OST
Ostschweizer
Fachhochschule

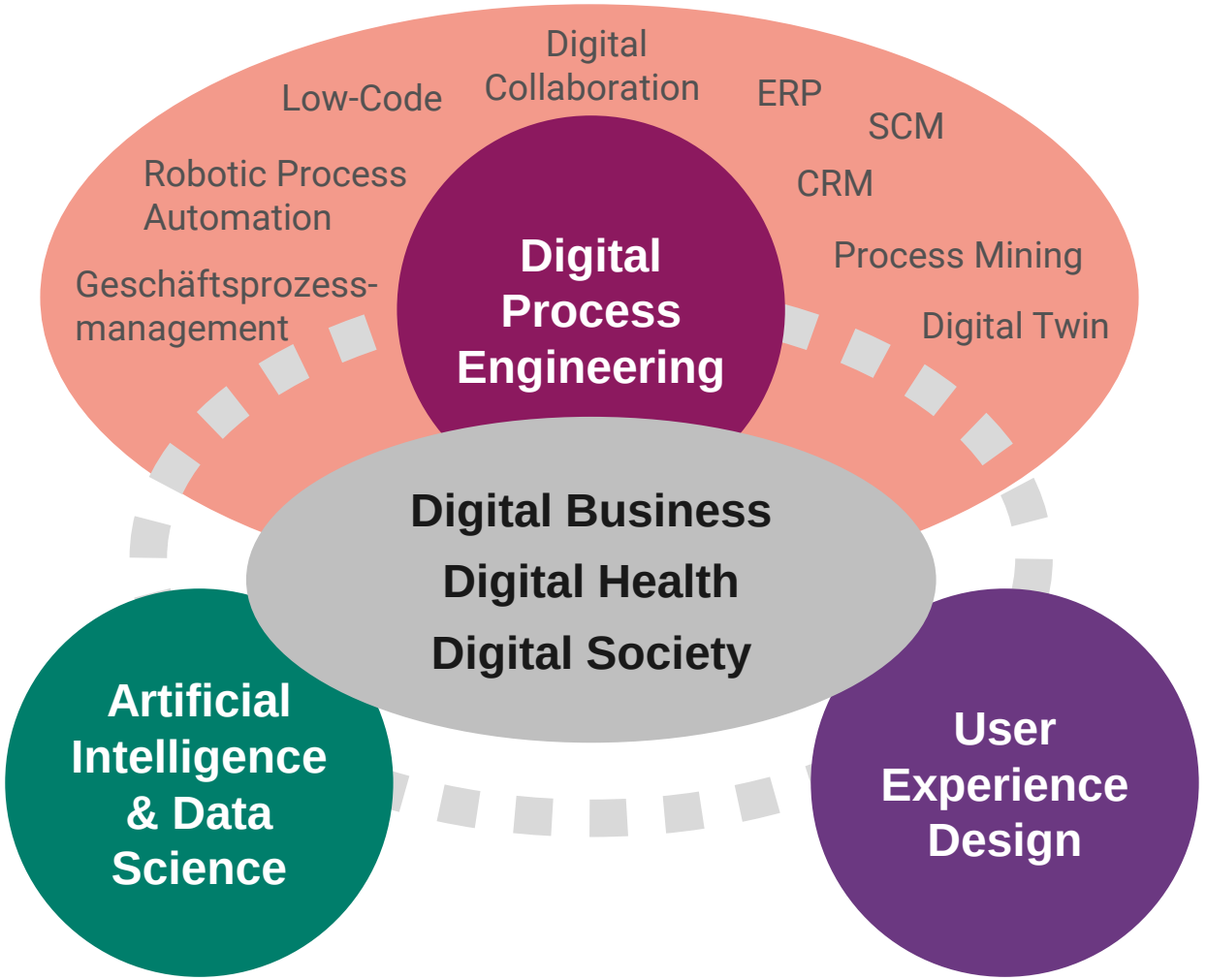
Datenbasierte Visualisierung und Optimierung von Geschäftsprozessen

Process Mining in der Praxis

IT-Puls am 22-06-2023

Wolfgang Groher, Michael Ziegler

Unsere Themenfelder und Kompetenzen



Agenda

1	**Process Mining: Einführung und Überblick**	17:20 – 17:40
2	**Process Mining Technologie:** **Welche Funktionalitäten bietet die Technologie den Anwendern?**	17:40 – 18:20
3	**Process Mining in Action:** **Erfahrungen, Tipps & Tricks aus dem Praxiseinsatz**	18:20 – 19:00
4	**Process Mining:** **State-of-the-art und aktuelle Weiterentwicklungen**	19:00 – 19:15
5	**Fragen - Diskussion - Apéro**	19:15 – 19:45

Wolfgang Groher
OST-IPM

Michael Ziegler
OST-IPM

Vincent Leber
Celonis Schweiz

Khaled El-Wafi
Siemens

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Process Mining - Definition

Der Begriff „Process Mining“ wurde 2001 durch Ton Weijters und Wil van der Aalst *) geprägt:

> "We use the term process mining for the method of distilling a structured process description from a set of real executions."

*) vgl. Weijters, A.J.M.M und van der Aalst, Wil .: Process Mining: Discovering Workflow Models from Event-Based Data (2001)

Möglichkeiten von Process Mining: From Insight to Action to Value

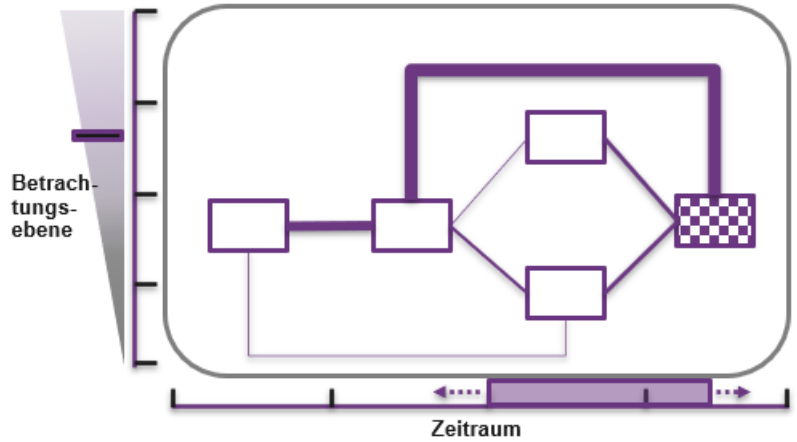
Medizin: Röntgenuntersuchung

Insight: Ursache für gesundheitliche Probleme

Action: Erstellen eines Therapieplans

Value: Nachhaltige Besserung

Unternehmen: Process Mining



Insight: Schwachstellen im Prozess

Action: Erarbeitung von gezielten Optimierungen

Value: Nachhaltige Prozessverbesserung

Process Mining – Anwendungsgebiete

Konformitätsvalidierung

Soll/Ist Modell-Vergleich anhand von Metriken mit dem Ziel, Engpässe zu identifizieren.

Beispiel-Fragestellungen

- Wird mit der neuen Abfüllanlage tatsächlich eine 50% kürzere Durchlaufzeit im Gesamtprozess erreicht?
- Verlieren wir tatsächlich am meisten Zeit bei der Angebotserstellung oder gibt es noch andere Schwachstellen ?

Prozessvorhersage

Der Fokus liegt auf der Vorhersage des Ergebnisses eines Prozesses und adressiert das Eintreffen bestimmter Ereignisse

Beispiel-Fragestellung

- Wird der Auftrag nach einer bestimmten Intervention verspätet an den Kunden ausgeliefert?

  → Anwendungsfall: «early warning» bei Paketdiensten

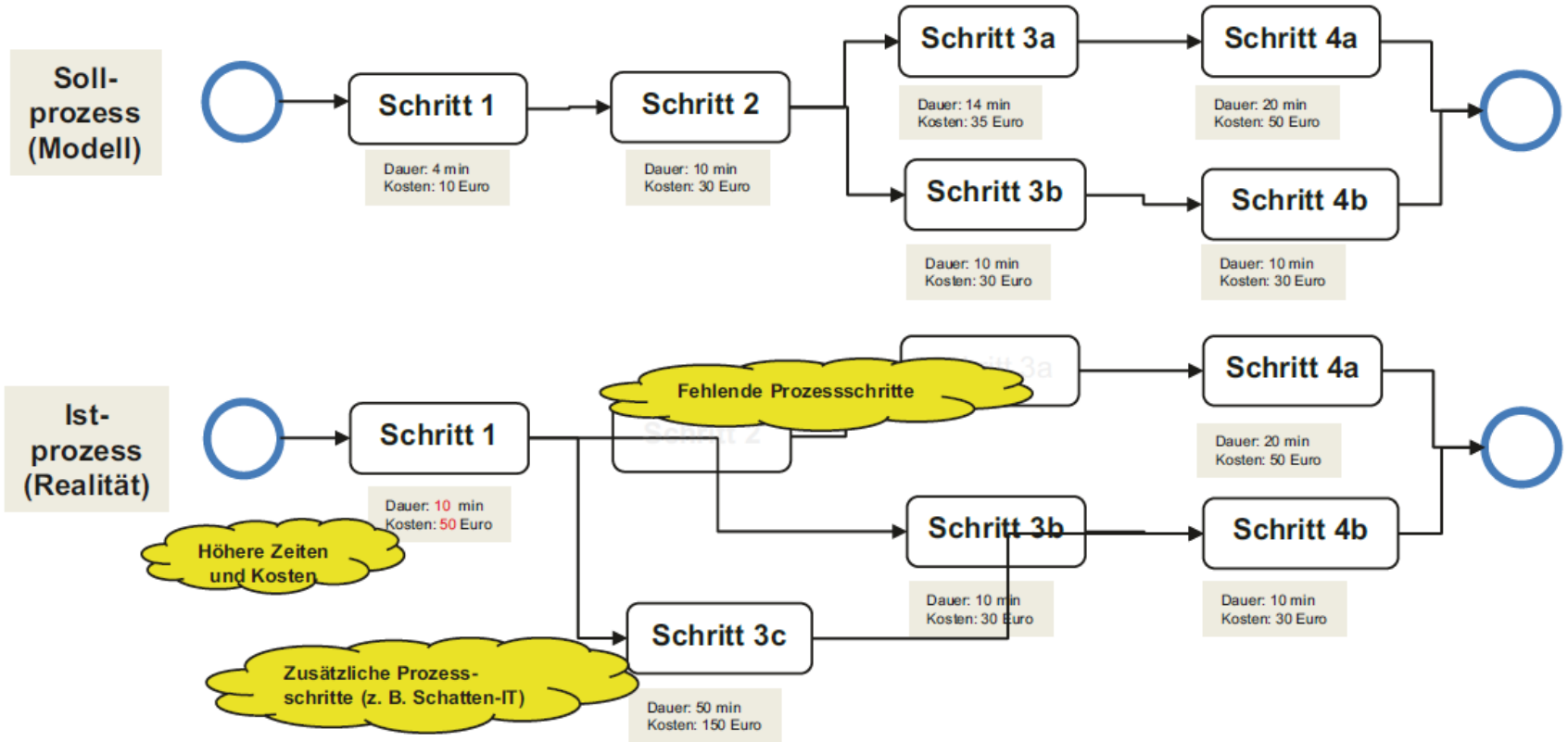
Prozessmodell-Synthese

Aus dem Ereignislog wird ein Modell konstruiert, um die Frage zu beantworten: „Was passiert wirklich?“

Beispiel-Fragestellung

- Sind die Bearbeitungsschritte für jede Produktfamilie tatsächlich unterschiedlich oder gibt es doch Gemeinsamkeiten ?

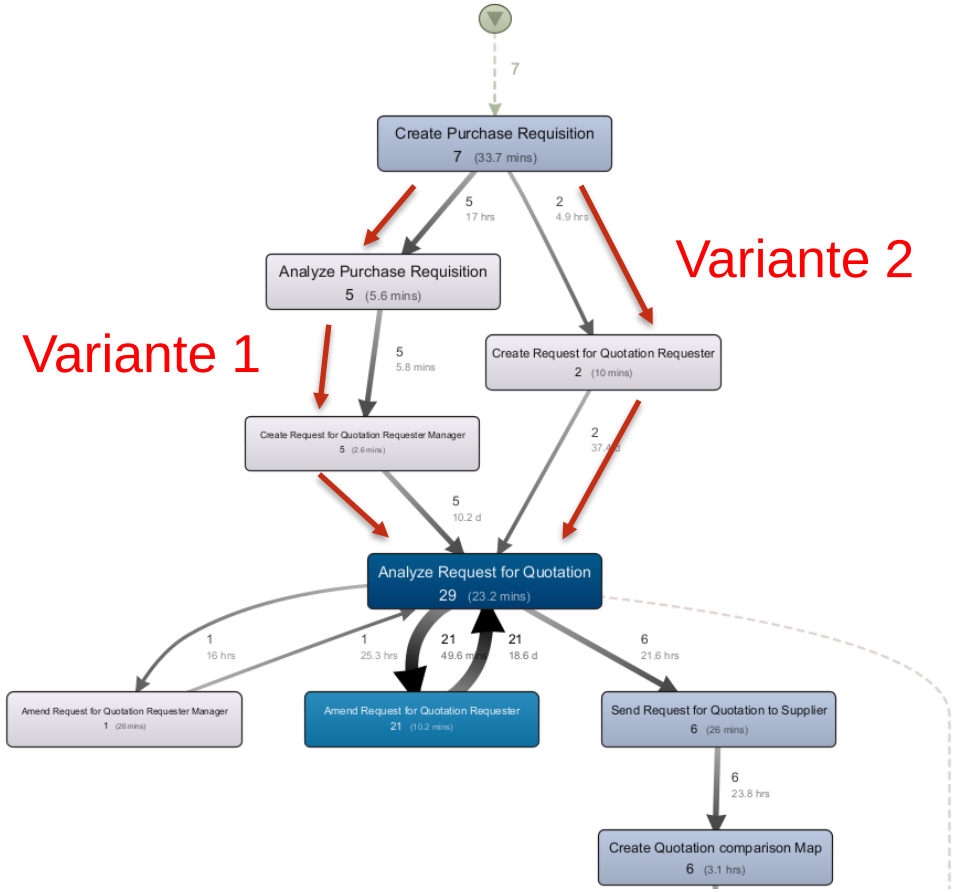
Process Mining - Konformitätsvalidierung



Process Mining ermöglicht den Abgleich, inwieweit der tatsächliche Ist-Prozess mit dem modellierten Soll-Prozess übereinstimmt.

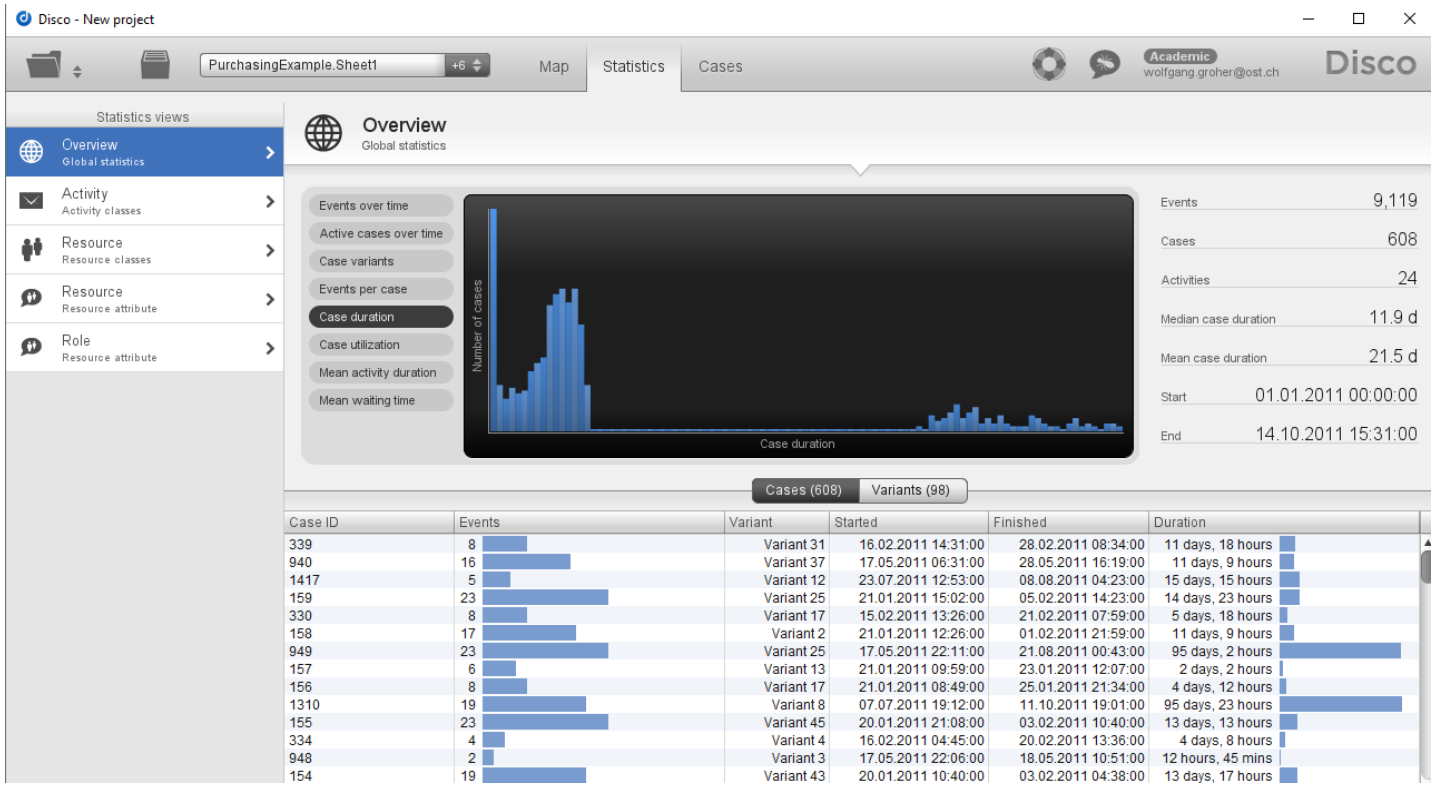
Quelle: Gadatsch 2020, S. 164

Prozess-Ausschnitt analysieren - Analyse-Sichten: (1) Map



- Grafische Darstellung des Prozessablaufs (analog BPMN 2.0): Baum/ Netzwerkstruktur, da es mehrere Alternativen (Prozessvarianten) für den Prozessablauf geben kann
- Die Pfeildicke symbolisiert die Häufigkeit, mit der eine Prozessvariante durchlaufen wird
- Die Farbe symbolisiert die Intensitivität (Häufigkeit), mit der eine Aktivität durchgeführt wird
  (hell = selten; dunkelblau = sehr häufig)
- Rücksprünge/ Schleifen sind direkt erkennbar

Prozess-Ausschnitt analysieren - Analyse-Sichten: (2) Statistics



- Kennzahlen-basierte Analyse, z.B.
  - Dauer eines Prozessdurchlaufs
  - Anzahl der Prozessvarianten
- Statistische Auswertungen nach verschiedenen Sichten
  - Event
  - Ressource
  - Bearbeitende Person
  - …

Prozess-Ausschnitt analysieren - Analyse-Sichten: (3) Animation

- Animierte Darstellung aller Prozessdurchläufe (Cases) über den erfassten Analyse-Zeitraum
- Jeder Case wird durch einen Kreis symbolisiert
- Zeitlich eng aufeinander folgende Cases führen zu einem grösseren Kreis-Durchmesser

Vor- und Nachteile von Process Mining

Vorteile gegenüber klassischer Prozessaufnahme

- Modellierung von implizitem (verborgenem) Prozesswissen
- Bestimmung quantitativer Eigenschaften von Geschäftsaktivitäten, z.B.
  - Warte-, Bearbeitungs-, Übergangszeiten
  - Prozessvarianten und deren Auftretenshäufigkeit
- Identifikation unerwarteter Abhängigkeiten zwischen Aktivitäten, z.B.
  - Unbekannte Rücksprache-/ Freigabeaktivitäten
  - Nacharbeit

Nachteile / Rahmenbedingungen

- Die Erstellung des erforderlichen Ereignislog scheitert teilweise aus Sicherheitsaspekten, wenn die Privatsphäre von Mitarbeitern verletzt werden könnte
  - z.B. Tracking des Nachrichtenflusses
- Fehlende / unvollständige Daten behindern eine Rekonstruktion der Prozesse aus dem Ereignislog
  - z. B. aufgrund von manuellen Tätigkeiten

Eine kleine Auswahl an etablierten Tool-Anbietern

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The Next Generation of Business Performance

Introducing the
Celonis Execution Management System

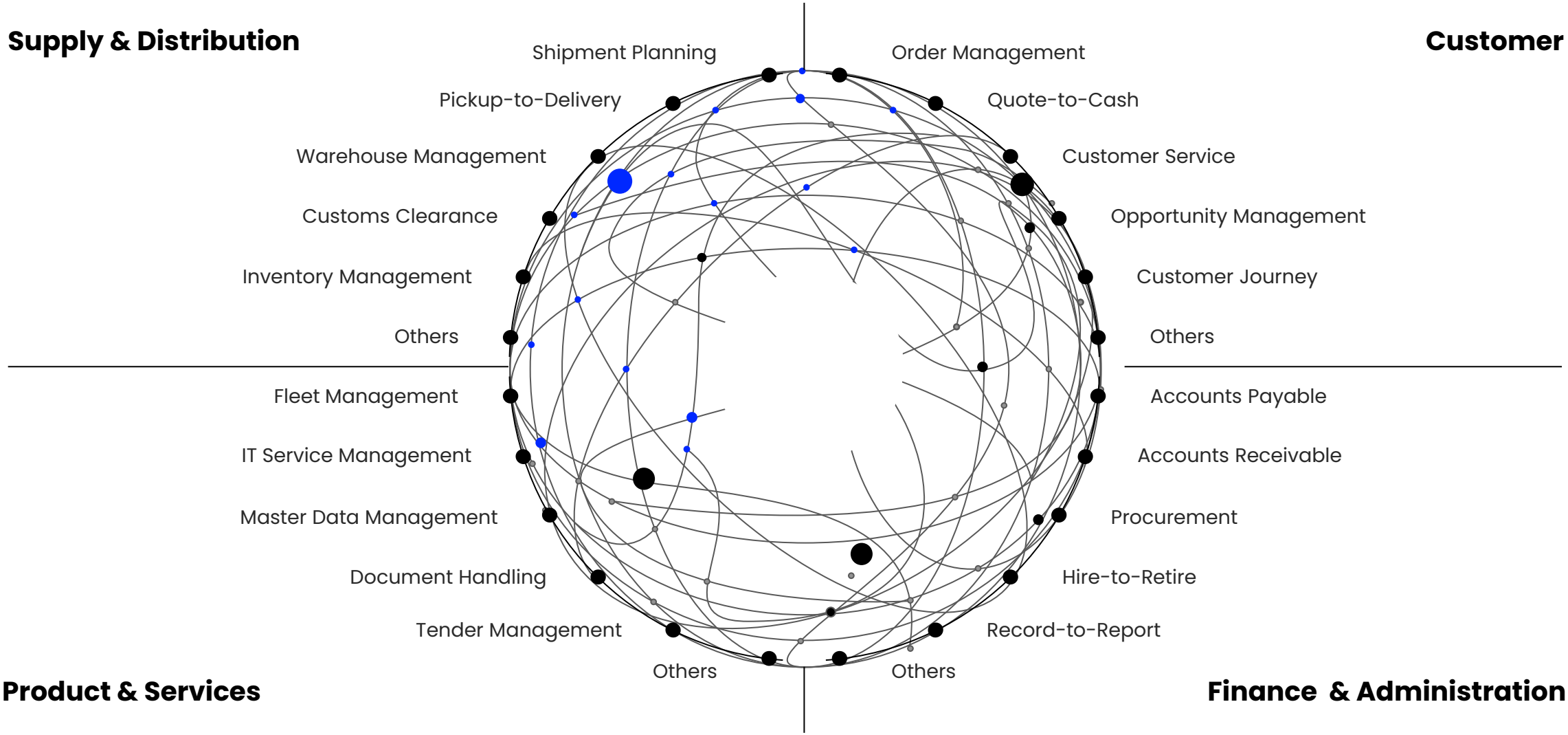
Vincent Leber, VP & Country Lead Switzerland,

June 2023

Agenda

- Intro and Recommended Process Mining Use Cases
- Deeper Dive on Procurement Use Cases
- Celonis High Level Architecture & Customer Examples
- Live Demonstration: Spend Reduction with Contract Compliance
- Implementation & Time to Value

Every business is a collection of interconnected processes



But they don’t always run the way you’d expect

01

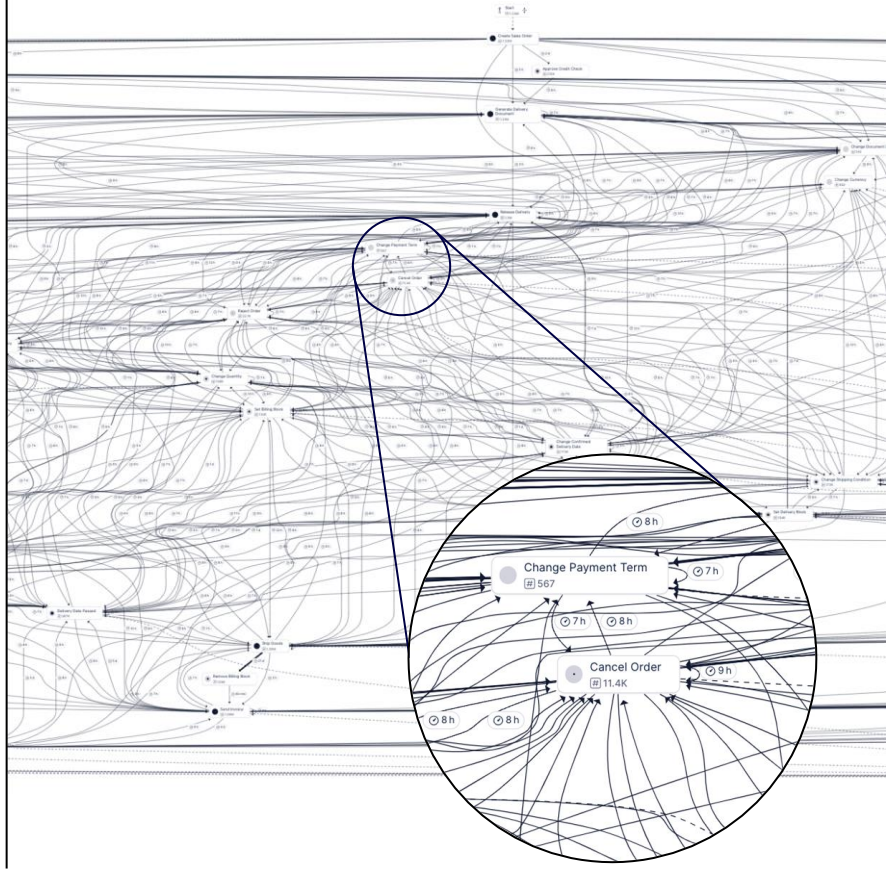
How the process was designed

02

How businesses think the process runs

03

How the process actually runs



20

Value opportunities lie hidden in and across your processes

Supply & Distribution	1 in 5 orders cancelled due to stock-outs	>12 days to confirm customer orders	Outdated safety stock points result in excess inventory
Customer	>10 multi-hop ticket reassignments	Hundreds of fines from SLA breaches	Misclassified tickets leading to delayed resolution
Finance & Administration	Invoices paid twice	Goods shipped but not billed	Contract prices violated in 2 out of 3 orders

… Product, Logistics, Administration, Risk & Compliance, and more

Capturing this value quickly is more critical than ever

Supply & Distribution

- 1 in 5 orders cancelled due to stock-outs
- >12 days to confirm customer orders
- Outdated safety stock points result in excess inventory

Customer

- >10 multi-hop ticket reassignments
- Hundreds of fines from SLA breaches
- Misclassified tickets leading to delayed resolution

Finance & Administration

- Invoices paid twice
- Goods shipped but not billed
- Contract prices violated in 2 out of 3 orders

... Product, Logistics, Administration, Risk & Compliance, and more

SUPPLY CHAIN VOLATILITY
Need for agility

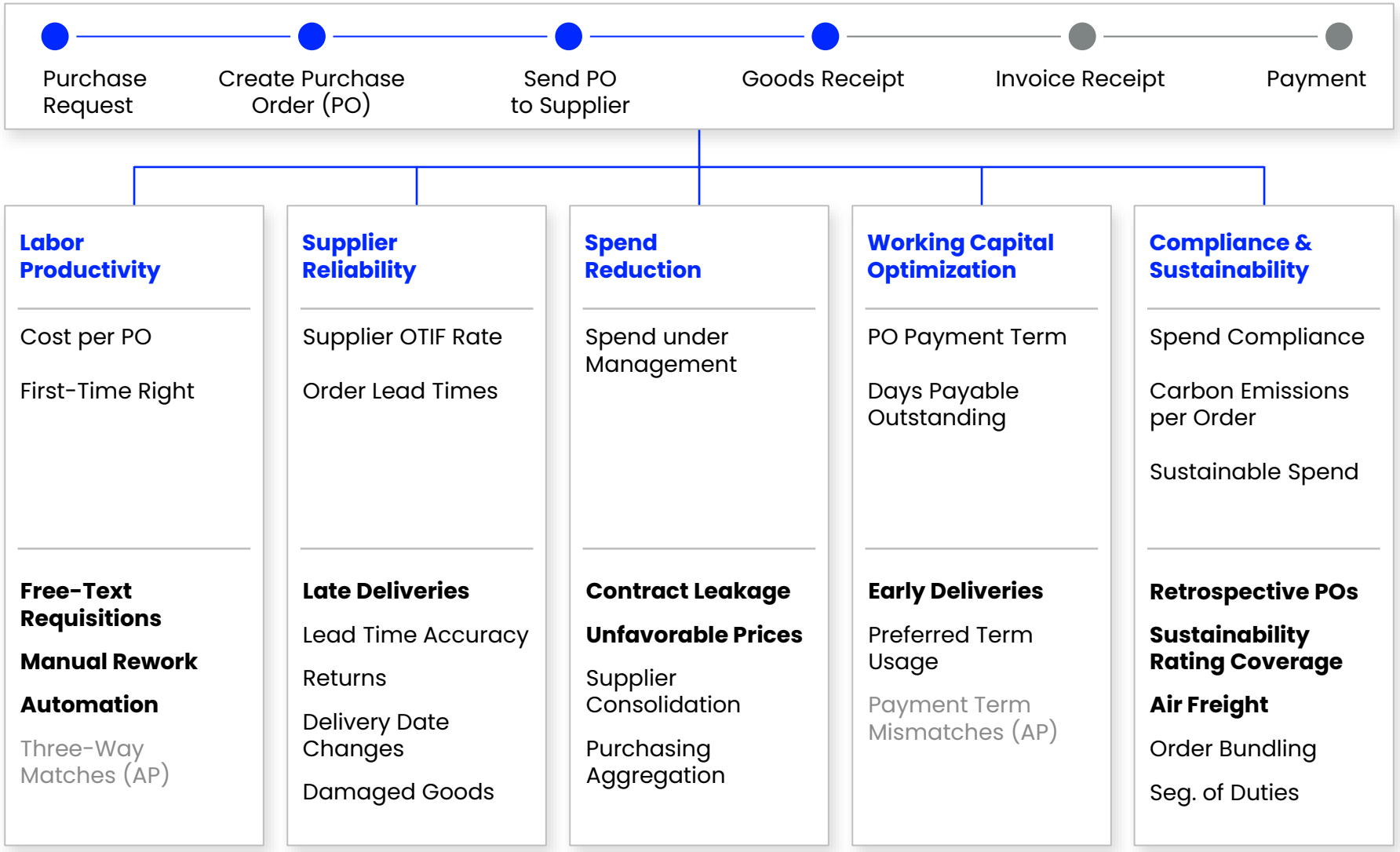
RECESSION
Cost take-out imperative

INFLATION
Pressure for profitability

ECOLOGICAL CRISIS
Drive for ESG accountability

Deeper Dive on Procurement Use Cases

Execution Excellence in Procurement



Success Story Highlights

vodafone

Perfect PO increased from **73% to 96%**

zalando

75% Reduction in Maverick Buying

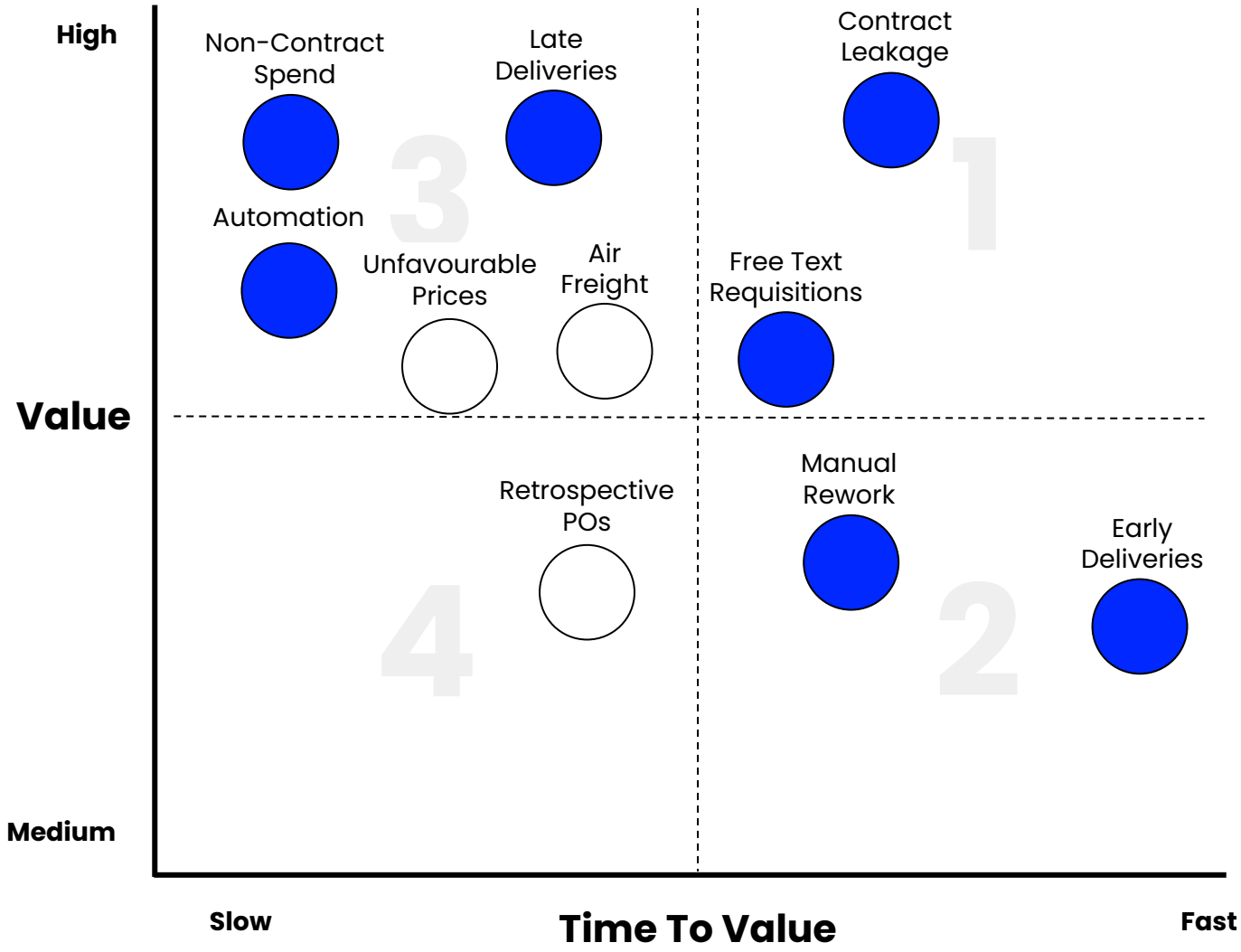
AVNET

Released **$7M** in working capital related to early deliveries

Keurig DrPepper

Improved Supplier OTD from **61% to 79%** in 4 months

Value Journey for Procurement



Recommended Journey

1 – Gold Nuggets
- Contract Leakage
- Free-Text Requisitions

2 – Low-hanging Fruit
- Early Deliveries
- Manual Rework

3 – Big Bets
- Late Deliveries
- Air Freight
- Non-Contract Spend
- Automation
- Unfavourable Prices

4 – Long-term Projects
- Retrospective POs (“Maverick Buying”)

Based on insights from 500+ Procurement implementations

Included in Starter Kit & Business Miner

Additional Green Line Impact

Identified Cash Value in Procurement

Assumptions	# PO Items:	PO Value:	FTE Cost:	FTE Hours:	Holding Cost:
	1.4M/year	$4B/year	$55k/year	1800/year	14%

Objective	Opportunity	Description	Value
Employee Productivity	Manual rework	Rework and changes cause significant manual effort. Resolve root causes such as outdated master data to increase labor productivity.	**$379K**
	Automation	Use a data-driven assessment to identify automation potentials in your process.	**$708K**
	Free-text requisitions	Minimize time spent in manual requisition operations and redirect employees' time to high value-added activities.	**$1.1M**
Spend Reduction	Unfavourable prices	Minimize price increases and ensure that you and your suppliers adhere to prices agreed upon in contracts.	**$1.8M**
	Contract usage	Decrease Procurement spend & ensure high spend under management by a high contract utilization.	**$2M**
Inventory Holding Cost Reduction	Early deliveries	Supply planning requires assumptions around how long it takes to receive product from suppliers, leading to issues in stocking.	**$166K**
Total Annual Impact (P&L)			**$6.2M**
Working Capital Optimization	Early deliveries	Supply planning requires assumptions around how long it takes to receive product from suppliers, leading to issues in payment schedules.	**$1.2M**
	Late deliveries	Reduce imprecise deliveries and reduce your inventory holding costs.	**$2.6M**
Total One-time Impact (FCF)			**$3.8M**
Total Cash Value			**$10M**

Value Calculator

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Celonis High Level Architecture & Customer Examples

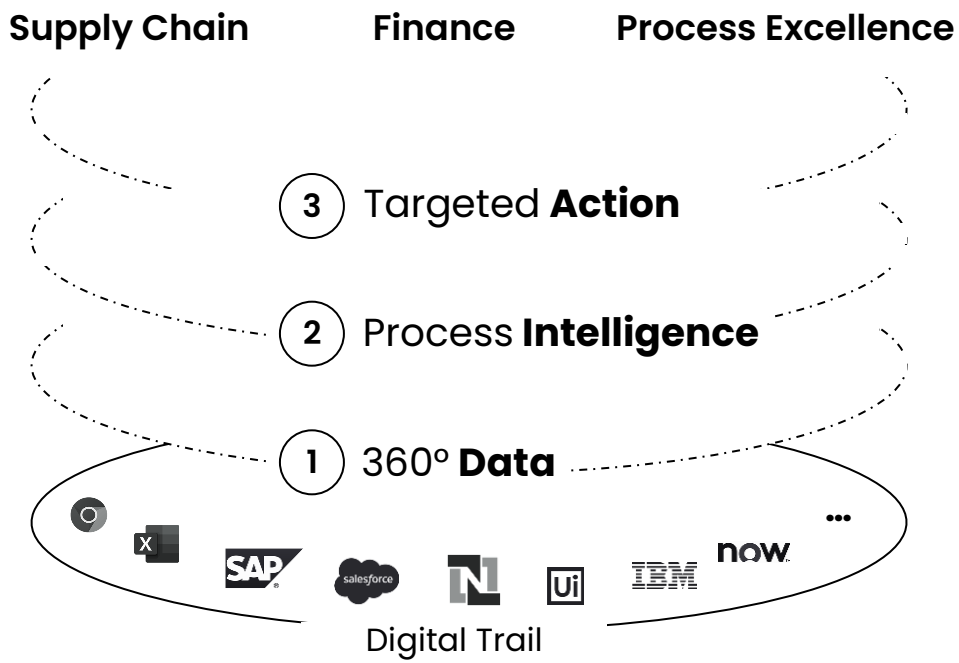
Meet the Celonis Execution Management System
Find and capture business value - fast

Celonis EMS sits on top of your existing systems

1. Integrates your data for a real-time MRI of your processes

2. Automatically reveals improvement opportunities and recommends actions

3. Intelligently orchestrates your teams and technologies to capture value



We’re Celonis.

We help companies find and **capture business value in their processes**, enabling them to perform at levels they never thought possible.

1,350+
Customers

250+
Partners

#1
Ranked by industry analysts*

22
Countries served

2011

From leader in

Process Mining

“Celonis is the clear market leader in Process Mining”

Gartner

2020

To world’s first

Execution Management System

“From a market share perspective, Celonis is dominating”

Gartner

* By Gartner, Everest Group, HFS Research, and NelsonHall

Proven Value and Experience in Switzerland & Globally

#1 Ranked by Industry Analysts*

>3,000 Deployments

Swiss companies

ARYZTA · NOVARTIS · Nestlé · PHILIP MORRIS INTERNATIONAL · HOLY FASHION GROUP · straumann · SULZER · Firmenich · Die Mobiliar · AXA · SWICA · KISTLER · ZURICH · axpo · Adecco · METTLER TOLEDO · swisscom · syngenta

International references

IKEA · BMW · Starbucks · BAYER · Johnson & Johnson · ExxonMobil · SIEMENS · GE · Honeywell · bp · Chevron · DELL · Volkswagen · Schlumberger · Google · Adobe · cisco · Uber · MARS · Carrefour · ADP · citi · vodafone

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ABB

>8%

CO_2e reduction potential identified

ARCHROMA LIFE ENHANCED

>150k

shipments with quantified emissions

Hitachi Energy

$300k

Savings with the help of action flows

GLOBUS

20%

decrease in customer cancellation rate

Roche

> $1M

Reduction in write-off risk

syngenta

78%

On-Time Delivery (OTD) rate established & improving

*By Everest Group, HFS Research, and NelsonHall

32

Siemens Q4 2020: Earning Call

$300M savings target on-track

"The Global Business Services team did an excellent job during the crisis to ensure **stable operations and resilient IT infrastructure** with a high degree of automation. The team is well **on track to reach their efficiency targets** and will further increase measurable impact for their customers through a recently announced **strategic partnership with Process Mining Pioneer, Celonis**."

SIEMENS

Roland Busch,
Siemens Group CEO

BP Q2 2021: Results Presentation

$800M Procurement cost savings

"We (. . .) **are now able to watch procurement flows across the globe with a tool called Celonis**. That sits on top of our SAP system and **finds out where inefficiencies exist in the system** – both bidding inefficiencies and process inefficiencies – and that is dragging cost out materially.

It is quite an amazing thing to be able to do."

bp

Murray Auchincloss
BP CFO

Demo: Spend Reduction with Contract Compliance – Personas Intro

► **Play Demo**

Jane
Executive

Overseeing overall performance

Lisa
Process Analyst

Finds hidden opportunities in the end-to-end process

Robert
Business Lead

Takes action to capture business value

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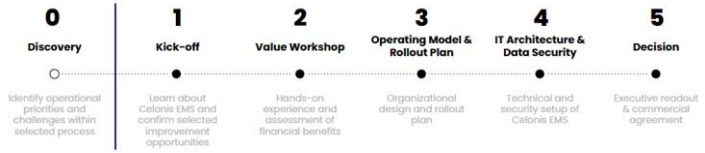
Implementation & Time to Value

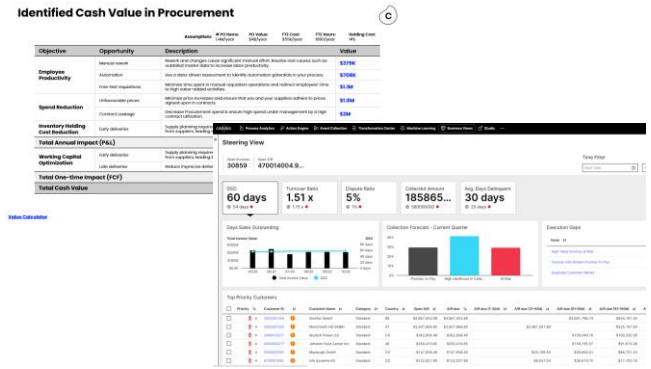
First Step: Discovery & Value Assessment

What it is



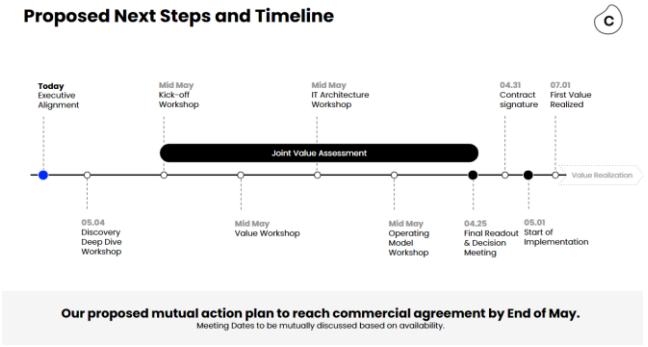
- **5 PDs consulting project** to quantify value Celonis will bring to your company and answer the important questions you have before starting with Celonis EMS
- Efficient series of 5 workshops only that means **minimal effort on your side** and brings you to a **decision in 2-3 weeks**

What you get



- Understand **how you can leverage Celonis** to **solve** your **challenges**, leveraging our experience with 2000+ customers incl. many of your peers
- Deliverables include a **tailored solution design, business case**, **operating model**, **roll-out plan**, **offer** and more - all **customized** to your needs

What's next



- **Assign project owner** in your organization
- Schedule **meetings** with business process experts and relevant **stakeholders** IT stakeholders in your company
- Schedule **date** for **executive read-out**

Example peers in your industry that kickstarted their successful Celonis journey with a value assessment

GraybaR · AmerisourceBergen · RICHEMONT · smith&nephew

Implementation

Project Plan

Recommended: Parallel user enablement via training cloud and on-site trainings

Phase	1 Project Kick-off & requirements definition	2 Set-up connection to source systems	3 Process connection	4 Business analysis & validation	5 Value creation & Action Engine	6 Finalization & handover
Description	• Goals and process definition • Process discovery • Kick-off Workshop • Requirements Workshop	• Set up continuous data extraction from source systems to EMS • Validation of process data	• Data model deployment and validation • Process visualization • Creation of analyses	• Business use case refinement • Business Validation Workshop • Analysis refinement and customization	• Setting-up skills for the Action Engine • Value Realization Workshop • Test and refinement of skills	• Documentation • Technical & business handover • Handover Workshop
Milestones		• Continuous data connection set-up	• Initial process connection • First analyses developed	• Analyses finalized • Process connection and analyses validated	• Action Engine skills set up • Root-causes for inefficiencies identified	• Handover of Celonis implementation to project team
Customer Team	Project Team on [Customer] side process experts	[Customer] IT for set up of servers, RFC module and network settings	[Customer] IT & business experts for validation	Business experts IT only as contact	Business experts IT only as contact	Business experts IT only as contact

Project kick-off
*MD = man day (8 hours)

Connection to source systems set-up

First scope developed

Analyses ready

Go live

Validated results & process documentation

Initial technical implementation

Adoption & impact realization

*Effort estimation for one source system and one EMS store process

<4 months

to payback on investment

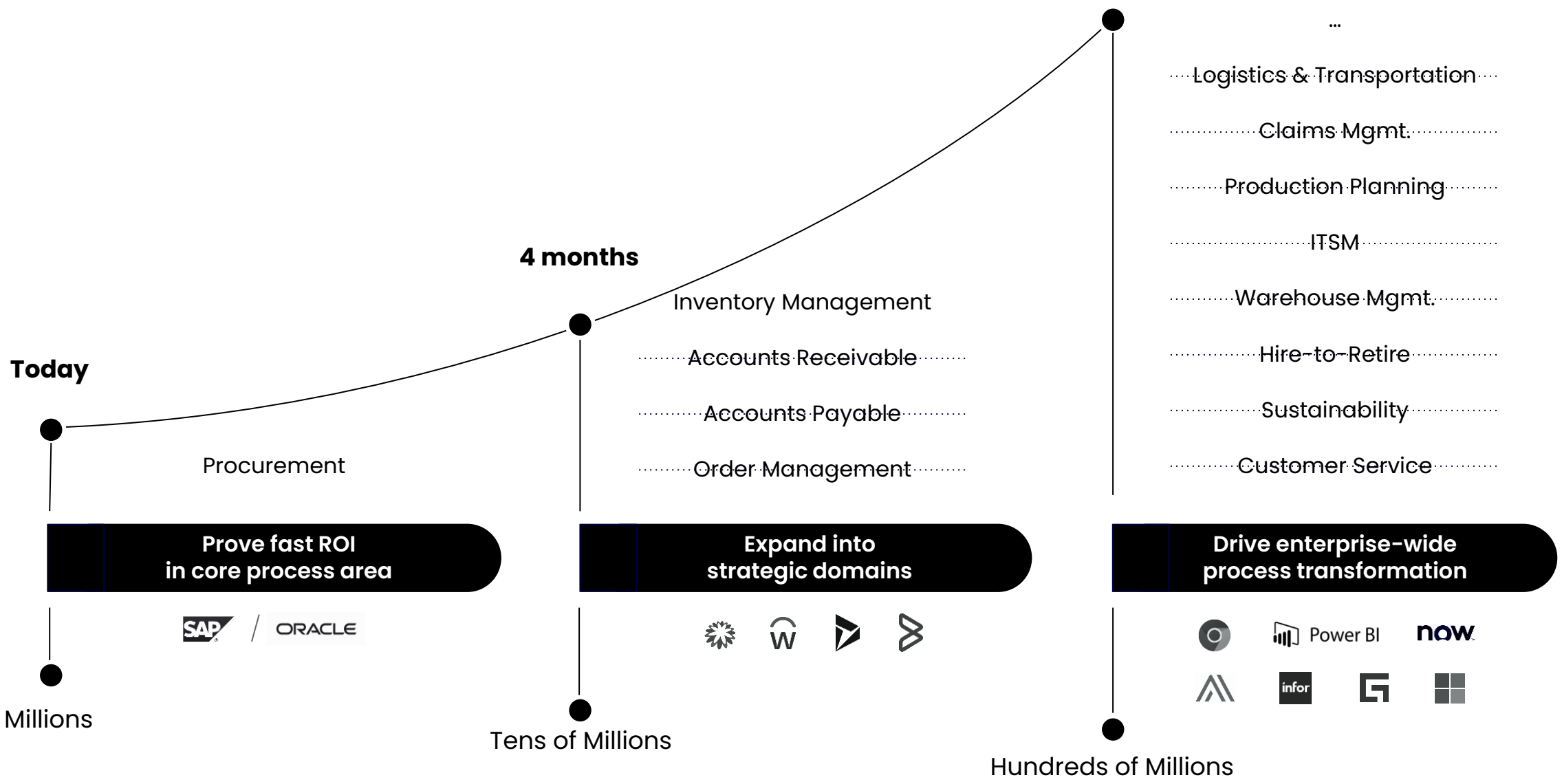
IDC

4 weeks

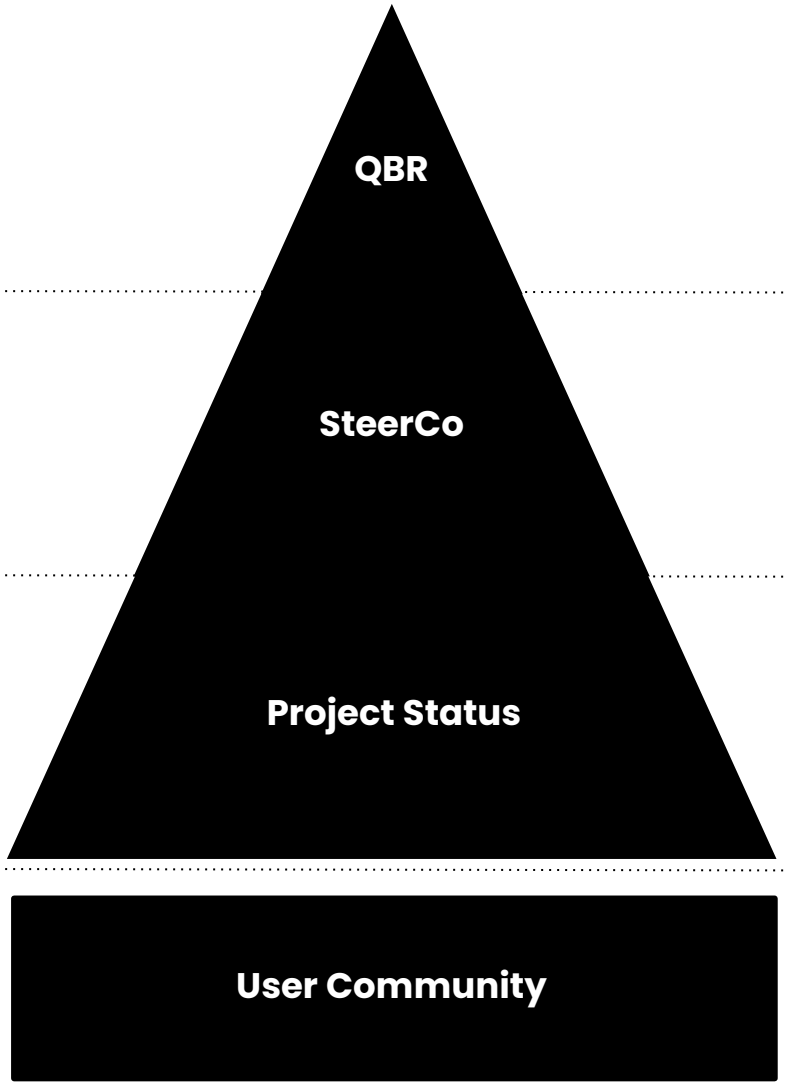
of resource investment

Typical initial investment:
1 x Project Owner – 2 weeks
1 x Process Expert – 2 weeks

Start quickly, scale infinitely

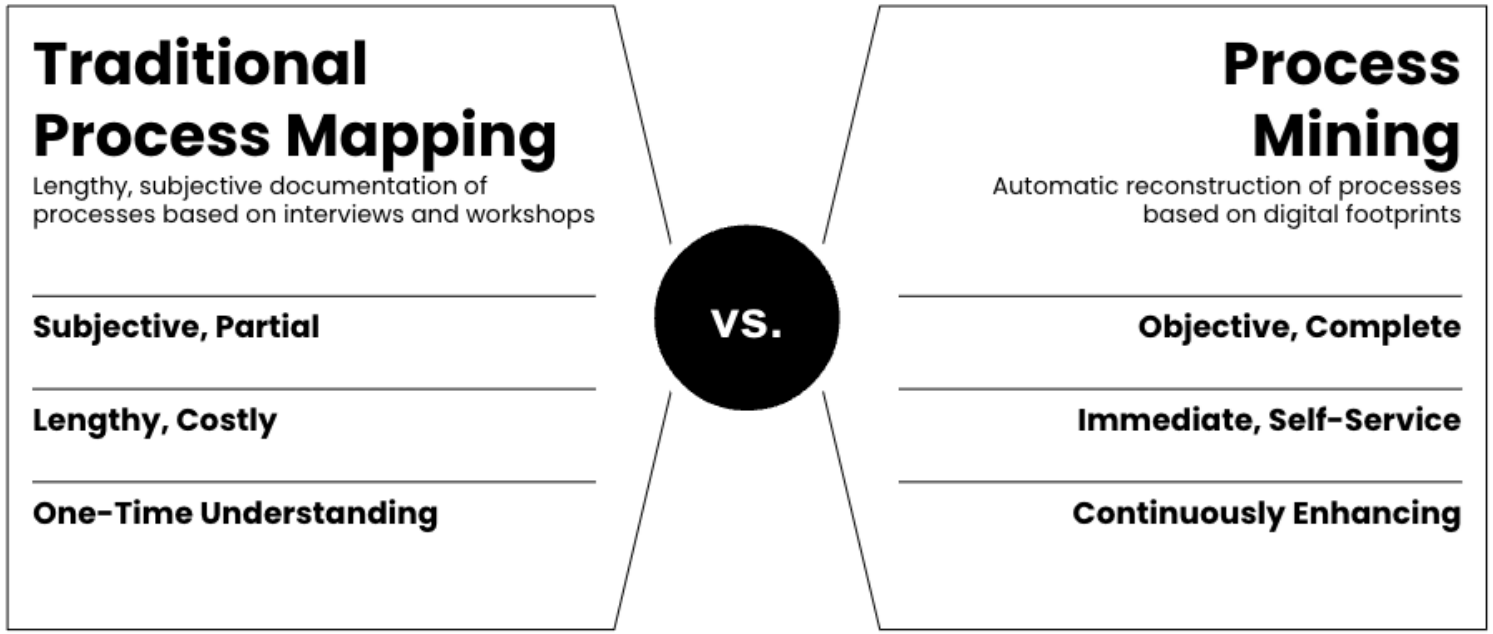


Managed with best-practice governance



	Agenda	Participants	Frequency
QBR	Strategic direction Performance review Value Roadmap	Exec Sponsor Customer Exec Sponsor Celonis GPOs/BPOs	Quarterly
SteerCo	Status per workstream User Adoption Obstacles / Challenges	GPOs/BPOs Value Team Transformation Advisor	Monthly
Project Status	Technical deployment Status per use case Demand Pipeline	Process leader CoE Leader VE	Weekly
User Community	Best Practices Innovation Evangelization	All interested in Celonis	Weekly

Key Takeaways



- Focus on Core Use Cases first - recommendation procurement (or accounts receivable & payable, order management)
- Value and ROI can be achieved in weeks not years
- Celonis offers easy to use tools to discover, analyze and execute on findings

Thank you.

v.leber@celonis.com
www.celonis.com

Working with the most recognizable brands around the world

Technology

Financial Services & Insurance

Life Sciences & Chemicals

Consumer & Retail

Manufacturing

TeleCo & Media

Energy & Utilities

Oil & Gas

Working with industry leaders across verticals

Technology

Financial Services & Insurance

Life Sciences & Chemicals

Consumer & Retail

Manufacturing

TeleCo & Media

Energy & Utilities

Oil & Gas

Reckitt mentions Celonis in 2022 annual report

Process mining and automation of order fulfilment, procurement, manufacturing and e-commerce activities **delivered direct P&L savings and significant improvements in net working capital this year in partnership with process mining company, Celonis.**

Daniel de rooij
SVP Digital Transformation and CIO Hygiene

reckitt

Link to annual report

Here’s how the Celonis EMS works

Celonis Execution Management System

reveal and fix hidden inefficiencies to deliver next generation business performance

Curated **Apps & Experiences**

across the core processes you want to transform and the systems you’re already using

01

360° **Data**

Integrates real-time and streaming data across systems, desktops, and documents

100+ Process Connectors

02

Process **Intelligence**

MRIs processes for inefficiencies and recommends improvements

500+ pre-built Apps

03

Targeted **Action**

Fixes inefficiencies automatically and orchestrates your existing technologies

1,000+ Integrations

Cloud **Platform**

with high reliability, hyperconnectivity, and airtight security

Supported by a thriving ecosystem

250+
Services Partners

100+
Integrations with Tech Partners

800+
Academic institutions

SERVICES PARTNERS

TECHNOLOGY & ISV PARTNERS

ACADEMIC INSTITUTIONS

Why Celonis?

Six reasons why Celonis is a true LEADER

01

Leadership & innovation

Acknowledged market leader, unmatched user recognition, award-winning technology and innovation & thought-leader

02

Execution Management

Pioneer of Execution Management, innovator and only Process Mining technology to combine data, intelligence & action.

03

Apps

350+ pre-built apps that solve key challenges for core processes; 10+ years of Celonis' process knowledge pre-packaged.

04

Depth of industry knowledge & ecosystem

Expertise from 270+ process implementations across >15 industries, and widest network of partners to deliver project success.

05

Enterprise readiness

Only enterprise ready solution to support customers scale in terms of data volumes, system connectivity and scope in a secure platform.

06

Results & time-to-value

Unmatched implementation track record of any process mining vendor. Analyst acknowledged return on investment in <4 months.

"From a market share perspective, Celonis is dominating." — Gartner

Delivering process excellence for 1,350+ enterprises

TATA CONSULTANCY SERVICES, SIEMENS, Deutsche Bank, sysmex, citi, Clientfocus, hp, ABB, MARS, ExxonMobil, splunk>, GE Healthcare, Qualcomm, sdg, Uber, workday., FARMERS INSURANCE, Johnson & Johnson, FARMERS INSURANCE, lyondellbasell, HEXION, Tech Mahindra, IBM, accenture, pwc, Capgemini, Cognizant, WNS, EY, Deloitte., KPMG, genpact, INGRAM MICRO, Infosys, HCL, cisco, AUTODESK., servicenow, NOKIA, wipro, COMCAST

Link to Celonis LEADER Framework

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Siemens Data & AI Services

Process Mining@Siemens

IT Data Analytics DF1
Khaled El-Wafi - Head of Procurement, Logistics & Factory AI Data Cloud
June, 22nd 2023

SIEMENS

Cloud & AI Innovation

Data driven Company

Data Management

Performance & Logic

snowflake

celonis

Celonis Execution Platform

Real Time Data Ingestion	Action Flows	Planning & Simulation

Intelligence & Interaction

User Interface

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Resilience User Story

SIEMENS everstream ANALYTICS

We are permanently accelerating disruptions.

250.000

noticed disruptions in 2022

How does disruptions affecting my Siemens' business networks?

What is going on in the world?
How to make sure not to **miss any relevant news**?

I have to figure out which **suppliers/ customers are affected** by the lockdown!

Oh no, my supplier might be affected! For which **materials** do I have **open orders**?

I need an alternative way to **fulfill my demands!** How can I cover my needs?

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Accelerate E2E Value Chain Impact by digital transforming the everyday.

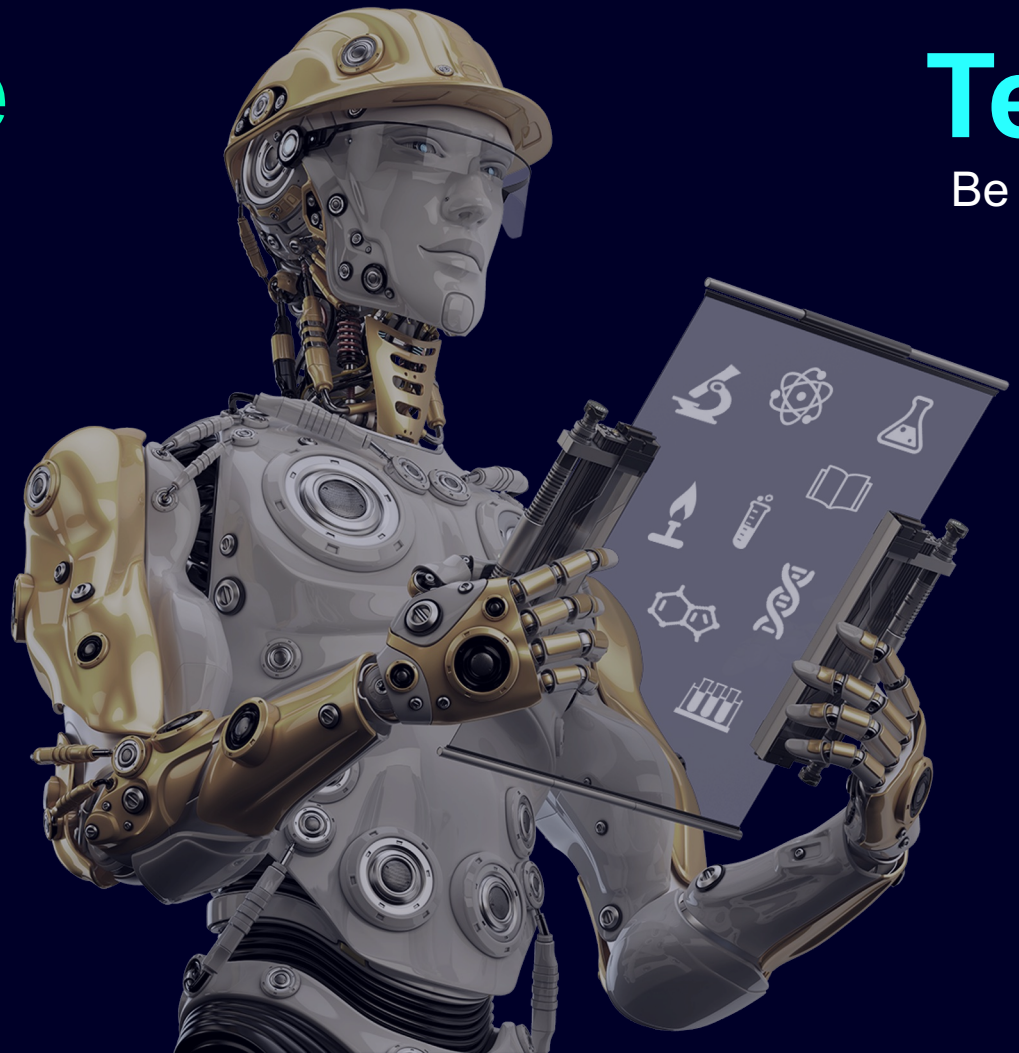
Business jointly *together with IT*

Resilience
Be prepared

Technology
Be innovative

in daily
business decisions

Innovation with
business relevant



Flexibility
Be fast

Purpose
Be customer-centric

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Analytics Lab's core offering can be categorized in (1) Products, (2) Services and (3) Projects

1 AI Products

- **Siemens KPI Forecast**
- **Generative NLP Product**
- **Factual GPT Chatbot Product**
- **Knowledge Extraction from Text & Speech**
- **Search Engine**

2 Services

- **Expert Consulting** (ideation, architecture & use case consulting on project basis and for products, usage of ML best practices)
- **Implementation** (technical development on project basis, scaling of products based on ML best practices)
- **ML Operations for AI Products**

3 Projects

- **Siemens KPI Forecast:** Daily Sales Prediction, CF R NAM Balance Sheet Prediction, Smart Forecast, DI Trade Payables
- **Knowledge Extraction from Text & Speech:** CF R Hemera PDF Extraction, CF F Automated Document Processing, iRAM Ticket Resolution
- **Search Engine:** DI MatSpec, Innoverse Search Engine, Similarity Search 2.0
- **Scoring Engine:** SFS My Dealmaker, SHS Payment Scoring
- **Text Generative A.I. based on GPT**

AI@Scale

ℹ Explore more use cases in the Analytics Lab & AI Hub of the Innoverse

Siemens [Logistics] Data Cloud
future fit & innovation of our BI Dash Apps …

… like our global Apps DIM/DIA App family,
E2E Deliver Monitor, SLPC, CFSC, etc.

Today current Generation

Future AI Cloud modern Evolution

Backend Data Model

SAP HANA

Classical data WH, limited data modelling flexibility, reach performance limit, cost intensive

8-10 hours → 15-30 min

Increase Job Load Performance

Data Modelling Flexibility

snowflake

Graphical cloud storage, endless data modelling flexibility, performance & cost credit system

User Webinterface Frontend

celonis
visualization on prem

6.000 SAG User

only software on market, who handle our ammount of SAG data!

100 Mio. Data
others: max. 20 Mio.

Mass Data Performance

Innovation Features Interaction - next best Action, Write back

Celonis Execution Platform
Real Time Data Ingestion | Action Flows | Planning & Simulation

celonis

Relation network analysis, critical path action drive,
All-in - no media breaks, impressive short loading times

Click – EMS teaser video

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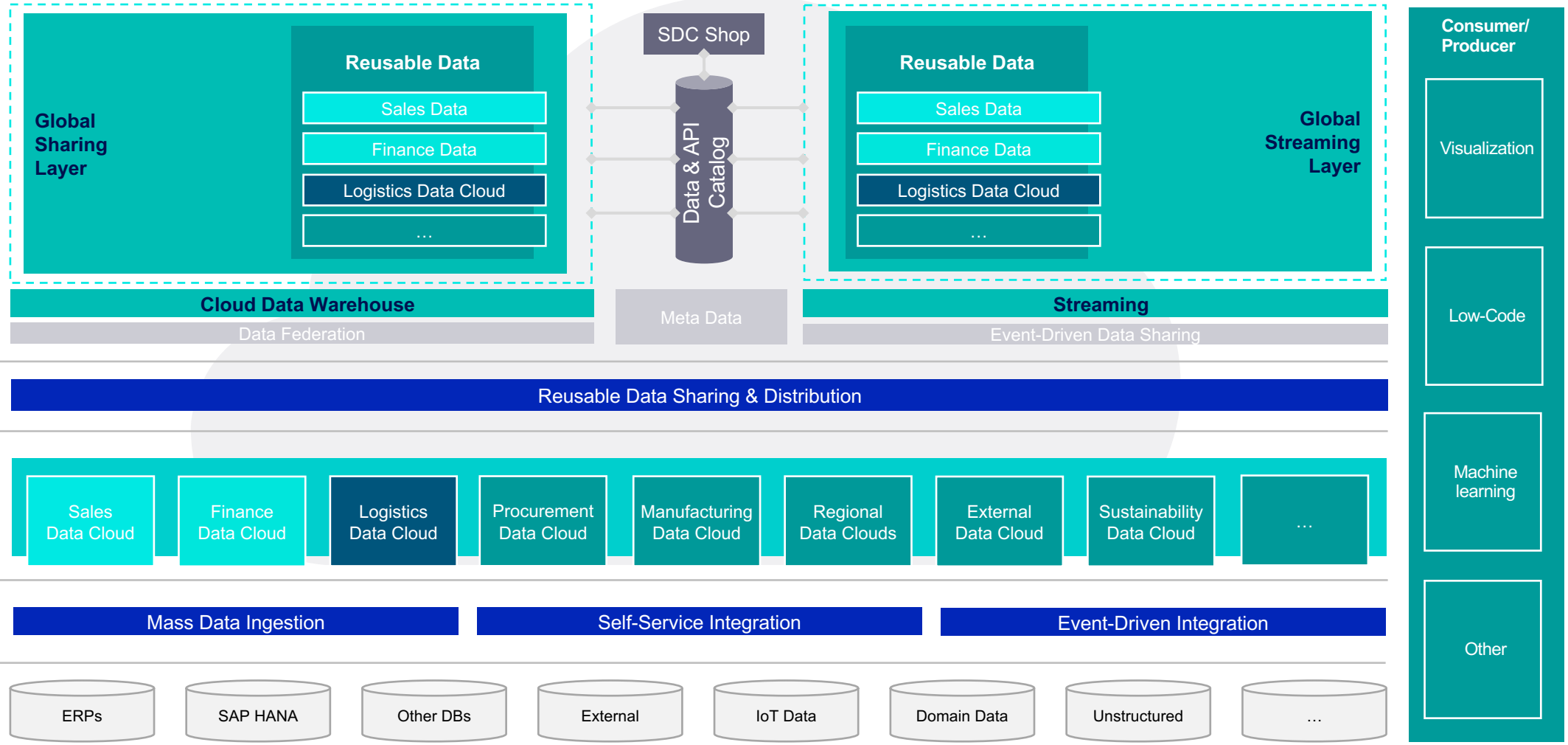
Siemens Data Cloud

The Siemens Data Cloud (SDC) is a cloud-based open data mesh platform ecosystem that allows to curate data products of any kind (BI, AI, ML) and to share those data products seamlessly across the Siemens data universe.



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Siemens Data Cloud
Call for action

Siemens Data Cloud

Current Set-Up

Limited Flexibility
- Limited scalability
- “One crashes all” - no workload isolation leads to frequent stability issues
- Unreliable availability of SAP HANA

Data Usage
- Limited data sharing possibilities
- Redundant development effort
- Limited Ad-hoc reporting
- No streaming possibility
- Performance constraints

AI/ML Time-To-Market
- AI/ML time-to-market not acceptable
- Integration is limited

High costs
- High fix costs
- Low cost transparency & limited consumption based charging

Siemens Data Cloud

Open Architecture
- Cloud Agnostic
- Flexibility & High Availability
- Scalability (Storage & Compute)
- Performance & Stability
- Internal and External Data Sharing
- Self Service Capabilities

New Opportunities
- Data Streaming
- API Management
- AI/ML Integration
- Attracting skilled employees
- Structured/Unstructured Data

Domain Enablement
- Various Integrations Levels
- Global Mesh Elements as SDC core
- Domain Mesh Elements allow flexible solution design

Cost Efficiency
- Cost Transparency & Cost savings
- Efficiency gains
- Consumption based charging

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IT DA Data Architecture – Conceptual Model

Siemens Data Cloud

Source	Ingest	Landing Zone	Staging	Transformation	Data Model	Distribution

Source

- ERP 1
- ERP 2
- ERP 3
- ERP n
- System 1
- System 2
- System n
- MD System 1
- MD System 2

Ingest

- CDC
- Inc. Load
- Full Load

Landing Zone

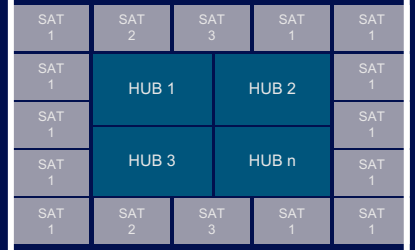
- ERP 1 (T1, T2, T3, Tn)
- ERP 2 (T1, T2, T3, Tn)
- ERP 3 (T1, T2, T3, Tn)
- ERP n (T1, T2, T3, Tn)
- System 1 (T1, T2, T3, Tn)
- System 2 (T1, T2, T3, Tn)
- System n (T1, T2, T3, Tn)
- MD System 1 (T1, T2, T3, Tn)
- MD System 2 (T1, T2, T3, Tn)

Staging

- Domain Procurement
- Purchase Orders
- Purchase Orders Line Items
- Purchase Requisitions
- Domain E2E Deliver Logistics
- Deliveries
- Deliveries Line Items
- Domain Sales
- Sales Items
- Opportunities
- Potentials
- Leads
- Domain Finance
- Copa Data
- Sales Documents
- Sales Document Items
- Account Receivables Data
- PCA Data
- Account Payables Data

Transformation

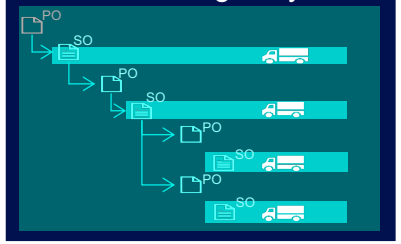
Domain & Global Business Logic



Use Case Business Logic

- Source Agnostic Business Logic
- Source Dependent Business Logic

Common Linkage Layer



Data Model

- Master Data 1
- Master Data 2
- Master Data 3
- Master Data n
- DAsh 1
- DAsh 2
- DAsh 3
- DAsh 4
- DAsh n
- Project 1
- Project 2
- Project n

Distribution

- Connect to Knime, Talend data catalog, Data Shop
- Portfolio Apps data, e.g. DIM, E2E Deliver
- Data Products (DaaS)

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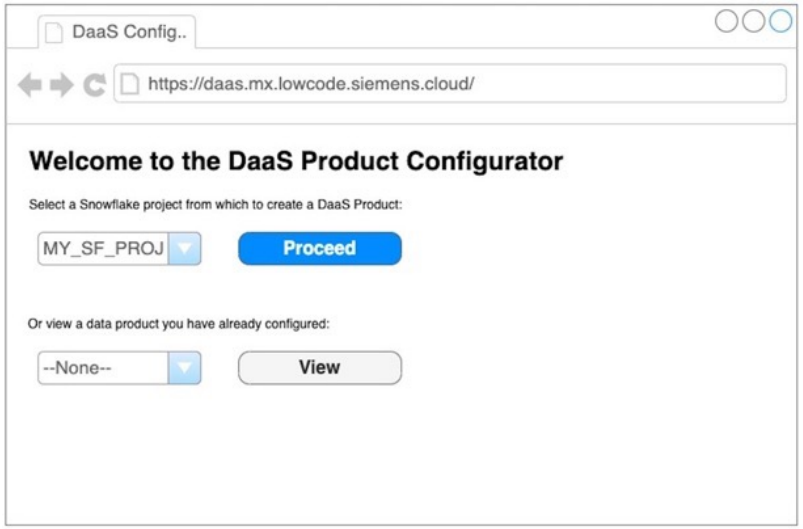


In future Data Products will be offered via the Siemens Data Cloud Data Shop in order to consume Quality Assured Data beyond the Standard Portfolio Dashboards, e.g. P2P

Data Product – P2P – PO Overview

Data Product – DIM – Material Market Place

Data Product – E2E Deliver – Delivery Reliability

Data Product – DIM – Allocation Management

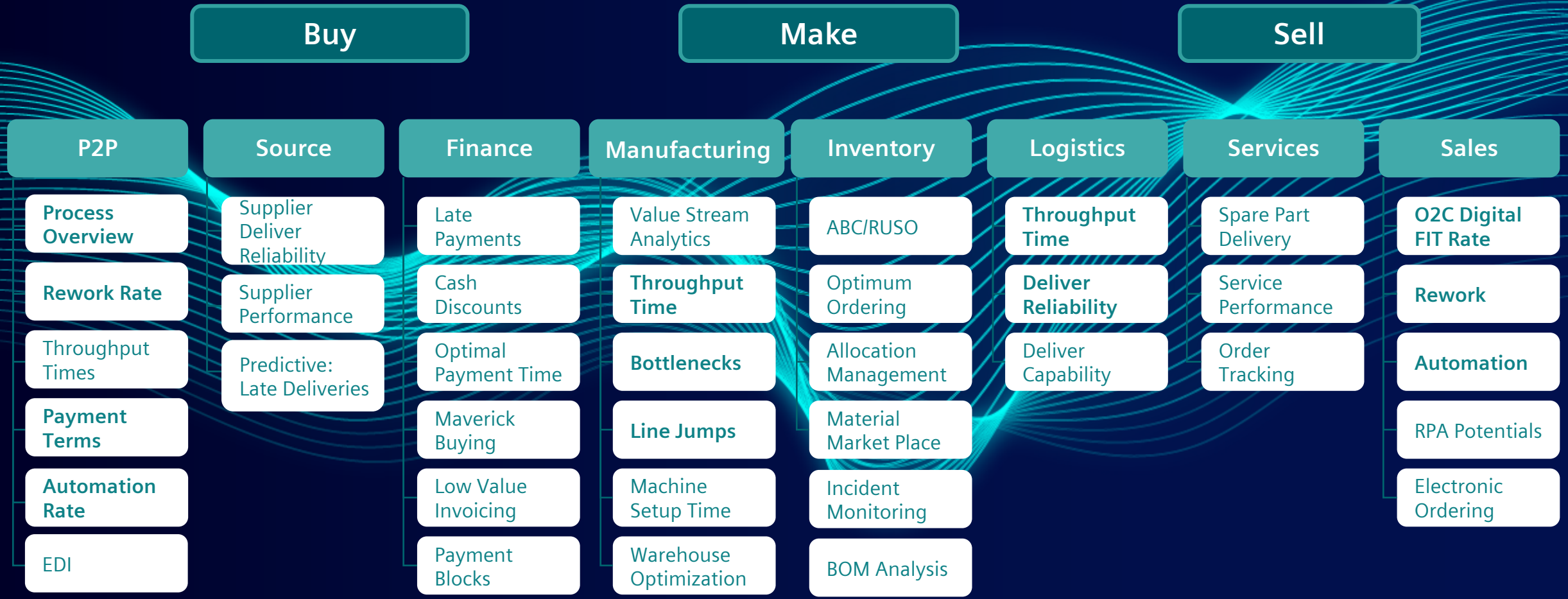
Snowflake – Siemens Data Cloud

Data Products (DaaS)

Siemens Data & AI Services Data Factory 1

Overview on Use Cases for Logistics, Procurement & Factory AI

Siemens Data Cloud



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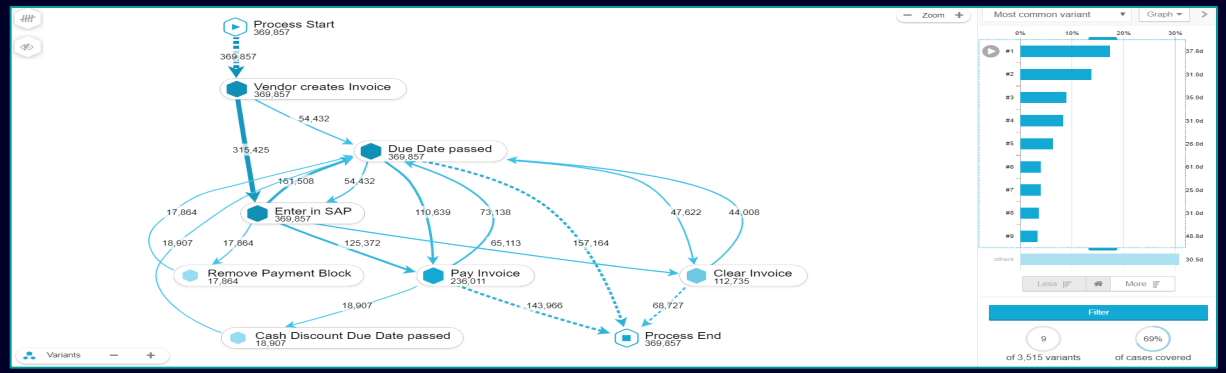
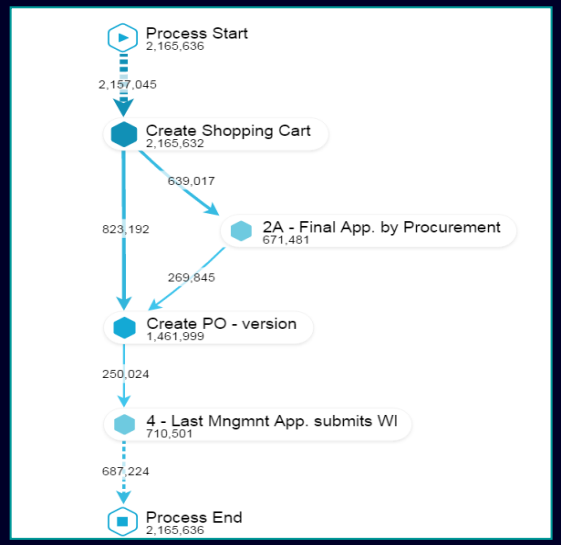
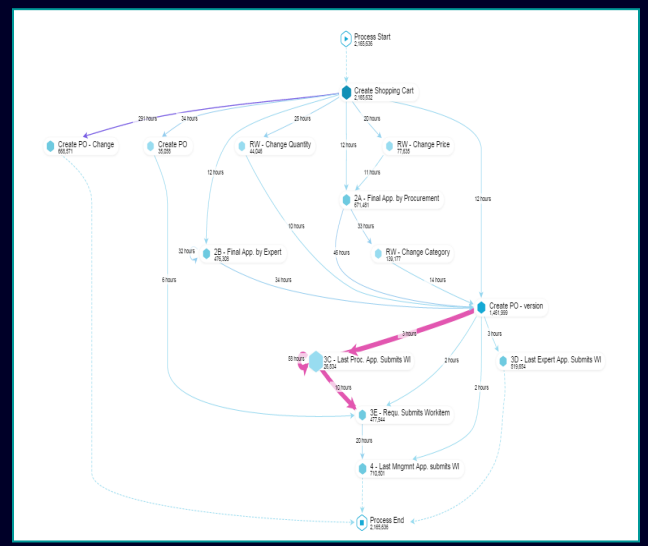
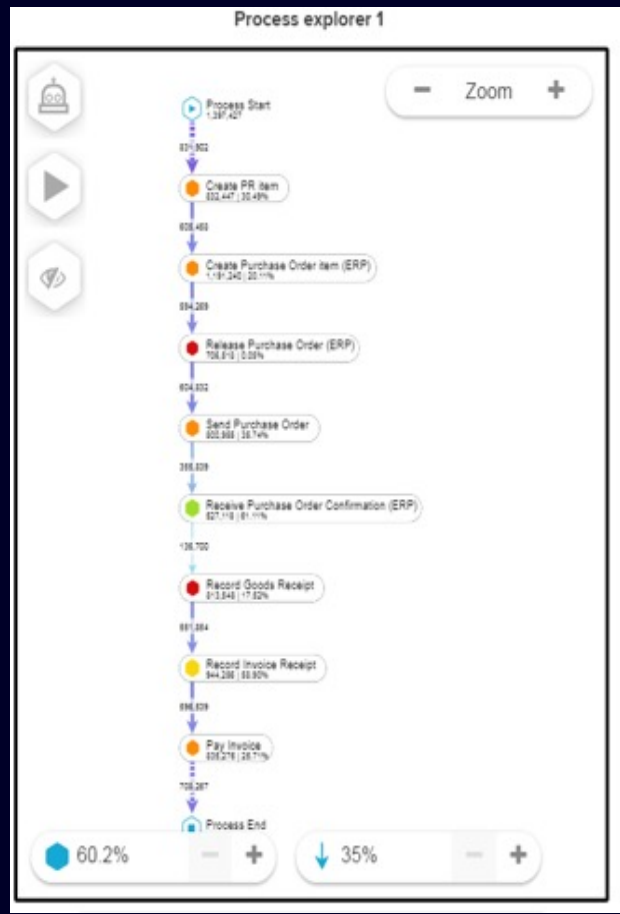
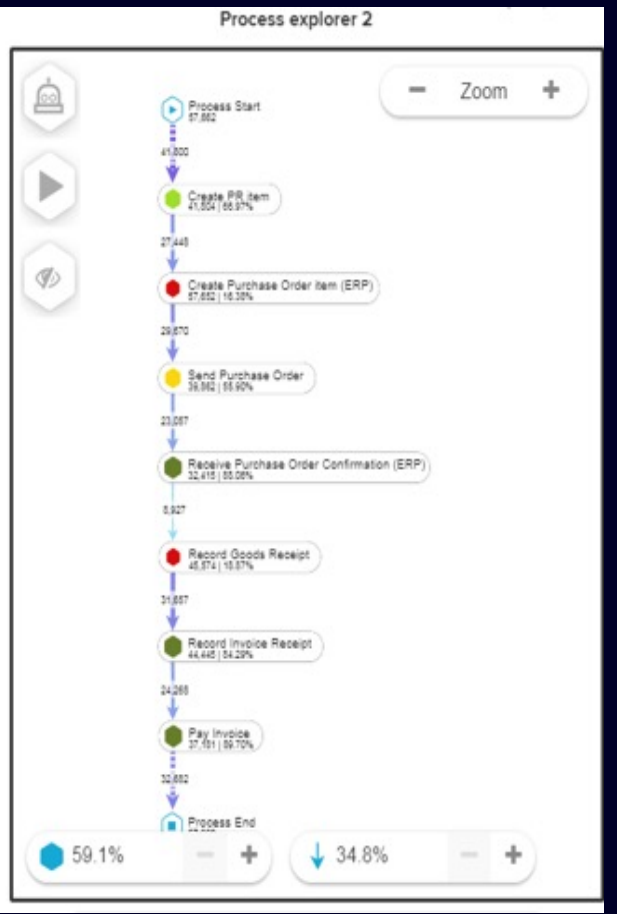
Process Mining & P2P Use Cases: P2P Process Mining has the objective to visualize process flows, identify process weaknesses and support process improvements. It allows to monitor and manage any process in global and complex organizations in an unprecedented form and efficiency











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Process Mining & P2P Use Cases: P2P Process Mining has the objective to visualize process flows, identify process weaknesses and support process improvements. It allows to monitor and manage any process in global and complex organizations in an unprecedented form and efficiency

Purpose:

- **Visualization** of Purchase to Pay (**P2P**) processes based on live data from SAP ERP systems; Time stamps for duration between relevant process steps.
- **Identification** of P2P process weaknesses, e.g., with low degree of automation or multiple approval steps.
- **Support process improvements** with immediate review of process adjustments and interactive remediation.

In a nutshell P2P Process Mining provides the answers to "***How can I increase operational efficiency?***" and "***how can I optimize my working capital by reducing cash out towards external suppliers?***" within the Purchase to Pay process.

P2P Use Cases		Potential Business benefits/savings
Increase operational efficiency	1. Process Overview: Overview of defined activities along the Purchase Order process 2. Rework: Transparency on process inefficiencies and Rework activities	1. Process Overview: i. Apply standard processes for direct and indirect material (manual BANF & manual PO) ii. Visualize P2P process complexities, identify process inefficiencies and support operational improvements 2. Rework: i. Reduce the amount of exceptions and variants ii. Decrease the rework quote and number of approvers per Purchase Order
Reduce Throughput Times	3. Throughput Times: Transparency on the lead times between different events in the P2P lifecycle	3. Throughput Times: i. Decrease average supplier lead time on purchase materials and reduce buffer stocks and inventory in direct and indirect material ii. Increase automation rate for creating purchase requisitions and purchase orders
Optimize Working Capital	4. Payment terms: Transparency on payment terms and payment discount with identification of savings potentials 5. Payment Accuracy: Transparency regarding payment accuracy along common identifiers	4. Payment terms: i. Shift to more favorable payment terms of 60 days net payment ii. Material costs & working capital: Manage payment term to 3% Skonto vs. 60 days payment terms where more lucrative for Siemens 5. Payment Accuracy: i. Identify lost cash discount by supplier and payment terms ii. Identify payments made too late and payment made too early by supplier and volume in €
Increase Digitalization	6. EDI: Transparency on EDI usage, with details per business partner	6. EDI: i. Increase percentage of EDI for already connected suppliers and decrease paper scanning ii. Increase introduction of EDI for further suppliers

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PI Conformance – Purchase to Pay
Rework Activities and potential improvement topics

Example of questions that can be answered using the dashboard for external suppliers by comparing the Overall Rework Performance vs. One Specific Plant:

1. What are the reasons for rework?
2. What is the rework rate by Division, Business Unit and company code/company type?
3. What are the top rework activities?
4. What is the rework rate by Siemens procurement commodity code (ESN)?
5. What type of PO Document type has more rework effort? (Urgent order, Framework order, Scheduling agreement, Standard PO, Contract to service, OneSRM PO)
6. What type of PO has more rework effort? (OneSRM, ERP)
7. What is the material group that has the highest rework rate?
8. What is the rework rate per plant?
9. How much is the price cluster for rework affected cases?
10. What is the amount of rework per rework cause?

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PI Conformance – Purchase to Pay
SCOPE: Key Facts from HANA Data Lake & Celonis Dashboards

Division XYZ

- BU1
- BU2

ERP Systems & Timeline

- OPP, PS1 & POS
- Data from HANA data lake or Snowflake

Plants

- Plants:
  Plant 1, Plant 2, etc.

POs and Invoices

- XXX POs
- XXX PO Items
- XXX active vendors
- PO Volume XXX B€
- XXX Invoices
- XXX B€

Throughput Time

- XX days overall throughput time, which is the time elapsed between the 1st and the very last activity of each case.

Rework rate

- XX,XX% rework rate by activity, which is the percentage of cases (PO items) with rework activities over the total number of activities.

Illustrative figures for methodology purposes only

Paym. terms & Variants

EXTERNAL SUPPLIERS

- 222 different payment terms for Purchase Orders
- XX.XXX process variants
- With XX variants XX% of all cases covered

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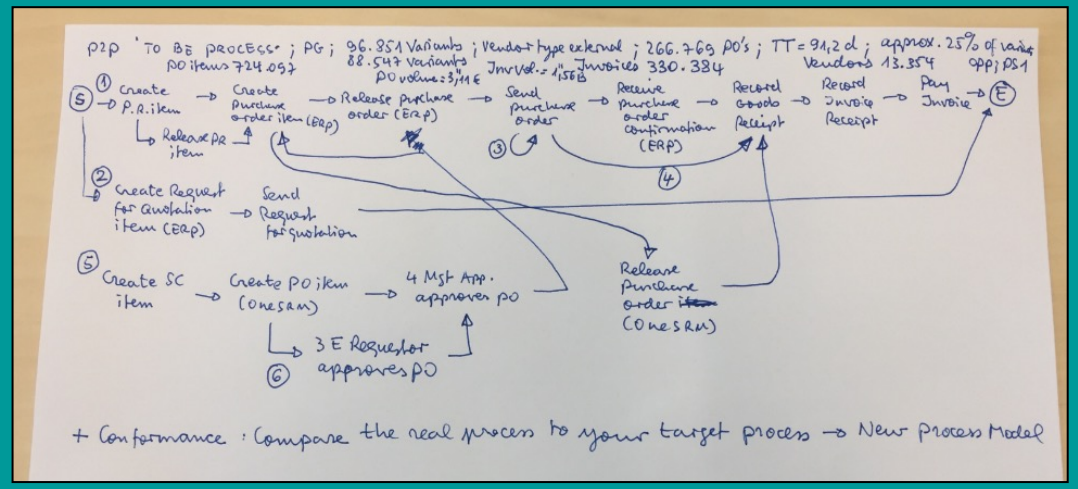
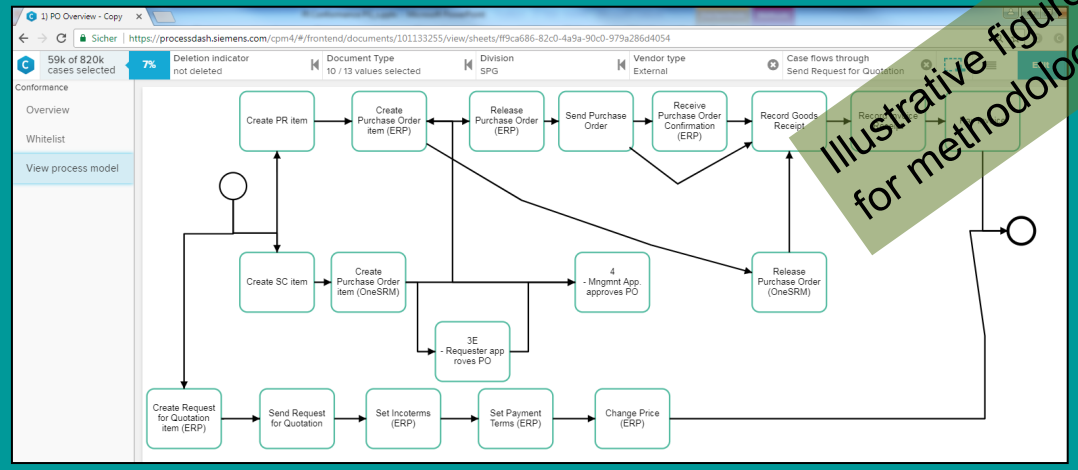
PI Conformance – Purchase to Pay
How to design and integrate the TO-BE process in Celonis





Illustrative figures for methodology purposes only

1. Design of the TO-BE process: It is recommended to **design the TO-BE Purchase to Pay process** in a **workshop** with the representatives and process owners of the respective Division or Business Unit.
2. Transfer the Model into PI Conformance: After writing down the different process steps and **allowed variants of the process on a flip chart**, it is now possible with the help of PI Conformance to take over the different activities and process steps via the drag and drop functionality of the TO-BE process and using the „**Edit Process Model**“. In this particular example, 6 different variants were designed as the TO-BE process.
3. Launch Analysis: As a last step, it is required to push on the „**Launch Analysis button** and the data of the analysis are generated for deeper analysis purposes.

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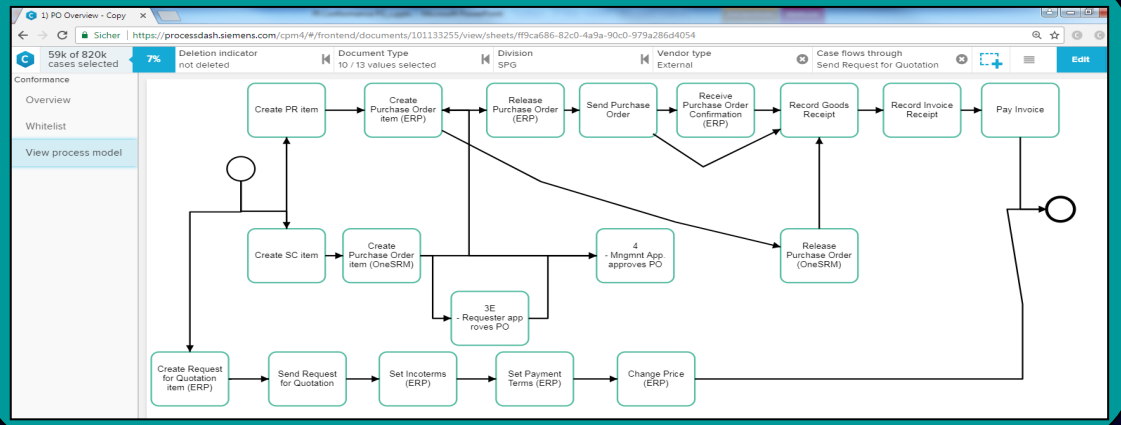
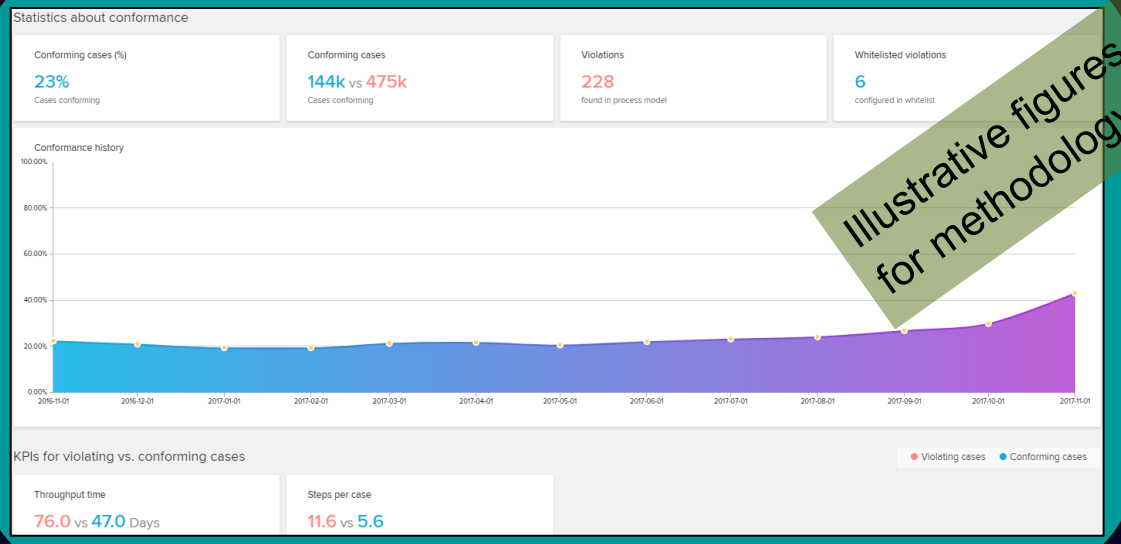
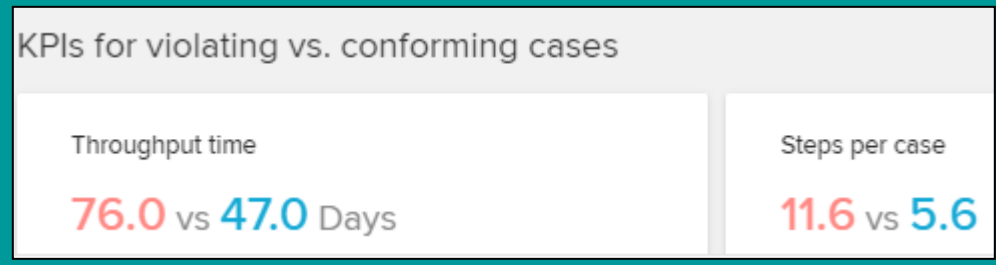
PI Conformance – Purchase to Pay
First results with regards to potential Violations





Illustrative figures for methodology purposes only



Details of the launched P2P analysis:

- XX% percent of all cases are conformant based on the TO-BE process definition
- XXX T cases are conformant and XXX T cases are non conformant
- XXX potential violations of the process have been identified
- Average throughput time is XX days vs. XX days for non conformant cases
- Average amount of steps by case is XX vs. XX steps for non conformant cases

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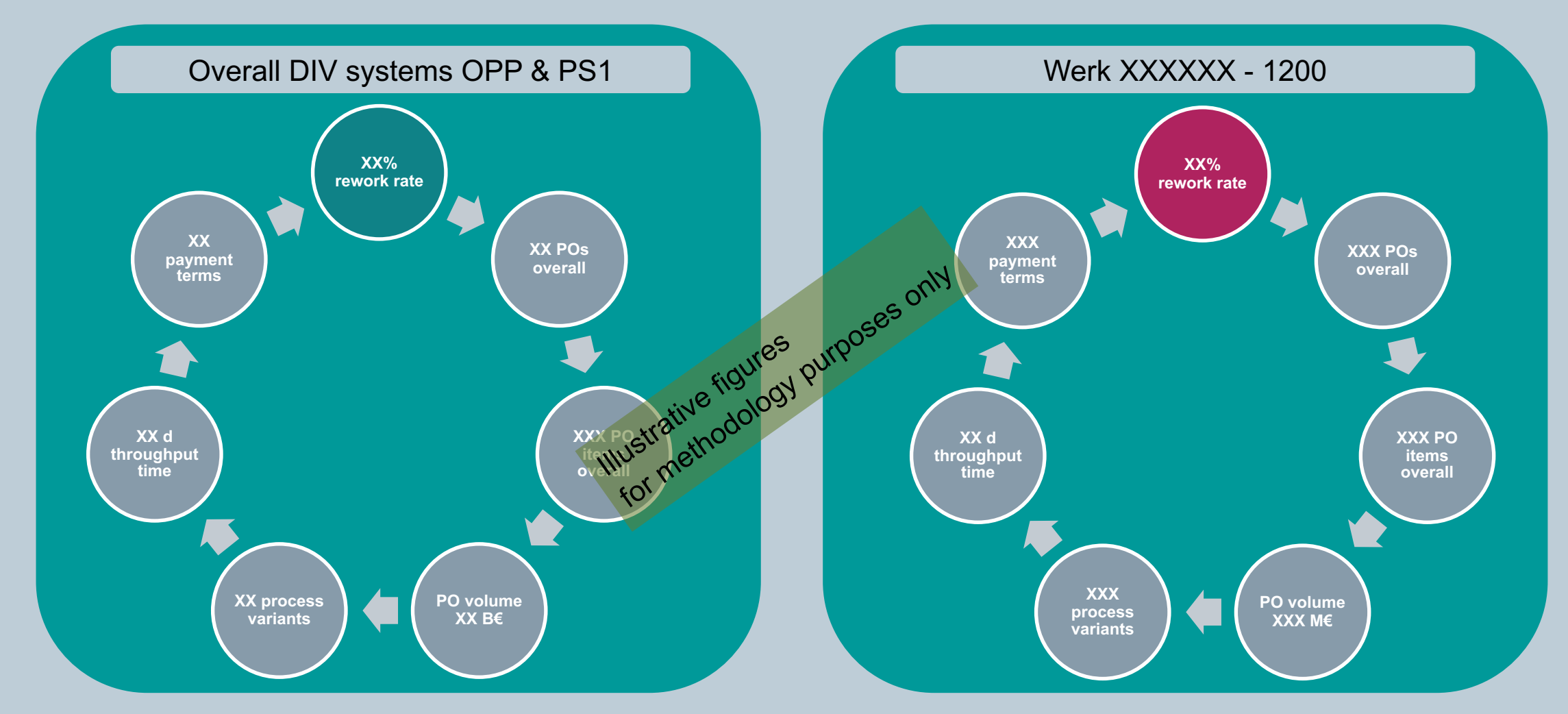
PI Conformance – Purchase to Pay
Focus Area 2: Rework Activities comparison Overall DIV vs Plant



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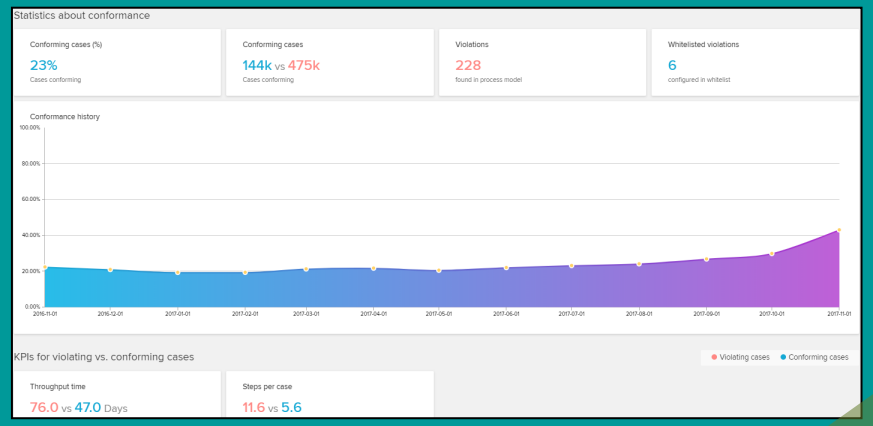
PI Conformance – Purchase to Pay
Rework Activities comparison Overall DIV vs One Plant

Overall DIV systems OPP & PS1



Key figures (starting point based on To-Be process)

XX% Conformance cases
XXXk vs. XXXk conforming cases
XXX types of potential violations
Throughput time XX days vs. XX days
Steps per case 1XX vs. XX

Illustrative figures for methodology purposes only

Werk XXXXXX - XXXX

Key figures (starting point based on To-Be process)

XX% Conformance cases
XXk vs. XXXk conforming cases
XXX types of potential violations
Throughput time XX d vs. XX days
Steps per case XX vs. XX

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PI Conformance – Purchase to Pay
Rework PI Conformance – Deep Dive in potential violations

No 2: Send PO (ERP) ➔ Change Price (ERP) – 9% of all cases, which takes 29 days longer

Plant 1200 – Possible improvement measure to reduce the rework rate by 30%

No	Rework activity	Hourly rate [€]	Avg time per activity [h]	# of Activities	30% improvement (Assumption)	Potential operational improvement [€]
1	Change Price (ERP)	XX	0,2	31.912	XX	XX
2	Change Quantity (ERP)	XX	XX	XX	XX	XX
3	Change ESN (ERP)	XX	XX	XX	XX	XX
SUM						

Illustrative figures for methodology purposes only

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Process DAsh Offering
EWM Reporting – Outbound delivery

Waren-eingang

Auslieferungs-position

Wellenfreigabe

Warenausgang Auslieferungsposition

Produktionsauftrag Fertigungsbereich

Lagerauftrags-erstellung

Lager-auftragstart

Lagerauftrags-quittierung

Lageraufgabestart

Entnah-me Lager

Bereit-stellung Kommi

Kommis-sionierung

Kommi Stich

Bereitstellung Transport

Abliefe-rung Ziel BHF

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Beispiel für ein Steckbrief Steckbrief für die Datenmodellierung

Project Use Cases and Activities								
Technical contact:		<your name>						
Entity for Activities		<your system>						
No	**Activity**	**Source**	**Table name**	**Table field (Timestamp)**	**Value -Optional**	**Example Table**	**Example Table field**	**Example Value**
Customizing SAP Messages								
What are the relevant customizing settings in your system for Purchase Order Messages?								
1	Ord.confirm.reminder	SAP MM				NAST	NACHART (Message Type)	YHRE for Oder confirmation Reminder
2	Send PO	SAP MM				NAST	NACHART (Message Type)	YHRE for Oder confirmation Reminder
3	Send Warning	SAP MM				NAST	NACHART (Message Type)	YHRE for Oder confirmation Reminder
4	Other relevant messages?	SAP MM				NAST	NACHART (Message Type)	??
Customizing SAP PO Approvals								
What transitions of values mean the approval of a PO and PR in your system?								
5	Approve PO	SAP MM				EKKO	FRGKZ	Value (", 'X') to (2, A)
6	Approve PR	SAP MM				EBAN	FRGKZ	Value (", 'X') to (2, A)
7	Remove PO Approval	SAP MM				EKKO	FRGKZ	Value (", 'X') to (2, A)
8	Remove PR approval	SAP MM				EBAN	FRGKZ	Value (", 'X') to (2, A)
Purchase Requisitions								
How does the Purchase Requisition release take place? Is there any external workflow system or is it done in SAP? If it is done								
9	Approve PR	SAP MM				EBAN	FRGKZ	Value (", 'X') to (2, A)
Purchase Orders								
How does the Purchase Order release take place? Is there any external workflow system? If it is done externally, how is it								
10	Approve PO	SAP MM				EKKO	FRGKZ	Value (", 'X') to (2, A)
Vendor type								
How can we determine if a vendor is internal or external? Can we use the accounting group (LFA1-KTOKK) as mapping field?								
11	Vendor types	SAP MM				LFA1	KTOKK	
Direct/indirect material and division mapping								
How can we make the separation between direct and indirect materials?								
12	Direct/indirect material	SAP MM				EKKN	PRCTR	
13	Direct/indirect material	SAP MM				EKKO	EKORG	
Payments of invoices								
Which posting keys (BSEG-BSCHL) and/or document types (BKPF-BSART) should be considered as invoices for this system?								
14	Posting keys	SAP FI				BSEG	BSCHL	
15	Document types	SAP MM				BKPF	BSART	
16	Profit center	SAP FI				BSEG	BSCHL	
17	purchasing group	SAP MM				BKPF	BSART	
Customizing Oder Confirmations								
Do you record Order Confirmations and what are the relevant fields?								
18	Order confirmation received	SAP MM				EKES	EBTYP	AB

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Process DAsh Offering – Warehouse Management
EWM Reporting – Outbound delivery for PD/PA Karlsruhe / DE

Lageraufgaben-erstellung

Lageraufgabenstart

Entnahme Lager

Bereitstellung Kommi

Kommissionierung

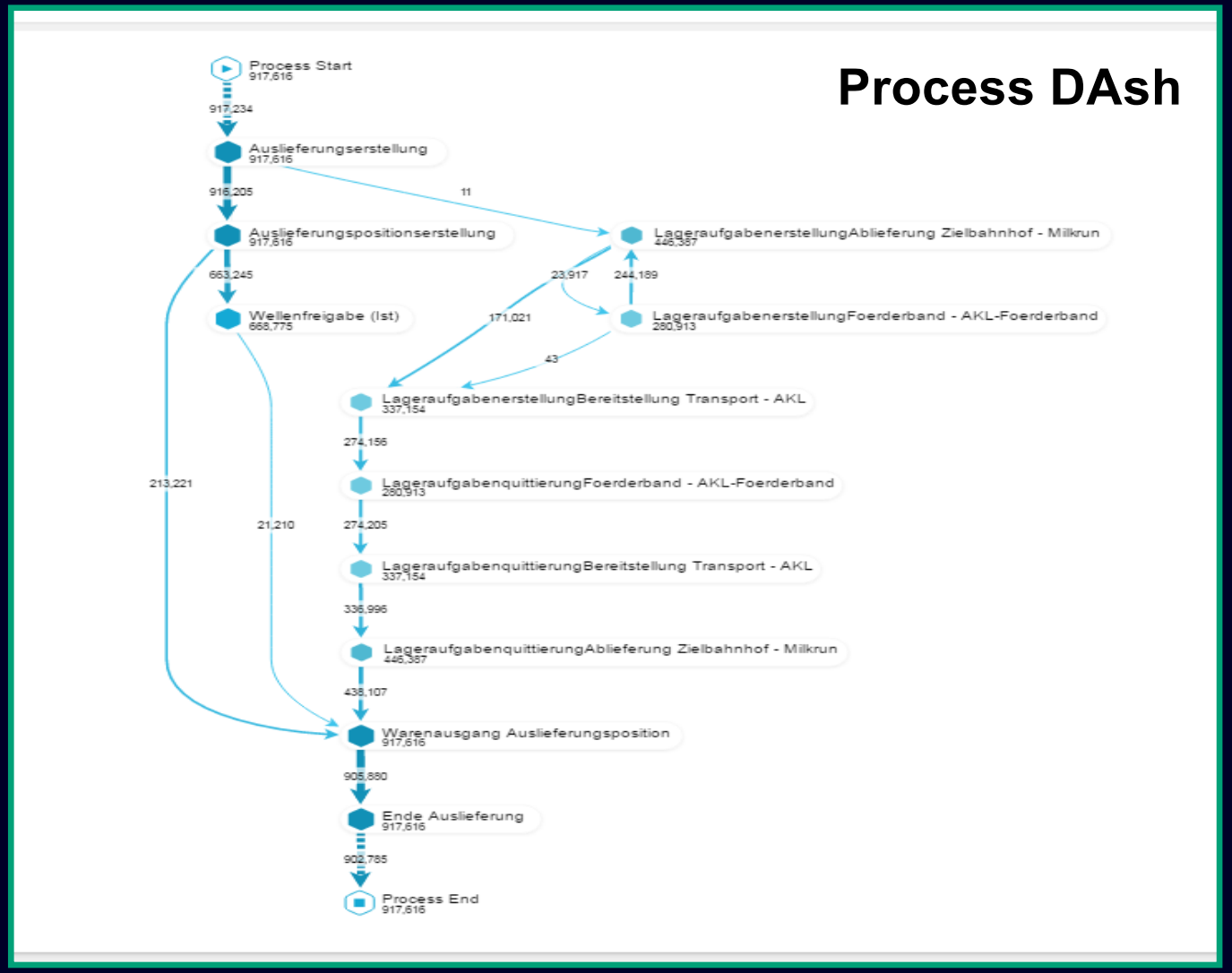
Kommi Stich

Bereitstellung Transport

Ablieferung Ziel BHF

Lageraufgaben-quittierung

Visualisierung



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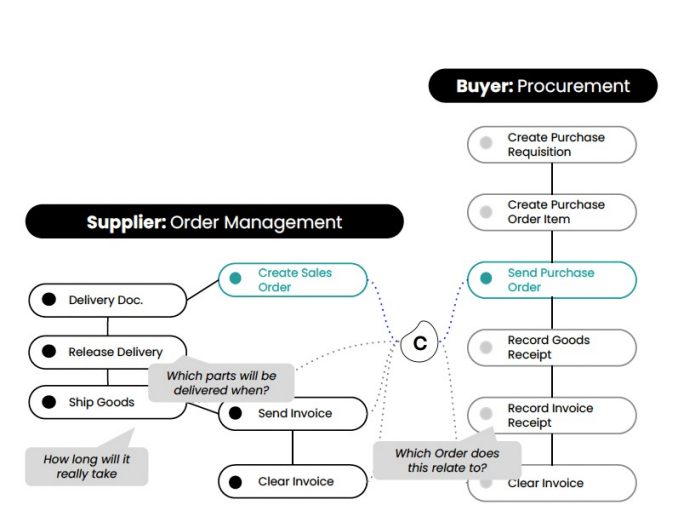
Cloud EMS

Dynamic Multi Event Log

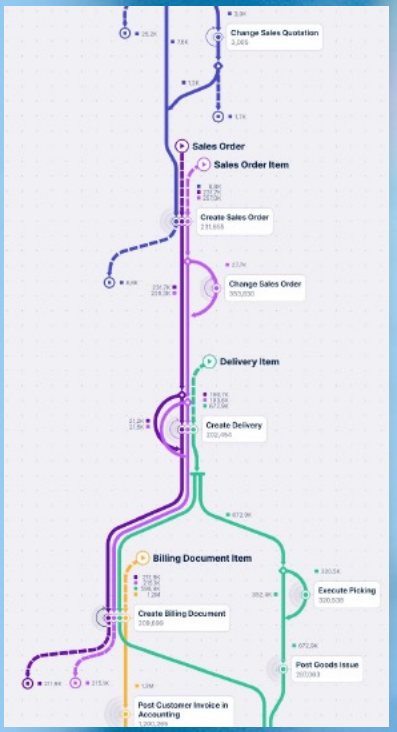


01 **Real-world view based on objects and events**
Full clarity across processes with new object-centric process mining technology

02 **Simplified 'subway' map**
A richer and simpler view of the business based on innovative semantic language

03 **Embedded process analytics**
A shorter time-to-insight with new analytical components embedded into the view.

Process Flow



Drive new levels of Performance with an end-to-end view of how all business processes operate and interact in real-time

SaaS

  Khaled El-Wafi

Contact

Khaled El-Wafi
Siemens AG
IT DA DF1
Otto-Hahn-Ring
81739 München
Germany

Email khaled.el-wafi@siemens.com

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Agenda

1	**Process Mining: Einführung und Überblick**	17:20 – 17:40
2	**Process Mining Technologie:** **Welche Funktionalitäten bietet die Technologie den Anwendern?**	17:40 – 18:20
3	**Process Mining in Action:** **Erfahrungen, Tipps & Tricks aus dem Praxiseinsatz**	18:20 – 19:00
4	**Process Mining:** **State-of-the-art und aktuelle Weiterentwicklungen**	19:00 – 19:15
5	**Fragen - Diskussion - Apero**	19:15 – 19:45

OST
Ostschweizer
Fachhochschule

IT Puls – Process Mining

Trends und Forschungsthemen

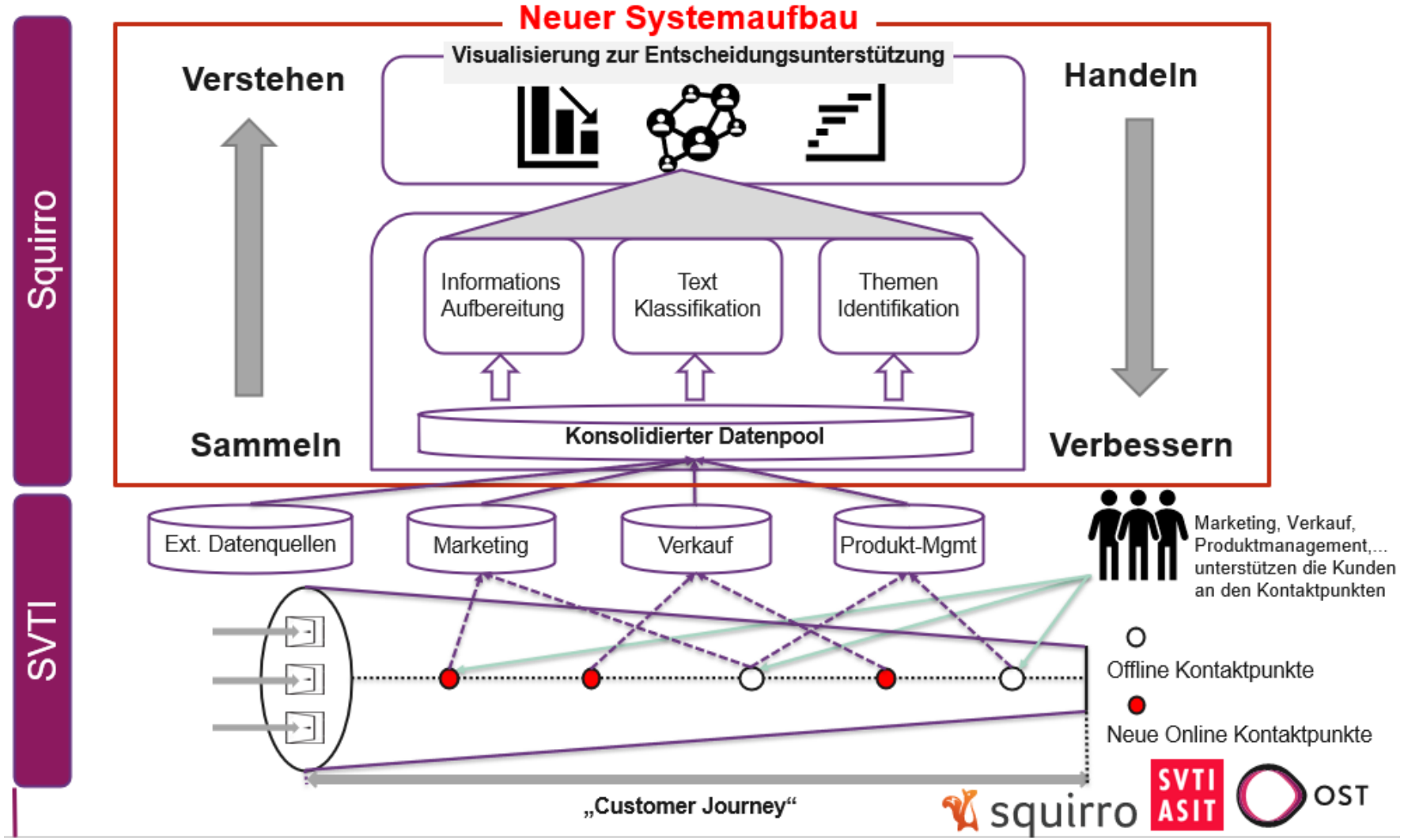
Wolfgang Groher, Michael Ziegler

Institut für Informations- und Prozessmanagement (IPM-OST)

Aktuelle Themen im IPM…

Forschung	**Ausbildung**
▪ Innosuisse-Projekt: Customer Journey managed by a Digital Twin for the Organization (DTO)	▪ Digitale Fallstudie: «Augmented Process Analysis and Optimization»
▪ CAS Business Process Management: Modul “Prozessorientierte Technologien”	▪ Prozessanalyse und -design, SW-Evaluation, Implementierungsunterstützung
Weiterbildung	**Dienstleistung**

IPM Forschung: DTO-Projekt



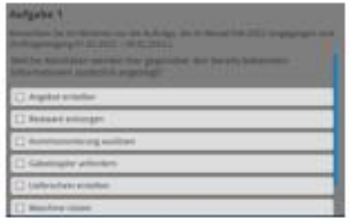
OST

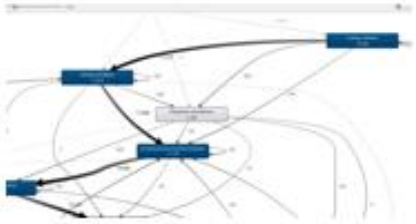
IPM Ausbildung: Fallstudie „Augmented Process Analysis & Optimization“

- **Phase-1:**
  Kennenlernen des Unternehmens und der Stationen der Auftragsabwicklung

- **Phase-2:**
  Qualitative Analyse der Auftragsabwicklung anhand von Prozess-Artefakten und Interviews mit Mitarbeitenden (Video-Sequenzen)

- **Phase-3:**
  Quantitative Analyse der Auftragsabwicklung mittels Process Mining (Zeitstempel)





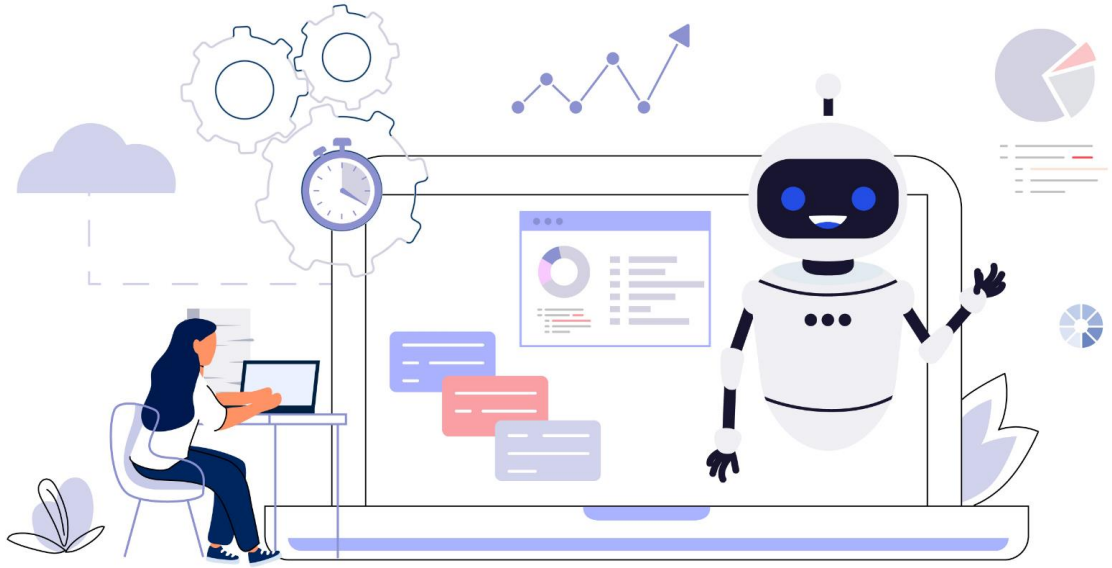
- **Phase-4:**
  Ausarbeitung von Empfehlungen für die Prozessverbesserung (Leistungsnachweis)

IPM Weiterbildung: CAS Business Process Management

- Berücksichtigung aktueller Technologietrends im Prozessmanagement
- Ziel: Eigene Erfahrung «hands-on» aufbauen

Process Mining (2 Tage)

Robotic Process Automation (2 Tage)



Wohin geht die Reise?

Task Mining

Robotic Process Mining (PM for RPA)

Self-learning and -Optimizing Systems

automated process improvement

“what-if” PM (data-driven process simulation)

reinforcement learning for simulating several scenarios

Inter-Company

Proactive Solutions

Intelligent Process Execution

Sustainability

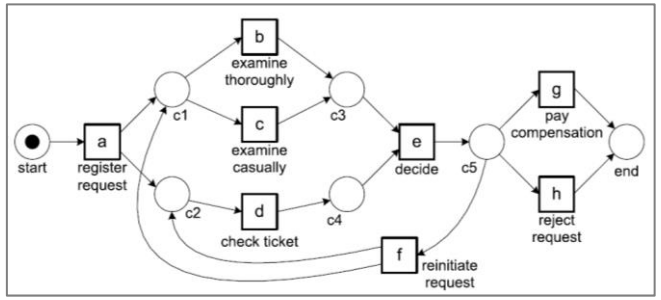
Predictive Solutions

ML approaches for providing explainability

semantics-aware process mining

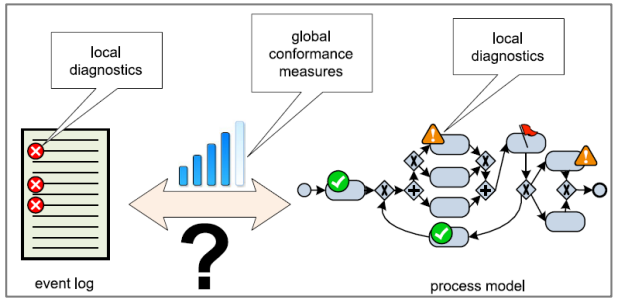
Unterschiedliche «Perspektiven» auf einen Prozess

Kontroll-Fluss (Discovery)



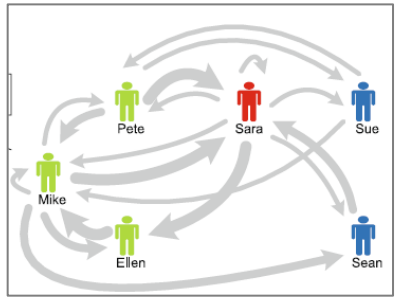
Quelle: van der Aalst, 2016, S.36

Conformance-Checking



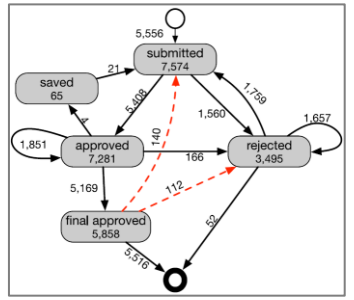
Quelle: van der Aalst, 2016, S.244

Social Network



Quelle: van der Aalst, 2016, S.136

Object-Centric



Quelle: Rebmann u. van der Aalst, 2022, S.14

!Theoretisch!

XES Standard

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<trace>
  <string key="concept:name" value="Case3.0"/>
  <event>
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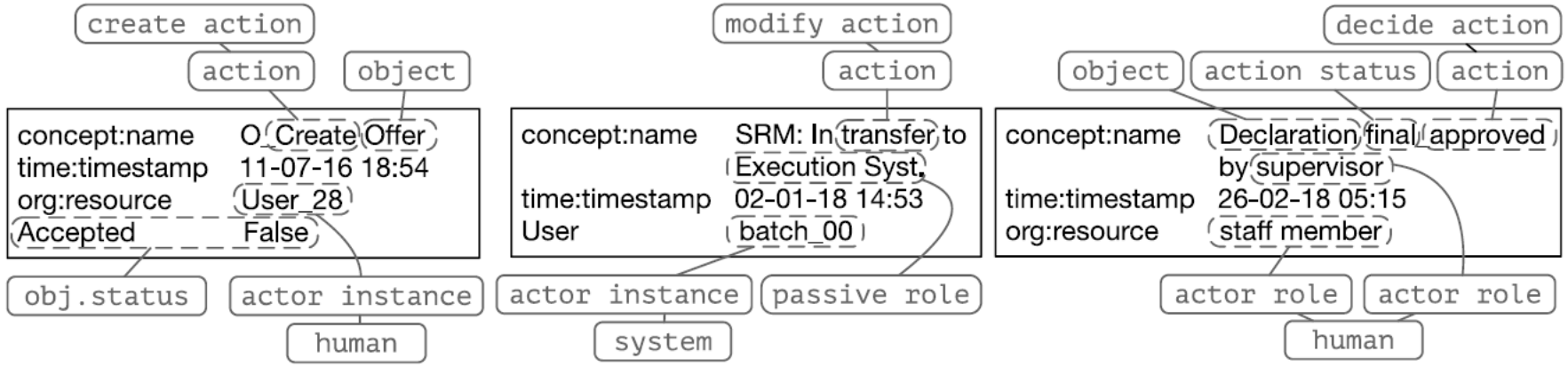
    <date key="time:timestamp" value="2008-12-09T08:20:01.527+01:00"/>
    <string key="concept:name" value="A"/>
    <string key="lifecycle:transition" value="complete"/>
  </event>
  <event>
    <string key="org:resource" value="UNDEFINED"/>
```

Unterschiedliche «Perspektiven» auf einen Prozess

Event-Logs in der Realität…



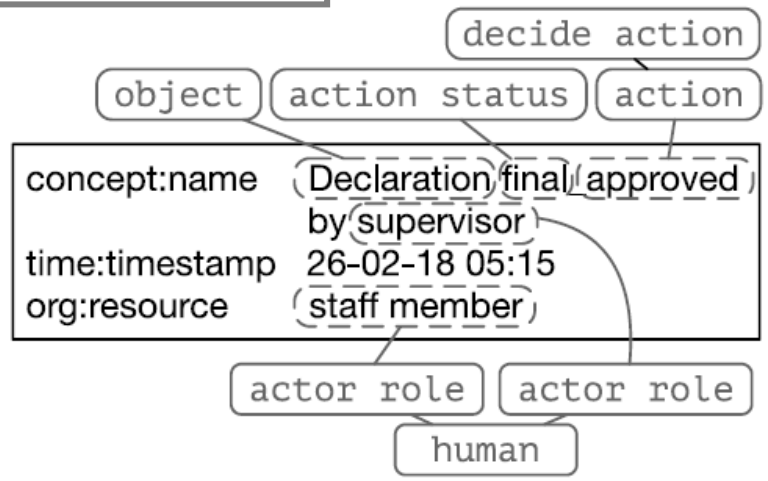
(a) Event e_1 from BPI17 [5] (b) Event e_2 from BPI19 [6] (c) Event e_3 from BPI20 [7]

Fig. 1. Exemplary events and their semantic components.

Quelle: Rebmann u. van der Aalst, 2022, S.2

Wie können die notwendigen Informationen extrahiert werden?

Event-Log



Quelle: Rebmann u. van der Aalst, 2022, S.2

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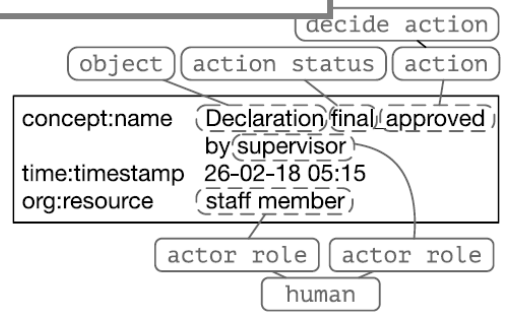
    <string key="lifecycle:transition" value="complete"/>
  </event>
  <event>
    <string key="org:resource" value="UNDEFINED"/>
```

Überführung in XES mit semantic-aware Process Mining

Input

Event-Log



Quelle: Rebmann u. van der Aalst, 2022, S.2

Semantic-Aware Process Mining

Data Type Pre-processing

Semantic Component Identification

Semantic Component Categorization

NLP (BERT)

Output

Augmented XES

```
<trace>
  <string key="concept:name" value="Case3.0"/>
  <event>
    <string key="org:resource" value="UNDEFINED"/>
    <date key="time:timestamp" value="2008-12-09T08:20:01.527+01:00"/>
    <string key="concept:name" value="A"/>
    <string key="lifecycle:transition" value="complete"/>
  </event>
  <event>
    <string key="org:resource" value="UNDEFINED"/>
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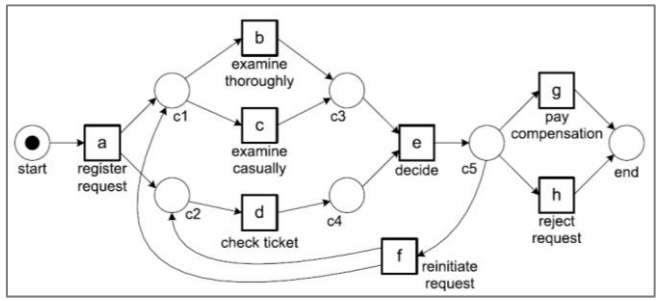
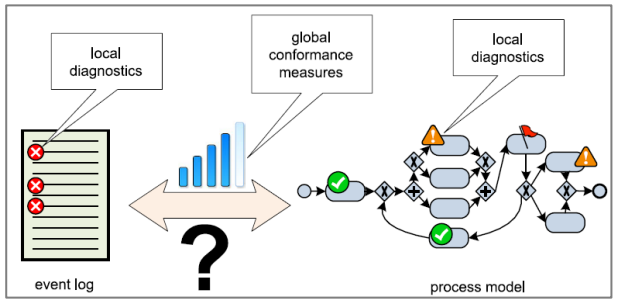
Unterschiedliche «Perspektiven» auf einen Prozess

Kontroll-Fluss (Discovery)



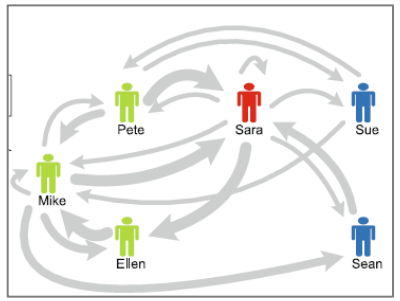
Quelle: van der Aalst, 2016, S.36

Conformance-Checking



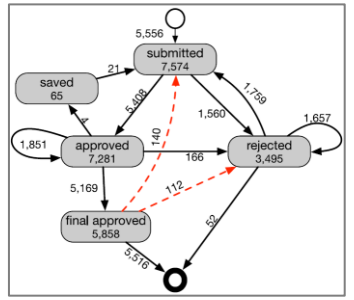
Quelle: van der Aalst, 2016, S.244

Social Network



Quelle: van der Aalst, 2016, S.136

Object-Centric



Quelle: Rebmann u. van der Aalst, 2022, S.14

+ Komplexitätsreduktion der Prozessmodelle

+ Berechnung Automatisierungsgrad

XES Standard

```
<trace>
  <string key="concept:name" value="Case3.0"/>
  <event>
    <string key="org:resource" value="UNDEFINED"/>
    <date key="time:timestamp" value="2008-12-09T08:20:01.527+01:00"/>
    <string key="concept:name" value="A"/>
    <string key="lifecycle:transition" value="complete"/>
  </event>
  <event>
    <string key="org:resource" value="UNDEFINED"/>
```

Agenda

1	**Process Mining: Einführung und Überblick**	17:20 – 17:40
2	**Process Mining Technologie:** **Welche Funktionalitäten bietet die Technologie den Anwendern?**	17:40 – 18:20
3	**Process Mining in Action:** **Erfahrungen, Tipps & Tricks aus dem Praxiseinsatz**	18:20 – 19:00
4	**Process Mining:** **State-of-the-art und aktuelle Weiterentwicklungen**	19:00 – 19:15
5	**Fragen - Diskussion - Apero**	19:15 – 19:45

…Herzliche Einladung zu Austausch & Diskussion !

Marktübersicht & Foliensets:

Kontakt IPM

Wolfgang Groher

Mail: wolfgang.groher@ost.ch

Telefon: +41 58 257 12 35

Michael Ziegler

Mail: michael.ziegler@ost.ch

Telefon: +41 58 257 16 42

IPM | Institut für Informations- und Prozessmanagement

https://www.ost.ch/ipm

BACKUP

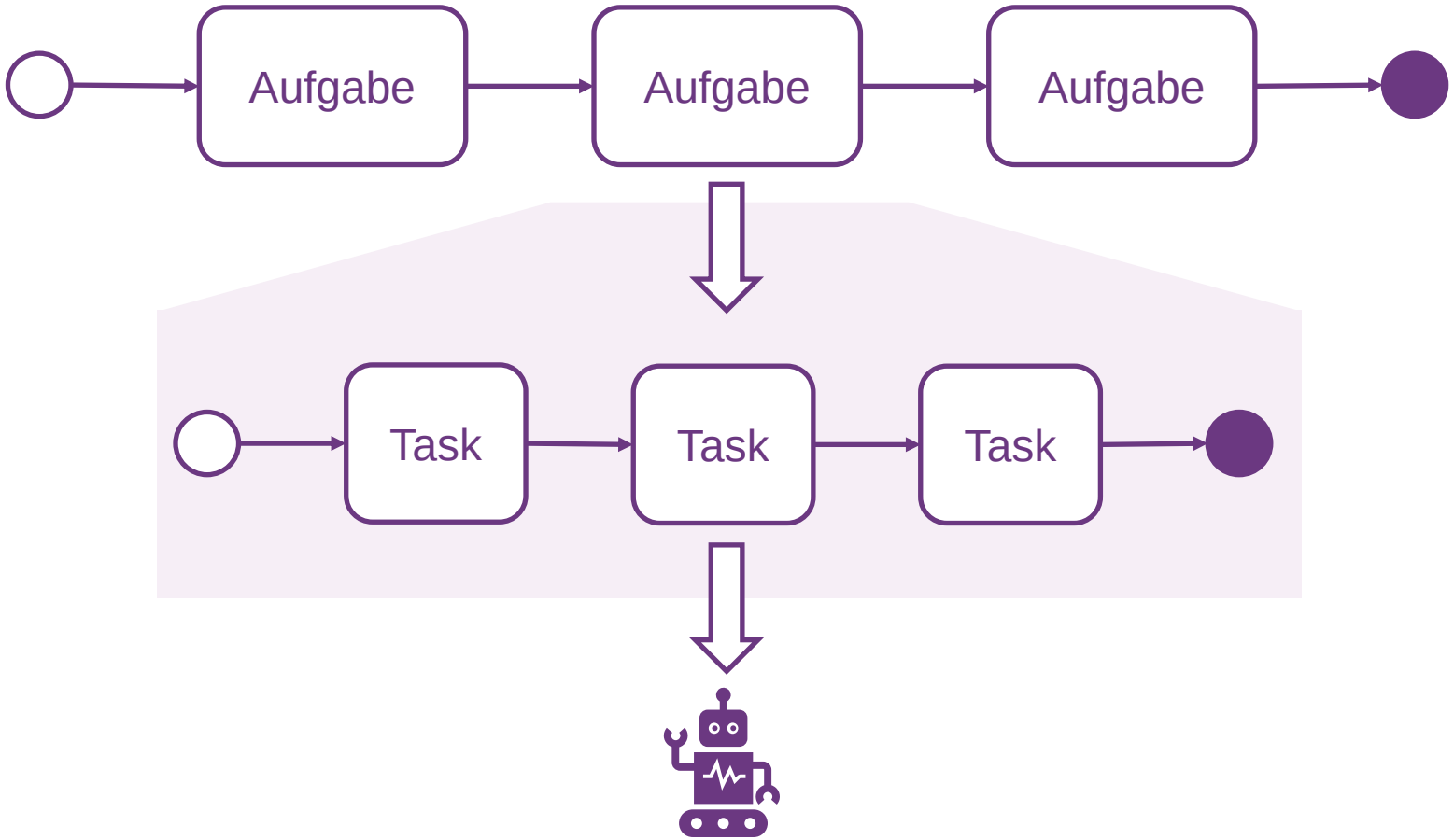
Robotic Process Mining (RPM)

Was ist Robotic Process Mining (RPM)?

"[…] Robotic Process Mining (RPM), which allow us to discover repetitive routines that can be automated using robotic process automation technology."

Dumas et al. (2022)

Wie funktioniert RPM?



Process Mining

- Basierend auf Event-Logs
- Gesamt-Prozess
- «High-Level»

Task Mining

- Basierend auf UI-Logs
- Einzelne Routinen
- «Low-Level»

+

RPM

- Kandidaten für Automatisierung mit RPA identifizieren
- Unterstützung in der «Executabel Definition»

OST

RPM für Robotic Process Automation (RPA)

- Fortschritte in der RPA Technologie
  - Kann einfache, «langweilige» Tasks automatisieren
  - Verkürzt bspw. Durchlaufzeit, kann Qualität erhöhen, etc.
  - ABER: Welche Tasks sollen mit «Bots» automatisiert werden? -> Investment!
    - Klassische Identifikation: Interviews, Workshops, … -> was gefunden wird, hängt von Wahl der Teilnehmer ab…
    - -> RPM hilft die richtigen Tasks zu identifizieren, datenbasiert

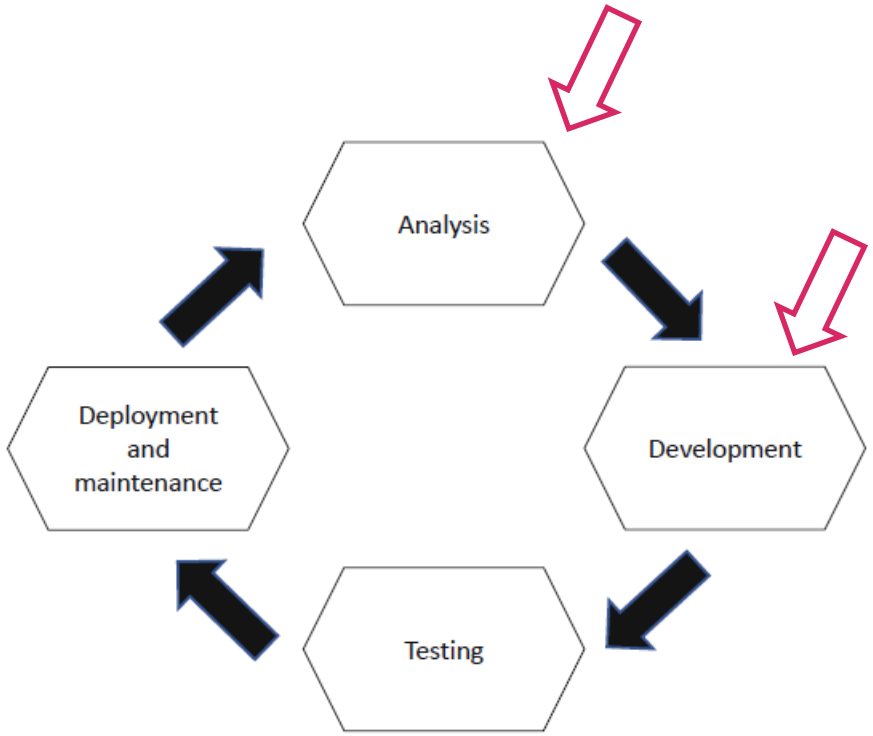


Fig. 1. Simple RPA bot lifecycle [23]

Quelle: Dumas et al., 2022, S.471

Literatur

- Dumas, M., Rosa, M.L., Leno, V., Polyvyanyy, A., Maggi, F.M. (2022). Robotic Process Mining. In: van der Aalst, W.M.P., Carmona, J. (eds) Process Mining Handbook. Lecture Notes in Business Information Processing, vol 448. Springer, Cham. https://doi.org/10.1007/978-3-031-08848-3_16
- Rebmann, A., & Van Der Aa, H. (2022). Enabling semantics-aware process mining through the automatic annotation of event logs. *Information Systems*, *110*, 102111. https://doi.org/10.1016/j.is.2022.102111
- van der Aalst, Wil (2016): Process mining. Data science in action. Second edition. Berlin, Heidelberg, New York, Dordrecht, London: Springer. Online verfügbar unter http://swbplus.bsz-bw.de/bsz468031596cov.htm.