

Analysis of Tracking of Project by Earned Value Management Method in High Rise Building

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Abstract— Earn value management is a project accomplishment approach that has been suitable for utilization in project management. Baseline plan can be calculated using EVM to check the progress of the project. EVM operation help in giving achievement standard to the assessment of evolution report of project and it likewise go about as a command gadget to deal with budget and time. The present study deals with planning, scheduling and performance of project process along with it also discusses main parameter's involving in the calculation of earned value analysis in cost and time management of civil construction project. the main objectives of manuscript is compare the project tracked by MSP and EVM with conventional tracking method using real time case study of G+15 story building by MSP software.

Keywords—EVM, Tracking, MSP Software, Planning, Scheduling.

I. INTRODUCTION

Construction industry is an important industry at both the global level and national level. It is second largest sector in India. It provides huge employment to the people and plays very significant role in country economy. Project delay is most common problems in the construction industry. In growing countries challenge overruns is a serious in which implementation of challenge faces many doubts. It outcomes in wastage of scare resource of finance, delay in providing facilities, development and too make costlier in construction. With globalization and technology determined economic growth all over the world, a scientific and systematic approach to project organization becomes imperative to make certain that project objectives are attain within the constraints of time and resources EVM is the procedure of measuring presentation of project employment against a baseline plan. EVM application allows in offering overall performance preferred for the assessment of advancement report of project & it also act as a manipulate tool to take care of time & cost schedule through responsibility described in OBS. It provide better performance picture of project and gives better forecast of the final completion cost

II. LITERATURE REVIEW

A. Three-Variance Approach for Updating Earned Value Management

The project management triad has scale, time, and cost. In this study, schedule variations and schedule performance indicators, in traditional dual-variance management (EVM), were shown not for real-time performance indicators, and it is

suggested that the physical body definitions as work variables (WV) and performance indicators be restored. It is found that the performance of the work may be equal to the performance of the same period before the scheduled project time in certain circumstances. However, the same is not always true, especially if the project is over. A performance measurement earned time (ETM) method is presented in this study, which can serve as an alternative to measuring project time upon completion. Finally, it is suggested that the independent performance measurement, WV, be added to EVM, and that a three-pronged approach be used to analyze work conditions, time, and costs in relation to a given project.

B. Estimated Cost at Completion: Integrating Risk into Earned Value Management

Earned Value Management (EVM) is the industry's standard for monitoring the performance of ongoing projects. The operating basis is set in the planning phase to measure any time and cost errors during the project. Based on current progress, it is estimated when completed (EAC). Traditionally, EVM focuses exclusively on project planning (SPI) and cost (CPI), and does not address other important aspects of health and safety, stakeholder satisfaction, and quality. Despite its high volatility, EVM forecasts are still influenced by project risk and uncertainty, leading to a conflict between the results of the EAC obtained by standard formulas. In order to measure a better EAC, a framework is developed that incorporates various key performance indicators in the risk performance indicator (RPI). Using SPI, CPI, and RPI, an integrated model is developed and several case studies are conducted to validate it. The findings show a better EAC compared to traditional methods. Introducing performance indicators to measure key project aspects will provide participants with a better monitoring and decision-making tool.

C. Study of the Stability of Earned Value Management Forecasting

In this paper, the authors focus on establishing mechanisms for predicting the value of earned value management (EVM). The contribution was tripled. First, a new condition for measuring stability that does not suffer as a result of a psychological malfunction that is historically used is proposed. Second, the stability of time and cost forecasting methods are compared and compared using computerized tests on a variety of data sets. In all of these tests, predictive accuracy is also reported, which helps to trade between accuracy and stability. Finally, the demonstration shows that the mathematical strength of the novel can be applied to real

worlds using two real projects. The results of these legal guarantees are found to be highly correlated with computer results.

III. RESEARCH METHODOLOGY

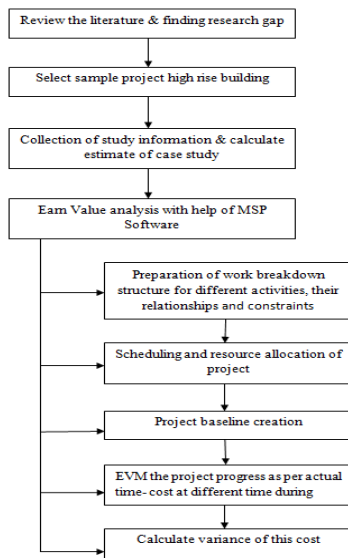


Fig. 1. Flowchart of Methodology

IV. PREPARE YOUR PAPER BEFORE STYLING

A. Earned Value Analysis-Process

Value Earn is a system management system that uses continuous activity to show what will happen in the future. EVA uses costs as a standard measure of project costs & schedule performance. Allows cost estimates by currency, hours, working days, or other similar item that can be used as the same amount of project-related amounts. EVA uses the following project parameters to evaluate project performance:

- ✓ Planned Value
- ✓ Earned Value
- ✓ Actual Value

As mentioned, there are several ways to calculate the EV, PV and AC of a work package in work. A comparison of those statistics can be used to identify performance and progress inadequate or sophisticated specific work packages, project manager and team can expect supportive actions. Cost and schedule performance should be measured and evaluated with consistency and severity with the magnitude of the performance risk as required by project management. The analysis should be progressive and follow the principle of management by exception. The variance limit should be set at the planning stage and used to guide the examination of performance.

B. Concepts & Terminologies Related to Earned Value Management

Value management systems gives different variations that can be analyzed to provide the current status of the project, initiate corrective action also predict future trends measure: Planned Value (PV), Actual Price (AC) and Acquired Value (EV). From the three measures, project performance indicators are formed.

- BCWS (PV) Budgeted Cost of Works Scheduled – It is the baseline for the analysis, cumulated planned

costs related to time of their incurrence; Figure 1 shows the graph of BCWS vs. Time

- BCWP(EV) – Budgeted Cost of Work Performed – It is a measure of physical progress of works expressed by cumulated planned cost of works actually done related to time, it is also called Earned Value (like the method it is used by);
- ACWP (AC) – Actual Cost of Work Performed – A cumulated amount payable for work done related to time;
- BAC – Budget at Completion – The total planned cost of the whole project, it equals BCWS at the planned finish;
- T – Planned duration of the project.
- ❖ SV: Schedule Variance (EV-PV)
 - A comparison of amount of work performed during a given period of time to what was scheduled to be performed.
 - A negative variance means the project is behind schedule
- ❖ CV: Cost Variance (EV-AC)
 - A comparison of the budgeted cost of work performed with actual cost.
 - A negative variance means the project is over budget
 - SPI: Schedule Performance Index $SPI = EV/PV$
 - If $SPI < 1$ means project is behind schedule
 - CPI: Cost Performance Index $CPI = EV/AC$
 - If $CPI < 1$ means project is over budget
 - CSI: Cost Schedule Index $CSI = CPI \times SPI$
 - The further CSI is from 1.0, the less likely project recovery becomes. Estimate at completion $EAC = BAC + CV$

C. Case Study

TABLE I. CASE STUDY INFORMATION

Name of the Project	Elixa Park
Client	Sachin Shinde, Kolhapur
Builder	Ajay Singh V. Desai, Builders and Developers, Kolhapur 416004
Total duration	1400 Day
Built up Area per Floor	643.82 sq.m = 6927.50 sq.ft
Rate per sq. ft	2850 per sq.ft
Start date	01 Jan 2018
End date	29 Oct 2021

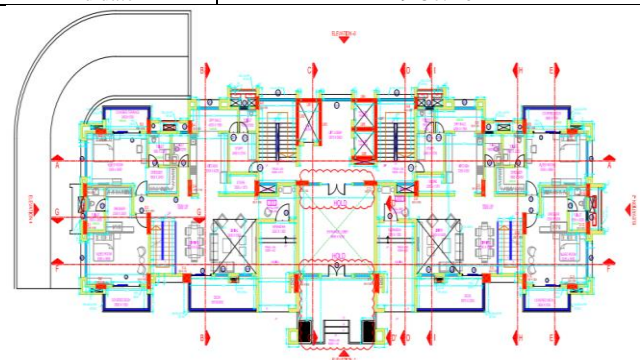


Fig. 2. Plan of Project

V. RESULT AND DISCUSSION

A. Conventional Model Results

1. Earned Value Overtime Report

TABLE II. EARNED VALUE OVERTIME REPORT

Year	Quarter	Earned Value	Planned Value	AC
2018	Q1	61493405.1	61540959.66	61493405.1
	Q2	103701832.6	103749387.1	103701832.6
	Q3	116020816.9	116068371.5	116020816.9
	Q4	133471552	133519106.5	133471552
2018 Total		133471552	133519106.5	133471552
2019	Q1	145859361.1	147058926.4	145859361.1
	Q2	156234168	157433733.3	156234168
	Q3	164347322.7	165546888.1	164347322.7
	Q4	173785638.3	174985203.6	173785638.3
2019 Total		173785638.3	174985203.6	173785638.3
2020	Q1	181675846.7	182875412.1	181675846.7
	Q2	189596239	190958371	189596239
	Q3	252731059.7	254093191.7	252731059.7
	Q4	264611082	265973213.9	264611082
2020 Total		264611082	265973213.9	264611082
2021	Q1	276564556.4	277926688.4	276564556.4
	Q2	287506496.1	288868628.1	287506496.1
	Q3	293348797.5	294710929.5	293348797.5
2021 Total		293348797.5	294710929.5	293348797.5
Grand Total		29,33,48,797.5	29,47,10,929.5	29,33,48,797.5

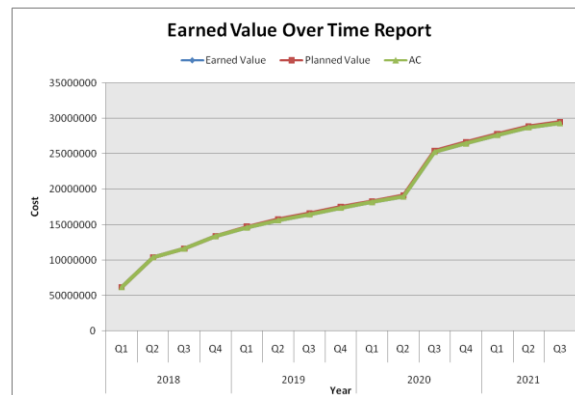


Fig. 3. Earned Value Overtime Report

2. Cash Flow

TABLE III. CASH FLOW REPORT FOR PROJECT

Year	Quarter	Cost	Cumulative Cost
2018	Q1	61540959.7	61540959.66
	Q2	42208427.5	103749387.1
	Q3	12318984.3	116068371.5
	Q4	17450735.1	133519106.5
2018 Total		133519107	133519106.5
2019	Q1	13392495	146911601.5
	Q2	10522131.8	157433733.3
	Q3	8113154.75	165546888.1
	Q4	9438315.55	174985203.6
2019 Total		41466097.1	174985203.6
2020	Q1	7890208.45	182875412.1
	Q2	8082958.9	190958371
	Q3	63134820.7	254093191.7
	Q4	11880022.3	265973213.9
2020 Total		90988010.3	265973213.9
2021	Q1	11953474.5	277926688.4
	Q2	10941939.7	288868628.1
	Q3	8397213.77	297265841.9
	Q4	933122.694	298198964.6
2021 Total		32225750.6	298198964.6
Grand Total		29,81,98,965	29,81,98,964.6

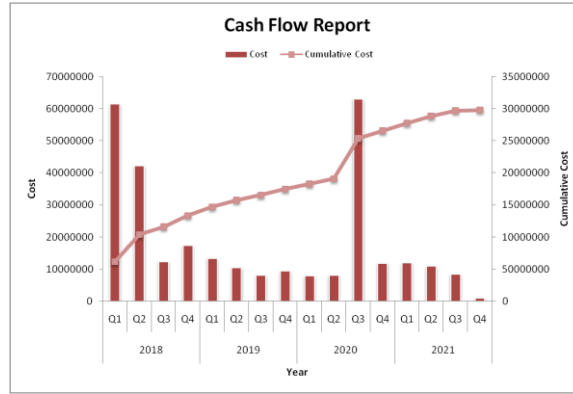


Fig. 4. Cash Flow of Project

3. Budget Cost

TABLE IV. BUDGET COST FOR PROJECT

Year	Quarter	Baseline Cost	Cost	Actual Cost
2018	Q1	61540959.66	61540959.66	61493405.1
	Q2	42208427.46	42208427.46	42208427.46
	Q3	12318984.35	12318984.35	12318984.35
	Q4	17450735.07	17450735.07	17450735.07
2018 Total		133519106.5	133519106.5	133471552
2019	Q1	13539819.91	13392494.95	12387809.12
	Q2	10374806.88	10522131.84	10374806.88
	Q3	8113154.751	8113154.751	8113154.751
	Q4	9438315.549	9438315.549	9438315.549
2019 Total		41466097.09	41466097.09	40314086.3
2020	Q1	7890208.449	7890208.449	7890208.449
	Q2	8082958.904	8082958.904	7920392.274
	Q3	63134820.68	63134820.68	63134820.68
	Q4	11880022.27	11880022.27	11880022.27
2020 Total		90988010.31	90988010.31	90825443.68
2021	Q1	11953474.48	11953474.48	11953474.48
	Q2	10941939.7	10941939.7	10941939.7
	Q3	8397213.767	8397213.767	7691873.144
	Q4	933122.6935	933122.6935	762655.7395
2021 Total		32225750.64	32225750.64	31349943.06
Grand Total		29,81,98,964.6	29,81,98,964.6	29,59,61,025

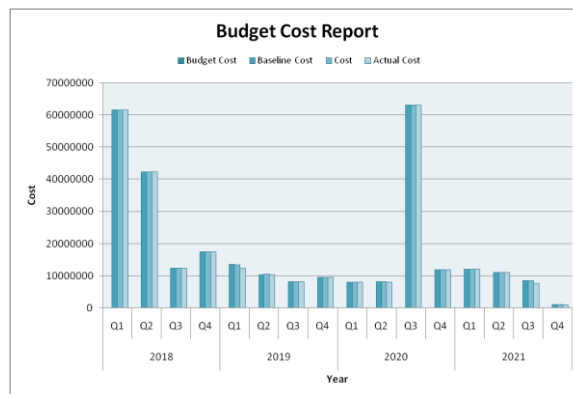


Fig. 5. Budget Cost For Project

4. Budget Work

TABLE V. BUDGET WORK FOR PROJECT

Year	Quarter	Baseline Work	Work	Actual Work
2018	Q1	328	328	311.5
	Q2	712	712	712
	Q3	1253.15	1253.15	1253.15
	Q4	1540.856	1540.856	1540.856
2018 Total		3834.006	3834.006	3817.506
2019	Q1	1462.911	1438.761	1140.911
	Q2	1066.433	1090.583	1066.433

	Q3	1041.75	1041.75	1041.75
	Q4	743.3	743.3	743.3
2019 Total		4314.394	4314.394	3992.394
2020	Q1	903.6	903.6	903.6
	Q2	807.85	807.85	742.85
	Q3	833.65	833.65	833.65
	Q4	1111	1111	1111
2020 Total		3656.1	3656.1	3591.1
2021	Q1	1083.872	1083.872	1083.872
	Q2	1420.828	1420.828	1420.828
	Q3	773.75	773.75	661.05
	Q4	185.55	185.55	88.91667
2021 Total		3464	3464	3254.667
Grand Total		15,268.5	15,268.5	14,655.67

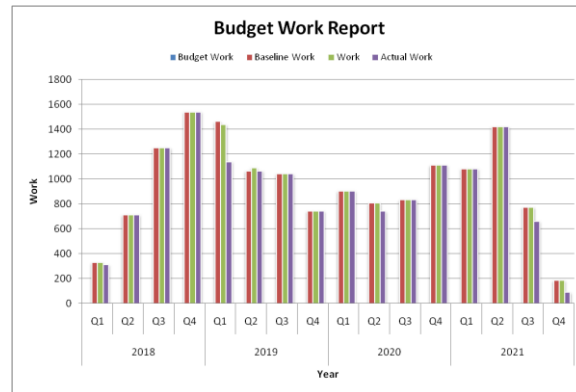


Fig. 6. Budget Work For Project

5. Resource Work Availability Report

TABLE VI. RESOURCE WORK AVAILABILITY REPORT

Year	Quarter	Work Availability	Work	Remaining Availability
2018	Q1	190944	312	190632
	Q2	190944	688	190256
	Q3	190944	1232	189712
	Q4	193392	1512	191880
2018 Total		766224	3744	762480
2019	Q1	188496	1440.167	187055.8333
	Q2	190944	1048.317	189895.6833
	Q3	190928	944	189984
	Q4	193392	808	192584
2019 Total		763760	4240.483	759519.5167
2020	Q1	190944	856	190088
	Q2	190944	792	190152
	Q3	193392	856	192536
	Q4	193392	1088	192304
2020 Total		768672	3592	765080
2021	Q1	188496	1008	187488
	Q2	190944	1416	189528
	Q3	193392	784	192608
	Q4	61200	200	61000
2021 Total		634032	3408	630624
Grand Total		29,32,688	14,984.48	29,17,703.517

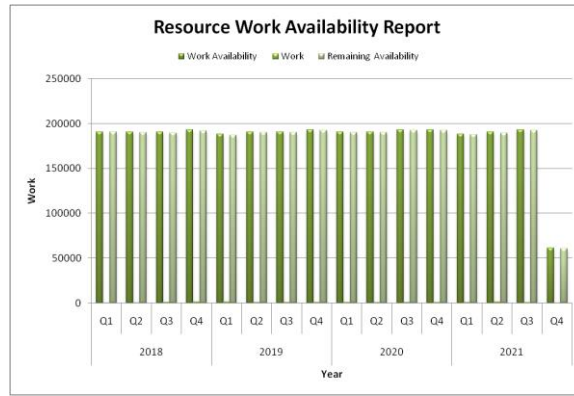


Fig. 7. Resource Work Availability Report

B. Tracking 1 Project Result (Date 12-November 2018)

TABLE VII. EARNED VALUE ANALYSIS IN TRACKING 1 PROJECT

Year	Quarter	Earned Value	Planned Value	AC
2018	Q1	61493405.1	61540959.66	61493405.1
	Q2	103701832.6	103749387.1	103701832.6
	Q3	116020816.9	116068371.5	116020816.9
	Q4	118861184	118908738.5	118861184
2018 Total		118861184	118908738.5	118861184
Grand Total		11,88,61,184	11,89,08,738.5	11,88,61,184

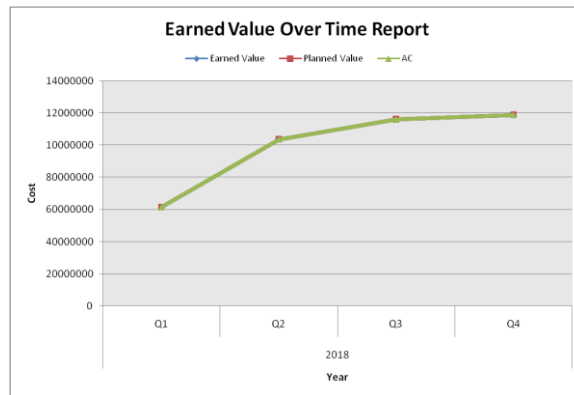


Fig. 8. Earned Value Analysis in Tracking 1 Project

C. Tracking 2 Project Result (Date 11-September 2020)

TABLE VIII. EARNED VALUE ANALYSIS IN TRACKING 2 PROJECT

Year	Earned Value	Planned Value	AC
2018	133471552	133519106.5	133471552
2019	173785638.3	174985203.6	173785638.3
2020	251549735.4	252911867.4	251549735.4
Grand Total	25,15,49,735.4	25,29,11,867.4	25,15,49,735.4

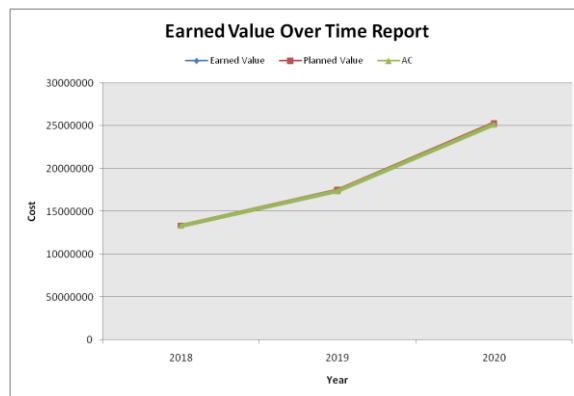


Fig. 9. Earned Value Analysis in Tracking 2 Project

6. Final Values for EVM Element

TABLE IX. VALUES FOR EVM PERFORMANCE INDICATOR

EVM Performance Indicator	1 st Tracking	2 nd Tracking	Conventional Method
SV	-47554.5	-1362132	-1362132
CV	0	0	0
SV%	-0.040	-0.539	-0.462
CV%	0	0	0
SPI	0.9996	0.9946	0.9954
CPI	1.0	1.0	1.0

TABLE X. VALUES FOR EVM FORECASTING PARAMETER

EVM Performance Indicator	1 st Tracking	2 nd Tracking	Conventional Method
EAC	29,81,98,964.6	29,81,98,964.6	29,81,98,964.6
VAC	0	0	0
TSPI	1.00	1.030	1.391
TCPI	1.00	1.00	1.00

- ✓ Value of schedule performance indicators i.e. $SV < 0$ and $SPI < 1$
- ✓ It indicates that, Project is running behind the schedule.
- ✓ Value of cost performance indicators $CV = 0$ and $CPI = 1$
- ✓ It indicates that Project is running according to budget.
- ✓ Value of cost forecasting parameters i.e. $TCPI = 1$ and $VAC = 0$, it interprets that the remaining work and money left from budget are in good coordination; And if it continues properly, then chances of budgeted timely completion are almost 100%.
- ✓ Value of schedule forecasting parameters i.e. $TSPI = 1.391$, it interprets that the coordination between remaining work and the time left from scheduled time is highly lacking; And in order to bring it back on track, crew members have to work 139% more than normal 100%

VI. CONCLUSION

✓ Final Results

- ✓ Earned value management provides information for the project work package in decision making.
- ✓ Tracking of construction project using earned value management is useful recognizing the risk factors of the project and to forecast the potential problem in order to face the remaining project work. It also helps the project team in decision making & to be proactive in managing their projects as well as find out progress of performance in construction projects.
- ✓ Tracking is provides practical level knowledge to the contractors about project and proves most helpful to any project manager who has made a firm commitment to complete the entire feature within a definite schedule and for a restricted amount of funds.
- ✓ The efficiency of project is demonstrated by SPI is 0.995 which is less than 1 hence the project is performed less efficiently and running at about 99% of the planned schedule.
- ✓ Schedule variance of the project is -1362132 Rs. The negative sign determine the project is lagging behind the original schedule.
- ✓ CPI indicates the project efficiency of project utilization. In our case study CPI is 1 means project is running according to the budget.
- ✓ Cost Variance of the project is Rs 0 because of actual cost and earned value of our project is same.
- ✓ The study shows important, implementation and unique features of EVM that benefits project managers and ultimately results in project success.
- ✓ In this study 1.41% of cost is reduced or saving with respect calculated planned estimated cost using EVM method.

TABLE XI. VALUES FOR EVM BASIC ELEMENT

EVM Basic Element	1 st Tracking (Rs.)	2 nd Tracking (Rs.)	Conventional Method (Rs.)	Saving Cost by EVM (Rs.)	% Saving Cost EVM
Estimated Cost (before start the project)	29,75,33,647.7	29,75,33,647.7	29,75,33,647.7		
Total Duration of Project	1400	1400	1400		
Remaining Duration	1054 Day	384 Day	-		
EV	11,88,61,184	25,15,49,735.4	293348797.5	4184850.18	1.41
PV	11,89,08,738.5	252911867.4	294710929.5	2822718.18	0.95
AC	11,88,61,184	25,15,49,735.4	293348797.5	4184850.18	1.41
Cash Flow Cumulated Cost	29,81,98,964.6	29,81,98,964.6	298198964.6		

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