

# Integrated project controls: using operations research methods to improve the efficiency of project control

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**Abstract.** Baseline scheduling and risk analysis go hand in hand and are crucial preparatory dimensions to provide information for the project control phase. One of the central lessons in training sessions to project managers is that scheduling without any form of risk management makes no sense since it then boils down to an academic and deterministic optimization exercise without much real life value. A project schedule is a dynamic instrument that needs to be adapted when necessary. Project managers have to deal with a continuous stream of unexpected events and need to take corrective actions to bring projects back on track or to update the initial estimates and expectations to a more realistic scenario. In that respect, a dynamic project schedule is the ideal tool to provide information and to support the corrective actions, and hence, the project baseline schedule acts as a point-of-reference to support these actions, rather than a forecast of the future that needs to be followed at all times.

**Keywords:** scheduling; risk analysis; project management

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## Introduction

In this presentation, the main results of a simulation study will be discussed that measures the accuracy of time forecasts and potential corrective actions taken when the project deadline is in danger. The results will show that integrating Earned

Value Management (EVM) and Schedule Risk Analysis (SRA) with the baseline schedule in order to control the time dimension of a project leads to promising results. The research question of the simulation study can be formulated as follows: how can we best measure the performance of a project during its progress and use the information obtained during the scheduling and risk analysis steps to monitor and update the project and to take corrective actions in case of problems? Two alternative black-and-white project tracking approaches will be discussed and their accuracy when measuring and forecasting time will be compared.

- Project-based project control: The EVM methodology offers the project manager a tool to calculate a quick and easy sanity check on the control account level or even higher levels of the work breakdown structure (WBS). In this respect, an EVM system is set up as an early warning signal system to detect problems and/or opportunities in an easy and efficient way, which is obviously less accurate than the detailed critical path based scheduling analyses of each individual activity. However, this early warning signal, if analyzed properly, defines the need to eventually drill down into lower WBS levels. In conjunction with the project baseline schedule, it allows taking corrective actions on those activities which are in trouble (especially those tasks which are on the critical path).
- Activity-based project control: Knowledge and information about the project's activities sensitivity using SRA is crucial to steer a project manager's attention towards a subset of the project activities that have a high expected effect on the overall project performance. The highly sensitive activities are said to have a high chance to have an impact on the project duration, and hence need to be the subject to intensive control, while other less sensitive activities require less or no attention during project execution. This approach is referred to as an activity based tracking approach to denote the bottom-up control and tracking approach (starting from the lowest WBS activity level) to take corrective actions on those activities with a highly expected effect on the overall project objective.

The results of the study have been summarized in the books "Measuring Time" (Vanhoucke, 2010) and "Dynamic Scheduling" (Vanhoucke, 2012). This research described in these books will be discussed, and extended with new results found over the last years during a follow-up study that is still on-going. References will be made to the Operations Research techniques (optimization as well as simulation experiments) used during these research projects.

## References

- Vanhoucke M., 2010, "Measuring Time - Improving Project Performance using Earned Value Management", International Series in Operations Research & Management Science, Vol. 136.
- Vanhoucke, M., 2012, "Project management with dynamic scheduling: Baseline scheduling, risk analysis and project control", Springer, XVIII, 310 p.