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A Review on Earned Value Management and Earned Schedule Method for Construction Project

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Abstract - *The most essential governing factors in project success are project cost and time. Private and public construction projects have a long history of cost and schedule overruns. Earned value management (EVM) and Earned Schedule (ES) are project management methodologies for monitoring project performance that have been adopted. The methodologies assist in the comparison of budgeted and actual work costs, as well as scheduling delays.*

EV (Earned Value Management) is an effective methodology for project evaluation and controlling. By implementing this methodology on a project executive, project managers, and other stakeholders will be able to visualize project status throughout the project's lifecycle, allowing them to better manage the project.

Earned Schedule (ES) is a concept and practice that builds on Earned Value Management. It is new extend to EVM methodology. To improve the evaluation of the project schedule performance and predict the duration needed to complete the project, the earned schedule allows earned value management outcomes to be converted to time or duration metrics. The earned schedule improves the project manager's comprehension of project schedule forecasts and helps him make better scheduling decisions. The purpose of the study is to apply EVM and ESM to a real-time infrastructure flyover construction project in Rajkot Gujarat, to analyse schedule delay and cost overrun, using above mythologies and then compare the results of two deterministic predicting techniques, EVM and ESM, using MS Software (MSP).

***Key Words*: Earned Value Management (EVM), Project Management, Earned Schedule (ESM)etc.**

1 INTRODUCTION

Projects are an unavoidable aspect of any organization's strategy and operational goals nowadays. As a result, businesses follow the project management principles and criteria outlined in PMBOK by the Project Management Institute (PMI). An organization can exert proper management and control over projects by using these project management methodologies and principles. Earned Value Analysis is a useful tool for tracking and controlling the project' cost constraints. The three limitations, according to PMI, are scope, schedule, and budget. As a project manager, you must deal with these critical obstacles and effectively manage them. As a result, it is critical for them to keep a watchful watch on the status of the projects in accordance to these constraints in real time. EVM was used to measure project performance and predict project costs at completion. EVM data were rarely utilized to estimate the time it would take to finish an activity, work package, or project, or to predict when they would be completed. Insufficient data poses a risk to the project manager's ability to make right decisions. The Earned Schedule (ES) concept allows EVM indicators to be transferred into time or duration metrics to improve project schedule evaluation and forecasting. As a result, the Project Manager can use the EVM& ESM Concept to predict schedule and budget problems early in the project and address them.

2 LITERATURE REVIEW

Sagar K. Bhosekar, Gayatri Vyas (2012) "Cost Controlling Using Earned Value Analysis in Construction Industries", author focuses on earned value management in the real estate construction industry in this article. The importance of the EVM tool was studied, and the basic formula of the EVM was discussed with performance indicators, and a case study for a residential building with a floor area of 120 sq.m was used to compute EVM analysis with time and cost tracking for the given case study. For comparison of EVM analysis with MSP, P6, and SQL created software, the author uses a variety of project management tools. & finally, a comparison of EVM Analysis different management tools.

Virle, Rajesh, Mhaske, Sumedh, (2013) "Application of Earned Value and Earned Schedule to Construction Project", In this paper author identified application of EVM in construction projects & discus elements of EVM and defined various factors & importance of EVM & ES Concept. Author at the end calculated EVM factors & with the help of EVM factors, ES Factors calculated for sky walk project. & finally based on the results conclusion drawn.

Rajesh Ganpat, Virle and Sumedh Mhanske(2013), "Monitoring of Construction Projects Using EVM And ESM Tools" The EVA project may be confidently dissected, and the actions taken will have a considerably higher possibility of success, according to this article. EVM is sophisticated, yet it is built on a simple base, as previously indicated. It aids in the tracking of project performance through simple arithmetical calculations & conclude comparison between EVM & ESM tools.

Shaik Mohammad Masood, Dayanand, Harsha H.N (2014), "An Analysis on Resource Planning, Cost Estimation and Tracking of Project by Earned Value Management" In this research focused on understanding the impact of EVM in monitoring and controlling construction project progress and timely completion. The main message was that Earned Value Analysis allows you to recognize possible problems early in the project and take action to fix them. A case study of a "Windmills of Your Mind" Duplex Apartment in Whitefield, Bangalore was taken. For project planning and EVM calculations, Primavera P6 software was used. 'Earned Value Management is a remarkable way of project management since it incorporates cost, schedule, and scope and can be used to estimate future performance and project completion dates,' the article stated. It enables projects to be managed more efficiently and on time.

S Suresh and Ganapathy N (2015),"Analysis of Project Performance Using Earned Value Analysis," Volume: 04 Issue: 04 | April-2015 | International Research Journal of Engineering and Technology (IRJET). This article addresses Earned Value Analysis as a tool for analysing project performance. EVM enables a better understanding of costs as well as other aspects such as scope, risks, and performance. It drives the management team to pay very close attention to cost, time, and progress, allowing the project to run more smoothly.

P. A. Chavan & P. S. Bhamre (2015), "Efficient Planning Scheduling and Delay Analysis of Residential Project" In this project research focused on construction project planning, scheduling, and delay analysis, with information on introduction to planning, steps in project planning, introduction to scheduling, Project Scheduling Steps, Manpower Management, and manpower planning. In addition, a case study of a residential unit project was presented utilizing MS Project and MS Excel software. At the conclusion of the paper, there was a discussion about the Master Schedule, Activities, and other topics. Unskilled labor, labor shortages, and labor shortages. the delay is caused by a lack of materials, poor management, poor planning, and weather issues. Recommendations were also made in order to reduce the time spent waiting.

H. Tserng, Wen Lin, Chien Li, Kai-Wei Weng, and Denise C. Loisel,(2015)"Research on The Earned Value Management System Applied in Consultancy Project Performance", Journal of marine science & technology Volume 23, Issue-1, Article-4- 2015 The main focus of this research work is on the development of project classification factor assessment indicators and a web-based information system. It is investigated which classification elements and performance evaluation indicators are suitable to consulting businesses utilising various instances. The future project tendency is governed by eight performance control values. This article concluded that EVM is appropriate for project management monitoring in engineering consulting businesses. This article investigates the use of EVM in consulting projects. The discriminant analysis method is used to generate real-time project cost and schedule performance monitoring with predictive capabilities. For a construction project, we conducted a case study and verification.

Amruta B. Vyas, (2016) "Tracking of Construction Projects by Earned Value Management" In this paper researcher focused on the earned value management in the construction industry. How Earned value management is better option over the traditional methods. Weaknesses of traditional methods over EVM methods are discussed. Researcher also takes helps of other literature for analysis of EVM. Benefits of Project management are also studied in this paper. Importance of EVM in construction Projects also illustrated. Basic elements of EVM is given with performance indicator is explained with the example & conclude about how project delays and cost are risk factor for decision making.

Shyama Sasikumar, (2016) "Application of Earned Value Analysis in Analyzing Project Performance" In this paper author researched on application of EVM for construction project & also define various factors for project planning and rate analysis preparation for resource calculation. Researcher also finds various EVM factors & indicators for case study by using EVM techniques. Based on results final conclusion about project calculated.

Lavanya S, G Narayana (2019), "Cost Analysis of Construction Building by Earned Value Method using MS Project Software", This article defined cost orientated parameters from EV analysis was done as before already done but only focused on cost factor using MSP Software for residential building. Based on calculation defined project status as on status date for better controlling and monitoring work in cost point of view.

Tejas A. Topkar (2020) "Study of Management of Earned Value by Advance Software" The mainly author focused on advance software with EVM analysis for residential buildings only. In this author was defined advantages & disadvantages of EVM analysis and only review part with EV calculation done using Prima Vera P6 Software for advance point of view.

Vaibhava, Prakash, Dheeraj and Chandra(2020), "Application of earned value method and earned schedule method for a residential apartment" In this paper author

defined various factors EVM & ES Concept and by using EVM & ES tool he calculated schedule variance, cost variance & various factors for residential apartment case study using primavera p6 software and finally using both methods compared results & conclusion drawn.

Sachin Nalawade, Omkar Ghode, Piyush Vaidya(May-2021)"Earn value analysis of construction project using primavera p6" In this paper author told, what is earn value management and defined all the parameter use in EVM and define benefits and also stated about primavera p6 software how to create activity, how it links, how to define calendar, how allocate resources, and how to track it to find the performance of the project finally. Conclusion predicted the complication time & Cost of the project with EVM technique.

Pavan Kumar (2021), "A Review on Earned Value Management Analysis in Construction Industry" In this paper author define various terminologies regarding time cost optimization techniques & EVM Concept. Also figure out how EV analysis is going to use for better optimization for resources using MS Software for residential project(apartment).

3 CALCULATION PARAMETERS

3.1 EVM PARAMETER (Anbari, F. T. (2012)

Budget at Completion (BAC)

Planned Value (PV) (BCWS)

Earned value (EV)(BCWP)

Actual cost (ACWP)

- CV = EV − AC
- SV = EV − PV
- CPI = EV ÷ AC
- SPI = EV ÷ PV
- EAC = BAC ÷ CPI
- VAC = BAC – EA

3.2 ES PARAMETERS (Anbari, F. T. (2012)

Schedule at Completion (SAC)

Actual Time (AT)

Earned Schedule (ES)

Planned Accomplishment Rate (PAR)

- PAR = BAC ÷ SAC
- TV = SV ÷ PAR
- ES = EV ÷ PAR
- TPI = ES ÷ AT
- TEAC = SAC + TV
- TVAC=SAC-TEAC

4 CONCLUSION

The above literature suggests that Earned Value Analysis and Earned Schedule Method have a lot of potential in the construction industry. Just the following literature implement the use of EVM and ESM as project monitoring & controlling tools for residential projects. As a result, it has been demonstrated that it may also be used to control and monitor the cost and schedule for infrastructure construction projects. We could predict an early warning of variance in project duration and cost by employing EVM and ESM parameters using different project management software's.

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