

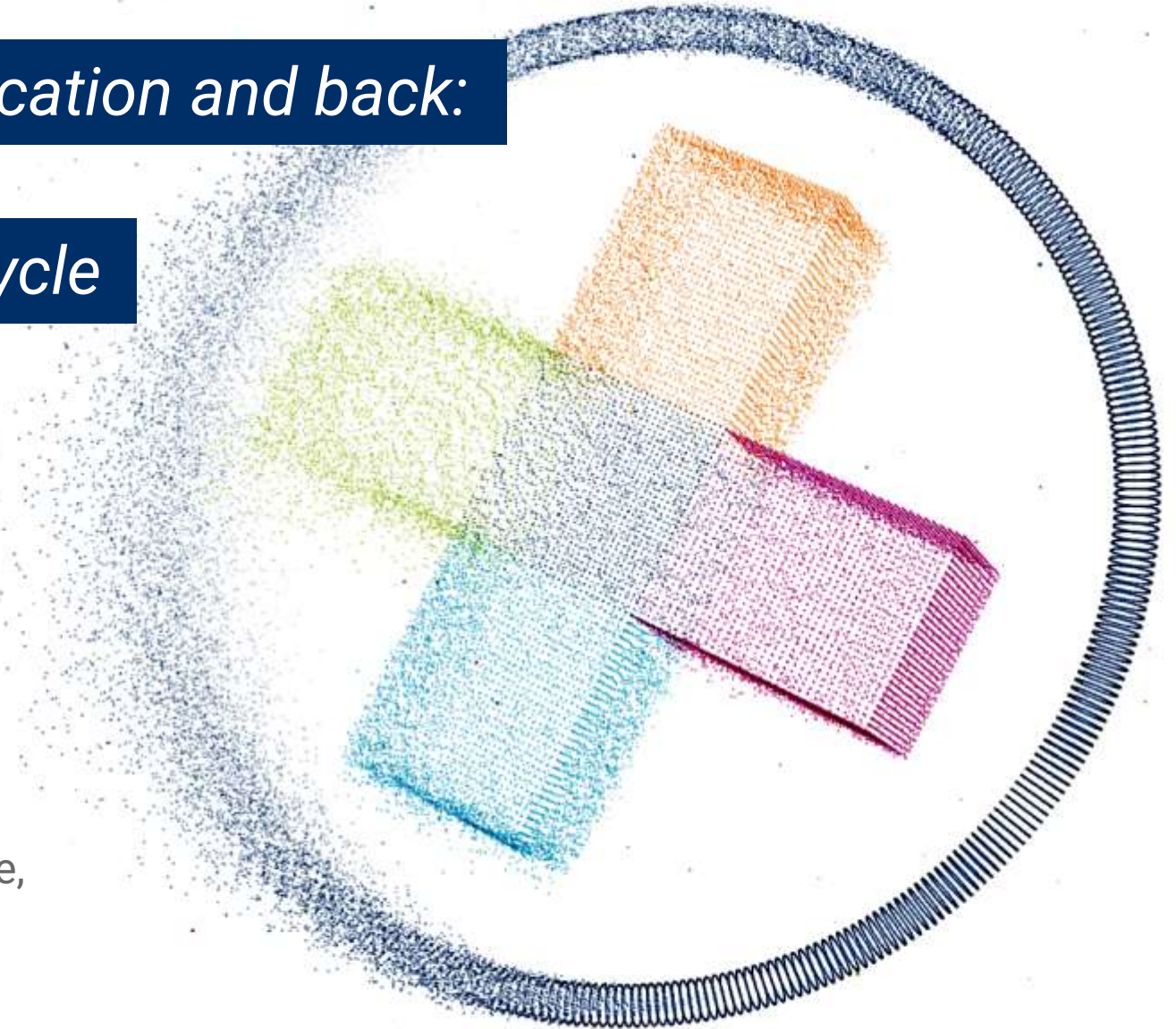
*From Collaboration to Education and back:*

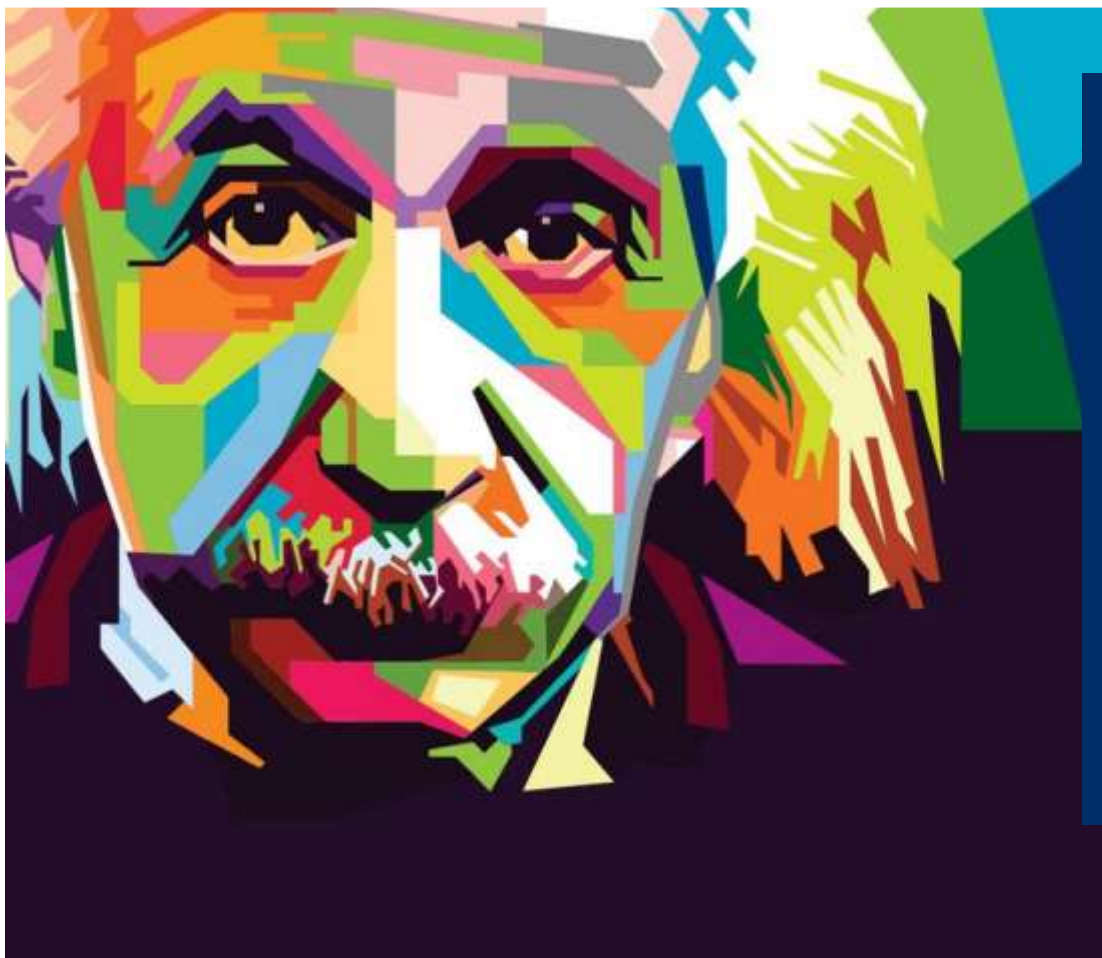
*a continuously revolving cycle*

Joaquim Gromicho

5th EURO Practitioners' Forum Conference,  
Coimbra, October 2024

**ORTEC**





“

**We're passionate about  
mathematics.**

**And eager to apply it  
to your benefit.**

”



“

We help many of the world's best-run organizations make better data-driven decisions. Our decision support software and data science expertise enable you to improve your business results and make a positive impact on the world.

**About ORTEC**

- 🏢 Founded in 1981
- 🏢 Offices in 13 countries
- 👛 1,200 customers
- 👤 1,000 employees

”

# We add value to various businesses...



Manufacturing



Retail & Wholesale



Energy



Professional & Technical Services



Transportation & Storage



Healthcare

... helping you to improve your business results and make a positive impact on the world.

## Higher Satisfaction

*People*



In 2023 through our solutions we reached over **1 million people**.

## Smaller Environmental Footprint

*Planet*



In 2023 our solutions prevented the emission of **639 kilotons CO2**.

## Improved Financial Performance

*Profit*

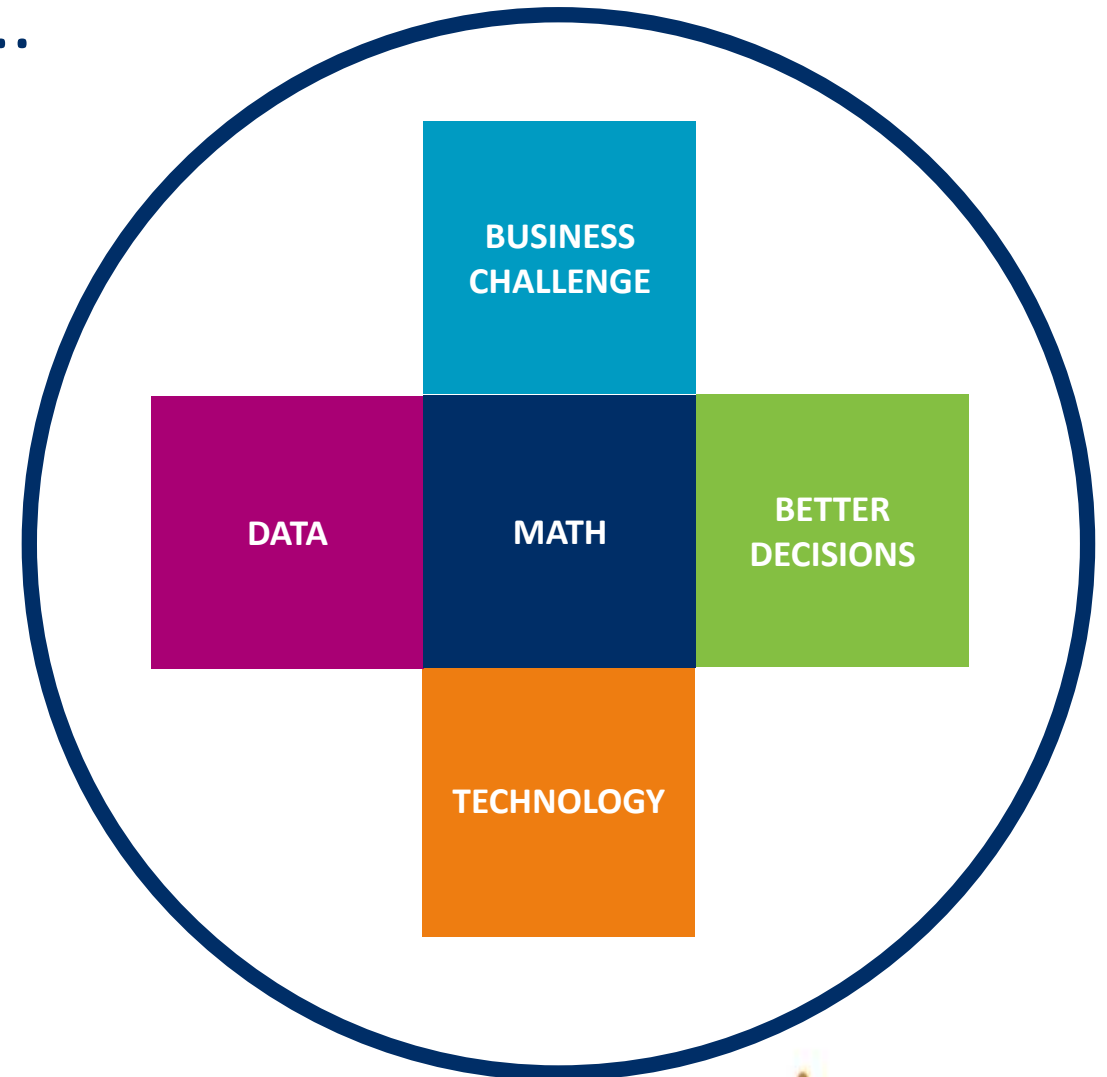


In 2023 we improved our customers' financial performance **EUR 1,2 billion**.

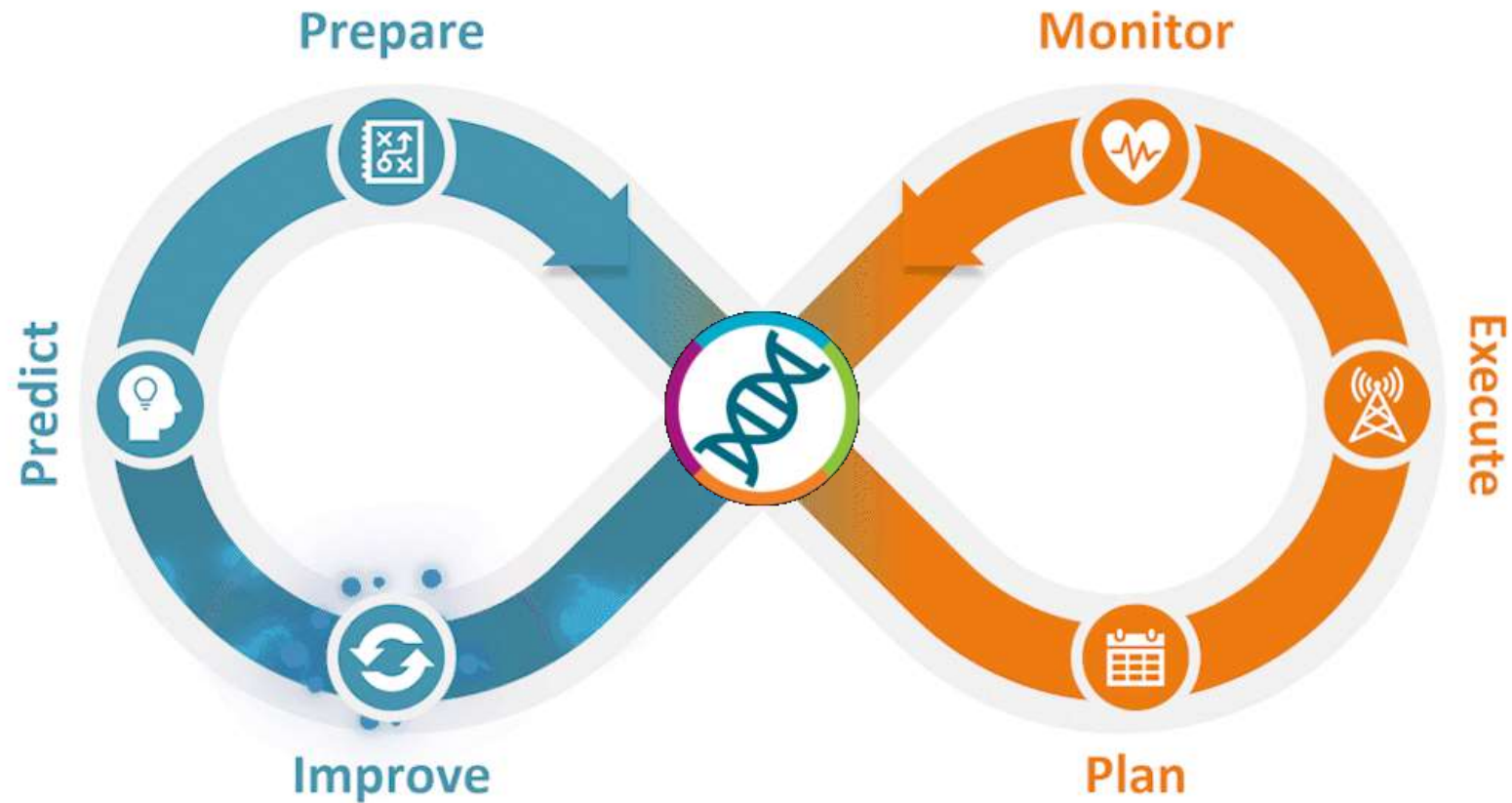


# By leveraging data and mathematics, we enable better decision-making..

- Analyze your **business challenge**.
- Collect relevant **data**.
- Create a **mathematical model**.  
Solve it with mathematical techniques.
- Use **technology** to enable it.
- Leading to better **decision-making**.



# Continuous improvement via the Learning Loop



# Our recognition, collaboration and sustainability

## Awards



Dutch Logistics Award (2009)  
Franz Edelman Award (2012)  
Dutch Mathematics Olympiad (2022)  
BNL Algorithm Programming Contest (2022)  
DIMACS VRP Challenge (2022)



## Academia



3 ORTEC Professors and 30+ PhDs  
Continuous PhD. and MSc. projects  
Collaboration on NWO R&D projects  
Collaboration MIT, GeorgiaTech, UvA, VU, TU  
Delft, TU Eindhoven, Tilburg University

The Analytics  
Academy

## Sustainability



Ecovadis Gold (2021)  
Founded "Analytics for a Better World"  
together with MIT and UvA (2022)

Analytics for a  
Better World



Enlightenment!



Joaquim  
Gromicho  
1965



MSc, 1990

Erasmus  
University  
Rotterdam



PhD, 1995



VRIJE  
UNIVERSITEIT  
AMSTERDAM

2001-2020, First chair 2011



**Science & Education Officer** at ORTEC  
(with ORTEC since 1996).



**Professor** of Business Analytics at the  
Amsterdam Business School, University of  
Amsterdam (since 2021).



**Lead Optimization Architect** at the  
Analytics for a Better World institute  
(since 2022).



**Editor in Chief** of STATOR, the 'glossy' of  
the Netherlands Society of Statistics and  
Operations Research (since 2011).



Member of the **steering committee** of the  
EURO Practitioner's Forum (since 2015).

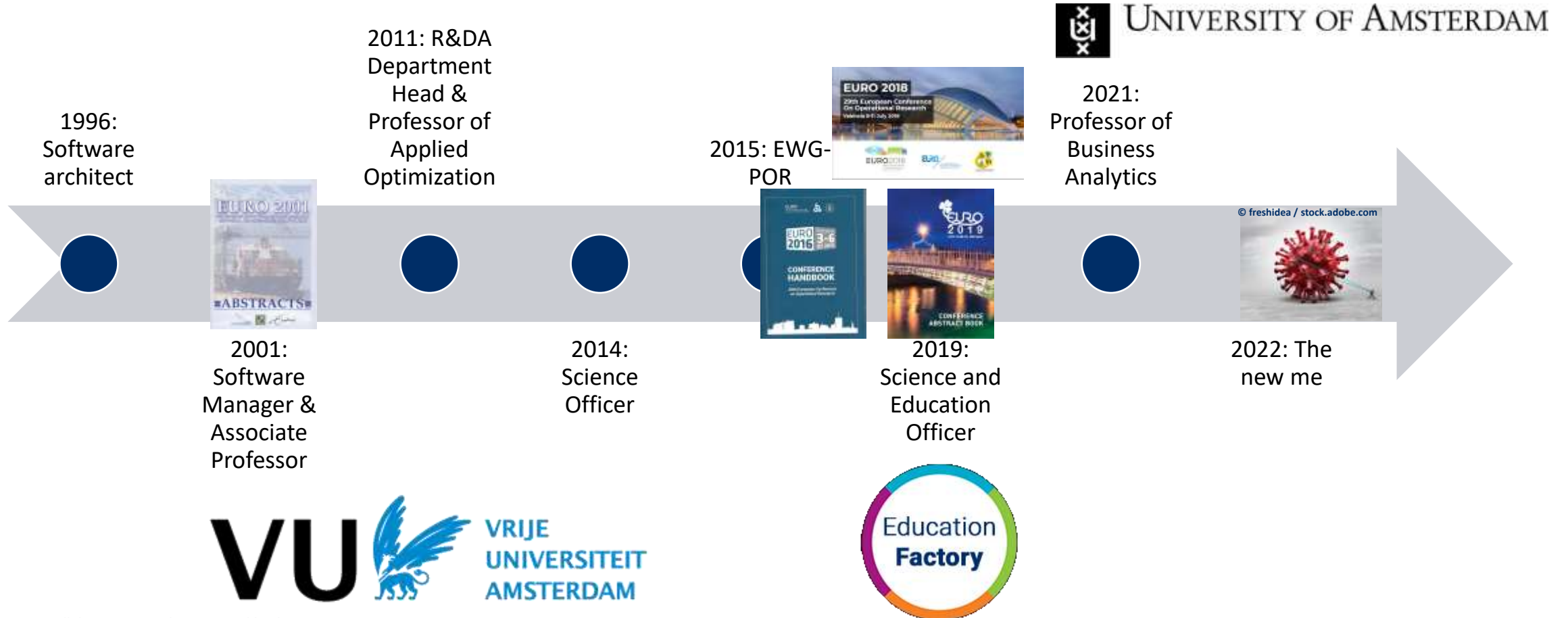


Academic spirit from the foundation of ORTEC onward

## Highlight CSO Prof. Dr. Gerrit Timmer



# Different milestones, different focus, different collaborations





✓ APPROVED



# Major changes in my live while at ORTEC

From collaboration to Education and back

How I discovered at the turn of the millennium that bridges can be build

[Home](#) > [Mathematical Programming](#) > [Article](#)

# A Primal–Dual Decomposition Algorithm for Multistage Stochastic Convex Programming

Published: 24 February 2005

Volume 104, pages 153–177, (2005) [Cite this article](#)



[Mathematical Programming](#)

Arjan Berkelaar · Joaquim A. S. Gromicho · Roy Kouwenberg · Shuzhong Zhang

## A Primal-Dual Decomposition Algorithm for Multistage Stochastic Convex Programming

Received: December 16, 2000 / Accepted: December 22, 2004

Published online: February 24, 2005 – © Springer-Verlag 2005



2014 





# Two visionaries from my PhD time changed things again in 2020

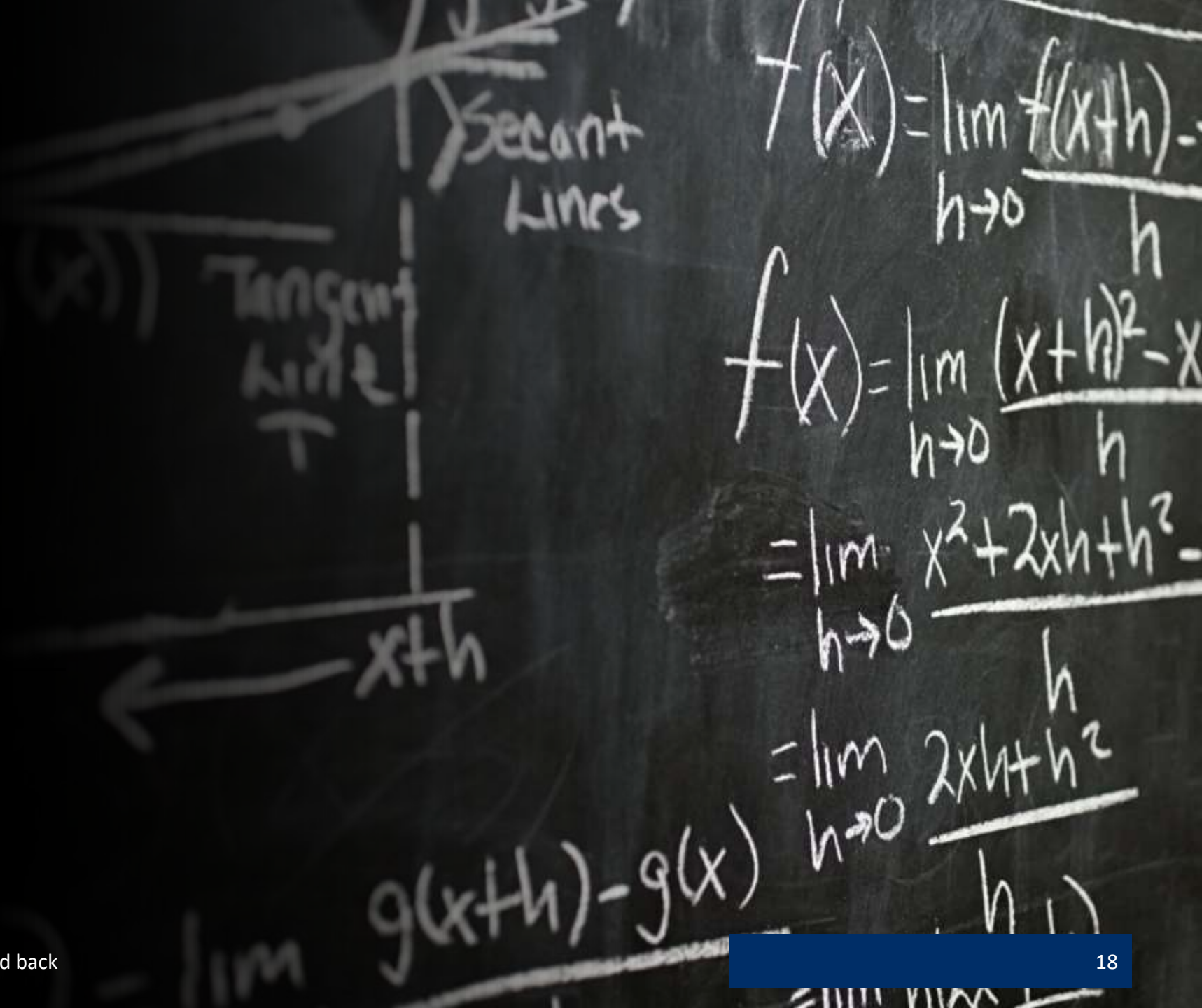


From collaboration to Education and back





# Scientific impact



# Challenging the routing community

- <https://verolog2017.ortec.com/>
  - [The VeRoLog solver challenge 2016–2017](#)
- <https://verolog2019.ortec.com/>
  - [The verolog solver challenge 2019](#)
- <https://euro-neurips-vrp-2022.challenges.ortec.com/>
  - [EURO Meets NeurIPS 2022 Vehicle Routing Competition](#)

## EURO Meets NeurIPS 2022 Vehicle Routing Competition



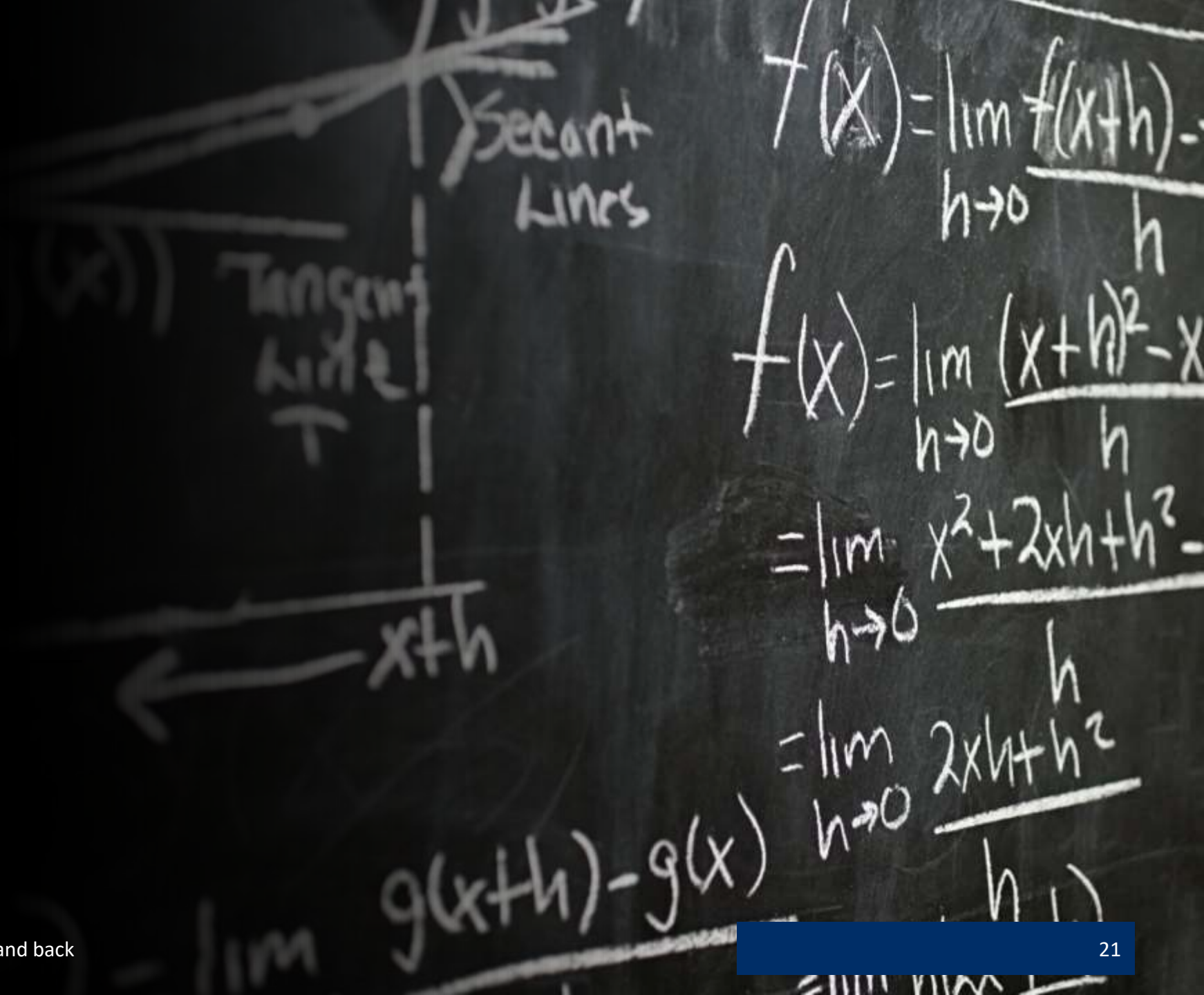


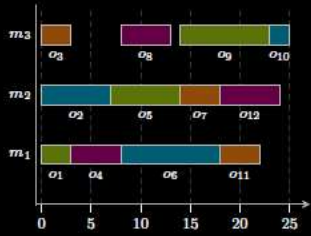
# Sometimes we also compete

- <http://dimacs.rutgers.edu/programs/challenge/vrp/vrptw/vrptw-competition/>
- <https://www.roadef.org/challenge/2022/en/finalresult.php>



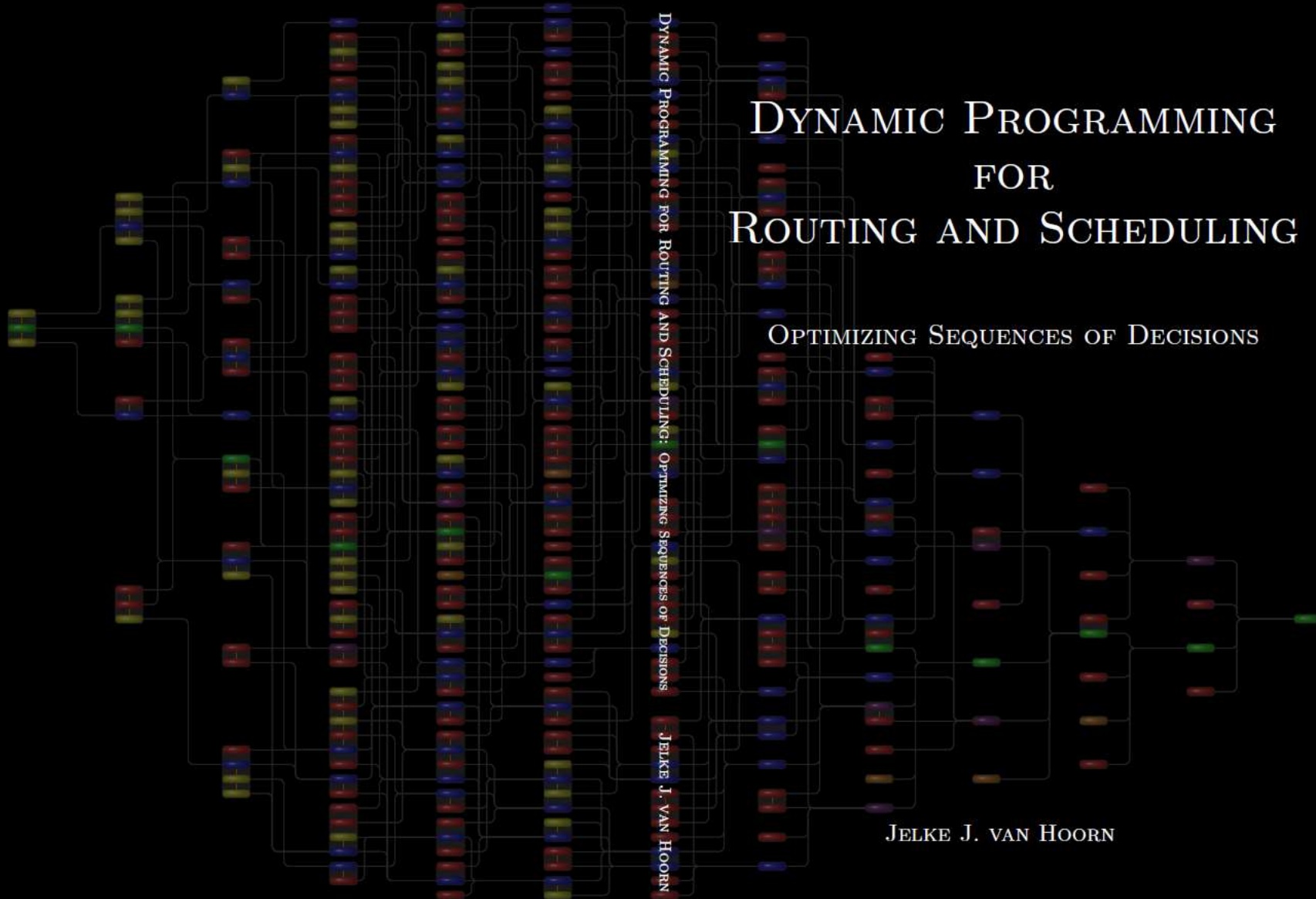
# Scientific output





# DYNAMIC PROGRAMMING FOR ROUTING AND SCHEDULING

OPTIMIZING SEQUENCES OF DECISIONS



- feasible
- optimal
- infeasible
- dominated
- bounded/feasible
- bounded/infeasible

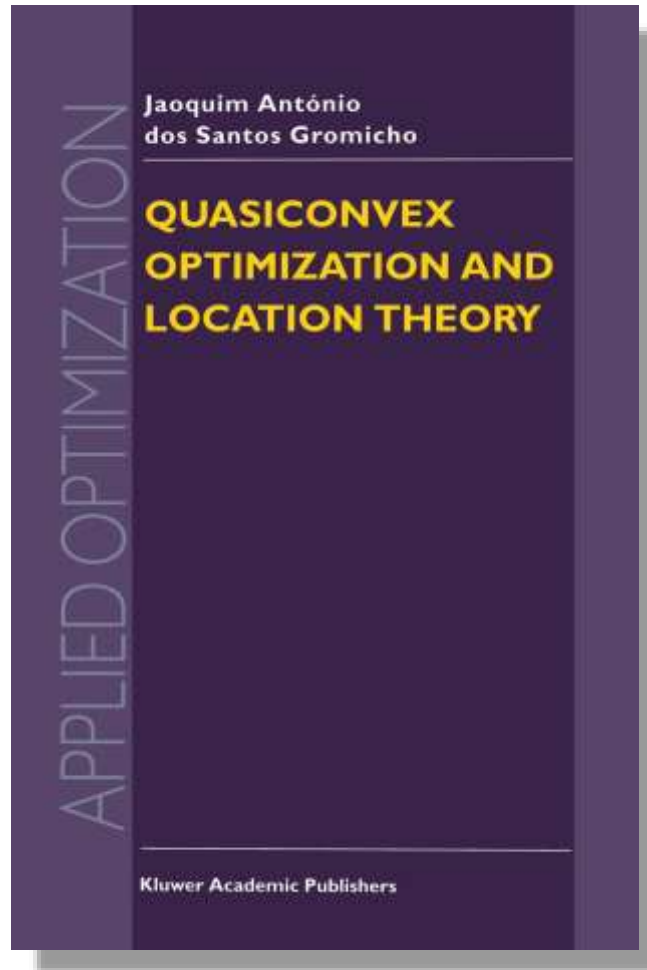
JELKE J. VAN HOORN

Job 1			Job 2		
	$m(o)$	$p(o)$		$m(o)$	$p(o)$
$o_1$	1	3	$o_2$	2	7
$o_5$	2	7	$o_6$	1	10
$o_9$	3	9	$o_{10}$	3	2

Job 3			Job 4		
	$m(o)$	$p(o)$		$m(o)$	$p(o)$
$o_3$	3	3	$o_4$	1	5
$o_7$	2	4	$o_8$	3	5
$o_{11}$	1	4	$o_{12}$	2	6

# Two own books, while at ORTEC and largely *from* ORTEC



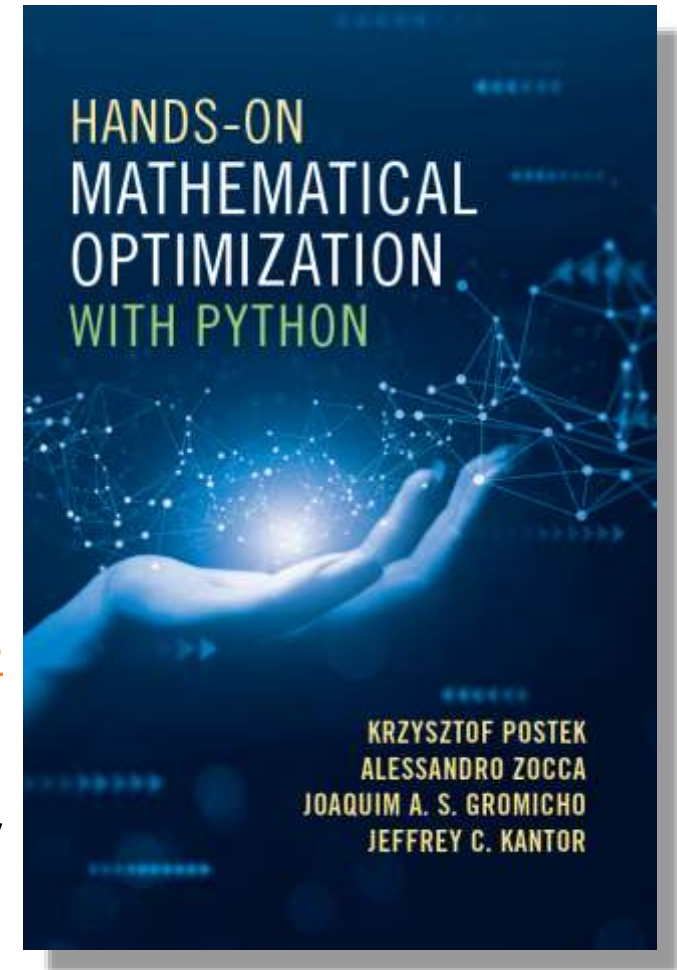
1998, [based on my PhD research](#)



2024, [based on our teaching experience](#)

Includes an [online companion](#).

This has been ported with attribution by [AMPL](#).



# HANDS-ON MATHEMATICAL OPTIMIZATION WITH PYTHON

Postek, Zocca,  
Gromicho and Kantor

HANDS-ON MATHEMATICAL OPTIMIZATION WITH PYTHON

This practical guide to optimization combines mathematical theory with hands-on coding examples to explore how Python can be used to model problems and obtain the best possible solutions. Presenting a balance of theory and practical applications, it is the ideal resource for upper-undergraduate and graduate students in applied mathematics, data science, business, and industrial engineering and operations research programs, as well as practitioners in related fields.

Begins with an introduction to the concept of optimization, the key ingredients of an optimization problem and the choices one needs to make when modeling a real-life problem mathematically.

- Provides thorough coverage of the mathematical fundamentals of optimization modeling, ranging from linear and network optimization to convex optimization and optimization under uncertainty.
- Contains Python code snippets in the book, along with 50+ Jupyter notebooks on an author-maintained GitHub, which allow students to put the theory into practice and solve problems inspired by real-life challenges in manufacturing, transport, finance, and energy networks.
- Numerous theoretical exercises sharpen students' understanding of the methods presented.

"This is a fantastic textbook on optimization! It contains the right mix of theoretical and more practical optimization aspects."

Dick den Hertog, *University of Amsterdam*

"This book delivers state-of-the-art models and their implementation. I highly recommend it to anyone interested in practical application of optimization."

David Woodruff, *University of California, Davis*

"This book is a great tool for instructors and students in engineering, business analytics, and many other areas for learning mathematical optimization using Python code language."

Belen Martin-Barragan, *University of Edinburgh*

"With clear guidance and hands-on exercises, this textbook empowers learners to not only understand but also implement optimization techniques effectively."

Bhupesh Shetty, *Drexel University*



Online Resources

[www.cambridge.org/postek-resources](http://www.cambridge.org/postek-resources)

For students:

- 50+ Jupyter notebooks with coding examples in Python

Restricted for instructors:

- Solutions manual



CAMBRIDGE  
UNIVERSITY PRESS

ISBN 978-1-009-49350-5



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CAMBRIDGE

KRZYSZTOF POSTEK  
ALESSANDRO ZOCCA  
JOAQUIM A. S. GROMICHO  
JEFFREY C. KANTOR

Cover image: Miha Creative / Shutterstock  
Cover design by Zoe Naylor



# AMPL

# Pyomo



COUNTRY	ACTIVE USERS	
United States	4.1K	-
Netherlands	1.6K	-
India	1.4K	-
Germany	748	-
United Kingdom	597	-
China	538	-
Canada	496	-

# A pair of ORTEC professors

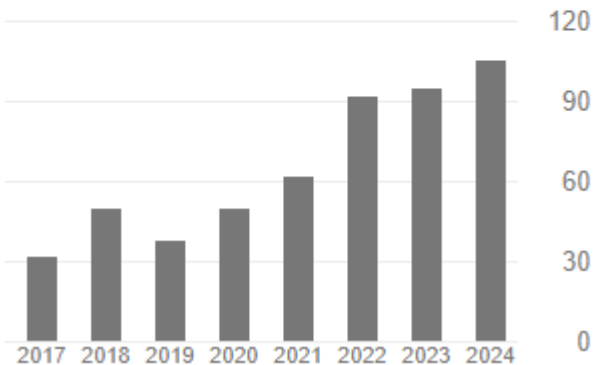


## Joaquim A. S. Gromicho

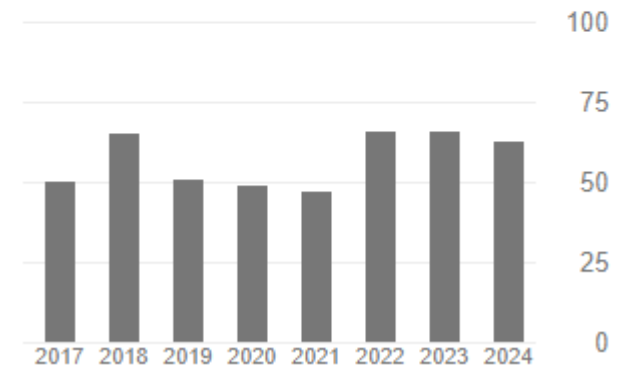
Professor of Business Analytics, [University of Amsterdam](#) & Science and Education Officer, ORTEC  
 Verified email at uva.nl - [Homepage](#)

operations research   modeling and optimization   big data analytics   machine learning  
 computer science

	All	Since 2019
Citations	897	444
h-index	13	10
i10-index	17	10



	All	Since 2019
Citations	2216	342
h-index	20	10
i10-index	25	10



## Goos Kant

Professor Logistic Optimization  
 Geverifieerd e-mailadres voor [tilburguniversity.edu](#) - [Homepage](#)  
 optimization   logistics   heuristics

# We are part timers... cannot compare with top-tier scholars!

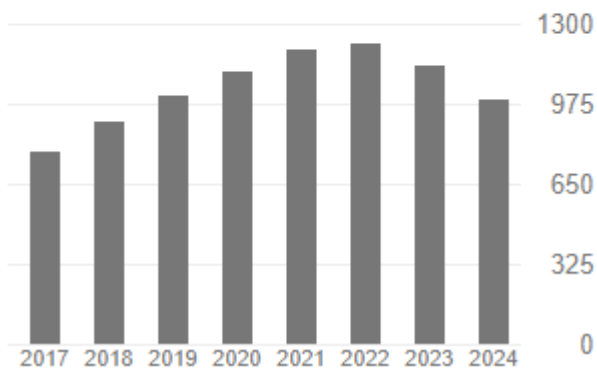


**Carlos Henggeler Antunes**

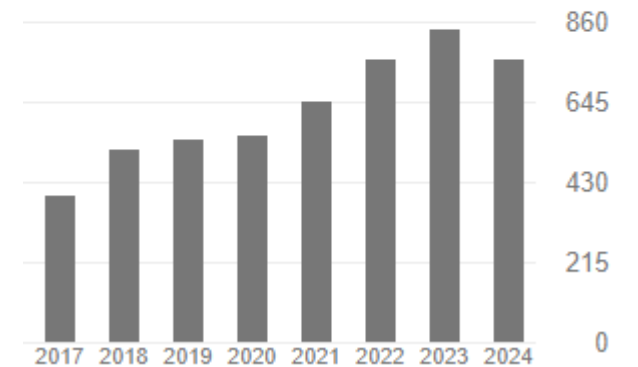
INESC Coimbra, [University of Coimbra](#)  
Verified email at deec.uc.pt - [Homepage](#)

Operations Research   Multiobjective Optimization   Energy Planning  
Evolutionary Computation   Computer Science

	All	Since 2019
Citations	12474	6666
h-index	58	42
i10-index	187	138



	All	Since 2019
Citations	7969	4130
h-index	39	32
i10-index	85	60



**Thorsten Koch**

TU Berlin / [Zuse Institute Berlin](#)  
Verified email at zib.de - [Homepage](#)

Mathematics   Linear Programming   Integer Programming

# A pair of officially no-timers in academia

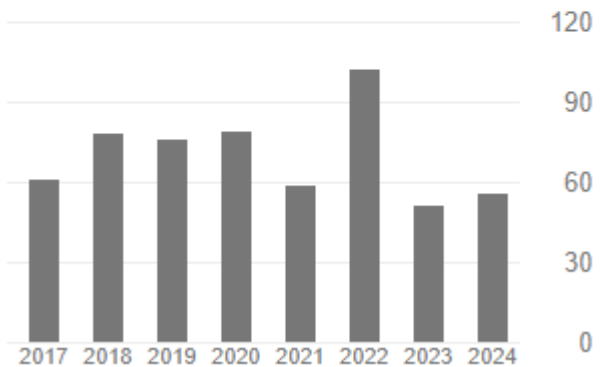


**Leendert Kok**

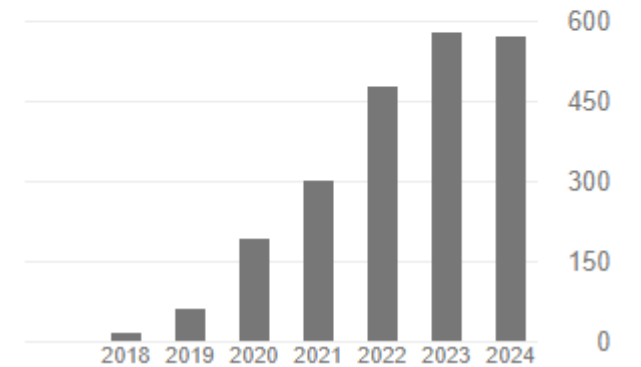
Chief Science Architect, ORTEC  
 Geverifieerd e-mailadres voor ortec.com

Operations research   data science   artificial intelligence

	All	Since 2019
Citations	919	424
h-index	12	10
i10-index	12	10



	All	Since 2019
Citations	2210	2187
h-index	10	10
i10-index	11	11



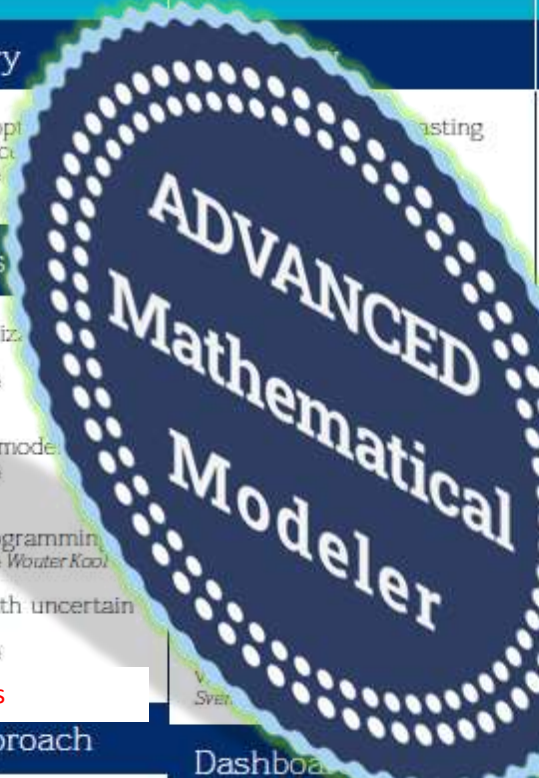
**Wouter Kool**

ORTEC  
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Machine Learning   Reinforcement Learning   Combinatorial Optimization  
 Vehicle Routing

# Education at ORTEC

PEOPLE SKILLS	BUSSINESS DELIVERY SKILLS	ORTEC	PORTFOLIO & GO-TO-MARKET STRATEGY	OPTIMIZATION	DATA SCIENCE	TECHNOLOGY
All experience levels	Foundation	General	Practice Briefings	Introductory		Foundation
Habit-hacking to increase your impactful behavior <i>Esther Franke &amp; Marsha Blaauw / Luc Analbers &amp; Annelies Bügel</i>	How to work in projects <i>Sjoerd van den Bruele (ICM) &amp; Marcel Koldewijn (ICM) &amp; Willemieke van Vliet &amp; Martjke Lijzenga</i>	Write like a pro <i>e-learning followed by online Q&amp;A session given by Fedri Riccardi</i>	Innovation & Design thinking <i>Erica D'Acunio &amp; Suzanne Thomasson</i>	Mathematical optimization <i>Joaquim Gromicho &amp; Niels van der Laan</i>		Angular for beginners <i>Leon Endhoven &amp; Daan Scheerens</i>
Foundation	Logistic processes & Industries <i>George Ninikas &amp; Ken Swagten</i>	LinkedInfluencers: Become an ORTEC LinkedIn brand ambassador <i>e-learning</i>	Portfolio & Sales	Techniques		TypeScript workshop <i>Leon Endhoven &amp; Daan Scheerens</i>
Time management <i>Sjoerd van den Bruele (ICM) &amp; Marcel Koldewijn</i>	The Art of Presenting <i>Bas den Heijer &amp; Ily van Putten / Victor Wierda &amp; vacancy</i>	Communications at ORTEC <i>e-learning</i>	The ORTEC portfolio: A primer <i>Wouter Luitjen</i>	Powerful optimization heuristics <i>Joaquim Gromicho &amp; Niels van der Laan</i>		The new world of our cloud routing products <i>Ward Vandepierre &amp; Maarten Peekstok</i>
Professional customer approach <i>Ted Marcus (EMC)</i>	Change Management	ORTEC's story: The power of mathematics <i>Gerrit Trimmer</i>	ORTEC for the industry <i>Georgios Sarigiannidis</i>	Pragmatic MIP models <i>Joaquim Gromicho &amp; Niels van der Laan</i>		IX for effective design solutions <i>Tej Akar &amp; Trishala Girgasing</i>
Intermediate	Case based change management <i>Bram Huijten &amp; Emma de Wit</i>	Data Security & Privacy	Sales and Presales	Competitive programming <i>Karmel Cornelissen &amp; Wouter Kool</i>		What is Devops? <i>Cern Kaya &amp; Okkeş Doker</i>
Become highly effective <i>Luc Analbers &amp; Martjke Lijzenga</i>	Change Management: A structured approach <i>Bram Huijten &amp; Emma de Wit</i>	Information security at ORTEC <i>Jet Woudstra &amp; Servaas Goossens</i>	Commercial storytelling <i>Jeff Bailey</i>	Optimization with uncertain data <i>Joaquim Gromicho &amp; Lorenzo Simons</i>		Production into automated testing <i>Uguralp Nirmal &amp; Marco Verhoeven</i>
Effective Communication: For team leads <i>Maarten Stoffers (External)</i>	Design	Privacy fundamentals: Does it affect your daily job? <i>Marcel Lodewijk</i>	Mastering Sales: A Toolkit for success <i>External (Kellogg School of Management)</i>	Project Approach		Technology for engineers <i>Geert Groenbroek &amp; vacancy</i>
Management Skills: For team leads & Project managers <i>Maarten Stoffers (External)</i>	Mastering the requirements & Solution design <i>Daniel Dutcu &amp; Paul Goldman</i>	Ethical decision making <i>Vincert van Mierlo</i>		OR business translation <i>Annelieke Baller &amp; Quinten Cederhout</i>		Human driven design <i>Wouter van Dijk</i>
Mentoring skills <i>Esther Franke &amp; Marsha Blaauw / Luc Analbers &amp; Annelies Bügel</i>	Project Management					Intermediate
The continuous conversation <i>Esther Franke &amp; Marsha Blaauw / Edwin Woltering &amp; Esther Franke</i>	Project management: Introduction <i>Tom de Kort &amp; vacancy</i>					Reactive programming workshop <i>Leon Endhoven &amp; Daan Scheerens</i>
Time management & delegation: For team leads <i>Sjoerd van den Bruele (ICM)</i>	Agile & Scrum essentials <i>Arian Hennink &amp; Martjke Lijzenga</i>					Cloud native software architecture <i>Jacob Kooijman &amp; Joel Pisser</i>
Advanced	Project management: Advanced <i>Irisius Went &amp; Witske Hoos</i>					Data driven UX improvements <i>Janno Teekens</i>
						SQL server performance tuning <i>Bouke Brinstra</i>
						Hands-on time series forecasting <i>Rogier Emmen / Kasper Groenbroek</i>
						Hands-on machine learning <i>David Doppenbervacag &amp; vacancy</i>
						Deep dive into deep learning



From collaboration to Education and back

# Analytics for a Better World: made possible by ORTEC



 **Analytics for  
Better World**

<https://analyticsbetterworld.org/updates/analytics-for-a-better-world-uva-courses/>  
<https://www.amsia.nl/impact-award-recipients-2023/dick-den-hertog/>





# ABW courses 2024/2025

- Bachelor (introduction) and Master (advanced)



Parvathy Krishnan CTO Analytics for a Better World & Data Scientist World Bank



# ABW fellowship

And the fellowship is on its third edition already!

**Cohort III Fellows**  
**25 countries - 32 organizations**



 Analytics for a Better World

Maybe the one I am most proud of

## Assessment of geographical accessibility to COVID-19 testing facilities in Nepal (2021)

Parvathy Krishnan Krishnakumari,<sup>a</sup> Hannah Bakker,<sup>b</sup> Nadia Lahrichi,<sup>c</sup> Fannie L. Côté,<sup>c</sup> Joaquim Gromicho,<sup>a,d,\*</sup> Arunkumar Govindakarnavar,<sup>e,f</sup> Priya Jha,<sup>e</sup> Saugat Shrestha,<sup>e</sup> Rashmi Mulmi,<sup>e</sup> Nirajan Bhusal,<sup>e</sup> Deepesh Stapith,<sup>e</sup> Runa Jha,<sup>g</sup> Lilee Shrestha,<sup>g</sup> Reuben Samuel,<sup>h</sup> Dhamari Naidoo,<sup>h</sup> and Victor Del Rio Vilas<sup>f,i</sup>

<sup>a</sup>Amsterdam Business School, University of Amsterdam, Amsterdam, The Netherlands

<sup>b</sup>Karlsruhe Institute of Technology, Karlsruhe, Germany

<sup>c</sup>Department of Mathematical and Industrial Engineering - Polytechnique Montréal, Canada

<sup>d</sup>ORTEC, Zoetermeer, the Netherlands

<sup>e</sup>World Health Organization Country Office for Nepal, Kathmandu, Nepal

<sup>f</sup>Principal Investigators, Project Lead

<sup>g</sup>National Public Health Laboratory, Kathmandu, Nepal

<sup>h</sup>World Health Organization South East Asia Regional Office, New Delhi, India

<sup>i</sup>UK Health Security Agency - Public Health Rapid Support Unit, UK

**The Lancet Regional  
Health - Southeast  
Asia 2024;27: 100436**

Published Online 1 July  
2024

<https://doi.org/10.1016/j.lansea.2024.100436>

