The Data-Driven Project Manager

A Statistical Battle Against Project Obstacles

A business novel

Mario Vanhoucke

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Printed on acid-free paper

To the memory of Koen De Vilder and Thierry Beernaert.

To my daily coffee, black, no sugar.

Contents

About the Author

Mario Vanhoucke is a professor at both Ghent University (Belgium) and Vlerick Business School (Belgium) as well as a senior teaching fellow at UCL School of Management (University College London, UK). He has previously written books about project scheduling, risk analysis, and project control. As a professor and researcher, Mario is constantly looking for better ways to measure, improve, and optimize the performance of projects in progress and their resource efficiency. Mario has a background in operations research and management science and aims at combining research with practice. As a founder of the Operations Research & Scheduling research group and leader of a more than a million euro research project, Mario sets up collaborations between national and international companies and universities in the United Kingdom, the United States, and China. He is very active in the Belgian Chapter of the Project Management Institute (PMI) and has been awarded by the International Project Management Association (IPMA) for his research in project management and control. Mario also writes his own project management software tools, both as standalone desktop versions and as integrative tools in company software environments. Mario shares his ideas at various international conferences.

Acknowledgments

It goes without saying that this book couldn't have been written without the help of my dearly beloved and close friends. I especially wish to thank Gaëtane Beernaert, William Wright, and Louis-Philippe Kerkhove for their valuable contributions to the manuscript. Gaëtane and William have worked their way through the various drafts of the manuscript, each time highlighting errors and suggesting improvements, and therefore any errors that have remained in the final manuscript are mine. Louis-Philippe was my sounding board and partner in developing the schedule risk-analysis sheets.

Introduction

Before you dive into the book and start reading the story about GlobalConstruct's tennis stadium construction project, here is a short summary of each of the chapters. If you're wondering whether this book will be worth a read, please read the next pages and then decide.

Chapter 1: Background

- Cast of characters
- Emily Reed (the protagonist)
- Global Construct Ltd. (the company)

Chapter 2: PLAN

- How planning works or fails
- How multiple estimates improve planning quality
- How variances should be added and compared
- How statistical simplifications lead to small errors
- How times have changed over the years

Chapter 3: RISK

- How a time machine works
- How probability and impact define risk
- How controllability reduces the fear of risk
- How sensitivity to changes helps detect bottlenecks
- How black swans should be ignored

Chapter 4: BUFFER

- How to avoid a burnout
- How to cope with a scarcity of resources
- How change is easy to propose but difficult to implement
- How buffering is a matter of giving and taking

Chapter 5: MONITOR

- How to collect data
- How time and cost can be integrated
- How planning finally gets a *raison d'être*
- How good performance can be misleading
- How predictions depend on past experiences and future expectations
- How the beauty of a unified system lies in its simplicity
- How value is not the same as progress

Chapter 6: CONTROL

- How to set your alarm
- How focusing always pays off
- How to aim and shoot in one motion
- How effort and quality are different sides of the same coin
- How efficiency is a goal in management
- How a control freak gets crazy
- How being lazy always turns out to be bad

Chapter 7: Exciting times ahead

- How to say goodbye
- How successes and failures define someone's career
- How the future always looks bright

Chapter 8: Afterword

- How I wrote this book
- How research drives teaching
- How books and papers are written
- How artificial and empirical data are merged
- How academics and professionals work together
- How I endlessly rely on my family and friends

Written as a business novel, this book demonstrates the highly interactive discussions among the main characters of a team responsible for a challenging project. It allows the reader to participate and consider options—as a project manager would—at each stage of a project. The main characters of this story and the company they work for are briefly introduced in Chapter 1.

Chapters 2 through 7 tell the story of Emily Reed and her colleagues, who are in charge of the management of a new tennis stadium construction project. Most of these chapters can be used in any data-driven project management lecture for university students, MBA students, and professional project managers.

The first part of each chapter always ends with an "action list summary" in a section entitled "Assignment." The text of each chapter, up to and including this assignment, can be used as a case study to be solved and discussed by anyone with an interest in data-driven project management.

I use these case studies in my project management lectures at several universities and business schools, as well as in company trainings. But as a reader of this book, you can also use each chapter's assignment as a challenging exercise to test whether you understand the relevance of data-driven methodologies for your own projects.

The second part of each chapter contains the solution to each assignment. I use this as a general framework for my feedback sessions to kickstart a discussion about the case study. For you, Dear Reader, it can be a tool to check whether you have solved each chapter's assignment correctly.

In Chapter 8, I have provided references to academic papers and technical books that were my main inspiration for writing this book. I have tried to keep the technical details out of the story as much as possible. So, this book is not only a story about data and projects; it's intended to be a reference tool for applying the newly presented concepts in practice and also (if desired) for diving more deeply into the advanced material presented in the afterword.

As a matter of fact, many of the chapters were initially a loose collection of exercises and case-study drafts before they were brought together into a book. The first part of each chapter has been tested, revised, sometimes completely rewritten, and finally fine-tuned in various project management lectures at Ghent University (Belgium), Vlerick Business School (Belgium), and the UCL School of Management (UK). The valuable feedback that we've received from students and project managers has been carefully taken into account and has contributed to the final version of this book.

If you have a passion for project management, an appetite for decision-making, and an affinity with numbers, then I invite you to read this book.

CHAPTER

1

Background

All of the characters in this book are ordinary, but nevertheless interesting, human beings. They are real people, living in real situations, trying to achieve their ambitions the best they can. They could be you or me or your colleague at your job.

The core team of GlobalConstruct's tennis stadium construction project consists of:

- Jacob Mitchell: Chief Executive Officer (CEO)
- Mark Rogers: Chief Financial Officer (CFO)
- Emily Reed: Chief Operations Officer (COO)

During the numerous meetings, Jacob decided to also involve the following people from GlobalConstruct:

- Ruth Bowman: Head of the Accounting Department and Data Scientist
- Joanna Barnes: Head of the Human Resource Management Department
- Mick Hudson: Computer Scientist in the IT Department, known as The IT Wonder-boy and Spreadsheet Guy

As needed, data collection was done by external experts, such as:

- Victoria: Expert 1
- Andrew: Expert 2

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Emily Reed (the Protagonist)

Emily Reed is a young project manager who is always in search of a better way. With her affinity for numbers, her ingenuity in problem solving, and her dyed-in-the-wool belief that data should be the driver in all decision-making processes, she ultimately tries to change the GlobalConstruct company's project management style. With the support of her mentor and CEO, Jacob Mitchell, and fed by the enthusiasm of her number-crunching colleague Mark Rogers, she starts a journey of team meetings and discussions to better prepare and manage a tennis stadium construction project—with the goal of paving the way toward a more data-driven project management methodology. In her typical interactive discussion style, and with a deep respect for wisdom and experience, she convinces her team members that the price of exploring data is less than the risk of battling the unexpected project obstacles with experience alone.

GlobalConstruct Ltd. (the Company)

GlobalConstruct Ltd. is a project management consultancy company headquartered in Brussels, Belgium, with affiliations all over Europe, America, and Asia. The company was founded by Jacob Mitchell, a young twentysomething looking for a temporary endeavor, and quickly grew into an internationally renowned project management consultancy company. After more than 30 years, Jacob is now the CEO of a company of over 2,000 employees in more than 30 offices worldwide.

Over the last decades, GlobalConstruct has provided solutions to improve project performance with proven project management consulting and sound approaches that have been implemented in hundreds of organizations all over the world. The company is known for diagnosing problems and the quick recovery of projects in trouble, an intuitive solution-based approach built on years of experience, and better management of key project issues. From the very beginning, the company mission expressed a strong focus on providing key resources to monitor and follow up on its clients' projects.

GlobalConstruct's aim is to provide senior project management consultants to its clients to help them manage their projects and to deliver better value from the early project phases to the final delivery. To that purpose, these project management consultants assist GlobalConstruct's clients during the project's entire life cycle—from negotiation and planning, to monitoring and supervision, and even to successful delivery and post-delivery once the project is finished. Their tasks include setting up project plans with the client, managing key resource dependencies during project progress, and providing advice when labor shortages start to bring the project objectives into the danger zone. GlobalConstruct's client remains the owner of the project and has the final

responsibility in communicating with its stakeholders. Moreover, the labor for the project work is always delivered by, and under the responsibility of, this project owner, and so these are external project teams for GlobalConstruct, but these teams do work under the direct supervision of GlobalConstruct's senior project management consultants. The consultants' day-to-day activities are often complex and vary depending on the needs of the client and the type of project. Their ability to work with large international teams across various sites undoubtedly has helped many clients deliver successful projects well ahead of their competitors.

While Jacob had been surrounded by an excellent team of people with different backgrounds and various alternative ideas, he was well aware that the future of GlobalConstruct was at stake. Supported by both the recent recruitment of some young talents who joined the board of directors and the increasing importance of data analytics as a tool to support major decisions, he thought the company was ready for a new step forward. As a result of his never-ending study of how much bad project management costs almost every company, he realized that GlobalConstruct was ready for a major change in its way of working. His ultimate goal was to install a data-oriented decision-making process at all layers of the company, and to make this data-driven project management approach the flagship of GlobalConstruct.

To reach this objective, he assigned Emily Reed as a permanent member to the board of directors. Only a few weeks after this assignment, she had not only become responsible for a prestigious tennis stadium construction project for clients in Australia and Singapore, but she had also gained full authority to apply a new data-driven project management approach to one of these projects. This new data-driven methodology should be developed in-house, in close collaboration with all members of GlobalConstruct's core project team, and the project data of the upcoming tennis stadium construction project should be used as a test case for the further development, and possible approval, of the new project management system.

Jacob was convinced that Emily was the right person for this challenging task. Not fully aware of the difficulties she could possibly face, Emily could only see the beauty of the challenge and the beneficial impact it could have on the future of GlobalConstruct. She had never been afraid of the impossible—and she had the ability to transform any impossible endeavor into an exciting challenge. And a challenge it turned out to be!

CHAPTER

2

Plan

"I still maintain that we should opt for Australia!" Mark Rogers, Chief Financial Officer (CFO) of GlobalConstruct, exclaimed. The meeting called by Chief Executive Officer (CEO) Jacob Mitchell still lacked consensus. Two options were on the table: GlobalConstruct could join the bidding process for a new and extremely prestigious tennis stadium construction project in either Singapore or Australia. Given the importance of these types of projects, their successful completion could easily lead to follow-up projects and propel GlobalConstruct's rise on the international playground. The Australian government was very keen on implementing the tennis stadium construction project with success, given the negative publicity it had suffered as a result of similar projects in the past. Announcing the timely delivery of such a well-publicized initiative might alter public opinion. And if this were the case, GlobalConstruct would become Australia's number one choice for additional tennis stadium construction projects.

Project Details

Jacob rubbed his eyes and said, "Let's go over this one more time. Emily, please give us an overview of the different phases involved in these projects." Emily Reed, the Chief Operations Officer (COO), had come up with the different work packages and activities that would be required in order to bring about the successful completion of either project.

"The technical requirements of these projects are very similar and can be deconstructed into five work packages." Emily had asked one of her team members to provide more details on each of the work packages. Furthermore, to obtain a detailed description of the dependencies between the work packages and the activities of the tennis stadium construction project, Jacob and Emily had conducted several interviews with Australian experts in these types of projects, which resulted in the design-structure matrix of Table 2-1.

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Table 2-1. Design-Structure Matrix of the Tennis Stadium Construction Project for Australia

		Activity ID (using x for succeeding activities)															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Preparation	Clearing the site (1)		x														
	Removing trees (2)			x			x										
Field work	Subsurface drainage (3)				x												
	Filling playing field/track (4)					x											
	Installing artificial playing turf (5)																
Ground work	Excavation (6)							x									
	Pouring concrete footings (7)								x			x					
Seating	Pouring supports seat galleries (8)									x							
	Erecting pre-cast galleries (9)										x						
	Pouring seats (10)																x
Construction	Steel structure (11)												x				
	Roof (12)													x	x	x	
	Dressing rooms (13)																x
	Painting (14)																x
	Lights (15)																x
	Scoreboard (16)																

Every member around the table was well aware of the different phases these types of projects needed to go through. Choosing between Australia and Singapore entailed several different considerations. While the work packages and activities were identical, Australian companies were backed by the government. Hence, the precedence logic of Table 2-1 for the Australian tennis stadium construction project could be slightly different for the Singaporean project. The main difference between the two countries' project implementations lay in the way the "construction" and "seating" work packages would have to be planned and executed. These work packages could be done in parallel for the Australian project, but for the Singaporean project, the "construction" work package (activities 11 to 16) could only begin when all of the "seating" work (activities 8 to 10) was finished. So, while the invested funds were at higher risk for the tennis stadium construction project in Australia, this could probably be countered by an earlier completion date compared to the planned finish of the Singaporean project. In order to compare both alternatives, Jacob wanted to get a clear overview of the completion dates of the Singaporean and Australian tennis stadium construction projects. Emily produced an overview of the activities and their durations in weeks as provided in Table 2-2.

Table 2-2. Overview of Activity-Duration Estimates (in Weeks)

Work Package	Activity	Singapore	Australia
Preparation	Clearing the site	6	6
	Removing trees	2	2
Field work	Subsurface drainage	8	8
	Filling playing field/track	14	14
	Installing artificial playing turf	12	12
Ground work	Excavation	4	4
	Pouring concrete footings	4	4
Seating	Pouring supports seat galleries	10	12
	Erecting pre-cast galleries	10	13
	Pouring seats	4	4
Construction	Steel structure	2	4
	Roof	4	8
	Dressing rooms	4	4
	Painting	3	5
	Lights	2	4
	Scoreboard	3	3

Mark tried to summarize the main differences between the two projects. "So, we see that the main difference lies in the sequence of the activities of the previously mentioned work packages. In Australia, some of the activities can take place at the same time, but the individual activities take longer. What is the reason for this?" Jacob argued that, since these activities were executed simultaneously, there was less information available. This could be one of the causes for the longer duration estimates. "Right," Jacob said. "We now have sufficient information to make a first comparison between the two projects."

"How long will it take to complete these projects?" he asked. "And which of the two alternatives is the most attractive?" he immediately added.

It was clear that Jacob was aiming at a quantitative analysis rather than a subjective judgement in order to analyze and compare the expected behavior of the two projects before expressing a preference for one of them—and he would certainly want such an analysis before he would be willing to make a definite decision.

"Hang on a second!" Mark, who was in charge of GlobalConstruct's finances, knew the pitfalls of working with estimates.

"These numbers are averages—or, most likely, rough estimates, right?" he interjected. "One thing we know is that estimates are always wrong. So, I would like to get some different views on these estimates." Jacob knew there was great merit to Mark's objection. He suggested they tap into GlobalConstruct's Knowledge Network and get the opinion of two other experts. Jacob proceeded by adjourning the meeting: "All right, let's meet again next week to go over the experts' opinions."

Next Meeting

A week goes by so fast for a project manager! While Mark and Emily had been mainly involved in getting to know both projects' potential features much better, Jacob had talked to the head of GlobalConstruct's Knowledge Network and come back with new estimates, seen from an outsider's point of view. Emily, in particular, believed that this additional data was the missing link for a deep and sound analysis of the two projects.

"Emily, Mark, thank you for coming. The goal of this second project meeting is to determine whether our previous preference for Australia still holds with the new data at our disposal. I've brought a memo that reflects the opinions of Victoria and Andrew, two of our experts. These numbers can be combined with the previous numbers, which are most likely estimates since they are based on historical data. It's worth noting that Victoria usually has an optimistic outlook on the projects we conduct, while the opposite is true of Andrew's point of view." A list of the estimates given by the two experts is given in Table 2-3.