Management for Professionals

Mario Vanhoucke

Integrated Project Management and Control

First Comes the Theory, then the Practice

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Preface

Completing a project on time and within budget is not an easy task. Project monitoring and controlling systems should consist of processes that are performed to observe project progress in such a way that potential problems can be identified in a timely manner. When necessary, corrective actions can be taken to exploit project opportunities or to bring projects in danger back on track. The requisite is that project performance is observed and measured regularly to identify deviations from the project baseline schedule. Therefore, monitoring the progress and performance of projects in progress requires a set of tools and techniques that should ideally be integrated into a single decision support system. The understanding of the basic elements and concepts is a requisite to successfully use and implement the various project control concepts in an integrated project management and control system.

The topic of this book is the management of projects through the integration of baseline scheduling, schedule risk analysis and project control. *Schedule Risk Analysis* (SRA) is a technique that relies on Monte Carlo simulations to generate activity duration and cost deviations from their baseline values to assess the impact of these variations on the time and cost objectives of the project. *Project control* is done using Earned Value Management (EVM) and Earned Schedule (ES) techniques and are further referred to as EVM/ES systems. Both methods can be used to monitor the performance of projects in progress and to trigger corrective actions in case the project objectives are jeopardised. The *baseline schedule* acts as a central point of reference for both methods and is a crucial element for proper use of the EVM/ES and SRA systems. The integration between EVM/ES and SRA using baseline scheduling is referred to as *dynamic scheduling* or *integrated project management and control*, and is the topic of this book.

The "Integrated Project Management and Control" theme entered my life somewhere in the beginning of 2001 and has, ever since, never left my professional life. Through collaborative work with academics (PhD students, professors at other universities and/or business schools), consultants at different national and international companies and colleagues and friends from various Project Management (PM) organisations, the research and work on integrated project management and control has quickly moved forward leading to articles, books, conference speeches and

collaborations throughout the world. An overview of the many people with whom I collaborated is beyond the scope of this introduction chapter. In Vanhoucke (2013a), I have written how the collaborations have led to numerous results, including consultancy projects, the development of software tools and business games and many projects with project management professionals as well as academics.

One of the most visible results of the fruitful collaborations with friends and colleagues from the field is the writing of the two books, *Measuring Time* and *Dynamic Scheduling* published by Springer (www.springer.com). The book *Measuring Time* (Vanhoucke 2010a) is a research book written for people interested in PM research and all technical details of the research study discussed in the book. It contains a detailed description of the methodology used in the research study and (too) many results are obtained by different computational experiments. Therefore, the content of this book requires some technical skills and knowledge on the project management and control topic and is mainly relevant for researchers and/or professionals with a lot of experience in managing and controlling projects.

The book *Dynamic Scheduling* (Vanhoucke 2012c) has a completely different focus. Rather than giving a detailed description of a research study, it gives an overview of the existing methods of dynamic scheduling in the literature. It explains its three dimensions, baseline scheduling, risk analysis and project control, in detail and serves very well as an introduction to this PM theme. The book is mainly intended to be a student handbook and is used in PM courses at universities and PM programmes at business schools. It should be perfectly understandable to people with little to no knowledge or experience in the project management and control theme. It only requires a great interest and deep passion for Project Management and the willingness and guts to walk through the different algorithmic aspects, case studies and formulas available in the PM literature.

And now, dear reader, you have a third book in your hands on exactly the same topic, and you might ask yourself the question whether it is really necessary to walk through the chapters of yet another book on the same topic. I asked myself that question before starting to write the different chapters of this book, but I believe the answer is clearly a "yes". I truly believe that the book you are now holding in your hands is fundamentally different from my two previous books, and holds the middle ground between the methodological details of a research book and the general overview descriptions of a student handbook. Despite the huge amount of excellent articles and other books available in literature, I believe the contribution of this book is threefold as briefly illustrated along the following lines:

- Technical scope: Rather than a research book with methodological details on EVM/ES and SRA systems or a detailed overview book on the three dimensions of dynamic scheduling, this book serves as a more technical book containing formulas and mathematical details on the calculations of the EVM/ES and SRA metrics. In a first part of this book (*First comes the theory*), all mathematical formulas are shown and illustrated on three fictitious project examples. Moreover, summary reports are given to illustrate the use of metrics and concepts for project performance reporting purposes.

- Ready for use: The EVM/ES and SRA concepts presented in this book should be used in a project management and control setting by students, professionals and researchers. In the second part of this book (*Then comes the practice*), both a commercial software tool ProTrack and a research tool P2 Engine are presented and an overview of their basic features is given. The integration of these tools with spreadsheets should allow the readers to quickly access all the underlying mathematical details leading to a better understanding.
- Illustrative examples: All metrics, mathematical calculations and underlying concepts are illustrated on three simple example projects. These illustrative projects are small in size and are fundamentally different in structure in order to illustrate the full potential of the use of EVM/ES and SRA methods. No references to case studies that show the potential of the concepts in a real business environments are given, and the reader is referred to many other excellent books available in literature.

Therefore, this book on *integrated project management and control* should be useful for anyone who wants to understand the theory first, and then wants to translate the theory into practice using software tools. It is written for students, professionals and academics with an interest and/or experience in running projects as well as for newcomers in the area of project control with limited knowledge of the EVM/ES and SRA concepts. Honestly, it is mainly written upon request of many of my students – the young and enthusiastic students at universities, the MBA students at business schools and/or professionals at commercial trainings – who struggle with the use of the formulas in EVM/ES and SRA systems and need an overview of the mathematics and their use in one single document. Therefore, the book is split in three main parts. First comes the theory. The focus of this first part lies on the presentation of the metrics and calculations used in EVM/ES and SRA and on their use in reporting progress performance reports for controlling projects. General guidelines on their correct use in various business settings and hints for proper implementation in business software systems are however not within the scope of this part of the book. Then comes the practice. In this second part, the use of the EVM/ES and SRA methods is illustrated using two software tools. ProTrack is a commercial software tool that is freely available to students to get acquainted with the integrated project management and control theme using real project data or case studies. The P2 Engine tool is a more sophisticated version of ProTrack and is intended to be used by master students and PhD researchers and requires some basic scripting skills. Finally, a conclusion is reached that summarises the main contributions of this book and takes a look at the needs for further research in this interesting domain. Through the use of the three small illustrative example projects, the overview of all mathematical details (Part I) and the availability of two software tools (Part II), the reader should be able to recalculate almost every little detail presented in the book. Where necessary or appropriate, references to other books or articles are given in order to stimulate further reading, but no effort has been made to give a complete literature overview.

So, dear reader, why should you read this book? Or in case you think about reading all three of them, which one should you read first? I believe that in case you want a complete and detailed overview on the three dimensions of dynamic scheduling, you should definitely read the book on "Dynamic Scheduling" (Vanhoucke 2012c). In case you have quite some experience in the PM topics and you are interested in a more fundamental and intricate view on scheduling, risk and control, then go for "Measuring Time" (Vanhoucke 2010a). In case you have (little or a lot of) knowledge on the integrated project management and control theme and you need an overview of the available techniques for controlling your projects, then I suggest you should start reading the book that you are now holding in your hands! I am not claiming that you really have to read this book chapter per chapter. Instead, you better use it as a support tool when managing and controlling projects using your spreadsheet models or software tools. Whatever your level of expertise is, in case you need an overview and/or a quick refresh of the formulas and underlying mathematical details, this book might be a helpful tool for you. A lot of the material presented in this book has been presented elsewhere, in my previous books, in articles written by researchers and professionals and in the many excellent books available in literature. Much of the work presented in this book has also been made available online on one of our websites, blogs, online learning tools, or other sources. The main reason why we share a lot of our work with the outside world is because one of the main targets of teaching is to get students involved in the exciting world of project management. Putting material online is a way to communicate with the outside world and to bring students and professionals together. In this respect, this book does not contain a lot of new concepts but rather brings all the old material together in a single document. We strongly advise readers to stay up to date with our latest developments, research and business outcomes, for which more information can be found at the following websites:

- OR-AS: Most of the work bridging the gap between academics (done at Ghent University (Belgium) and Vlerick Business School (Belgium)) and the Project Management professionals is carried out in collaboration with OR-AS. Visit our OR-AS website and browse your way to the right and relevant content on www.or-as.be.
- EVM Europe: The European organisation that brings professionals and researchers together to share new ideas, to stimulate innovative research and to advance the state of the art and best practices on integrated project management and control, welcomes any interested person on the yearly conference at www.evm-europe.eu.
- PM Knowledge Center (PMKC): PMKC is a free and online learning tool to stimulate interaction between researchers, students and practitioners in the field of project management. It contains articles and reference resources to inform and to improve the practice of dynamic scheduling and integrated project management and control. You can browse the content at www.pmknowledgecenter.com.
- ProTrack: ProTrack is the software tool described in the second part of this book and is completely integrated with PM Knowledge Center. Thanks to its strong

focus on the integration of baseline scheduling, risk analysis and project control, it is the ideal learning tool to stimulate interaction between researchers, students and practitioners in the field of project management and dynamic scheduling. More information is available at www.protrack.be.

- P2 Engine: P2 Engine is a command line utility tool based on the LUA scripting language to generate gigabytes of project data. It generates project baseline scheduling data and risk analysis metrics as well as dynamic project progress data that can be used for testing and validating novel research ideas. Tutorials and explanations on how to use the scripting language of P2 Engine can be found at www.p2engine.com.
- PSG: The Project Scheduling Game (PSG) is an IT-supported simulation game to teach young project management professionals the basic concepts of baseline scheduling, risk management and project control. It is used at universities, business schools and commercial trainings and is useful for people with an interest in project scheduling and control. The game can be ordered at www.protrack.be/psg.
- OR&S: A summary of the research done at the Operations Research and Scheduling (OR&S) Research group of the Faculty of Economics and Business Administration at Ghent University (Belgium) can be found at www.projectmanagement.ugent.be. Most of the activities are done in collaboration with Vlerick Business School and other international universities.

It is worth noting that all this information has been integrated in the ORASTalks app available in the Apple App Store and Google Play Store and can be downloaded via the links mentioned on the www.or-as.be/orastalks website. Although this app has been created as a communication tool for students in Project Management and Operations Research, it also contains links to blogs, software tools and interesting websites that might be relevant to researchers and professionals too.

I would like to thank the people who have contributed, directly or indirectly, to this book. Thank you to Tom Van Acker and Stephan Vandevoorde for the collaborative work with OR-AS and EVM Europe, respectively. Without them, there certainly would not have been a new book. Thanks to Walt Lipke and Kym Henderson for sharing their thoughts on this interesting topic with me. A special thank you goes to (in alphabetical order) Jordy Batselier, Jeroen Colin, Louis-Philippe Kerkhove, Pieter Leyman, Len Vandenheede, Mathieu Wauters and Laura Willems for reading the draft version of this book. A million thankful words go to Gaëtane Beernaert for editing and motivating me along the writing process, and to Joyce and Thierry. To them, I owe more than I can express. And finally . . . a thank you to anyone else I have met and forgotten to mention.

Finally, for the passionate people who are really, yes really, interested in Project Management and that hard collaborative work done throughout the years, a document is available online that provides a summary of the work done on PM. More precisely, in the book *The Art of Project Management: A Story about Work and Passion*, which is available at www.or-as.be/books/wp, an overview is given about the endeavours done in the past and the ideas that will be explored in the

future. It gives the reader a quick look behind the results. It tells about the products and ideas in Project Management and gives a brief overview of the most important people who inspired the OR-AS group for the work that has been done in the past. It does not look at the Project Management work from merely a research and teaching point of view, but also from a commercial point of view. It tells about work, and the passion that has led to the results of the hard work. It is not a scientific book. It is not a managerial book either. It is just a story . . . about work and passion.

Gent, Belgium Mario Vanhoucke

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Part I
First Comes the Theory