Mario Vanhoucke

Integrated Project Management Sourcebook

A Technical Guide to Project Scheduling, Risk and Control

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Knowledge is of two kinds. We know a subject ourselves, or we know where we can find information upon it.

Samuel Johnson

Preface

This book is intended to be an Integrated Project Management Sourcebook for students of any project management (PM) course focusing on the integration between baseline scheduling, schedule risk analysis, and project control, known as *Dynamic Scheduling* or *Integrated Project Management and Control*. It contains a set of +70 articles that are also available online at www.pmknowledgecenter.com. The introduction of the book contains an overview article of the Project Management Knowledge Center with references to a PM bookstore, software tools, research results, and much more material relevant to the reader. The main body of this book contains articles on *baseline scheduling*, *risk analysis*, and *project control*. Each individual article focuses on one particular topic, and links are provided to the other articles (chapters) in this book. Almost all articles are accompanied with a set of questions (unlike the articles, these questions cannot be found online), for which the answers are provided at the end of this book.

This book has been written in the sunlight of Lisbon during my 4-month stay at the city of light. While artists say that light is all important to creating a masterpiece, I just think back on it as a period where I enjoyed writing in my apartment at Beco da Boavista and on the terraces of Jardim da Praça Dom Luís I (my favorite one, I called it the red terrace), Praça do Comércio, and Portas do Sol but also on the Miradouro de Santa Catarina, the city beach of Cais do Sodré, and of course at Universidade Aberta de Lisboa. In fact, it is my stay at the city that has become the masterpiece, while the book is simply the result of hard work in complete isolation from all Belgian distractions.

It goes without saying that the writing of such a manuscript is not an individual work, but is done in collaboration with people willing to help in many ways. Thank you to friend and colleague José Coelho for the many work meetings with fruitful and enriching discussions at various places in Lisbon. Thank you to Jordy Batselier, Jeroen Burgelman, Danica D'hont, Louis-Philippe Kerkhove, Pieter Leyman, Annelies Martens, and Vincent Van Peteghem for helping me with providing a set of questions and for checking the calculations throughout the many examples given in each chapter. Thank you to Mathieu Wauters for proofreading most of the articles. Thank you Louis-Philippe Kerkhove once again for setting up

a shared online correction system for our research group and for double-checking the questions of all the articles over and over again. Thank you to Tom Van Acker for providing the IT technology to put all the articles online. Thank you to Gaëtane Beernaert for supporting me in extending this work from an online learning tool to a complete integrated manuscript.

Lisbon, Portugal Mario Vanhoucke
August 2015

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Chapter 1
Introduction

Welcome to PM Knowledge Center[1]

Project baseline scheduling, risk analysis and project control are crucial steps in the life of a project. The project manager uses the project schedule to help planning, executing and controlling project activities and to track and monitor the progress of the project. A major component of a project schedule is a work breakdown structure (WBS). However, the basic critical path method (CPM) schedules, or its often more sophisticated extensions, are nothing more than the starting point for schedule management. Information about the sensitivity of the various parts of the schedule, quantified in schedule risk numbers or of a more qualitative nature, offers an extra opportunity to increase the accuracy of the schedules and might serve as an additional tool to improve project monitoring and tracking. Consequently, project scheduling and monitoring/control tools and techniques should give project managers access to real-time data including activity sensitivity, project completion percentages, actuals and forecasts on time and cost in order to gain a better understanding of the overall project performance and to be able to make faster and more effective corrective decisions. All this requires understandable project performance dashboards that visualize important key project metrics that quickly reveal information on time and cost deviations at the project level or the activity level. During monitoring and tracking, the project manager should use all this information and should set thresholds on the project level or on lower WBS levels to receive warning signals during project execution. These thresholds serve as triggers to take, when exceeded, corrective actions.

This triangular role of a project schedule is often labeled as *dynamic scheduling* (see Fig. 1.1) to highlight the need and ability of project scheduling software

[1]This section is also available as an article entitled "Dynamic scheduling: Welcome to PM Knowledge Center" published online at PM Knowledge Center.

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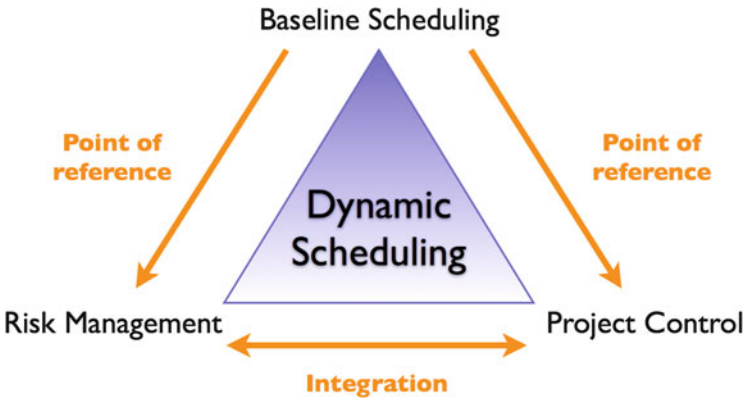

Fig. 1.1 Dynamic scheduling: the baseline schedule, risk management and project control triangle

to dynamically create a baseline schedule environment that provides information during project execution and that can be easily adapted using the new information during project monitoring and tracking. Consequently, the three dimensions of dynamic scheduling can be summarized as follows:

- Baseline schedule construction: A project baseline schedule visualized in a Gantt chart acts as a point of reference in the project life cycle. It should especially be considered as nothing more than a predictive model that can be used for resource efficiency calculations, time and cost risk analysis, project tracking and performance measurement, and so on (see section "BS1: An Introduction to Baseline Scheduling" on page 9).
- Schedule risk analysis: When management has a certain feeling of the relative sensitivity of the various project activities on the project objective, a better management's focus and a more accurate response during project tracking should positively contribute to the overall performance of the project. Through the use of buffers inserted into the baseline schedule, the project is better protected against unexpected delays and corrective actions can be restricted to a minimum (see section "RA1: An Introduction to Risk Analysis" on page 109).
- Project control: Using dynamic information during project progress to improve corrective action decisions is the key target of project monitoring and control. The performance information obtained through EVM will be dynamically used to steer the corrective action decision making process and improve the overall success of the project (see section "PC1: An Introduction to Project Control" on page 197).

This book acts as an Integrated Project Management Sourcebook on dynamic scheduling, integrating these three dimensions in three different parts of the book. It is considered to be part of the Project Management Knowledge Center (further abbreviated as PM Knowledge Center or PMKC) that is the topic of this chapter.

The purpose of PM Knowledge Center is to act as a Project Management guide for students, lecturers and professionals interested in the field of Dynamic Scheduling. All topics described in the articles are based on research done at Ghent University (Belgium). Additionally, the aim of PMKC is to share knowledge and invoke interest in Project Management. To that purpose, a number of tools are available, that are summarized along the following lines.

- ORASTalks app: Stimulate interaction
- ProTrack: Dynamic scheduling on your desktop
- Business Game: Learning by doing
- Bookstore: Literature for students and professionals
- P2 Engine: Advancing the state-of-the-art knowledge
- Research: Project Management research

ORASTalks

The main purpose of PM Knowledge Center is to interact with our audience consisting of undergraduate and graduate students, MBAs and practitioners. All summary articles of PM Knowledge Center in this book are therefore also freely available from the website www.pmknowledgecenter.com. In order to get and stay in contact with our PMKC audience, a free mobile app has been developed. ORASTalks is an app that aims at bringing students together to offer them a central place for their course content, to provide them with additional background information and to bring them in contact with interested professionals. OR-AS is an acronym for "Operations Research—Applications and Solutions" and develops software Applications and Solutions for academia and business based on a well-balanced combination between academic knowledge and practical experience. It serves as a bridge between the academic environment of our university and MBA students and the business world that they will soon (re-)discover after their graduation. The specific approach to improve and optimise business processes consists of data analysis, simulation and optimisation using state-of-the-art tools and techniques, followed by the implementation and validation. The field of Operations Research is applicable to many complex business processes. Special attention will be devoted to Integrated Project Management and Control using well-known as well as novel project management tools and techniques. More information can be found at www.or-as.be/orastalks.

ProTrack

ProTrack 3.0 is a complete redesigned version of the smart version of ProTrack 2.0. Its integration with PM Knowledge Center and its strong focus on the integration of