

# Chapter XXII

## Static and Dynamic Determinants of Earned Value Based Time Forecast Accuracy

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### **ABSTRACT**

*It is well-known that well managed and controlled projects are more likely to be delivered on time and within budget. The construction of a (resource-feasible) baseline schedule and the follow-up during execution are primary contributors to the success or failure of a project. Earned value management systems have been set up to deal with the complex task of controlling and adjusting the baseline project schedule during execution. Although earned value systems have been proven to provide reliable estimates for the follow-up of cost performance, they often fail to predict the total duration of the project. In this chapter, results of a large simulation study to evaluate the forecast accuracy of earned value based predictive metrics are presented. No detailed mathematical calculations are presented in the chapter, but instead an overview from a project life cycle point-of-view is presented. Details can be found at the end of the chapter (key terms and definitions) or in the references cited throughout this chapter.*

### **INTRODUCTION**

Typically, a project goes through a number of different phases, which is often referred to as the *project life cycle*. This cycle has been described extensively by many authors (see e.g., the Project

Management Body of Knowledge (PMBOK, 2004)) and consists of a project conception phase, a project definition phase, a phase in which the project has to be scheduled, the execution of the project, the project control phase which monitors the current performance of the project and the

termination and/or evaluation of the project. Figure 1 displays a 6 phased example project life cycle that will be used throughout this chapter.

The simulation research study deals with the control phase of the project life cycle, and the corresponding performance measurement feedback loop (see figure 1) from project control to the planning/scheduling phase. More precisely, the focus is on a reactive scheduling and performance measurement system using Earned Value Management (EVM). Although EVM has been set up to follow-up both time and cost, the majority of the research has been focused on the cost aspect (for a general overview of earned value, the reader is referred to Fleming and Koppelman (2005)). Recently, different sources in literature show that the ‘classic’ earned value metrics fail in predicting the total project duration in an accurate way (see e.g., Lipke (2003)). In this chapter, the accuracy of various earned value predictive methods is tested to measure and forecast the final duration (i.e., time focus, not a cost focus) of a project in order to look for determinants that affect the accuracy of these predictive methods.

The outline of this chapter is given along the following lines. The section “An overview of predictive EVM measures” presents a brief review of three earned value based predictive methods that will be used in the simulation study. Section “Determinants of forecast accuracy” presents static (i.e., before the start of the project) as well as dynamic (i.e., during project execution) determinants that affect the forecast accuracy of the predictions. In section “simulation results”, an

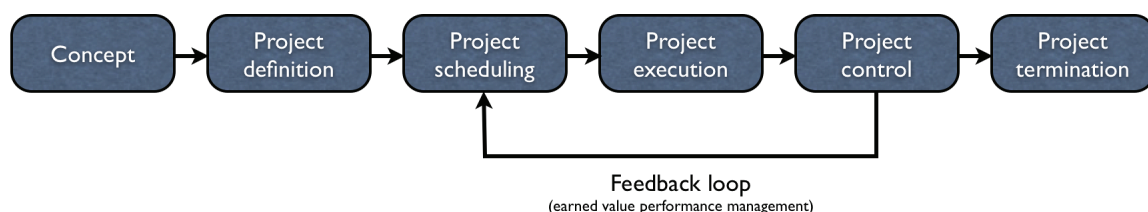
objective comparison between the various state-of-the-art EVM based methods is presented that predict a project’s final duration. Section “Earned schedule project tracking in software” briefly introduces the reader to a software tool that is able to rerun the simulation tests presented in the chapter. The final section ends with overall conclusions and highlights possible avenues for future research.

## **AN OVERVIEW OF PREDICTIVE EVM MEASURES**

The terminology used throughout this chapter is based on the overview paper written by Vandevoorde and Vanhoucke (2006). Three project duration forecasting methods have been presented in literature, referred to in this chapter as the *Planned Value Method* (PVM, Anbari (2003)), the *Earned Duration Method* (EDM, Jacob (2003)) and the *Earned Schedule Method* (ESM, Lipke (2003)).

Both the planned value method and the earned duration method rely on the traditional schedule performance index  $SPI = EV / PV$  used to measure the current time performance and to predict the project’s final duration. However, the classic SPI indicator has been shown to report an unreliable performance estimate at the end of the project since it always tends to go to 1 (indicating a 100% perfect performance) when  $EV = PV$  (which is always the case at the end of the project, regardless of its performance!). The earned schedule method has been developed to overcome this quirky behavior

*Figure 1. The project life cycle (PLC) with a reactive scheduling approach*



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