

## **A Review Paper on Earned Value Analysis**

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**Abstract:-** Earned value is the measurement of work. It is used to evaluate the progress of a project based on the cost of work performed up to the project status date. The earned value calculation enables to conduct comparative study of original cost estimate and the actual cost. This helps in evaluating economic status of the project. Despite of having various benefits, the earned value analysis (EVA) is not being used in India extensively as compared to developed countries. A detailed review on application of EVA has been presented in this paper.

**Keywords:-** earned value analysis; cost; project management; performance measurement; cost control.

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### **I. INTRODUCTION**

A project can be simply defined as set of activities which has to be completed in certain duration to produce a unique product or service, to meet unique goals and objectives. There are numerous techniques to assist project performance with respect to cost of the project such as life cycle cost analysis (LCCA), S-curve analysis, cash flow analysis. Earned Value Analysis (EVA) is the project management tool that can objectively status cost and duration of project throughout the life of a project. When earned value (EV) of a project is calculated, original cost estimates to the actual estimates of the actual work performed is compared. EV is a measurement that indicates how much of the budget should have been spent, when comparing the cost of work performed to the baseline cost for the task or resource. In EVA, there are three main data fields: the budget (or planned) value of work scheduled, the actual value of work completed, the earned value of the work completed.

### **II. LITERATURE REVIEW**

#### **A. Background**

EVA considers these three data sources; planned value (PV), EV and actual cost (AC) and is able to compare the budgeted value of work scheduled and compare it to the “earned value of actual work completed”. With the help of EVA, to keep deep understanding of risk areas is made easy for project managers.

#### **B. Earned Value Analysis: A Tool for Project Management**

Suketu (2002) explained EVA with an illustrative example. EVA is a better method of program/project management because it integrates cost, schedule and scope and can be used to forecast future performance and project completion dates. It is an “early warning” program/project management tool that enables managers to identify and control problems before they become insurmountable. It allows projects to be managed better – on time, on budget.

Agata (2008) explained that if EV to be implemented, the method should be used according to its purpose: it is not a tool for forecasting; instead, it facilitates progress monitoring, determination of project status (on time? to budget?), a rough estimate of their combined effect on the project’s outcome.

Anbari (2003) detailed the various approaches to use the EVA. EVA helps focus management's interest on projects that need most attention and may aid the prioritization and emphasis management gives project within portfolio enhancing enterprise's project portfolio management.

Lukas (2008) explained the problems in implementing the EVA such as no proper documentation; work breakdown schedule (WBS) not used or not accepted; incomplete WBS; incorrect schedule and/or budget; incorrect progress reporting; and management influence and/or control.

#### **C. Implementation of EVA in Field**

Implementation of EVA in the field is very helpful in determining whether the project is to budget and on time or not. EVA gives early warning about project progress.

Theodoros T. et al (2010) studied the bridge project. Researcher demonstrates the application of the two methods on a late construction project with variations and unforeseen events, having the actual data of the schedule as planned, the actual progress and the actual finish date. The methods are tested with three scenarios including a re-base lining of the schedule and a group of activities along the critical path, giving a very good insight of how the methods are performing in each case in terms of forecasting the duration and progress

indicators and compared with the real case. It helps the reader and potential user of a tracking method, to get an appreciation of the use of the techniques for particular cases and how the indices resulting from the methods should be read, their reliability during the 2/3 duration of the project and how these can be assessed and combined to obtain a good idea of how the schedule is performing leading to an optimum decision to recover from a possible disaster.

Dr. Dhawale & Tuljapurkar (2015) studied on building and studied EVA with the help of Microsoft Project. According to referred case study, it can be concluded that the project is over budget and within the schedule. Two parameters of EV i.e. cost performance index (CPI) and schedule performance index (SPI) clearly indicate the lacunas of project in terms of cost and schedule which can help to track the project and hence help in successful completion of project. The calculation of EV parameters can also be done manually but with the help of MS Project, calculation can be done in an efficient manner within short time, this can be helpful in megaprojects.

Mahadik & Bhangale (2013) studied construction of Natural Draught Cooling Tower for a power plant of capacity 685 MW at village area in Chattisgarh state, India. It showed the steps to implement the EVA effectively. the steps are- 1) Obtain top level organization commitment with Earned Value management System (EVMS). 2) Education and training of the people in the project in EVMS. 3) Scope well defined, detailed and identified, with proper WBS and packages. Schedule and budget organized according to the WBS 4) Clear flowchart of activities and relationship with the main participants 5) Cost/Schedule Control System with database and data collection procedures 6) Suitable reports related to EVA, well planned, analysed and distributed 8. Procedures to consistency analysis and validation of information.

Bhosekar & Vyas (2010) studied Residential Project, using the information of an actual project its cost and scheduling. The Built-up Area of residential building was 120 sq.m. Project was analysed using the developed software (in C#, .Net & SQL server) and MS Project 2007 and Primavera P6 based on Earned Value Analysis Method. CPI, planned duration (PD), actual duration (AD), Cost Variance (CV), PV, AC, EV variable were selected. The result shows a strong relation between each software. The final result gives more than 99.5 percentage accuracy. A new parameter SV (t) (Schedule Variances respect to time) is identified and incorporated in developed software which is not in MS Project 2007 and Primavera 6. The final result gives almost 100 percentage accuracy.

Anning Liu et al (2015) studied construction project cost control based on Lean Construction thought. He suggested cost control system, activity based costing method, earned value analysis and cost variance, and improvement measures based on lean construction.

#### **D. Different Methods for the Application of Earned Value Analysis**

There are different methods available to apply EVA as project management tool such as statistical method, dynamic control and with the help of software use. Method of applying software involves large data tabulation while other methods involves statistical formulae and probability calculations.

Byung-Cheol and Kenneth (2010) applied Kalman Filter. The Kalman Filter Forecasting Method (KFFM) provides probabilistic predictions of project duration at completion and can be used from the beginning of a project without significant loss of accuracy. KFFM has been programmed in an add-in for Microsoft Excel and it can be implemented on all kinds of projects monitored by earned value management or any other S-curve approach. Applications on two real projects are presented to demonstrate the advantages of KFFM in extracting additional information from data about the status, trend, and future project schedule performance and associated risks.

Hanna A. S. (2012) studied how to provide guidelines for how EV can best be used in electrical construction to maximize contractor performance. Electrical construction is characterized by a high percentage of labour as a percentage of total cost of the project.

#### **E. Problems In Implementing EVA:**

EVA implementation is one of the most important process in project management. It depends on various aspects such as creating WBS, progress reporting, correct budgeting etc. The problems in implementation of EVA has been identified in Indian scenario.

Listed below are the major reasons of failure in implementing EVA:

1. No proper documentation;
2. WBS not used or not accepted;
3. Incomplete WBS;
4. Incorrect schedule and/or budget;
5. Incorrect progress reporting; and
6. Management influence and/or control. [13].

### III. CONCLUSION

Various case studies show that EVA is an effective application in project management. EVA can be used for part-progress payments of contractors based on the earned value of definite outsourced work. Different approaches given for the application of the EVA. Hence it is essential to work on EVA to enhance application of it in current ongoing projects.

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