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Is Something Missing from Project Management?

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Abstract

There are many elements to a project … requirements, schedule, cost, quality, human resources, communications, risk, procurement, and… Every project is complex and extremely difficult to manage to successful completion, even those considered "small." The majority of the life of a project occurs during its execution. Although the execution phase is preponderant, there doesn't seem to be much emphasis on it. The literature, the training, professional meetings, and conferences do not commit proportionate energy to methods and techniques to prepare project managers for monitoring and reporting performance. Neither do these venues for knowledge transference bring focus to addressing performance measures and indicators, or using them for controlling the project. This paper examines the assertion and proposes the application of Earned Value Management and its extension, Earned Schedule, as a way forward.

Introduction

Over the last 30 years, from about 1980 until the present, there has been a significant evolution in software development, quality systems and project management. The foundation for this advancement in practice is strongly connected to a few devoted quality experts and world events occurring more than 70 years ago.

After World War II the United States (U.S.) was the predominant industrial nation in the world. The U.S. produced. The world consumed. The quality of the U.S. products was of little concern; they would sell regardless. This economic position was held until about 1970 after which the market for U.S. products declined.

Beginning with the post war reconstruction, Japan's business leaders learned and adopted manufacturing practices the U.S. utilized during and prior to the WWII. Most notably, the Japanese were taught the methods of quality by W. Edwards Deming. As Deming had prophesied to Japan's leaders, economic growth came from their dedicated use of the techniques he had learned from Walter Shewhart at Bell laboratories.

During the 1980s Japan's automobile industry began to make noticeable inroads into the U.S. market. Their success was an alarming wake-up to U.S. manufacturers, who recognized that they truly had serious competition. Thus began the quality revolution in the United States.

No longer was quality perceived as an expendable portion of the production process, largely ignored. During this period, Deming videos and seminars were commonplace. Every industry was determined to improve their operation and business practices using the methods and practices of Dr. Deming. With pervasive emphasis, the methods of statistical process control and continuous improvement were taught to managers and workers alike. For those of you who are old enough to have experienced that quality training, I am certain you will recall vividly the “Red Bead” experiment, which opened our eyes and minds to the concept of natural variation. If you have never heard of the experiment, I highly recommend doing a bit of research; it will be well worth your time.

Along with the increased focus on quality came Deming’s idea of “profound knowledge.” Profound knowledge could never be achieved with “job hopping” managers and employees. Dr. Deming espoused that deep understanding of the company and its products only comes from years of experience and progression within the organization. Deming insisted that quality improvement required having complete understanding of the process by which the products of the business were made. Dr. Deming, in his characteristically blunt style, acerbically denigrating management, most likely would have said it this way, “How can you improve if you don’t know what you are doing?”

Other extremely notable influences to the quality revolution in the U.S. came from Joseph Juran and Philip Crosby. Juran focused on the education and training of management and the human relations problem of resistance to change. The “Pareto principle,”[1] was introduced to the vocabulary of quality due to the work of Juran. Philip Crosby’s book, *Quality is Free*[2], made, unequivocally, the business case for quality and the improvements it offered. Succinctly stated, the investment and implementation of a good quality system will pay for itself many times over. Crosby also put forth the Quality Management Maturity Grid, which represents the characteristics of the quality system using five evolutionary stages: (1) uncertainty, (2) awakening, (3) enlightenment, (4) wisdom, and (5) certainty. By utilizing the grid, businesses have a template for understanding and improving their quality system.

Quality Culture

The startling success of Japanese business, coupled to the loss of market share along with project failures in the U.S., created the impetus for dramatic change. The terminology describing this abrupt departure from present business practice and culture is “paradigm shift.” These words have become commonplace and are integral to the jargon of those involved in process and quality improvement today.

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[1] Pareto principle: eighty percent of the problems come from twenty percent of the causes.
[2] Crosby, Philip B. *Quality is Free*, Penguin Books, New York 1979

Out of the desperate desire to improve and the recognition of quality as the pathway came the creation of the Software Engineering Institute (SEI) in 1984 and the first *Project Management Body of Knowledge* (*PMBOK® Guide*)[3] in 1987. To heighten the emphasis for embracing the culture of quality, the U.S. government in 1987 created the national award for performance excellence, the *Malcolm Baldridge National Quality Award*.[4] The award was intended to incentivize and recognize U.S. business for achieving world-class quality. To receive the award a company must show excellence in seven areas of performance: (1) leadership, (2) strategic planning, (3) customer focus, (4) measurement, analysis, and knowledge management, (5) workforce focus, (6) process management, and (7) demonstrable results.

Possibly the most recognized contribution of the SEI to improving the software development process and product quality was the creation of the Capability Maturity Model (CMM®). Through Watts Humphrey's initial work[5], the CMM® evolved from the adaptation of Crosby's Quality Management Maturity Grid to a staged improvement approach for software development.[6] The CMM® is characterized by five levels of process maturity: (1) initial, (2) managed, (3) defined, (4) quantitatively managed, and (5) optimizing. The CMM® provided software organizations a template for improvement that could be objectively assessed. Evidence supports the assertion that software projects performed by organizations attaining maturity levels 4 and 5 are significantly more likely to deliver products that satisfy the requirements of the customer.[7] Although the SEI focused its efforts toward military software, primarily U.S. Air Force systems, the CMM®[8] came to be used extensively by commercial software companies, as well.

The *PMBOK®*, now in its fourth edition[9], is the recognized embodiment of the knowledge and practice of project management. Professional project management is presented as activities for nine knowledge areas[10] occurring over the five life-phases[11] of the project process. The quality improvement view of the Project Management Institute (PMI®) is that by standardizing the methods in the *PMBOK®* and certifying managers through the Project Management Professional (PMP) examination,

[3] For brevity, *PMBOK® Guide* is shortened to *PMBOK®* hereafter.
[4] The Malcolm Baldridge Award has its basis in the The Malcolm Baldridge National Quality Improvement Act of 1987.
[5] Humphrey, Watts S. *Managing the Software Process*, Addison-Wesley, New York 1989
[6] Paulk, Mark C., Weber, Curtis, Chrissis. *The Capability Maturity Model: Guidelines for Improving the Software Process*, Addison-Wesley, Boston 1995
[7] Goldenson, Dennis R., Gibson, Ferguson. "Evidence About the Benefits of CMMI," SEPG 2004 (http://www.sei.cmu.edu/library/assets/evidence.pdf)
[8] Although the CMM® has evolved to the CMMI, only the former is referenced for the purpose of this paper.
[9] ANSI/PMI 99-001-2008, *A Guide to the Project Management Body of Knowledge*, PMI, Newtown Square, PA 2008
[10] Knowledge areas: integration, scope, time, cost, quality, human resource, risk, procurement
[11] Project phases: initiation, planning, executing, monitoring & controlling, closing

improvement in project results can be expected. That is, by increasing the number of project managers knowledgeable of the best practices, a growing percentage of projects should complete with good quality, on time and within budget.

Both the SEI and PMI® have the same objective of institutionalizing quality in organization, process, and product. However, in comparing the two approaches it is observed that an organization utilizing the PMI® method would likely be rated, at best, as maturity level 3 (defined) of the five levels defined for the CMM®. The CMM® makes a distinction between desirable characteristics for projects and organizations, whereas it is not so clear in the *PMBOK®*. Depending upon how organizations approach using the *PMBOK®*, there may not be company policy for managing its projects. If management methodology is inconsistent and not tailored to the application from the standard for the organization, the best the company could be rated is CMM® level 2 (managed).

The more significant difference is the aspiration for each of the two approaches. The CMM® seeks continuous improvement, whereas the *PMBOK®* with the PMP certification is limited to the improvement offered by standardization. The CMM® approach at level 4 seeks evidence of management's use of data for project control and process improvement. Also, this maturity level requires a quality system that prevents defects from propagating through the process. At level 5, the application of Statistical Process Control (SPC)[12] is utilized to understand process changes intended to reduce the natural variation in the organization's processes. Achievement of levels 4 and 5 leads to the application and the long term benefits of knowledge management.[13]

The *PMBOK®* mentions the use of data and measures for performance reports and has a brief discussion of Earned Value Management (EVM) as a method for project control.[14] Furthermore, the *PMBOK®* alludes to having and using project performance data and quality measures, but there is little verbiage compelling a project manager or his/her organization to be data driven.[15] Without performance measures and indicators, management decisions come solely from experience and intuition. Doesn't it make sense for managers to be as well informed as possible concerning their project's performance? And doesn't it also seem reasonable that better informed decisions increase the probability of a successful project outcome?

Similarly, making systemic improvement has little basis when measures and indicators are not ingrained in the organizational culture. How is it known an improvement is needed? And, after a change is introduced, how can management know if improvement

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[12] Pitt, Hy. *SPC for the Rest of Us*, Addison-Wesley, Reading, MA 1994
[13] Knowledge management is the deliberate effort of an enterprise to gather, organize, refine, and disseminate knowledge, tacit and explicit, concerning its practices, processes and products for the purposes of retention and transference.
[14] Reference PMBOK 7.3.2 (Control Costs: Tools and Techniques)
[15] Reference PMBOK 4.4.1.2 (Performance Reports), 10.5.3 (Report Performance: Outputs)

is achieved when there is no or scanty evidence of how the present process performs or the quality of its products? Likewise, when measurement and analysis is not common practice, there is low need for the application of knowledge management for improving project planning and understanding long term process improvement and performance drift.

Improving the Practice

The message to this point should be obvious: the *PMBOK®* establishes a standard for good practice, but does not promote a culture of continuous improvement. Unlike the CMM®, there is no assessment to see if the best practices of the *PMBOK®* are implemented and performed well. Without having an understanding of whether or not best practices are used, how can success or failure of a project be evaluated? How can the organization improve its methods and policy, thereby providing an environment where projects are delivered successfully, waste is reduced, and business flourishes?

The methodology intended to fill this void is the *Organizational Project Management Maturity Model*, more commonly termed "*OPM3*." The project management model for improvement was issued initially in October 2003 and was later updated in December 2008 to align with the fourth edition of the *PMBOK®*. *OPM3* is a best practice standard for assessing and developing project management capability. It is an approach for understanding project management behavior and bringing focus to areas of performance needing improvement.

OPM3 is meant to serve the field of project management in a similar manner to the CMM® for software process improvement. The improvement stages ascribed to *OPM3* are (1) Standardize, (2) Measure, (3) Control, and (4) Continuously Improve. The process characterization for each of these four stages is very much the same as those for the software model. Initially, the organizational processes are standardized. Once standardization is in place, measurement of the process can proceed. Having measures in place, controlling and subsequently improving the process become possible.

The *OPM3* project domain framework identifies nine process areas that show correspondence between *PMBOK®* processes and *OPM3* best practices.[16] Of the forty four *PMBOK®* processes within the nine areas, only four directly relate to project execution: schedule control, cost control, quality control, and risk monitoring and control.

From the viewpoint that execution utilizes the most project resources over the longest phase of the project, it would seem appropriate that the methods and tools for these important control processes would be discussed in detail. Although Measure is an important stage in the *OPM3* approach to improvement, there is minimal guidance for

[16] Northrop, J. Alan. *Every Organization Can Implement OPM3*, Triple Constraint Inc., Marion, IA 2007

what constitutes its successful achievement. *OPM3* does describe the characteristics of measures, but to progress and advance to the Control and Continuously Improve stages something more specific would be helpful.

The Way Forward

To emphasize the importance of measures, the quotations of Lord Kelvin are often used. One especially makes the point:

"In physical science the first essential step in the direction of learning any subject is to find principles of numerical reckoning and practicable methods for measuring some quality connected with it. I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely in your thoughts advanced to the state of Science*, whatever the matter may be."*[17]

Although Lord Kelvin is addressing his comments toward the hard sciences, such as physics and chemistry, his point is equally applicable to project management. When a project manager does not have objective measures of performance for cost and schedule, he/she cannot react intelligently and, consequently, has little chance of guiding the project to successful completion. Under these circumstances, the manager has only his/her personal knowledge and intuition as a basis for action.

As discussed earlier, EVM is mentioned only briefly in the *PMBOK®* as a "Tool and Technique" for controlling cost and schedule performance. Furthermore, *OPM3* identifies the performance measures and indicators from EVM as merely an approach to be considered for satisfying the Measure stage of project management improvement. Unquestionably, the power and usefulness of the earned value methodology has not been exploited to the degree it should be. Therefore, it becomes arguable that the lack of emphasis from these two principal documents, regarding EVM, has slowed the advancement of the project management profession to the "state of Science."

When the performance of a project is known in qualitative terms, we can say we know something about it. However, in general, the qualitative description is not enough information for analysis and management action. Only when performance is described by objective measures can project managers truly gain deeper understanding and formulate reasoned tactics for improving the opportunity for success.

EVM is more than 40 years old; a well defined project management methodology, which has the capability to provide the quantitative measures to advance project management

[17] Lord Kelvin quote is from http://zapatopi.net/kelvin/quotes/, October 2010

to the level of science. It is supported by standards[18][19], textbooks[20], an improvement model[21], training[22], certifications for both individuals[23], as well as organizations[24], and automation applications are readily available from several vendors[25]. As all of the footnotes associated with the previous sentence attest, EVM is a well developed technology with considerable infrastructure. EVM, in fact, is approximately twenty years older than the *PMBOK*® and possibly more mature in its application.

The known capability and availability of the management method lead us to the question, "Why isn't the use of EVM more prevalent?" The reasons cannot be stated with certainty, but the following is offered as a rational summation for consideration. In its beginnings, EVM was imposed on defense contractors performing development of major weapon systems. In the late 1960s and throughout the 1970s, the creation of custom EVM systems for each application was not a simple matter. The computing capability to connect time accounting, the project schedule, earned value (work accomplished), and actual costs was expensive to develop. EVM was in its infancy, as was the necessary computing technology to make its use practicable. The early EVM systems were very likely cumbersome to use and not that accurate either. All of these things created the prevailing reputation that EVM is terribly complex, difficult to do, overly burdensome to employees and managers, and expensive to create and implement. When this is the perception, the likelihood of employing EVM is very low. It is contended that this attitude persists and is prevalent within the project management community today.

This negative reputation for EVM, however, is not the present circumstance, at all. As expressed earlier, there is considerable support available. EVM can be implemented and applied without undue difficulty. Possibly the most troublesome hurdle to implementation is the reporting of earned value; i.e., assessment of project accomplishment. Disciplined reporting is a difficult transition to make for most, people and organizations, as well. However, once reporting becomes a commonplace expectation, an environment of transparency and accountability is created for everyone

18 *Earned Value Management Systems*, ANSI/EIA 748-B, Arlington, VA June 2007

19 *Practice Standard for Earned Value Management*, PMI, Newtown Square, PA 2005

20 Several text books are available. One I highly recommend is *Project Management Using Earned Value*, Humphreys & Associates, Inc., Orange, CA 2002.

21 Stratton, Ray W. *The Earned Value Management Maturity Model*, Management Concepts, Vienna, VA 2006

22 Very good training is readily available. The following sources are well respected: Humphreys & Associates, Performance Management Associates, and Management Technologies. A good analysis course is available from Project Management Training Institute.

23 For individuals, the certification process to obtain the credential of Earned Value Professional™ is administered by the Association for the Advancement of Cost Engineering International.

24 For organizations, The Defense Contracts Management Agency certifies compliance to the requirements of the ANSI/EIA 748-B standard.

25 A few sources for EVM tools are: Deltek, Dekker, Primavera, Artemis, ProTrack, ProjectFlightDeck, EVEngine, and Microsoft Project.

involved. Both characteristics are most assuredly desirable outcomes. Certainly there are more implementation hurdles, but generally, these pertain to the need or desire for having a sophisticated, or even a certified EVM system.

Of significant importance is the realization that the elements prescribed by the *PMBOK®* to prepare the project for execution are the necessary ingredients for applying EVM; i.e., Work Breakdown Structure, estimates of task cost and duration, task sequencing, and creation of the schedule. The additional step of aggregating the information into the Performance Measurement Baseline (PMB)[26] creates the necessary reference for EVM performance analysis. The key point from this discussion is that, when the accepted project management guidance is utilized, taking the next step to employ EVM is not an overwhelming undertaking. Conversely, when employing EVM is the organization's standard method of project control and reporting, it encourages and re-enforces *PMBOK®* guidance and *OPM3* best practice. Also, once implemented, EVM greatly facilitates improvement to project management practice, and thereby promotes achievement of the higher levels of *OPM3*: Measure, Control, and Continuous Improvement.

EVM has a primary focus on the cost aspect of projects, but does have indicators for assessing schedule performance. However, these schedule indicators are limited in usefulness due to their flawed behavior for late performing projects. To overcome this deficiency, Earned Schedule (ES) was created in 2003.[27] ES extends EVM and provides reliable analysis of the schedule performance.[28]

Together, EVM and ES provide incredible capability for measuring and analyzing project performance. With the employment of EVM project managers can assess present cost performance status, forecast final cost, and determine performance necessary to meet the cost objective. In an analogous manner, the application of ES provides the ability to perform schedule analysis; i.e., report status, forecast completion, and determine the future performance required to achieve the desired completion date. Additionally, ES introduces a new concept, schedule adherence. The measure of schedule adherence increases understanding of how the project is being performed. The concept yields the ability to analyze critical path performance, identify constraints, impediments, and potential areas of rework. Furthermore, when project performance is poor, ES used with EVM gives project managers the ability to develop tactics for recovery. It should be clear from this discussion that the numerical methods inherent with EVM and ES provide the ingredients to propel project management to the "state of Science."

Beyond the application to monitoring and controlling the project in its execution phase, the numerical data contribute to creating a project archive. The execution history,

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[26] The PMB is the time phased budget plan used as the reference for project performance analysis.
[27] Lipke, Walt. "Schedule Is Different," *The Measurable News,* March 2003, 10-15
[28] Lipke, Walter H. *Earned Schedule*, Lulu Publishing, Raleigh, NC 2009

aggregated with other project documents, form a complete project record. The assembly of formalized project records further promotes making the data useful for the planning of new projects and for analysis of improvement initiatives. As a natural consequence, without emphasis, the organization will gravitate to the employment of knowledge management.

Through the use of EVM with ES, the argument is made that project performance will improve as well as the organizational practice. The numerical evidence of performance with the accompanying analysis capability, as a result of their application, provides primary input to the achievement of the higher levels of *OPM3*. Performance measures are available for stage 2 (Measure). Analysis of the measures and derived indicators yield methods of project control necessary to achieve stage 3 (Control), and the application of knowledge management facilitates the accomplishment of stage 4, Continuous Improvement.

A quantum advance for project management is readily available through the implementation of EVM and its ES extension.

Summary

Quality in the 1980s became the driving force for product and process improvement. The approach for achieving quality is derived from the initial work of Walter Shewhart, with subsequent evolutions contributed by Deming, Juran, and Crosby. Building on the significant work of these men, Humphrey and the SEI formalized the quality system for organizational application to software development. Subsequently, PMI adapted the ideas and concepts from the SEI to project management.

The embodiment of quality for project management is the collection of best practices included in the *PMBOK®*, while the methodology for improvement of the practice is contained in *OPM3*. The observation is made that EVM and ES are not sufficiently emphasized by the two PMI documents. Implementing EVM and ES is encouraged and shown to reinforce good practice and support quality. The stated expectation from the application of EVM along with ES is improvement in project performance, while advancing and maturing organizational behavior.

The proposition is made that the application of the system of measures and analysis methods from EVM and ES advances project management to the "state of Science." And ultimately, achieving this state leads to knowledge management and continuous improvement.

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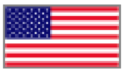

Walt Lipke retired in 2005 as deputy chief of the Software Division at Tinker Air Force Base. He has over 35 years of experience in the development, maintenance, and management of software for automated testing of avionics. During his tenure, the division achieved several software process improvement milestones, including the coveted SEI/IEEE award for Software Process Achievement. Mr. Lipke has published several articles and presented at conferences, internationally, on the benefits of software process improvement and the application of earned value management and statistical methods to software projects. He is the creator of the technique *Earned Schedule*, which extracts schedule information from earned value data. Mr. Lipke is a graduate of the USA DoD course for Program Managers. He is a professional engineer with a master's degree in physics, and is a member of the physics honor society, Sigma Pi Sigma (ΣΠΣ). Lipke achieved distinguished academic honors with the selection to Phi Kappa Phi (ΦΚΦ). During 2007 Mr. Lipke received the PMI® Metrics Specific Interest Group Scholar Award. Also in 2007, he received the PMI® Eric Jenett Award for Project Management Excellence for his leadership role and contribution to project management resulting from his creation of the Earned Schedule method. Mr. Lipke was recently selected for the 2010 Who's Who in the World. He can be contacted at waltlipke@cox.net.