.

²¹ Earned Value Management System, DFARS 234.2.

²² GAO, *DoD Business Systems Modernization: Additional Action Needed to Achieve Intended Outcomes*, GAO-15-627, accessed November 9, 2017, <http://www.gao.gov/assets/680/671452.pdf>.

Implications for Other Agencies

- There are no cross-agency implications for this recommendation.