

A Time Cost Optimization through Earned Value Management Analysis

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Abstract - Project cost is the one of the governing aspects in project success. Construction projects, both private and public, have a long history of escalation in cost and schedule. A large number of studies and research projects have established individual factors that contribute to increased project cost and schedule. Project management is used to increase human and material resource productivity. Earned value management is a technique for assessing project performance that has been adapted for use in project management. The technique helps in comparison of budgeted cost and actual cost of work. This study deals with the review of the project management involving earned value analysis.

EVM is a forecasting technique that provides an early warning of cost and schedule. It not only assesses the project's performance, but also measures the progress of the schedule. It is a useful tool for assessing a project's cost, schedule, and performance. The evolution, basic terminologies, and effective use of earned Value analysis in the construction industry by Microsoft Project software are summarized in this study. There are a variety of ways to incorporate EVA into a construction project. Primavera is a programme that can be used to calculate the EV and its parameters quickly and accurately.

Key Words: Earned Value Management, Project Planning, Scheduling, Project Control, Earned Value Management Analysis, Time Cost Optimization etc.

1. INTRODUCTION

The building industry is widely recognized as one of the most ductile industries on the market. The construction process is repeatedly described as a method of problem solving, and the problem is to create a facility for low budget, on short amount of time and far too regularly with minimal amount of information [Winch, 2002]. Change is inherent in the construction work and the industry has in many ways adapted its organizational grouping in order to solve those changes more efficiently than most other industries and corporations. In spite of that the construction industry has had a poor prominence for years for its impotence to cope with the long term negative effects of change as many projects fail to reconcile their deadlines as well as cost and quality targets. One of the things that should be considered is that it is achievable that the project managers and engineers focus too much effort on the short term problem solving whilst the long term effects on the project duration, cost and

quality remain unknown. This is not surprising given that there are no known perfect engineers, just as there are no known perfect project designs.[Smith, Merna & Jobling, 2006].

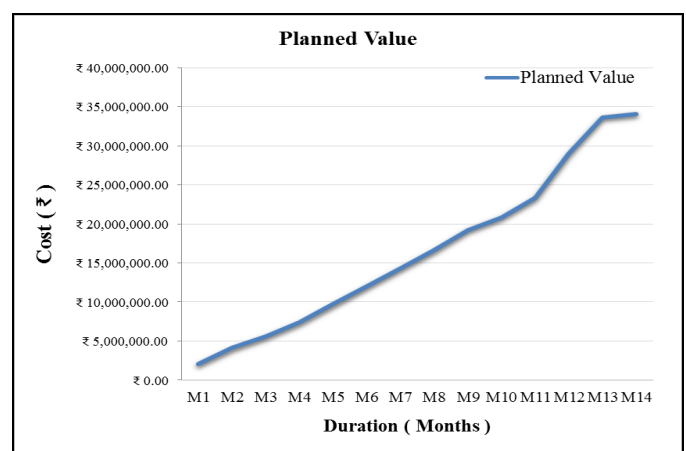
2. CASE STUDY

Earned Value Analysis is done on a residential building project in Solapur. The Project duration is 357 days i.e. approximately 12 months. The planned budget for this project is . Earned Value Analysis is done at the end of about 5 months after commencing the project 4 times in one month gap. This analysis will reveal the efficiency at which the work was done and the rate at which it was completed.

Based on the rate analysis and the planned schedule and project duration prepared before the commencement of the project the cumulative Planned Value is established. Based upon the actual work completed the % completion is estimated and then from the % complete the Earned Value is computed. Finally from the accounts department, the actual expenditure for the work done till this point is collected. This is called the Actual Cost.

3. RESULTS AND DISCUSSION

From the collected data, cost Vs duration curve is plotted for the planned value (PV) of the project. This curve is called the S- curve, which forms the base for EV analysis. The curve is shown in graph 1.



Graph 1 S- Curve for the planned value

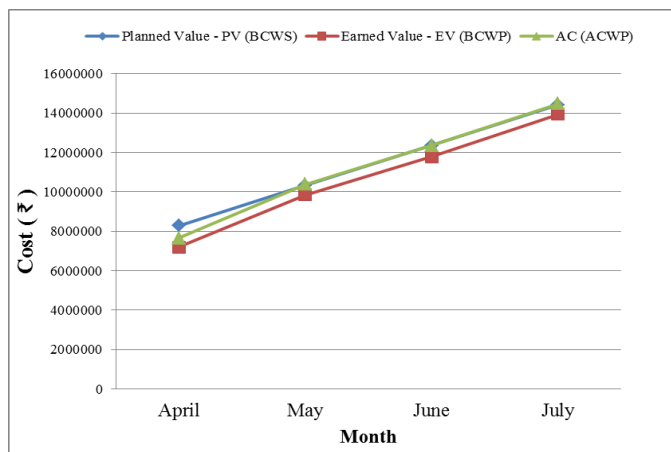
3.1 EV Analysis

- BCWS (Budgeted Cost of Work Scheduled) - PV (Planned Value)
- BCWP (Budgeted Cost of Work Performed) - EV (Earned Value)
- ACWP (Actual Cost of Work Performed) - AC (Actual Cost)
- SV (Schedule Variance): $VP = EV - PV$;
- CV (Cost Variance): $VC = EV - AC$.

Table 1 EVA Graph

Month	BCWS	BCWP	ACWP
April	82,90,725	72,01,218	76,52,625
May	1,03,23,392	98,50,329	1,03,94,465
June	1,23,56,058	1,17,93,731	1,23,63,665
July	1,44,16,213	1,39,43,151	1,44,87,286

From the table 1 we calculated the graph between PV, EV and AC here in graph 2 we can see the difference of project performance is changed in the duration progress the actual cost deflection than it perform according to schedule after 3rd interval. This shows the Earned Value Analysis is very useful for controlling project in terms of cost and schedule.



Graph 2 EV Analysis graph

Table 2 and Table 3 shows schedule performance index and cost performance index. Table value taken from the report generated in MSP.

Table 2 Schedule Performance Index

Month	SV	SPI	CV	CPI
April	-10,89,507	0.87	-4,51,407	0.94
May	-4,73,063	0.95	-5,44,136	0.95
June	-5,62,327	0.95	-5,69,934	0.95
July	-4,73,062	0.95	-5,44,135	0.96

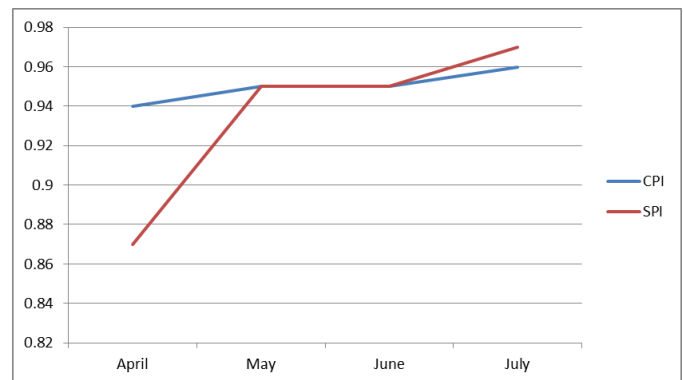
Table 3 Cost Performance Index

Month	EAC	BAC	VAC
April	3,22,40,278	3,02,58,473	-19,81,805
May	3,19,91,670	3,02,58,473	-17,33,197
June	3,17,71,906	3,02,58,473	-15,13,433
July	3,14,82,219	3,02,58,473	-12,23,746

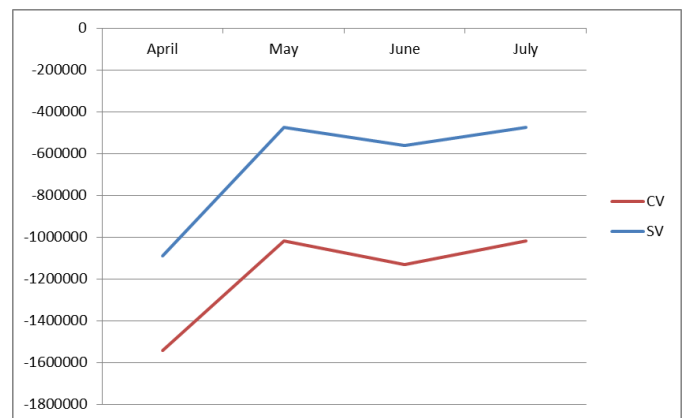
From the EVA the Schedule Performance Index (SPI) and Cost Performance Index (CPI) are tabulated in table 2 and 3.

These tables' shows that SPI and CPI are at starting of intervals are lower and how they increased as the progress of the project is increased. The graph 3 is calculated from the same.

From the EVA the Schedule Variance (SV) and Cost Variance (CV) are tabulated in table 1. The graph 4 shows the variation in SV and CV.



Graph 3 the graph between SPI and CPI



Graph 4 the graph between SV and CV

Table 4 Variation in Project Duration

Month	SPI	Planned Project Duration	Estimated time at project completion	Variation in Project Duration
April	0.87	357	410	53
May	0.95	357	375	18

June	0.95	357	375	18
July	0.97	357	368	11

From above study, analysis and by using different tables and graphs (Table 1, 2, 3 and Graph 1, 2, 3, 4) we can give results as following

1. At the start of April the project is going in behind schedule (SPI<1) and Project is in over budget (CPI<1)
2. At the start of May the project is going in behind schedule (SPI<1) but we can see there is increase in Schedule Performance i.e. increase in the gap in schedule and Project is in over budget (CPI<1) because the resources are increases.
3. At the start of June the project is going in behind schedule (SPI<1) and Project is in over budget (CPI<1) but there is no change in schedule performance and cost performance which neutral
4. At the start of July the project is going in behind schedule (SPI<1) but having progress as SPI is heading towards 1 and Project is in over budget (CPI<1) but its value is progressing towards 1.
5. As we can see from table 4 Variation in Project Duration which is reducing as heading towards project completion.

4. CONCLUSIONS

Proper planning and execution on the construction site is very crucial and important in any construction project. Because the project involves a significant amount of time and money, it must be completed on time and on budget. Earned value analysis may be most easily correlated with the monitoring and evaluation of project cost that are undertaken within an organization, it can also be readily applied, with some adjustment, to the control of project cost that are performed by contractors and owners. Organizations face an extreme challenge in controlling project budgets over the time span between project initiation and the completion of construction. Earn value determines how much of the budget should have been spent, when correlate the cost of work performed to the baseline cost for the task, resource or assignment. Earn value method gives project's status and the scale of current variances from the plan. Moreover, it allows a project manager to make interpretation on the final effect of the project in terms of cost and, to some extent, in terms of duration, by extrapolating current trends. In this project, concept of EVM analysis is tried to elaborate through planning, scheduling and tracking of project in MSP. Reports generated from MSP are used for EVM analysis.

The primary goal of this research was to comprehend the role of monitoring and control in the progress and timely completion of a construction project. This objective was achieved through revision of literatures and methodologies

involved in monitoring and control. The case study proved to be a guideline in understanding the progress of standard design factory construction work and also to identify the specific problems rising during the process.

From the results obtained by using software we concluded that

1. From Table 2 we concluded that at the starting of April the SPI is 0.87 and CPI is 0.94 then as the project progresses these values heading towards 1 means the schedule is already behind schedule, at the start of July it is nearly equal to 1, in upcoming months it will be on schedule i.e. 1.
2. Also the CPI is heading towards 1 means we are able to control the project from over budgeting.
3. The SV is higher at the start of April month, after that we see that its value is decreasing and CV is also constant which can be further decreased as project progresses.
4. From Table 4 as project progresses the cost Variance at Completion of project is reducing which is good sign to complete the project on planned budget.
5. The EVA technique is very useful for controlling project as it present the required resources for the particular activity to control the schedule and budget.

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