

Industrial AI from PILOT to PROFIT

Key Concepts, Success Factors, Use Cases
and Market Mechanics

» Hier geht's
direkt
zum Buch

DAS VORWORT

**Part I:
Introduction
and Key
Concepts**

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Introduction

1.1 About the Author



Boris Scharinger serves Siemens Digital Industries, the Industry 4.0 and PLM software division of Siemens, in numerous initiatives centered on industrial-grade AI.

With a professional career spanning more than three decades, Boris possesses a uniquely broad background that bridges the gap between complex IT infrastructure and strategic business innovation.

His diverse roles have included Enterprise IT Architecture Management for digital services, leading a large-scale IT carve-out program, leading innovation campaigns in IT outsourcing, directing IT audits in North America with a focus on data analytics and cybersecurity, moderating cross-company data collaboration initiatives, and defining global technology roadmaps.

He plays a vital role in identifying and mentoring pioneering startups through initiatives such as the Siemens Industrial AI Awards and co-hosting the annual AI with Purpose Summit, which foster collaboration between established industrial players and innovative newcomers to make AI *industrial-grade*.

Contact the author via his website www.industrial-ai-book.com!

1.2 Foreword by Prof. Wil v. d. Aalst



It is a great pleasure to write this foreword for *Industrial AI: From Pilot to Profit* by Boris Scharinger. We are living in a moment when the public imagination has been captivated by AI, triggered by the “ChatGPT moment” of November 2022. From generating poetry and PowerPoint slides to drafting business plans and writing Python code, the promises of AI can appear limitless.

Yet, as this book rightly observes, the industrial world is now entering a necessary and sobering phase. As Boris notes, roughly 95% of enterprise GenAI initiatives fail to deliver measurable return on investment and are abandoned before reaching production. The gap between impressive demos and sustained industrial impact remains wide.

After providing an excellent historical overview and a clear survey of emerging AI-based technologies, Boris explains why AI applications in industrial settings are fundamentally more challenging. He identifies three core reasons:

1. High-stakes consequences;
2. Physical constraints and long-lived assets; and
3. Brownfield complexity and legacy integration.

In industry, AI errors can have severe real-world consequences – financial losses, safety incidents, environmental damage, or even loss of life. Unlike consumer-facing AI, where mistakes are usually benign, industrial AI must meet far higher standards of reliability, validation, and accountability, and this inevitably slows down adoption and deployment. Moreover, industrial systems are governed by the laws of physics and embedded in expensive physical assets with lifecycles that often span decades. AI models must respect physical limits, engineering constraints, and safety margins, while integrating with machinery and processes that cannot be frequently redesigned or replaced. Most industrial environments are brownfield systems: heterogeneous, highly customized, and developed over many years using legacy equipment, proprietary protocols, and siloed data sources. This fragmentation makes data integration, model deployment, and continuous updating far more difficult than in greenfield, cloud-native digital environments.

This analysis is both accurate and insightful. I would add that many successful AI applications focus on optimizing a single task or isolated step. However, true complexity emerges when we consider end-to-end processes. This is precisely why my own work has increasingly focused on *Object-Centric Process Mining* (OCPM). OCPM moves beyond simplified, case-centric representations and models processes as they actually occur in industrial reality. Real-world industrial processes involve interactions among

multiple object types – machines, orders, materials, products, sensors, and assets – that evolve over long lifecycles, operate under physical constraints, and interact in dynamic environments. OCPM is particularly well-suited to brownfield settings, as it integrates fragmented event data originating from heterogeneous legacy systems.

However, seeing the problem is not enough. Moving the needle on productivity requires sustained commitment to motivation, implementation, and change management. We have seen this before with Industry 4.0, where substantial upfront investments often failed to deliver the promised returns because organizations struggled to scale beyond siloed pilots. The digital gap is as much a cultural and organizational challenge as it is a technical one. For this reason, the book wisely addresses not only technology but also economic, legal, and organizational dimensions. In particular, it emphasizes the importance of governance of AI systems, data infrastructures, and decision rights – as a prerequisite for lasting success.

This book serves as a vital map for navigating the transition from experimentation to value creation. It performs the essential task of translating the world of business to technologists and the world of technology to business leaders. Along the way, it demystifies technical concepts such as retrieval-augmented generation and surrogate models, grounding them firmly in the operational realities of enterprise environments.

Importantly, the book also looks beyond today's hurdles to offer an inspiring outlook on the next frontier of industrial intelligence. We are entering a phase where the intersection of agentic AI and process mining will enable entirely new paradigms. In such environments, process mining provides a transparent “mirror” for autonomous agents, ensuring that as AI systems begin to plan and execute multi-step actions independently, they do so within the boundaries defined by process models, compliance requirements, and quality standards.

At *Celonis*, we summarize this philosophy under the “no AI without PI” banner, where AI refers to *artificial intelligence* in organizations and industries, and PI stands for *process intelligence* powered by OCPM. AI needs context to make sound decisions, and process models combined with event data provide exactly that context. Most data stored in industrial systems already describes events and objects – machines, people, suppliers, products, tools, and assets. From bills of material and SCADA data to supply chain and CRM systems, a large share of industrial data is structured, operational, and readily available. It is, therefore, naïve to assume that general-purpose large language models trained primarily on text and images can, on their own, manage and improve complex industrial systems.

For those ready to move from ambition to action, this book offers the guidance needed to ensure that industrial AI does not remain a collection of costly experiments. Instead, it becomes a true engine of the next revolution in intelligence.

Enjoy reading!

Prof. Dr. Wil van der Aalst

Full professor at RWTH Aachen University & Chief Scientist at Celonis

1.3 Navigating the Industrial Revolution of Intelligence

Industry doesn't need another hype cycle; it requires tools that work. While consumer AI tolerates hallucination, industrial AI demands precision. This book is a compendium that provides guidance for transitioning from experimental pilots to mission-critical operations. It explains the buzzwords while still focusing on the engineering and shop-floor realities: reliability, safety, and Return on Investment. Insights into the mechanics of market and business cases help us understand why industrial AI takes longer.

And last but not least: This book inspires by crawling through all the primary functions of an industrial enterprise: Each function is explained and its potential AI support laid out while commercial solution briefs for each function provide a valid entry point into market screenings for any reader with the ambition to tackle AI's potential in these functions.

1.4 Target Audience

Of course, every person on this planet (and beyond) must read this book! However, the way it is shaped aims to be *particularly useful* to the following roles:

- *Corporate Decision Makers* (e. g., CEOs, CIOs, Supervisory board members) who require a broad overview of the potential of AI for their enterprise and guidelines to understand risks, both on the technical and business side of life.
- *MBA students* of AI, IT, Engineering, and Business Administration – requiring a generalist's insight into the most critical enterprise functions and the way AI can provide a competitive difference.
- *Consultants* on a mission to monetize their technical and managerial capabilities within corporate environments.
- *Startups* where great technology seeks practical application. And where insights into market and business case mechanics are vital to success.
- Finally: *Anyone wanting to join the mission to make AI industrial-grade.*

1.5 How to Read this Book

This book is designed to guide readers through a structured journey, from foundational knowledge to practical application.

Part I: Introduction and Concepts begins by establishing a solid foundation. It traces the history of AI from its origins to the current era of generative models, providing the essential context for understanding today's landscape. It then clarifies key modern concepts, including generative AI, agentic AI, the Digital Twin, and the Industrial Metaverse, thereby establishing a precise vocabulary for the subsequent discussions. Part I also examines various AI technologies, at least to some degree, to understand their differences and their relevance to industry AI approaches.

Part II: Adoption Hurdles confronts the practical challenges head-on. It examines the paradox of slower industrial adoption than in other sectors and delves into the specifics of making AI “industrial-grade”. This section provides an honest look at the unique data challenges, the mechanics of the business case, and the critical need for new engineering disciplines to bridge the gap between algorithm and application.

Part III: from Ambition to Action offers a strategic framework for getting started, outlining the necessary organizational capabilities, the crucial role of partnerships, and a methodology for assessing and prioritizing use cases.

Part IV: Enterprise Functions and AI Use Cases makes the potential of Industrial AI tangible. It presents a comprehensive functional breakdown of a modern industrial enterprise. It showcases examples of how AI is creating value at every stage – from innovation management and product design to production engineering, operations, and service.

Part V: Conclusion and Annexes summarizes and adds a comprehensive references list, table, and figure indexes, abbreviations, keywords, and a company register.

1.6 A Big Thank You

This book is inspired by *Prof. Peter Mertens*. Prof. Mertens is a key pioneer in the field of *Business Information Systems*, and both his lectures and his books have shaped my passion and skills for my professional career, bridging technology and business. The structure of his book, *Integrated Information Systems* [1], served as the blueprint for Part IV of this book.

This book would not have been possible without input and advice from many industrial AI experts out there, namely

- *Robert Weber and Peter Seeberg*, running the Industrial AI Podcast (*aipod.de*) and orchestrating a lively community of industrial AI practitioners and startup entrepreneurs;
- *Roberto d'Ippolito, Volkmar Sterzing, and Peter Mas* from Siemens, as well as *Moritz Frenzel* from Altair, who helped me understand the impact of AI in engineering, particularly in simulation and design space exploration;
- *Erik Scepaniski and Armin Hadzalic* from Siemens on what it takes to mature industrial copilot technology, and *Filippos Petridis* (Siemens) and *Tom Cadera* (Cadera Design) for their input on (and passion for) AI user experience;
- *Vlad Larichev* from Accenture for our great discussions on Agentic AI and the Digital (Reasoning) Thread concepts;
- *Torsten Kroeger* and the Intrinsic team for helping me capture where AI-based industrial robotics is heading;
- *Tom Hurd* from ZEKI Data for both data points and insights on AI talent movement trends;
- *Prof. Marco Huber* from Fraunhofer IPA and the University of Stuttgart for reviewing this book diligently and for providing excellent use case examples; and
- *Prof. Wil van der Aalst* from the RWTH Aachen University and Chief Scientist at Celonis for this review of the process mining-related sections and his highly appreciated foreword!

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Thank you all for driving AI to become industrial-grade – keep on rockin'!

Last but not least: Thank you from the very bottom of my heart to my wife, *Martina*, and my kids, *Emma* and *Nicklas*, for your support and tolerance of my dedication to getting this book project finished in a pretty short time frame!