

Standard Practices of Earn Value Management and It's Impact on Construction Industry

T.N Weerasinghe Mohottige

Abstract— Earn Value Management is a commonly used performance measuring and reporting mechanism. There are different types of construction projects exist. Some projects are rather similar, while others are completely different in characteristics. Hence the same EVM technique will not give the best results for every project and that EVM is not even appropriate for certain projects. In applying EVM to projects, there are three commonly used Standard Practices are existed in the current practice. All these standards meet their stated objectives, but are different in their approach to the subject and detail they provide.

Index Terms— Construction Projects, EVM, Performance Measuring, Standards.

I. INTRODUCTION

In the construction industry's present scenario, the systematic ways of performance measurement have influenced many construction firms, government sectors, public and private clients and other project stakeholders. Performance measurement is the regular collecting and reporting of information about the inputs, efficiency and effectiveness of construction projects (Takim et al. 2003).

II. LITERATURE REVIEW

During the years, a lot of research has been done in the Earn Value Management domain. The following section presents literature review findings on Earn Value Method and current industry practices; it discusses the importance of performance measurement on construction projects and standard practices of Earn Value Method. Towards the end of the section the importance of EVM as guideline is discussed as well as pros and cons of traditional and EVM.

According to PMBOK, a project is a temporary endeavor undertaken to create a unique product, service or result. Hence project planning, monitoring and controlling are important processes in ensuring proper execution of a project. The main objective of the project planning is to ensure that work is carried out to the desired quality, during the stipulated time period and according to budget. However, within the construction process, divergences from the plan occur and such occurrences are common to any type of project. In the case where the differences between plan and the actual work performance are large, control action is normally required to try to bring the actual performance on course with the desired state of the plan (Al Jibouri 2003). Performance measurement of the project is required to be monitored and compared as the work proceeds in order to be

able to identify and measure these differences.

A. Influence of Characteristics of Construction Projects on Earn Value Management.

There are different types of construction projects exist. Some projects are rather similar, while others are completely different in characteristics. Hence the same EVM technique will not give the best results for every project and that EVM is not even appropriate for certain projects. In this section three main characteristics of a construction project and their influence on the use of EVM are discussed.

- Contract Type

The first main characteristic of construction projects is the contract type. There are two basic types of contracts "Fixed Type Contracts" and "Cost reimbursable Contracts". In general, use as "Lump Sum Contracts" and "Measure and Pay Contracts" respectively. It was always believed that EVM was only useful for cost reimbursable contracts and that for fixed type contracts EVM was rather useless. The last decade however, this point of view has been criticized and nowadays a more mixed belief on contract selection exists (Buyse, Vandebussche 2010).

The EVM technique was established by large US government departments. They shared the belief that EVM was only required for large cost reimbursable contracts. Buyse and Vandebussche (2010) stated that the last decade a lot of evidence has been found to reject this traditional point of view and generalize it to include also fixed price contracts. First of all, several anecdotes went around about successful implementation of EVM on fixed price contracts. A method to transform fixed price data into key EVM parameters was discovered (Alvorado et al., 2004). When also Marshall (2007), one of the main investigators in this domain published his preference to include EVM on fixed price contracts, many project managers were convinced. Although still some proponents exist, nowadays contract type is mostly considered not to have a huge impact on the choice whether to apply EVM or not.

- Length of the Project

A second characteristic that was heavily discussed during the years is the length of the project. It has gone through a similar process as the contract type discussion. In the early years of EVM it was considered that EVM was only worth to be used on very long (> five years) projects. As a thumb rule of EVM, stability of CPI at the twenty percent completion point is only achieved in projects with a long duration. This way the CPI and SPI at the twenty percent completion point can be used to make accurate forecasts about the total cost and duration from early on in the project (Buyse, Vandebussche 2010). However during the last years, more and more project managers started to believe that EVM could also be a good technique for small and medium sized projects.

Revised Manuscript Received on 30 November 2013.

* Correspondence Author

Mrs. T.N Weerasinghe Mohottige, National Water Supply and Drainage Board, Sri Lanka.

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an open access article under the CC-BY-NC-ND license <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

This belief is only appropriate if some rules are taken into account. First it is interesting to increase the reporting cycle from months to weeks or even days for very small projects. Secondly it might be hard and expensive to calculate the actual cost on a daily basis. Then the compromise can be made to adjust the actual costs for example on a weekly basis while adjusting the schedule on a daily basis. Besides a study on projects with a cost of around \$200,000 and length of only six months, revealed that EVM was very beneficial to these projects (Custers, 2008).

Buyse, Vandebussche (2010) stated, another finding concerning the duration of projects is that often projects get stuck at ninety percent completion. The last ten percent takes much longer than expected and costs much more than ten percent of the budget. This behaviour is called the '90 percent syndrome' and can be found across different types of projects and industries. This symptom can be explained by a common archetype from System Dynamics known as 'Shifting the Burden' (Winston and Maroulis, 1998). This relates to the time when activities are completed. Executing activities before they are scheduled can create rework later on in the project life and may be accumulated until the end of the project. This then causes the last ten percent to take ages. This can be seen as one of the main reasons why the p-factor, a recently proposed earn value measure is useful in following up a project.

- Budget

Projects are also characterized by a budget that is allocated to them. Although the influence of the budget is less crucial to the usefulness of EVM than that of the duration, it is also heavily discussed. The budget itself doesn't have an influence on the efficiency of EVM but EVM practitioners think it is not worthwhile to apply EVM on projects with a limited budget. However, this opinion is not realistic due to following reasons.

Many project managers and people in general have the idea that EVM creates a lot of extra work which costs money. But actually most EVM key parameters already exist on most projects. The issue is just to find a common ground between the schedule and cost estimates of a project. For construction projects this connection is present in the public tender that is submitted by the company but afterwards this connection is neglected (Buyse, Vandebussche 2010).

Secondly there is the fear of having to change the organization of the company or project team when implementing EVM. This could require serious investments if it was really necessary. But this is not the case. EVM just requires that the functional organizational units within the company, which have a certain responsibility over the project, also show up on the project organization chart.

A last thing that managers think will raise the costs of the project when implementing EVM is the need for a new software package. Most of the time these software packages are pretty expensive but such packages can be useful for large projects but are definitely not necessary. The straightforward calculations that are used by EVM can be easily done in Microsoft Excel.

B. Standard Practices of Earn Value Management

Three commonly used Standard Practices are existed in the current practice. All these standards meet their stated objectives, but are different in their approach to the subject and detail they provide (Harris 2006).

- AS4817-2006

This is a standard that establishes requirements and gives guidance for the measurement and reporting of cost and schedule performance of projects and programmes using the EVPM method.

- ANSI Standard 748-A-1998

These guidelines are purposely high levelled and goal orientated as they are intended to state the qualities and operational considerations of an integrated management system using earned value analysis method without mandating detail system characteristics.

- The PMI Practice Standard for EVM

This is designed to provide readers who are familiar with the PMBOK Guide with a fundamental understanding of the principles of EVM and its role in facilitating effective project management.

III. MAJOR FINDINGS

In the detail Literature Review major differences were identified in the earlier mentioned major Standard Practices. The scopes of the three main standard practices were defined as follows,

AS4817-2006 defines its scope as this standard establishes requirements and gives guidance for the measurement and reporting of cost and schedule performance of **projects and programmes** using the EVPM method. In the ANSI Standard 748-A-1998, their scope is to guide for the establishment and application of an integrated managements system with coordination of work scope, schedule, and cost objectives and application of earned value methods for **programme or enterprise** planning and control. PMI Practice Standard for EVM is designed to provide readers who are familiar with the PMBOK Guide with a fundamental understanding of the principles of EVM and its role in facilitating effective project management (Harris 2006).

According to Barrett 2013 the following advantages and disadvantages were identified in the major standard practices of Earn value Management.

ANSI Standard 748-A-1998

Advantages:

- Widely Recognized and Established Standard for Large or Complex, Cost Plus Contracts
- 4 of 32 Guidelines are Focused on Indirect Costs

Disadvantages:

- High Level of Expertise Required for Full Implementation
- Schedule Performance Metrics are Focused Only on Effects of Schedule Variances on Cost Estimates
- Tailoring to Smaller Projects is Difficult AS 4817-2006

Advantages:

- Excellent for INTERNAL, Firm-Fixed-Price or Agile Project Management Efforts
- Clear Linkages to Critical Path Method (CPM) Scheduling Techniques
- Easily Understood & Embraced by Senior Management & Executives

Disadvantages:

- Not Suitable for Large & Complex, Cost Plus Contracts. PMI Practice Standard for EVM

Advantages:

- Most Widely Used EVMS Standard – Approximately 40% of Projects World-Wide Use It
- Contains Earned Schedule Variance Techniques to get Schedule Variances as a Function of Time
- Easily Tailored
- Disadvantages :
- Not Suitable for Large and Complex, Cost Plus Contracts

In these three Standard Practices, they define Earn Value Management steps in different ways.

The basic steps are listed in the AS 4817-2006 as,

1. Determine what work has to be done, by whom, and when;
2. Establish realistic resource requirements for the work;
3. Objectively measure work achievement and record associated costs
4. Report any significant deviations from the plan;
5. Forecast the completion date and cost;
6. Plan and implement corrective action and authorize scope changes.

However, according to ANSI Standard 748-A-1998 the basic principles of EVM implementation is as listed below,

1. Plan all work scope for the program to completion.
2. Break down the program work scope into finite pieces that can be assigned to a responsible person or organization for control of technical, schedule and cost objectives.
3. Integrate program work scope, schedule, and cost objectives into a performance measurement baseline plan against which accomplishments may be measured. Control changes to the baseline.
4. Use actual costs incurred and recorded in accomplishing the work performed.
5. Objectively assess accomplishments at the work performance level.
6. Analyze significant variances from the plan, forecast impacts, and prepare an estimate at completion based on performance to date and work to be performed.
7. Use EVMS information in the company's management processes.

In PMI Practice Standard for EVM the basic steps for EVM implementation is divided into two main parts as establish a Performance Measurement Baseline (PMB) and Measure and analyze performance against the baseline. Each of this process has 5 steps of implementation.

The main processes come under the establish a Performance Measuring Baseline (PMB) is,

1. Decompose the work to a manageable level
2. Assign unambiguous management responsibility
3. Develop time-phased budget for each work task
4. Select EV measurement techniques for all tasks
5. Maintain the integrity of the PMB throughout the project

The processes come under the Measure and analyze performance against the baseline is,

1. Record the resource usage during the project execution
2. Objectively measure the physical work progress
3. Credit earned value according to EV techniques
4. Analyze and forecast cost/schedule performance.
5. Report performance problems and/or take action.

ACKNOWLEDGMENT

Author wishes to acknowledge the assistance given by the staff of the Civil Engineering Department and the Staff of the

Library, University of Moratuwa, and organizations and professionals who helped to the research by sacrificing their precious time and energy.

REFERENCES

1. Agency, Defence Contract Management. Earn value Management Implementation Guide. Department of Defence, 2006.
2. Anbari F T. "Earned Value Project Management Method and Extensions." Project management Journal, 2003, XXXIV: 12-23.
3. Australia, Standards. AS 4817-2006. Australia: Standards Australia, 2006.
4. Barrett T J. "A High Level Comparison of Earn Value Management System Standards." AACE NCS Meeting, 2013
5. Buyse P, Vandebussche T. Performance analysis of Earn Value Management in construction industry. MSc Thesis, University GENT, 2010.
6. Custer, K. Ten Things You Need to know About Earned Value Method. Custer Consultants Inc, 2008.
7. Harris, P E. Comparison of Earn value standards. Australia: Eastwood Harris (Pvt) Ltd, 2006.
8. Howes R. "Improving the performance of Earned Value Analysis as a construction project management tool." Engineering, Construction and Architectural Management, 2000: 399-411.
9. Institute, Project Management. Practice Standard for Earn Value Management. Standard, Pennsylvania: Project Management Institute, 2005.
10. Khan K A. Earned Value Project Management as an Alternative Framework for Monitoring and Evaluation of Public Sector. Management brief, Punjab: Planning and Development Department, Government of the Punjab, 2003.
11. Marshall R. The contribution of earned value management to project success on contracted efforts: A quantitative statistics approach within the population of experienced practitioners. PMI, 2007.
12. Song L. Earned Value Management, A global and cross industry perspective on current EVM practice. USA: PMI, 2010.
13. Takim, R, A Akintoye, and J Kelly. "Performance Measurement Systems in Construction." 19th Annual ARCOM Conference, University of Brighton (Association of Researchers in Construction Management, University of Brighton), 2003: Vol. 1, 423-32.
14. Thamhain H J. Integrating Project Management Tools with Project Teams. Long Beach: Annual Project Management Institute Seminars and Symposium, 1998.
15. Vandevoorde S, Vanhoucke M. "A comparison of different project duration forecasting methods." International Journal of Project Management 24, 2006: 289-302.
16. Virgas RV. Earned value Analysis in control projects: Success or Failure? USA: Association of Advancement of Cost Engineering, 47th Annual General meeting, 2003.
17. W, Bokhary. "Project Evaluation and Control System." Cost Engineering Journal, July 2010: 7-15.