Applicability of Earn Value Management in Sri Lankan Construction Projects

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Abstract: Earn Value Management is a globally accepted and well established integrated planning and control methodology that combines the measurement of cost, schedule and technical performance. The objective of this study is to establish the feasibility of introducing Earn Value Management as an ICTAD Condition of Contract in Standard Bidding Document for Major Contracts for the performance reporting and evaluation. In literature review derived the several important benefits of the EVM as an effective performance measuring technique, the problems in implementing and commonly used practice standards in the globe. However, in Sri Lankan construction industry there is a need of a globally established performance monitoring technique for the development of the industry and better performance. The result of this study confirms the feasibility of introducing the EVM in Sri Lankan construction industry for performance reporting and evaluation. Further, results highlight that the importance and necessity of Earn Value Management to enhance the efficiency and effectiveness of Sri Lankan construction industry.

Keywords: Earn Value Management, Performance evaluation, Sri Lankan Construction Industry, Performance measuring technique, Standard.

1 INTRODUCTION

In the competitive business environment, more challenges are faced by construction industry in achieving better performance. Both client and contractor, continuously focus their attention on better performance, regardless of project cost, project type and geographical location. Further with the economic uncertainty, deliver the project faster and do more with fewer resources becomes path to project success.

In projects, planning is compulsory in initial stage to ensure that work is carried out to the desired quality, in the allowed time and according to budget. However, deviations from the initial plan are common in construction industry. In the case where the differences between the plan and the actual work performance are large, control action is required to try to bring the actual performance on course with the desired state of the plan. Progress on the project is required to be monitored and compared continuously to identify and measure these differences.

Earned Value Management (EVM) is a project management tool, which measures project success. Earned Value Management provides an integrated management control methodology that combines the measurement of technical, schedule and cost performance, and it provides forecasts and early warnings of performance issues for timely corrective actions to ensure project success (Song 2010). EVM kept the stakeholder aware about project performance as well as project team focused on achieving project progress.

EVM was formally introduced in 1960s by U.S department of defence, and present EVM is widely use tool in measurement of project performance.
1.1 Earn Value Method

“If you can’t measure it, you can’t manage it”. Whether one trusts the validity of this common phrase most of the time or all of the time, measuring the true progress of a project presents a formidable task (Coiffi 2006). The measure of physical progress of a project is a challenge in the context of three different important aspects such as scope, schedule and cost. In practical scenario, it’s difficult to use different tools to measure performance in three above mentioned aspects. Hence, in effective project management perspective, it’s beneficial to minimize number of performance measurement, while ensuring maximum coverage and visibility into the project. Therefore having a tool covering all these aspects is ideal for performance measurement. Earned Value Management (EVM) is a methodology used to measure and communicate the real physical progress of a project and to integrate the three critical elements of project management (scope, time and cost management) (Vandevoorde & Vanhoucke 2006).

For implementing EVM, a clear project scope is required together with a project budget and a project schedule. The project budget must reflect all planned cost incurred by the activities of which the project consists (Buyse & Vandenbussche 2010). According to PMBOK Guide, 3rd Edition, the Earn Value Method involves developing following key variables for each schedule activity or work package,

- Planned Value (PV) – Budgeted cost for the work schedule to be completed on an activity or Work Breakdown Structure (WBS) component up to a given point in time.
- Earned Value (EV) – Budgeted amount for the work actually completed on the schedule activity or WBS component up to a given point in time.
- Actual Cost (AC) – Total cost incurred in accomplishing work on the schedule activity or WBS component up to a given point in time.
- Budget Cost at Completion (BAC) – This is known as original budget

![Figure 1: Basics of Earn Value Management](https://via.placeholder.com/150)

Source: Performance analysis of Earned Value Management in the construction industry by Buyse, Vandenbussche (2010)

From the above mentioned variables, two types of performance measures can be calculated. The first type of performance measures is variances, which represent the difference between the current status of the project and its baseline in monetary terms.

The second type of performance measure is indices, also calculated from above variables. The indices are again used to display how well the project is performing, now relatively in comparison with the baseline.

In practical, due to the over complication of EVM methodologies and procedures, as well as massive efforts involved in data gathering, reporting and integrated information analysis, EVM is underused.
development of a project baseline, measurement of physical progress of a project and determining the actual cost are challenges. This complexity is further increased with the nature of construction projects, because many activities are involved in a construction project with different characteristics. The first step of developing a project baseline is crucial with frequent scope changes in the initial stage and lack of price and resource requirement details. In measuring physical progress of the project, percentage completed of each activity at a particular point in time has to be determined by the Project Manager. This task also needs more effort and time consuming. In obtaining the actual cost, requires a good reporting system to get the possible resource changes and the price changes. The invoices can be used for the calculation of actual cost because they include the most recent prices. However, the difficulty here is that although invoices may be the most accurate source for price information, they do not represent the actual amounts of resource used.

2 BACKGROUND

EVM has been successfully applied in projects of various natures in a wide variety of industries in the world. However, Sri Lankan Construction Industry doesn’t practice this method in their projects except a few organizations. EVM is included in construction management guidelines as a performance measurement tool in some countries, for example in United States of America.

Today, globalization has created more distributed projects among different industries and different countries. Therefore, in such cross country collaboration projects, globally accepted project performance measurement tool as EVM is more useful.

In Sri Lanka Institute for Construction Training and Development (ICTAD) is the authorized organization in preparing construction management guidelines. In ICTAD conditions of contract, there’s no specific method highlighted for performance measurement, which is one of the most important aspect in project success. The most effective way, to make EVM practice in construction industry is introducing EVM as a ICTAD condition of contract.

The goal of this study is to establish the feasibility of introducing the EVM as the technique for the performance reporting and evaluation in Sri Lankan construction industry.

More specifically, the objectives of this study are,

- To identify the benefits and standard practices of EVM.
- To identify the issues that hinder the usage and acceptance of EVM.
- To investigate the feasibility of introducing EVM as an ICTAD Condition.
- To establish Sri Lankan Construction Industry’s perception on EVM.

2.1 Limitations to the study

There were several limitations to this study. Some of them may be common to survey-based studies, while some are unique to this study. First of all, from a random sampling perspective, the data set is non-probabilistic, that is not a purely random sample. This is because the respondents were voluntary participants in the survey and were not selected at random.

In Sri Lanka, the projects which are practicing EVM are very limited and the knowledge about EVM also limited within the industry. Further, there was no any previous research done in the area of this study in Sri Lanka. Therefore all the literature was from foreign countries. So this is a limitation to the study.

Most of the companies may not encourage sharing of information (Especially management information). In such a situation, responses can be obtained only through informal means. Such can be considered as another limitation.

In addition to research specific limitations, possibility of non-complete responses, delays responses and lack of response are also limitations to the study.
3 METHODOLOGY

The previously mentioned research objectives were achieved through literature review and survey research. First a literature review was conducted to gain understanding on current practices in Sri Lankan Construction Industry, History and evolution of EVM, Standard practices of EVM, benefits of EVM and problems & limitations of EVM. Then data was collected from a questionnaire survey and statistically analysed. The purpose of this survey were to investigate the effectiveness of current ICTAD condition on performance measuring (Time Schedule) to the industry, industry’s perspective on existing practice (Time Schedule), how well Time Schedule is established within the industry as an ICTAD Condition, industry’s awareness on Earn Value Method, necessity of EVM to Sri Lankan construction industry and feasibility of implementing EVM.

The Literature Review gives an overview of the concept and principle behind EVM, Problems in implementing EVM, Limitations of traditional EVM, Influence on characteristics of construction projects on EVM based on EVM literature. This review also provided inputs to the subsequent research activities.

The Questionnaire Survey is based on the descriptive research method and provides an effective way to gather information about the industry’s perception on existing practices, usage of existing Practice and feasibility of EVM implementation.

3.1 Argument

To identify the applicability of Earn Value Method to Sri Lankan Construction Industry, six main elements were investigated, which was determined by myself.

The necessity of the EVM was determined by questioning some important benefits of EVM derived from the literature review. In Department of Defence's (USA) EVM Implementation Guide describes several important benefits of EVM,

- Relates time-phased budgets to specific contract tasks
- Properly relates cost, schedule, and technical accomplishment
- Allows for informed decision making and corrective action
- Allows for statistical estimation of future costs

The questionnaire was formed base on these benefits to inquire the necessity of EVM to the industry. The feasibility of implementing EVM as an ICTAD condition was investigated using the Critical Success Factors in EVM implementation. Song (2010) had identified five critical success factors in EVM implementation from views of EVM practitioners in the globe. These are,

- Top management support
- Buy-in of EVM by the project management staff
- EVM training
- Culture of the organization and top management leadership style
- Maturity of the organization’s project management system

The first four factors were questioned from the respondents to get an understanding about the availability of these factors within the industry.

These elements cover a broad area of information that affect the applicability of EVM to Sri Lankan Construction Industry and effectiveness of introducing EVM as ICTAD Condition of Contract.

(i) The effectiveness of current ICTAD condition on performance measuring (Time Schedule) to the industry

It was important to find out the effectiveness of existing condition on performance measuring, when introducing a new ICTAD condition. In order to investigate the effectiveness of the current ICTAD condition, Usage of Time Schedule and the adhesiveness to the ICTAD condition was tested from the questionnaire survey.
(ii) Industry's perspective on existing practice (Time Schedule)
From this element of the questionnaire, the main focus was to identify the limitations of the Time Schedule and the importance of these limitations to the construction industry. Hence the requirement of an advanced mechanism can be identify to fulfill these limitations.

(iii) How well Time Schedule is established within the industry as an ICTAD Condition
As the existing practice and the current ICTAD condition for the performance measuring, the importance given to Time Schedule preparation and how well it is established within the industry was investigated. Before introducing a new ICTAD condition, it is important to understand the significance of existing practice within the industry.

(iv) Industry’s awareness on Earn Value Method
In the process of introducing EVM as an ICTAD condition, it is important to get an understanding on Sri Lankan construction industry’s awareness on EVM. In the global context EVM is a well established performance measuring technique in USA, UK, Middle East Countries and European Countries. However, in Sri Lanka still it is a new concept to Construction Industry.

(v) The necessity of EVM to Sri Lankan construction industry
EVM has many benefits as an effective method of performance measuring. However it is necessary to find out whether there is a requirement for such information in Sri Lankan construction industry. In order to investigate the necessity of EVM, five main areas of benefits were tested from the questionnaire survey.

(vi) Feasibility of implementing EVM
To improve EVM acceptance and usage, the barriers for EVM adaptation and critical success factors for EVM implementation must be clearly understood. Therefore to investigate the feasibility of implementing EVM, it is important to understand industry’s requirement, resource availability and critical success factors in implementation.

4 RESULTS
The literature review and the survey study resulted in a better understanding of the effectiveness and level of usage of existing performance management techniques in practice, need of Earn Value Management to Sri Lankan construction industry and feasibility of implementing Earn Value Management. The results of the study can be summarized as follows,

- Earn Value Management is a globally accepted and well established integrated planning and control methodology that combines the measurement of cost, schedule and technical performance. It enables early detection of performance issues and allows corrective actions to be implemented in a timely manner.

- In Sri Lanka Time Schedule has become a common technique for representing the phases and activities of a project baseline, so they can be understood by a wide audience in the construction field.

- The effectiveness of the ICTAD document to the industry is high. The level of acceptance is significant; the responses show that 64% of respondents accept the Time Schedule as an effective tool and 37.3% submit it on-time for all projects to fulfil the ICTAD requirement. Further they make utilize of the Time Schedule by reviewing weekly or monthly to measure the performance.

- Sri Lankan construction industry doesn’t have a proper understanding and knowledge about the use of Time Schedule and its limitations. The lack of knowledge about the technique hinders the getting appropriate use of the technique. However, respondents believe effective performance measuring technique should not have these limitations.

- The results clearly indicate that the Time Schedule is well established within the Industry as a performance measuring technique. 61.5% use Time Schedule for all projects to evaluate the performance of the projects. In most projects there’s a Planning Engineer to develop Time Schedule and MS Project software is widely use for this purpose.
• More than 60% of the respondents have at least knowledge about the concept of EVM. Further, 18.4% of the respondents have experience on EVM, this indicates EVM is practicing within the Industry up to certain extent.

• The majority of respondents believe the most important aspect of the EVM is, it helps projects to be completed within time and cost constraints compared to other benefits. Giving early warnings was selected as the second most important benefit and allows informed decision making and corrective actions was selected to the third place.

• The survey results illustrate that more than 80% of respondents believe Sri Lankan construction industry need EVM concept for effective and accurate performance management. The cost performance management is the primary concern of the Industry.

• The Industry’s perception on feasibility of EVM implementation is satisfactory. The respondents are confident on the capability of professionals in the process of implementing the practice. However, the financial availability to implement the EVM is uncertain at earlier stage. Availability of Critical Success Factors of the implementation of EVM is in a high rank. More than 65% of respondents agree that all four Critical Success Factors are available within the industry.

5 CONCLUSION AND RECOMMENDATION

The result of this study confirms the feasibility of introducing the EVM in Sri Lankan construction industry for performance reporting and evaluation. Further, results highlight that the importance and necessity of Earn Value Management to enhance the efficiency and effectiveness of Sri Lankan construction industry.

By this study it was found some areas need more attention in the process of introducing EVM as an ICTAD condition and in enhancing the industry’s standard in performance management aspect.

• The construction industry has to pay more attention on performance management of projects. The knowledge about the tools and techniques use in this regard should be enhanced by training to get maximum use of the technique.

• The industry need more time to adjust to an advanced mechanism like EVM to get the real value of this technique.

• With the competitiveness of the construction industry, it will be difficult to make resource allocations for new practice like EVM which needs more resources for better implementation. However, by properly conveying the benefits of this method and giving proper understanding about the how the method works, will increase the use.

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