

# Critical Path Method Vs EVM: A Comparative Analysis

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## Abstract

Performing well in construction project management rests on excellent scheduling and performance tracking. Of the project control tools used, the Critical Path Method (CPM) and Earned Value Management (EVM) provide stand-alone perspectives, but they are also related. EVM facilitates the integration of cost and schedule performance, while CPM emphasizes task sequencing and time management. As Primavera P6 continues to gain adoption amongst organizations, the synergy and distillation between these project management methodologies is becoming more marked. Based on this, this paper compares the two of them from the perspectives of construction management. It investigates the applications, limitations, and impacts on CPM and EVM project outcomes. This informs the project managers of the strategic benefits of combining these methods for better control and forecasting.

**Keywords:** Critical Path Method, Earned Value Management, Construction Management, Primavera P6, Project Scheduling, Performance Analysis

## Introduction

Construction projects are, by their very nature, complex and dictated by many schedules, many players, and limited budgets. Structured project control techniques were adopted to address the need for exact scheduling and strict performance keeping. The industry uses the most common methodologies, CPM and Earned Value Management (EVM). CPM assists in determining the important project activities and their schedules, whereas EVM facilitates quantitative analysis of the project's performance against the budget and schedule [1]. These methodologies are designed to substantially improve decision-making, mitigate risks, and improve project delivery when employed effectively by sophisticated Primavera P6-type tools. Despite the similarities, CPM and EVM do not work similarly and, as a result, have different applications and interpretations in practice. This paper examines these distinctions and synergies in the area of construction management.

## Literature Review

It was the last part of the 1950s; Morgan R. Walker and James E. Kelley developed a project modeling technique called the Critical Path Method. From its inception, CPM has been responsible for finding the minimum duration for the project by identifying the longest sequence of dependent tasks. Due to its integration with modern project management tools, especially in construction industries, sequencing, and resource allocation, it has evolved. Detailed implementation of CPM is possible through using Primavera P6, one of the leading software tools in project management, by which project managers can model activity relationships, set baseline, and monitor slippage.

On the contrary, Earned Value Management was developed in the United States Department of Defense to track project cost performance. The scope, schedule, and cost variables are integrated to give a complete picture of the progress made on the project. Key indicators are calculated based on these core metrics of EVM: Planned Value (PV), Earned Value (EV), and Actual Cost (AC), including Schedule Performance Index (SPI) and Cost Performance Index (CPI). EVM began as a government contract but has spread to the private sector, including construction, because it is so predictive and insightful regarding finances.

Recent research assesses the strengths and weaknesses of both types of approaches. [3] states that CPM provides a good visual view of project dependencies, but this is not coupled with cost metrics, making the analysis incomplete. However, EVM has a coherent view of time and cost but loses detail on the interdependencies of tasks. Practically, CPM and EVM can be integrated to increase accuracy in forecasting and decision-making, which is proven by research findings, as evidenced by the Primavera P6 tool, which can support both methods [4].

Nevertheless, these methodologies have proved effective in terms of impact on the construction sector, which is defined by common delays and overrun costs. EVM informs project managers about the potential loss of the project. At the same time, CPM gives the management the ability to pull down resources and reallocate them to critical activities before the schedule slips. Another shortcoming of this method is to depend on one method. For example, CPM may deceive managers about the overall project health without considering cost, or EVM might give the impression of an overly optimistic view without considering schedule logic. Following this, CPM and EVM integration have been suggested as best practices for modern construction management [5].

## Scope

Primavera P6 is used as the reference tool for implementation, compared to CPM and EVM in this paper, specifically within the construction industry. The focus is on schedule and cost control aspects of project management, ignoring other aspects of a project's project governance framework or risk management strategies unless such were directly concerned by the analysis. It also discusses the theoretical underpinning and the practical applications to give a balanced view to the practitioners and researchers [6].

## Problem Statement

CPM and EVM are used widely in construction projects, yet many project managers struggle to integrate and use these methods. They are often used in isolation. An approach like this can also give skewed insights, such as projects may be on track according to schedule but go over budget or vice versa. In addition, simultaneous use of both methods can be made possible by tools such as the Primavera P6, which are capable of doing so, and this can lead to underutilization of the software's potential if it is not integrated. It is important to understand these methodologies' differences and/or complementation and how they may be co-applied to improve overall project control.

## Solution

Bridging the gap between CPM and EVM would mean understanding the strength of either of those different ways and integrating them systematically to make it better. CPM performs well in the area of

planning and sequencing and in identifying critical activities that are associated with determining the project duration. Adding a financial dimension to EVM helps managers know how much work has been done versus how much should have been spent and planned. These methodologies will identify discrepancies between expenditure and progress, allowing for corrective action. This integration is made easier by Primavera P6, which assists users in creating detailed CPM schedules and linking cost data with activities. The software links the planned value of the tasks to the project timeline and updates the actual progress and expenditures to create real-time EVM reports. It gives managers visibility to review whether delays are occurring on the critical path and the effect on cost performance. It is important to train project teams to use both of them synergistically. The benefits of integration can be increased by standardizing data entry, creating an up-to-date baseline, and aligning project controls with contract requirements. This dual-method approach is embedded into the project management practice by organizations, and they generally report better forecasting, lower cost overruns, and more timely project completions [7].

## Uses

CPM is generally used in construction projects to help identify critical tasks, allocate resources, and manage changes to the project timeline during planning and execution. It can calculate the float time for non-critical activities to optimize schedules and prioritize the workload. However, EVM offers the most value towards execution when tracking deviations from the plan in the dimensions of time and cost is essential. Both methods are supported by Primavera P6 in that they provide schedule development modules, resource loading modules, and financial tracking modules. It has robust analytics and reporting features allow project managers to view SPI CPI along with the project's critical path. Contractors and owners use these insights to negotiate change, forecast risks, and support claims. CPM and EVM are combined in public infrastructure projects where accountability and documentation are crucial to conform to the regulatory standard. This same approach is applied in commercial projects for internal auditing and performance benchmarking. More and more, the integrated methodology is being used by organizations to drive performance-based contracts and incentive structures [8].

## Impact

The integration of CPM and EVM significantly affects construction project outcomes. These tools provide an overall view of time and cost performance, reduce uncertainty, and facilitate proactive decision-making. Delays, cost overruns, and increased stakeholder satisfaction are significantly less likely to be experienced for projects that effectively employ both methods. Additionally, Primavera P6 has magnified the effect of these methodologies as calculations are automated, performance data are made visible, and project environments are made collaborative. It provides live dashboards, scenario simulation, and timely reporting to stakeholders; teams can access and use it. It hastens the decision cycle and helps reduce manual errors. At a wider scope, employing CPM and EVM extends the organizational maturity to project management. Firms are instituting these practices, which are associated with better project portfolio performance, more accurate budgeting, and better strategic alignment. Such advantages in an industry where profit margins are slim, and risks are high are critical to long-term competitiveness.

## Conclusion

Finally, although CPM and EVM come from two traditions (time management and cost), they play important roles in construction project management. Together, they provide a robust package for their application, especially with tools like Primavera P6 for planning, monitoring, and controlling a complex project. Based on this, we have seen that each method used stand-alone provides less data but, when integrated, gives a proper and holistic view of project performance. Adopting this dual-method approach would be a big boon to the construction industry. Standardization training and software support enhance project delivery capabilities, reducing risk and improving profitability for organizations. However, as construction projects expand in scale and complexity, the strategic combination of CPM and EVM will achieve benefits and be essential to creating success.

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