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Monitoring and controlling tool for project management

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ABSTRACT

Construction industries are facing challenges day by day .the industry contributes to the growth of our company to a large extent.one of the main problem that the industry faces is project delay. This can be caused due to various reasons like a deviation from the initial plan, scarcity of resources, poor planning, poor execution, etc. This causes the project to go over the expected budget and fails to complete within the scheduled time. The construction itself becomes costlier amidst all these challenges it is very crucial to improve the performance of a project with respect to Schedule and Cost. Earned Value Analysis is an important tool in analyzing the performance of any construction project. It measures the project progress and helps in identifying the critical activities thereby bringing the project on schedule. The Earned Value Analysis (EVA) is a very effective tool in measuring the progress of contractors in external projects. Computation of earned value can be part of audit activity, or it can be integrated into the progress monitoring system.

Keywords— *Progress of project, Earned Value Analysis*

1. INTRODUCTION

Earned value analysis is a quantitative project management technique for evaluating project performance and predicting final project results, based on comparing the progress and budget of work packages to planned work and actual costs. Earned value analysis is a project control technique which provides cost and schedule performance measurements of the project. It is a frequently used method of performance measurement for projects. It integrates the project scope baseline and the cost baseline, along with the schedule baseline, to form the performance baseline, which helps the project management team assess and measure project performance and progress. EVM provides project managers and the organization with triggers or early warning signals that allow them to take timely actions in response to indicators of poor performance and enhance the opportunities for project success. Better planning and resource allocation associated with the early periods of a project might be the cause of this reliability.

EV analysis is an important tool to measure the performance of a project. It is a program management technique that uses “work in progress” to indicate what will happen to the work in future. It compares the actual work performed against a baseline plan. In this way, the analysis helps in setting a standard for performance evaluation and controls the time and cost constraints. It also helps in identifying the critical activities which maybe noted down and taken care of during further progress of the project. It compares the planned amount of work with what has actually been completed, to determine if the cost, schedule, and work accomplished are progressing in accordance with the plan. As work is completed, it is considered "earned". EVA is a snapshot in time, which can be used as a management tool as an early warning system to detect deficient or endangered progress. It ensures a clear definition of work prior to beginning that work. It provides an objective measure of accomplishments, and an early and accurate picture of the contract status.

2. EARNED VALUE ANALYSIS INDICATORS

Schedule variance (SV) = Earned value – Planned value
Cost variance (CV) = Earned value – Actual cost
Schedule performance index (SPI) = Earned value / planned value

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Cost performed index (CPI) = Earned value / actual cost

(a) ACWP (AC) – Actual cost of work performed (ACWP) or Actual cost (AC) is the actual cost incurred for the activities that are performed in a given period

(b) BCWP (EV) – Budgeted cost of work performed (BCWP) or Earned value (EV) is the approximation sum of budget for actually completed work

(c) BCWS (PV) - Budgeted cost of work schedule (BCWS) or Planned value (PV) is the sum of the approved cost of budget for all activities to be completed in a given time period.

3. LITERATURE REVIEW

Gupta Radhika, "Earned Value Management System Engineering Journal of Emerging Engineering Research and Technology" Earned Value Management is able to provide accurate forecasts of project performance problems which are an important contribution for project management. Earned Value analysis is a method of performance measurement that uses "work in progress" to indicate what will happen to work in the future. Earned Value Management System is not a specific system or tool set, but rather, a set of guidelines that guide a company's management control system. Earned Value Management allows us to integrate project scope, schedule and cost objectives against a baseline plan for accomplishment of project objectives.

Earned Value Analysis 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. The main contribution of the EVMS process was the motivation of the project manager and his staff concerning the cost management and the goal to finish the project on budget. The EVMS process provided more perception about the costs and their related elements of scope, contracts, performance, suppliers, risks, procurement, communications, quality, people and negotiations. EVMS inspires the participants to pay more attention to costs and progress, motivates the participants to discuss the cost elements with more intensity and optimize the costs resulting in a project that was finished on time and on budget.

Shu Chen and Xueqing Zhang, "An Analytic Review of Earned Value Management Studies in the Construction Industry." Earned value management (EVM) is a methodology for evaluating project performance and progress by integrating project scope, schedule, and cost. EVM has been widely applied in various industrial sectors and many studies have been conducted on EVM and its application in the industry. This paper provides an analytic review of EVM studies and its applications. These studies are classified as either empirical or non-empirical. For empirical studies, key issues reviewed include effective implementation of EVM, behaviours of cost performance index, accuracy of cost control techniques, and accuracy of time control techniques. For non-empirical studies, key issues reviewed include schedule performance index, accuracy of time control techniques, and the integration of EVM with other project management This paper introduces a description of the background of EVM, including its terminologies, performance analysis and forecasting measures, and advantages as well as disadvantages of EVM. Nowadays, EVM has become a widely used tool for different sizes projects in both private and public sectors. The internationally recognized EVM method, when introduced into different countries, should be structurally adjusted to accommodate the existing project control techniques. Particularly, as EVM outputs depend on the collection and processing of cost and schedule integrated data EVM offers the project manager a tool to timely evaluate the general health of a project along the life of the project. Particularly, EVM has been used to: (1) estimate cost and time to complete (2) identify cost and schedule impacts of known problems; (3) accurately portray the cost status of a project (4) trace problems to their sources (5) portray the schedule status of a project (6) provide timely information on projects, and (7) identify problem areas not previously recognized.

Sandhya Suresh, Ganapathy Ramasamy N "Analysis of project performance using Earned Value Analysis" EVMS provides value to the project management team it improves the project ability to monitor and schedule. Earned value goes one step further and examines actual accomplishment. This give mangers greater insights into potential risk areas. With clearer picture, mangers can create risk mitigation plans based on actual cost, schedule and technical progress of the work. It an early warning project management tool that enables managers to identify the control problems before they become insurmountable. EVM inspires the management team to pay more attention to cost, schedule and progress with more intensity and optimizes the project. EVM can provide an important contribution in cost management of a construction project. it can be sensitive to scope change. It provides a warning system to the mangers and thus helps in efficient project management. The reports can be used in future projects. EVM provides more perception about the cost and other element of the scope, risks, performance, etc.

Rajhans S. Mathpati, Dr. A. S. Wayal "Continuous project evaluation of an infrastructure using Earned Value Analysis" Earned value analysis can be used as a project performance evaluator for infrastructure project. Earned value which gives the quantitative measure of a project performance. In earned value analysis comparison between planed baseline and actual progress of work is conducted. Earned value analysis is a management tool that integrates the scope, schedule and budget of the project. If the project is completed, within the allocated time period, budgeted cost and at the proper performance or specification level then the project can be called as successful project. Earned value analysis is a method of performance measurement. Earned value is a project Management technique that uses "work in progress" to indicate what is the status of project and what we happened to work in future. It is an "early warning" project management tool that enables managers to identify an control problems before they become insolvable.in a project execution process, earned value analysis requires the recording of resource utilization (i.e., labour, materials and the like) for the work performed within each of the work elements included in the project management plan. In other words, actual cost needs to be captured in such a way that permits their comparison with the performance measurements baseline. Analysis of variance from the baseline provides the cost related information for problem identification, trend analysis and corrective actions such as re-planning and revising budget. Also, it calculates the budget at the completion, time required to complete the project, delays and cost overrun. Work breakdown structure forms the basis for defining the scope of work,

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identifying activities, scheduling the work-logic, structuring the organization, assigning responsibilities, estimating cost, codifying systems, organizing data an analysing the sources of risks. Work break down structure of concrete road is prepared such that separate packages are obtained an activity were listed out. List of various activities is sequenced and their appropriate groups are maintained. For activity duration and their relationships, resources such as labour, material, machineries, time and fund are considered with help of contractor.

4. OBJECTIVES

(a) To study controlling tool, EVA along with its indicator for project management.
(b) Application of EVA to selected residential project activities.
(c) Identifying the progress and cost related parameters through EV analysis.

5. METHODOLOGY

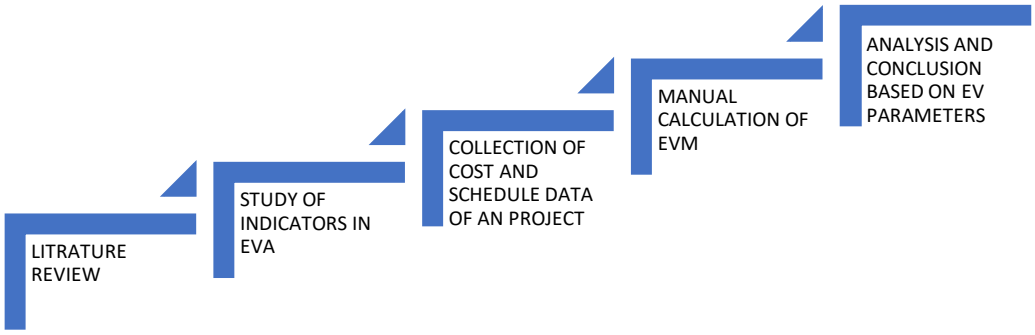

Fig. 1: Methodology

- The first stage is to study EVA with the help of existing research papers.
- The second stage is to study all the indicators and formulas with respect to EVA.
- The third stage is to collect the site details of ongoing site including its schedule and cost of project.
- The fourth stage is to calculate the terms of EVA with the help of site details.
- The final stage is to make the suitable conclusion based on schedule and cost indices obtained after Earned value analysis

6. APPLICATION

The whole project is expected to be complete within 8 months. And EV analysis is done at 3rd month of the project for ground floor consist of 11 activities from that we are going to select first 8 activities that is cleaning, excavation, ground beam, PCC for footing, PCC bed with the nominal reinforcement, RCC footing, RCC column and RCC stair case should be completed till 25/6/2019.

Table 1: Details of selected activities consist of planned cost and schedule

Activity id	Activity	Start date	Finish date	Planned cost (rs)
A	Cleaning	2/5/2019	3/5/2019	5000
B	Excavation	4/5/2019	13/5/2019	6480
C	Ground Beam	14/5/2019	17/5/2019	120000
D	PCC For Footing	20/5/2019	20/5/2019	14560
E	PCC Bed With Nominal Reinforcement	21/5/2019	22/5/2019	52800
F	RCC Footing	23/5/2019	31/5/2019	52500
G	RCC Coloumn	1/6/2019	10/6/2019	58500
H	RCC Staircase	11/6/2019	25/6/2019	42000

Table 1 shows the details of selected activities which includes schedule and planned cost. After starting of actual execution of project work is was noticed that actual cost of work was different as compare to planned cost as shown in below table 2.

Table 2: Completion Status for selected activities in 3rd Month Of project

Activity ID	Completion Status (%)	Actual Cost(RS)
A	100	2300
B	100	31825
C	100	189650
D	100	28231
E	100	54900
F	100	80999
G	100	60133
H	100	45013

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Analysis was carried out from the available data as shown in table 1 and 2 by using controlling tool Earned Value (EV). The EV indicators obtained for the related activities is shown in table 3.

Table 3: EV calculations for selected activities

Activity Id	PV	AC	EV	CV	CPI	SV	SPI
A	5000	2300	5000	2700	-2.17	0	1
B	6480	31825	6480	-25345	0.20	0	1
C	120000	189650	120000	-69650	0.63	0	1
D	14560	28231	14560	-13671	0.51	0	1
E	52800	54900	52800	-2100	0.96	0	1
F	52500	80999	52500	-28499	0.64	0	1
G	58500	60133	58500	-10633	0.97	0	1
H	42000	45013	42000	-3013	0.93	0	1

Table no 3 indicates activity wise updating on 26th of June. For any activity having the CV value is negative and CPI value is less than 1 which indicates that particular activities are overbudget. If the value of SV is negative and SPI is less than 1 which indicates that particular activity behind the schedule.

Table 4: Data updating after completion of selected 8 activities

	PV	AC	EV	CV	CPI	SV	SPI
Selected Activities	351840	493051	351840	-150211	0.71	0	1

Table no 4 indicates project updating after completion of selected 8 activities. The value of CV is negative and value of CPI is less than 1 which indicates these completed activities of project are overbudget. The value of SV is zero and value of SPI is 1 which indicates that the project is on the schedule.

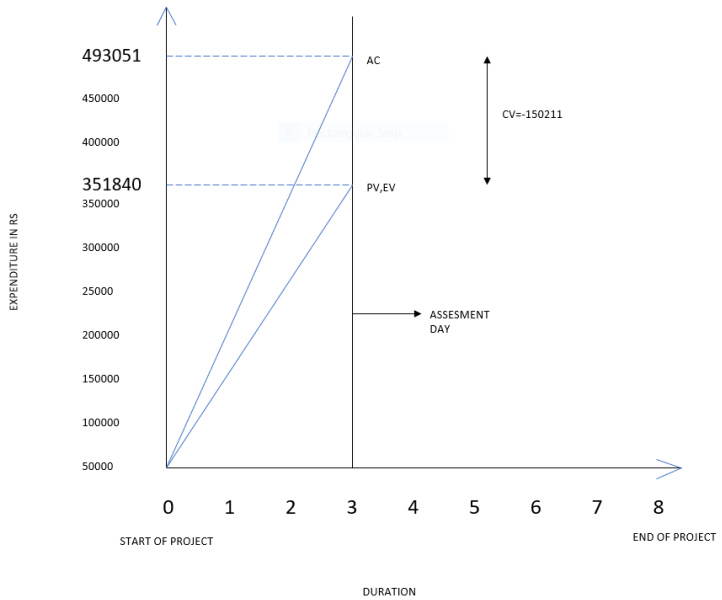

Fig. 2: Showing Analysis of EV Indicator for selected project

Figure 2 is a graph of Cost and Time of project. The difference between the curve PV and curve EV shows schedule variance (behind). And the difference between curve AC and curve EV shows cost variance (over).

6. CONCLUSION

Application of EVA for selected construction project activities for selected construction project activities helped for identifying benefits for project management the analysis was carried out for third month with available project details of activities duration and their corresponding cost. While conducting study planed data was set as was set as base line and actual cost details for all activities was collected and used for analysis. Table no. 3 shows EVA indicators for all activities. This detail helps to identify cost variance activity wise while table no 4 gives details of all completed activities. Graph no 1 show obtained EVA indicators after carrying out analysis for selected project activities. E.g. take activity E, CPI value is 0.96 which means for every one rupee that they have spent of activity B they have earned only 0.96 rupees till completion. For same activity SPI value is 1 which means it is with the schedule. Thus, EVA is controlling tool which helps to track and monitor project at any phase of ongoing project as well as after completion. Hence, we suggest EVA is one of the cost and scheduled variances measuring tool for effective project management.

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