Cross-Industry Panel Discussion: I4.NOW – Making Industry4.0 Happen with SAP

April 27th, 2021 – International SAP Conference for Building Products | Chemicals | Forest Products, Paper and Packaging | Metals & Mining

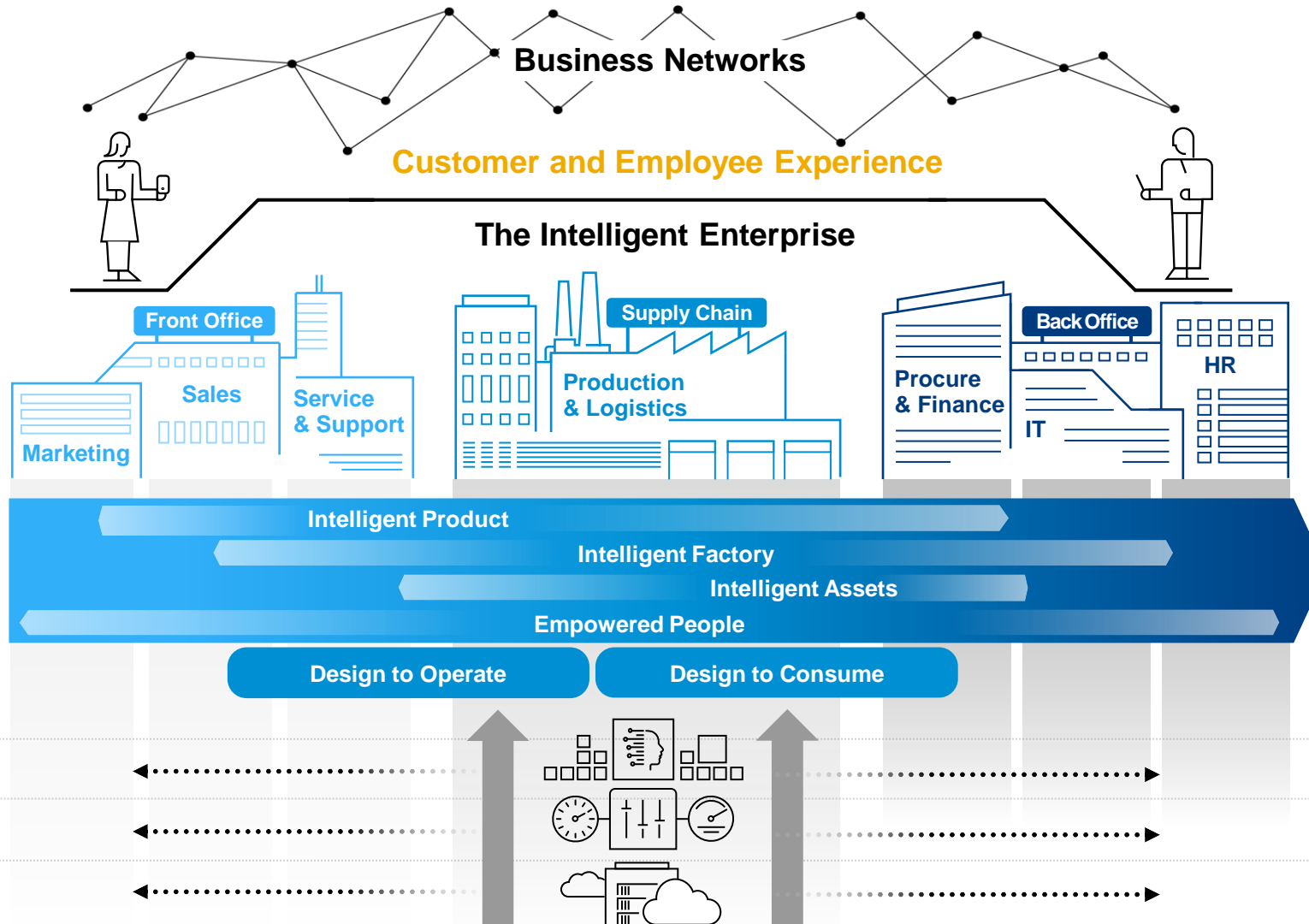Kai Aldinger, Andreas Forster, Dr. Marko Lange, Dr. Manfred Schulz

SAP

THE BEST RUN **SAP**

Industry 4.0

Leveraging Intelligent Enterprise Technologies and Applications

Business Networks

Customer and Employee Experience

The Intelligent Enterprise

Front Office

Supply Chain

Back Office

Marketing

Sales

Service & Support

Production & Logistics

Procure & Finance

IT

HR

SAP Industry 4.Now Themes

Intelligent Product

Intelligent Factory

Intelligent Assets

Empowered People

Design to Operate

Design to Consume

Cloud Computing	Edge Computing
Internet of Things	Artificial Intelligence
IT/OT Integration	Sematic Integration

Design to Consume – High-Level Building Blocks

Design	Plan	Manufacture	Operate	Deliver

L5
Business Networks

Supply Chain Networks (LBN + AIN + GBT)

L4
Enterprise Business Processes

EPD
- Collaboration
- Engineering
- Connected products
- PLC (future)

PLM (S/4)
- Recipe Development
- Product compliance
- Change record
- Product Data Governance

IBP
- S&OP
- Demand Management
- Inventory optimization
- Response and Supply
- Demand-driven MRP

Supply Chain Control Tower

ePP/DS (S/4)
- Finite production planning
- **Production Operations**
- **QM (S/4)**
- **EHS (S/4)**
- **Inventory (S/4)**
- **MRP (S/4)**

Digital Manufacturing Cloud
- Recipe Management
- Resource orchestration
- Shop floor design
- Shop floor insight
- Predictive quality

PM (S/4)

ASPM

PDMS

ATP (S/4)

TM (S/4)

EWM (S/4)

Yard Logistics (S/4)

L3
Manufacturing Operations Management

MII
- Mfg execution

DMC
- Mfg execution

Asset Manager

EWM (S/4)
- Log. execution

L0-L2
Monitoring & Process Control

Plant Connectivity

IoT and Edge

Business Technology Platform

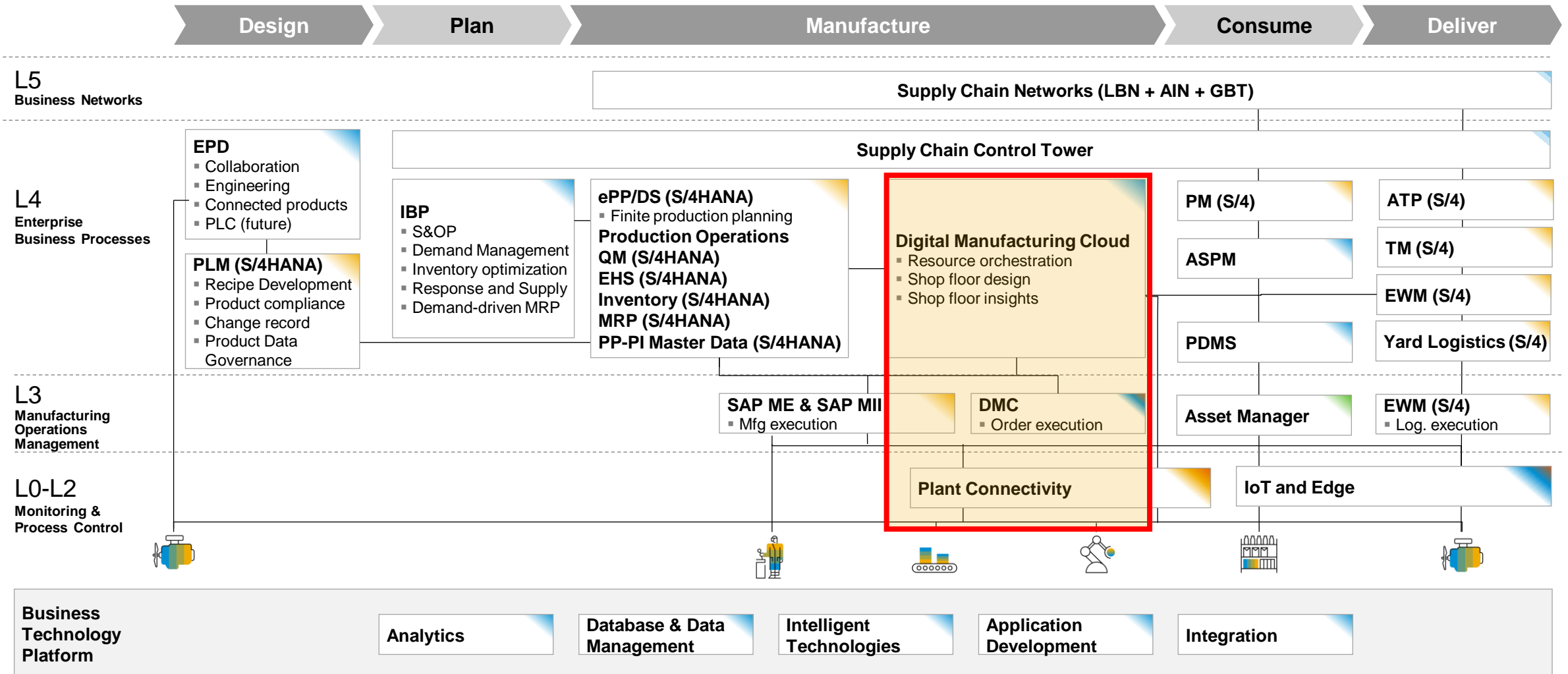| Analytics	Database & Data Management	Intelligent Technologies	Application Development	Integration

Abbreviations:
EPD: SAP Enterprise Product Development; **PLC**: SAP Product Lifecycle Costing; **PLM**: SAP Product Lifecycle Management; **IBP**: SAP Integrated Business Planning for Supply Chain; **ePP/DS**: SAP ERP, add-on for embedded production planning and detailed scheduling; **PEO**: SAP S/4HANA Manufacturing for production engineering and operations; **ME**: SAP Manufacturing Execution; **MII**: SAP Manufacturing Integration and Intelligence; **PM: SAP** Plant Maintenance; **EHS:** Environmental Health and Safety; **DMC**: SAP Digital Manufacturing Cloud; **PCo**: SAP Plant Connectivity; **LBN**: SAP Logistics Business Network; **TM**: SAP Transportation Management; **YL**: SAP Yard Logistics; **EWM**: SAP Enterprise Warehouse Management; **AIN**: SAP Asset Intelligence Network; **ASPM**: SAP Asset Strategy and Performance Management; **PDMS**: SAP Predictive Maintenance and Service; **QM: SAP** Quality Management

Legend:

Deployed on mobile | Deployed in the cloud | Deployed on premise | Deployed on the Edge

3

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Inventory (S/4HANA)
MRP (S/4HANA)
PP-PI Master Data (S/4HANA)

Digital Manufacturing Cloud
- Resource orchestration
- Shop floor design
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- Order execution

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**Business
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Platform**

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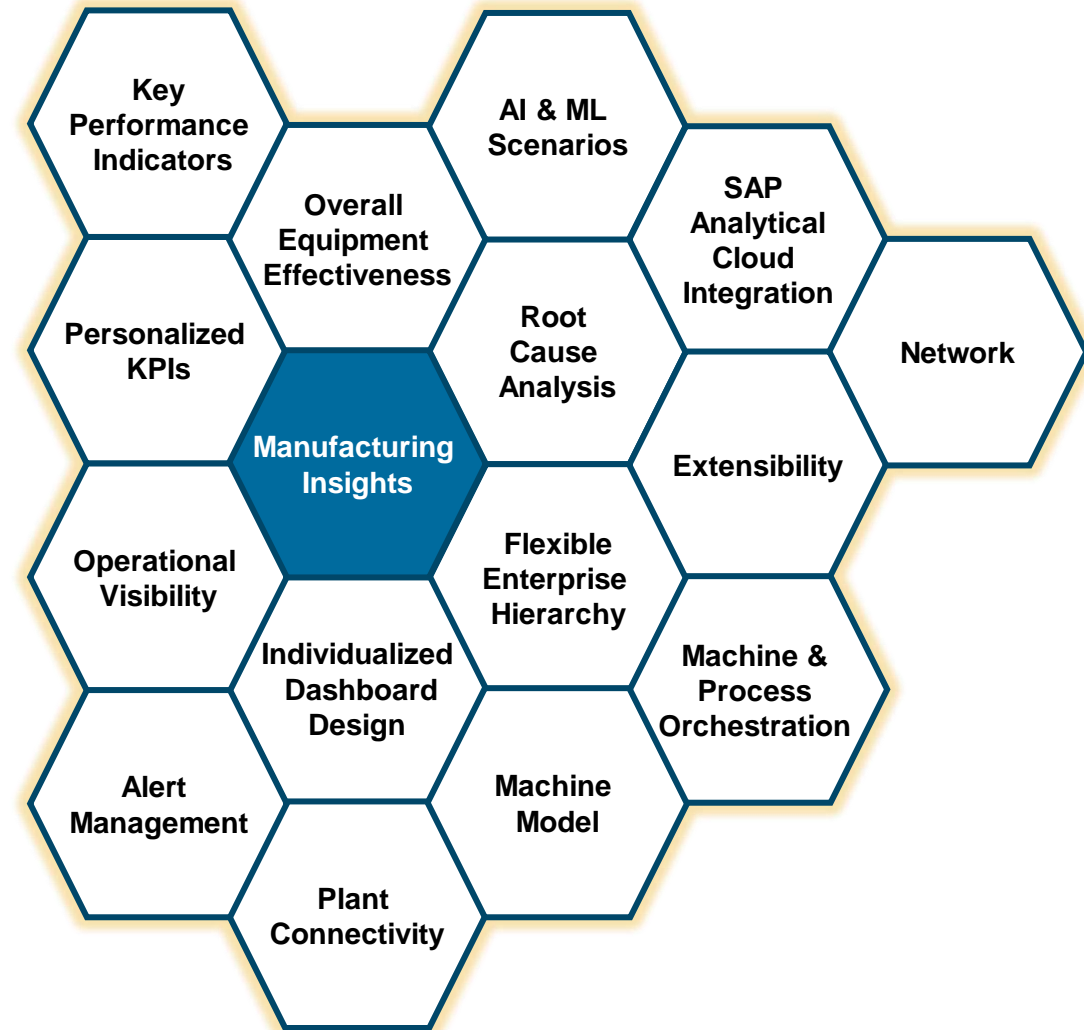- Deployed on premise
- Deployed on the Edge

4

SAP Digital Manufacturing Cloud for Insights

Digital system to gain real-time visibility of production performance with business context across the enterprise
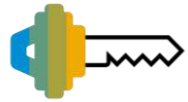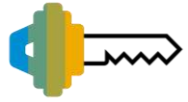
Key capabilities

- Gain insights on performance and productivity across different levels of the enterprise hierarchy (i.e. across regions, plants, work centers , resources, etc.)

- Take informed decisions by combining and utilizing data from shop floor systems, execution systems, along with contextual information from business sources (i.e. ERP)

- Use pre-delivered interactive dashboards filled with standardized key performance indicators (KPI) based on harmonized data

- Incorporate data from non-SAP sources, build customized KPI's and personalize your dashboards & reports

- Perform root cause analysis, drill -down and -up across different levels of the enterprise hierarchy

Key Performance Indicators · AI & ML Scenarios · Overall Equipment Effectiveness · SAP Analytical Cloud Integration · Personalized KPIs · Root Cause Analysis · Network · Manufacturing Insights · Extensibility · Operational Visibility · Flexible Enterprise Hierarchy · Individualized Dashboard Design · Machine & Process Orchestration · Alert Management · Machine Model · Plant Connectivity

SAP Digital Manufacturing Cloud for Execution – Process Industries

Orchestrate and control the shop floor

🔑 Key capabilities

- Implement top-floor to shop-floor scenarios to achieve rapid return-on-investment through **out-of-the-box integration to SAP solutions**

- Utilize **intuitive user interfaces** for production operators and transform to paperless production

- **Dispatch and sequence operations** to reflect the real world in the short term

- **Execute process orders** in Order POD

- **Monitor** the entire manufacturing process to optimize resources and execution

- **Integrate seamlessly** with S/4HANA Cloud and S/4HANA on-premise

Hexagon diagram with "Manufacturing Execution" at center surrounded by: Batch related Process Order Execution, Formula based calculation, Overall Equipment Effectiveness, Shop Floor Automation, Production Operator Dashboard Designer (POD), Batch Management, Labor Management & Skills, QM Integration, Resource Orchestration & Dispatching, Work Instructions, Floor Stock, Data Collection, Printing, Recipe Integration & Definition, SAP ERP / S/4HANA Integration, Process Parameters.

SAP Digital Manufacturing Cloud for Execution
Main Capabilities

- **Extend Master Recipes** integrated from S/4HANA with Work Instructions, Data Collections and Process Parameters

- **Execute batch-related Process Orders** in the Production Order Dashboard (POD)

- **Create and Valuate Batches** for Main-Products as well as for **Co-Products and By-Products** during Production and search and **Consume batches** based on characteristics

- **Confirm process order phases** with Yield, Scrap and Activities integrated with S/4HANA

- Post **goods movements** for goods issues and receipts seamlessly integrated with S/4HANA

- **Record inspection results** integrated with S/4HANA QM

- **Integrate with the Shop Floor** in a **bi-directional** way using Equipment Connectivity (Production Process Designer) and Plant Connectivity (PCo)

- Enable **Post-Production Reporting**

- **Customize** your application with the POD Designer

- Print customized **Labels**

- **View product history report** for produced batches
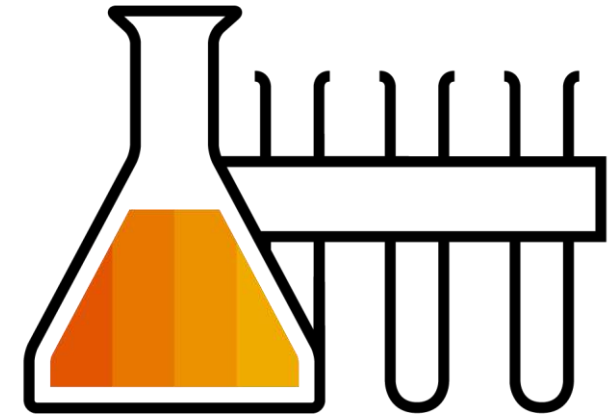
SAP Digital Manufacturing Cloud

Product road map overview
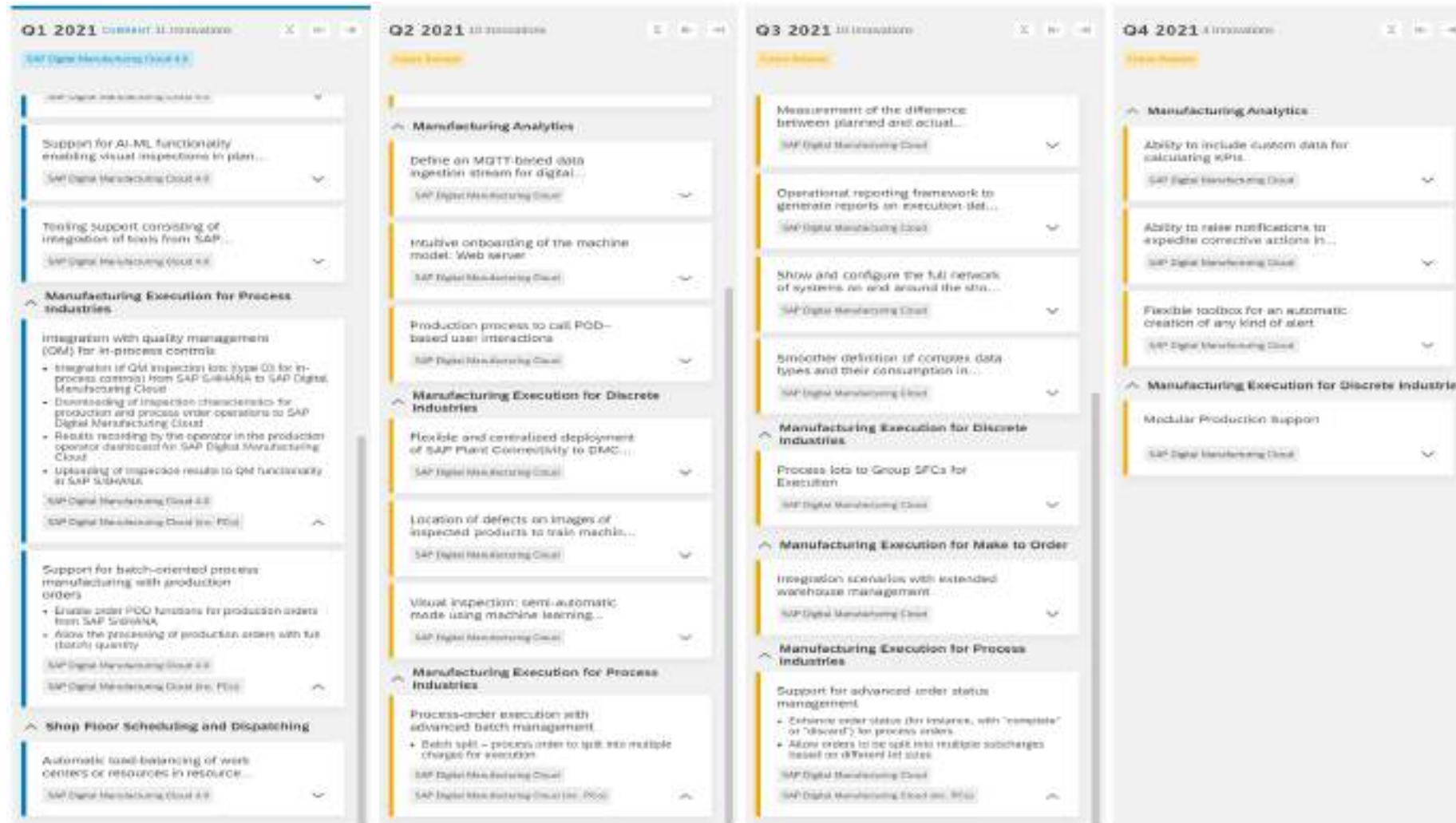
SAP Digital Manufacturing Execution - Summary

Statement of direction for process industries

❑ SAP has decided to build a new Manufacturing Execution Solution for the Process Industries. The new key capabilities will be delivered as part of the SAP Digital Manufacturing Cloud (DMC) for execution

❑ SAP plans to offer new state of the art capabilities in the cloud to manage recipes, enriching them with execution relevant information like process parameters / setpoints, work instruction, data collection and supporting manual and automated manufacturing execution outside of S/4HANA.

❑ While PI-Sheets, Control Recipes, XSteps, and Process Messages are still available in S/4HANA On-Premise and S/4HANA Private Cloud Edition, there is no further development planned. These functions are part of S/4HANA On-Premise Compatibility Scope, **but will receive extended use rights until 2030 to enable a smooth migration to alternative solutions such as SAP DMC.** For details on compatibility scope, please refer to note 2269324 and notes referenced therein.

❑ Those PI-PCS interface functions (including Xsteps) relevant for integration with external systems are planned to become part of S/4HANA On-Premise as *Manufacturing Execution Connect (classic)*. See note 3035702 and related notes. Modern APIs and OData services are already available as alternatives for PI-PCS in S/4HANA. In addition, SAP is planning to provide "Distributed Manufacturing" functionality as part of SAP DMC.

❑ SAP DMC is proposed as alternative for the PI-Sheet. Portfolio items to deliver Process Industry capabilities are already shipped with SAP DMC. More details and updates are published frequently in the official Roadmap communications.

❑ SAP is evaluating how to support GxP requirements for its Cloud products.

Further Information Digital Manufacturing

Key links

- SAP Road Maps   https://roadmaps.sap.com
- SAP Manufacturing Community   http://www.sap.com/community/topic/manufacturing.html
- Industry4.Now Showcase   Industry 4.Now Experience

- SAP Help Portal   https://help.sap.com/viewer/p/SAP_DIGITAL_MANUFACTURING_CLOUD

Manufacturing Quality

Increase planning security

Increase customer satisfaction

Reduce effors to enhance out-of-spec output into spec

Understand pattern behind out-of-spec

Reduce out-of-spec

Take pro-active action during manufacturing

Reduce wasteage

Identify relevant sensors on the shop floor
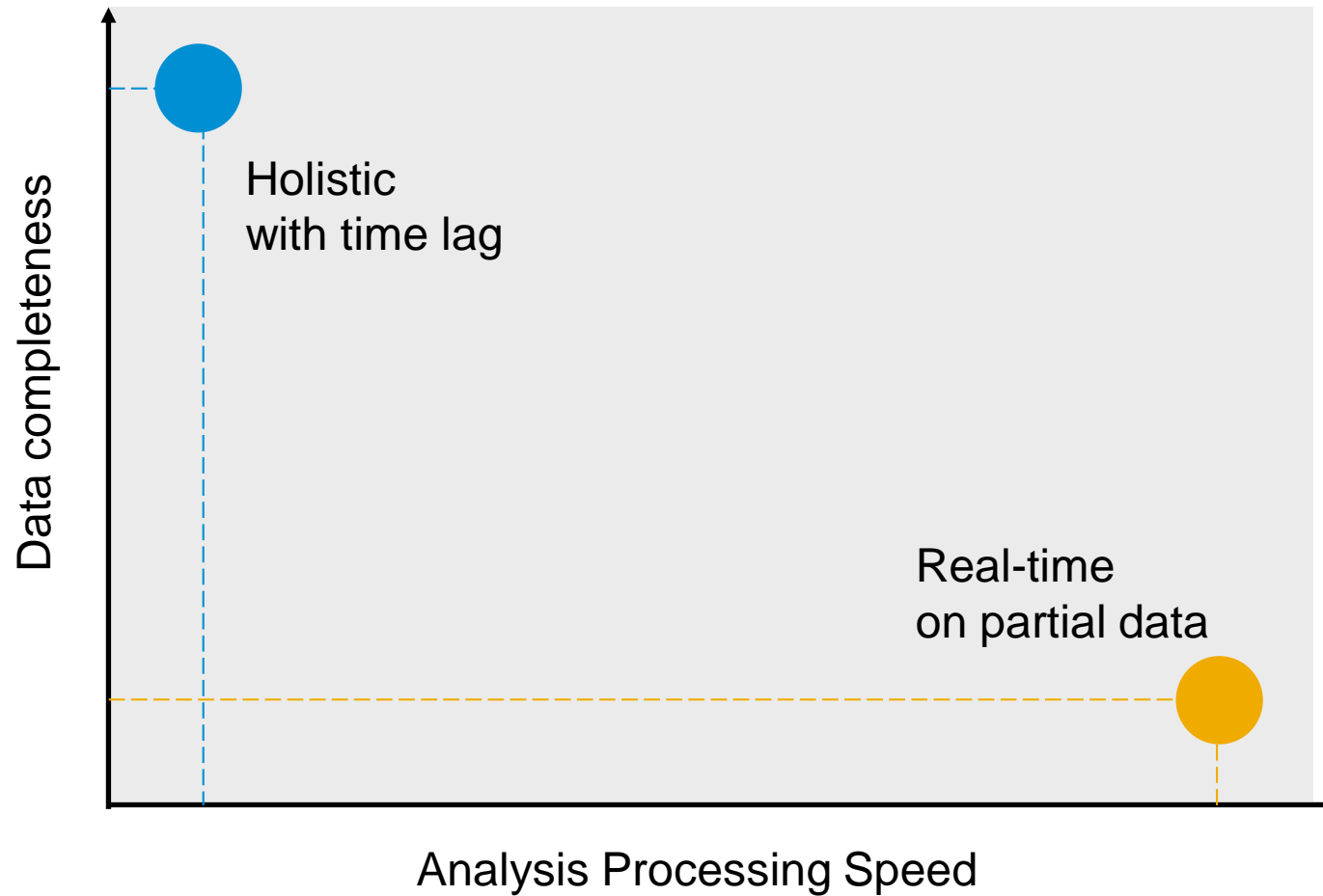
Manufacturing Quality

Analysing Manufacturing Quality is often a compromise for Manufacturers

- 🔵 **Holistic:** sensor + ERP with delay
- 🟠 **Real-time:** sensors only

The chart shows "Data completeness" on the vertical axis and "Analysis Processing Speed" on the horizontal axis. The blue point (high completeness, low speed) is labeled "Holistic with time lag". The orange point (low completeness, high speed) is labeled "Real-time on partial data".

Manufacturing Quality

Data completeness (vertical axis) / Analysis Processing Speed (horizontal axis)

- Holistic with time lag
- Real-time + holistic
- Real-time on partial data
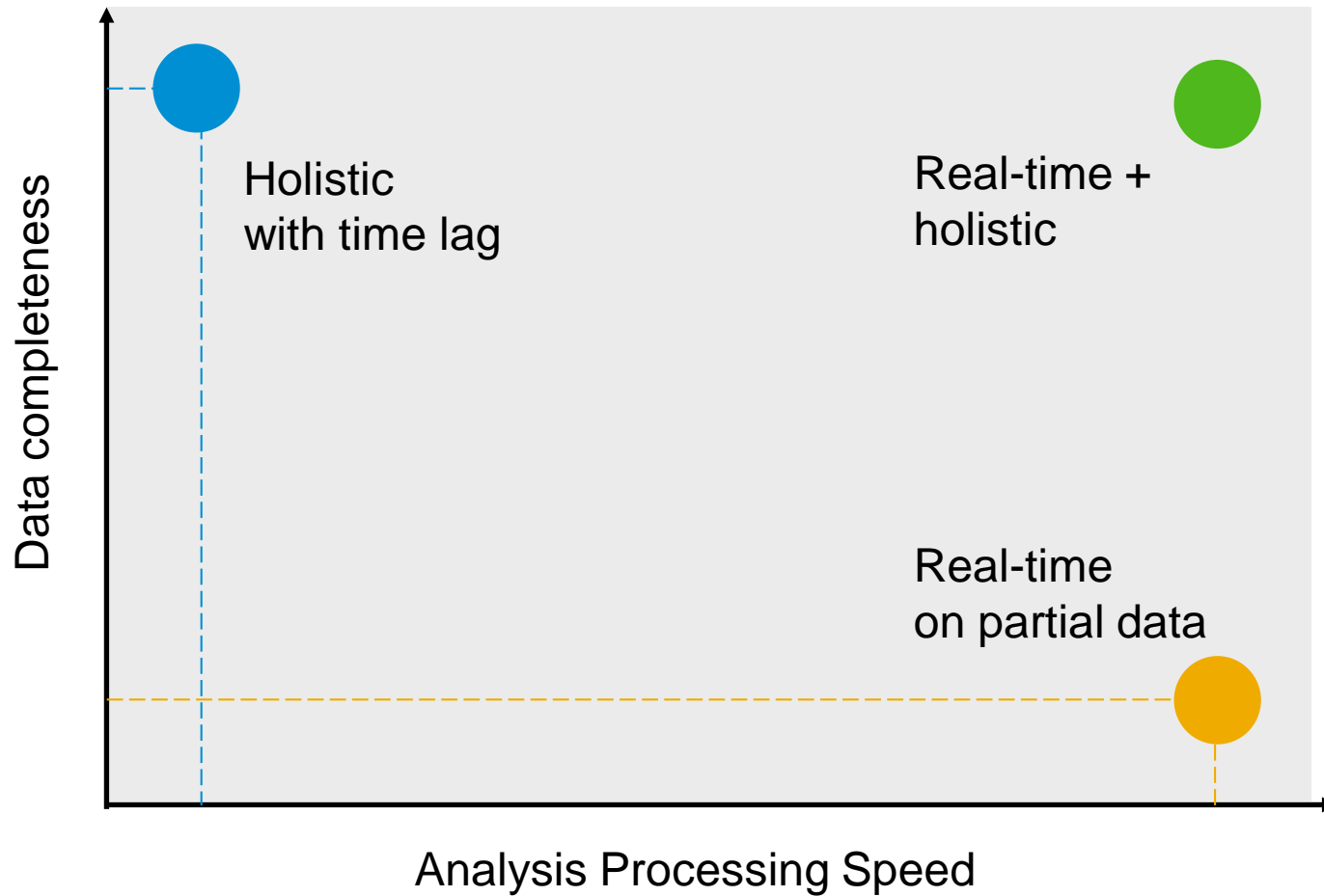
Analysing Manufacturing Quality is often a compromise for Manufacturers

- **Holistic:** sensor + ERP with delay
- **Real-time:** sensors only
- **SAP Business Technology Platform:** sensors + ERP in <u>real-time</u>

Manufacturing Quality
Exemplatory use case for SAP's Business Technology Platform

BUSINESS TECHNOLOGY PLATFORM

DATABASE & DATA MANAGEMENT

ANALYTICS

APPLICATION DEVELOPMENT & INTEGRATION

INTELLIGENT TECHNOLOGIES

- Advise in real-time
- Apply Machine Learning
- Merge the data source
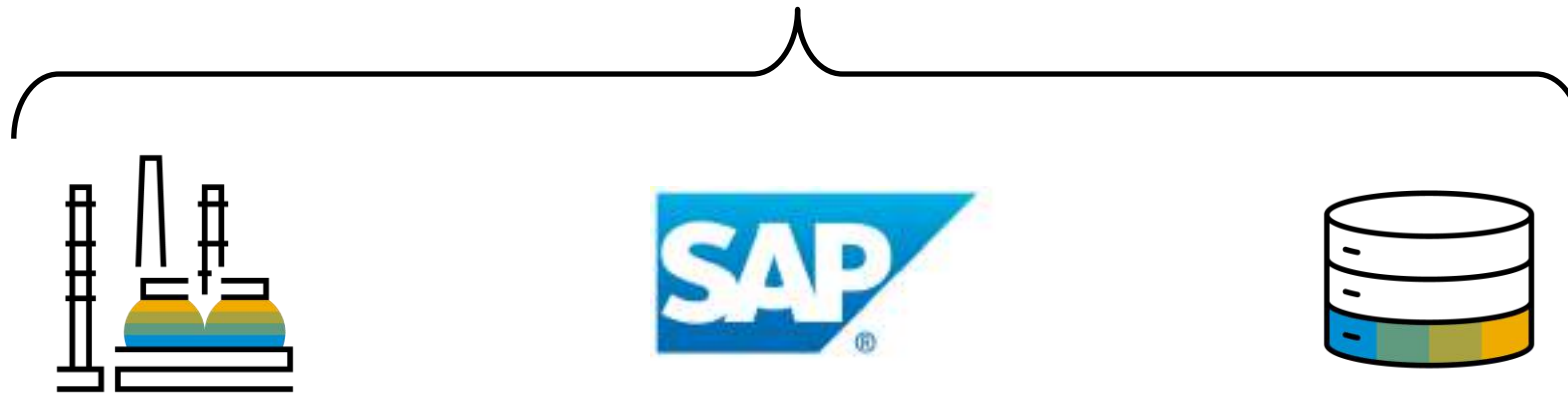
Production plant

- Sensor data

SAP ERP

- Historic quality data
- Raw materials
- Supplier details
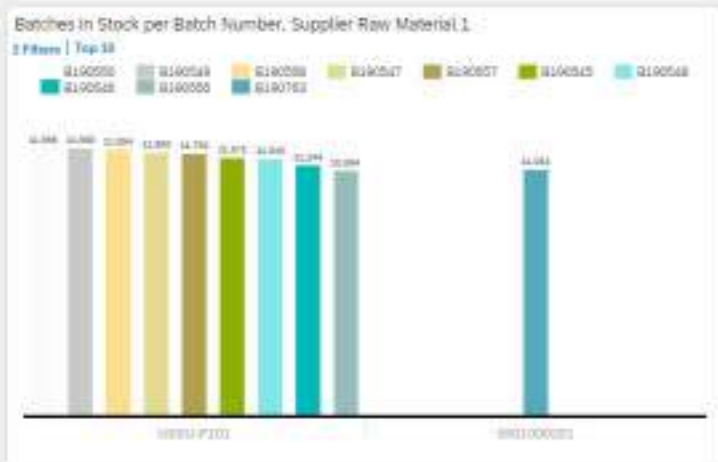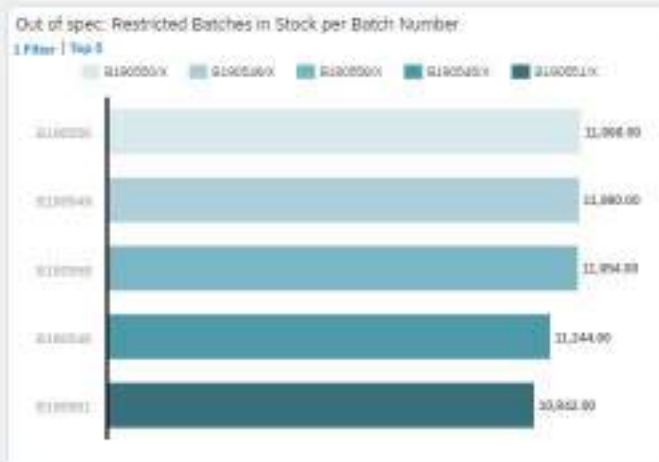
Further data sources

- …

Manufacturing Quality
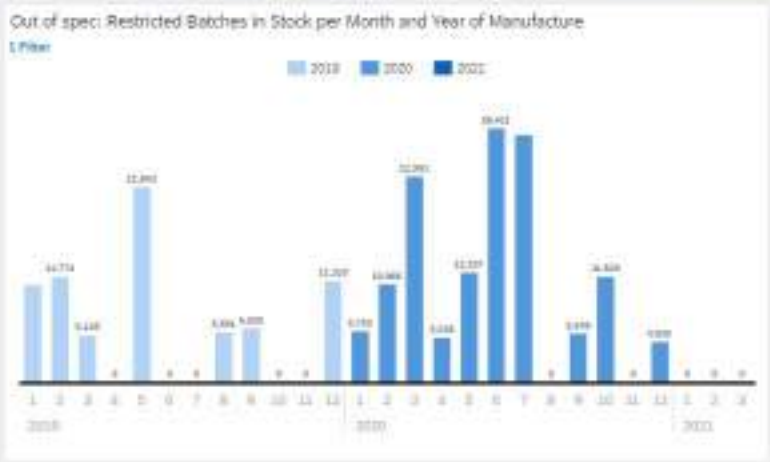## Analyse, predict and take preventive measures in real-time

BUSINESS TECHNOLOGY PLATFORM
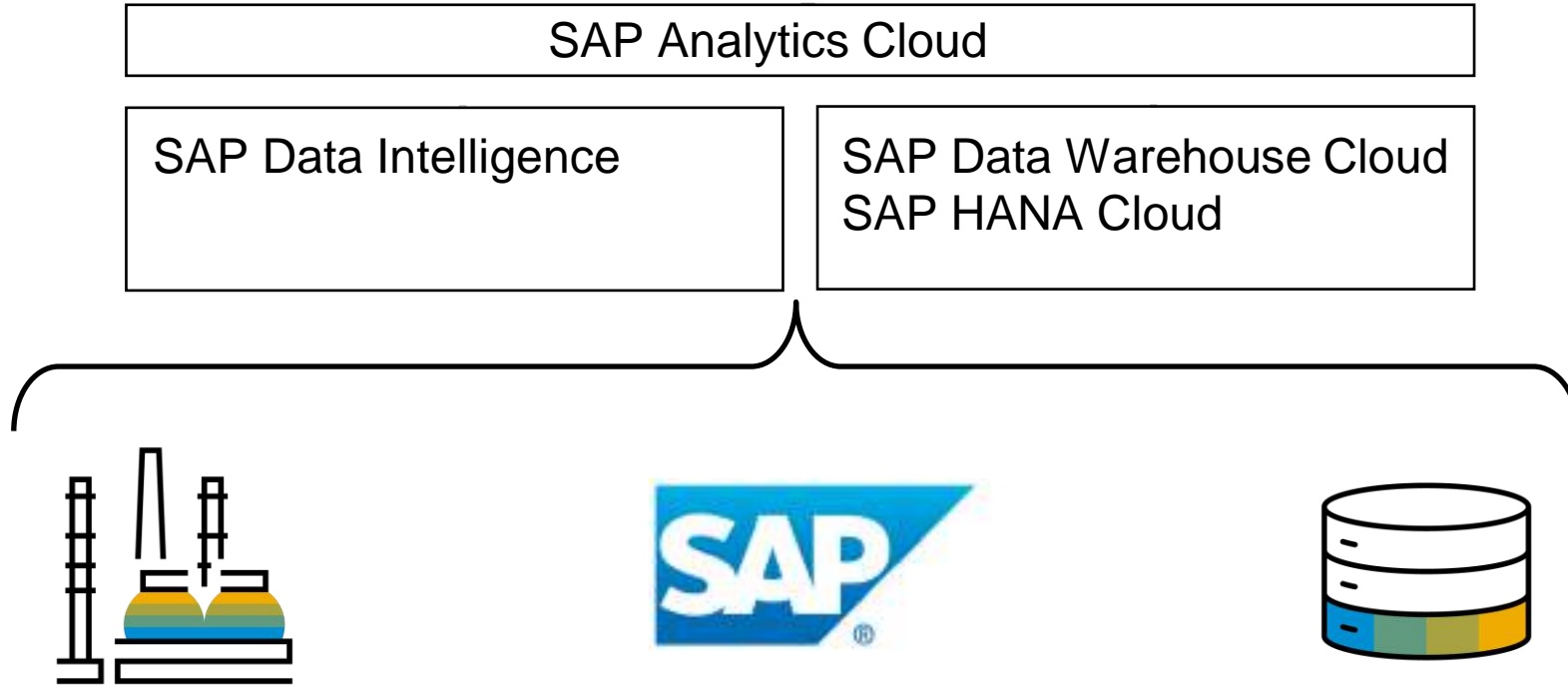
SAP Analytics Cloud

SAP Data Intelligence	SAP Data Warehouse Cloud SAP HANA Cloud

- Advise in real-time
- Apply Machine Learning
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Production plant

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SAP ERP

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Demonstration Manufacturing Quality
Plant Manager
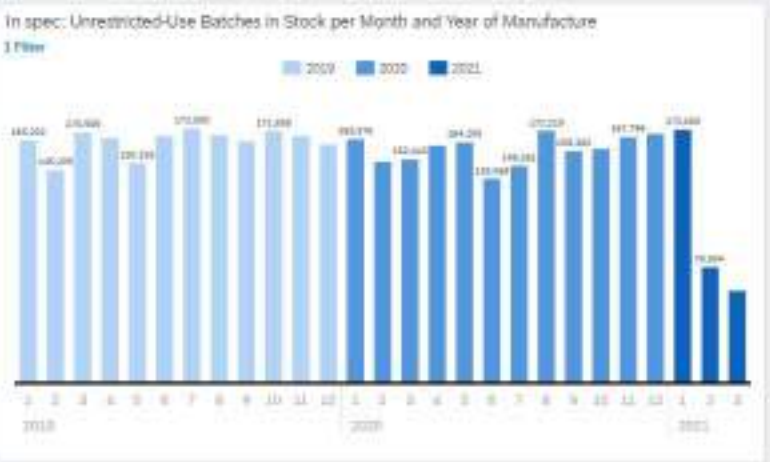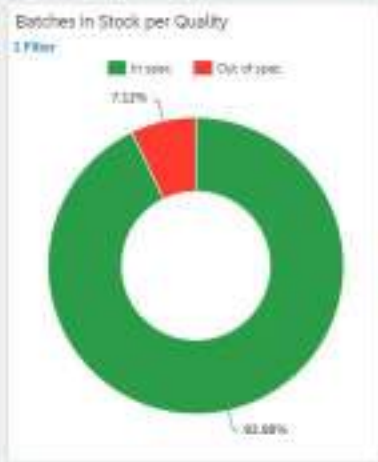
Demonstration Manufacturing Quality
Data Scientist

Home | SAP Data Intelligence   ×   ML Scenario Manager   ×   +

vsystem.ingress.dh-gg8xuujx7.dh-canary.shoot.live.k8s-hana.ondemand.com/app/ml-scenario-manager/#/scenarios/38cfe34f-93df-43dc-bbab-31ccf600f426/versions/1/EndColumnFullScreen

SAP   **ML Scenario Manager**   ⑦   **Sh**

All Scenarios / Scenario Details
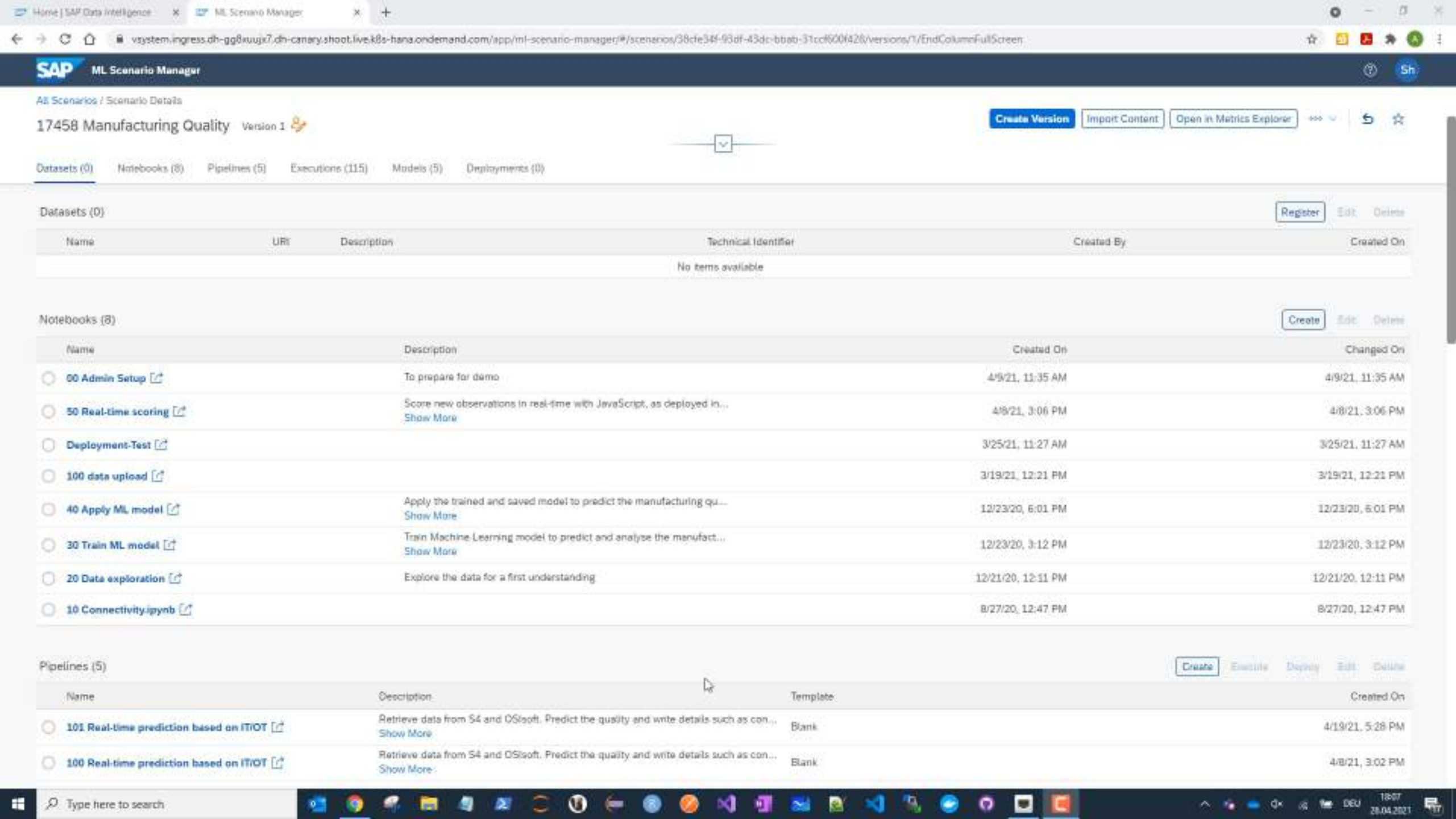
17458 Manufacturing Quality   Version 1 ✏️

                   Create Version | Import Content | Open in Metrics Explorer | ••• ∨   ↺   ☆

Datasets (0)	Notebooks (8)	Pipelines (5)	Executions (115)	Models (5)	Deployments (0)

Datasets (0)   Register   Edit   Delete

Name	URI	Description	Technical Identifier	Created By	Created On
			No items available		

Notebooks (8)   Create   Edit   Delete

Name	Description	Created On	Changed On
○ **00 Admin Setup** ↗	To prepare for demo	4/9/21, 11:35 AM	4/9/21, 11:35 AM
○ **50 Real-time scoring** ↗	Score new observations in real-time with JavaScript, as deployed in... Show More	4/8/21, 3:06 PM	4/8/21, 3:06 PM
○ **Deployment-Test** ↗		3/25/21, 11:27 AM	3/25/21, 11:27 AM
○ **100 data upload** ↗		3/19/21, 12:21 PM	3/19/21, 12:21 PM
○ **40 Apply ML model** ↗	Apply the trained and saved model to predict the manufacturing qu... Show More	12/23/20, 6:01 PM	12/23/20, 6:01 PM
○ **30 Train ML model** ↗	Train Machine Learning model to predict and analyse the manufact... Show More	12/23/20, 3:12 PM	12/23/20, 3:12 PM
○ **20 Data exploration** ↗	Explore the data for a first understanding	12/21/20, 12:11 PM	12/21/20, 12:11 PM
○ **10 Connectivity.ipynb** ↗		8/27/20, 12:47 PM	8/27/20, 12:47 PM

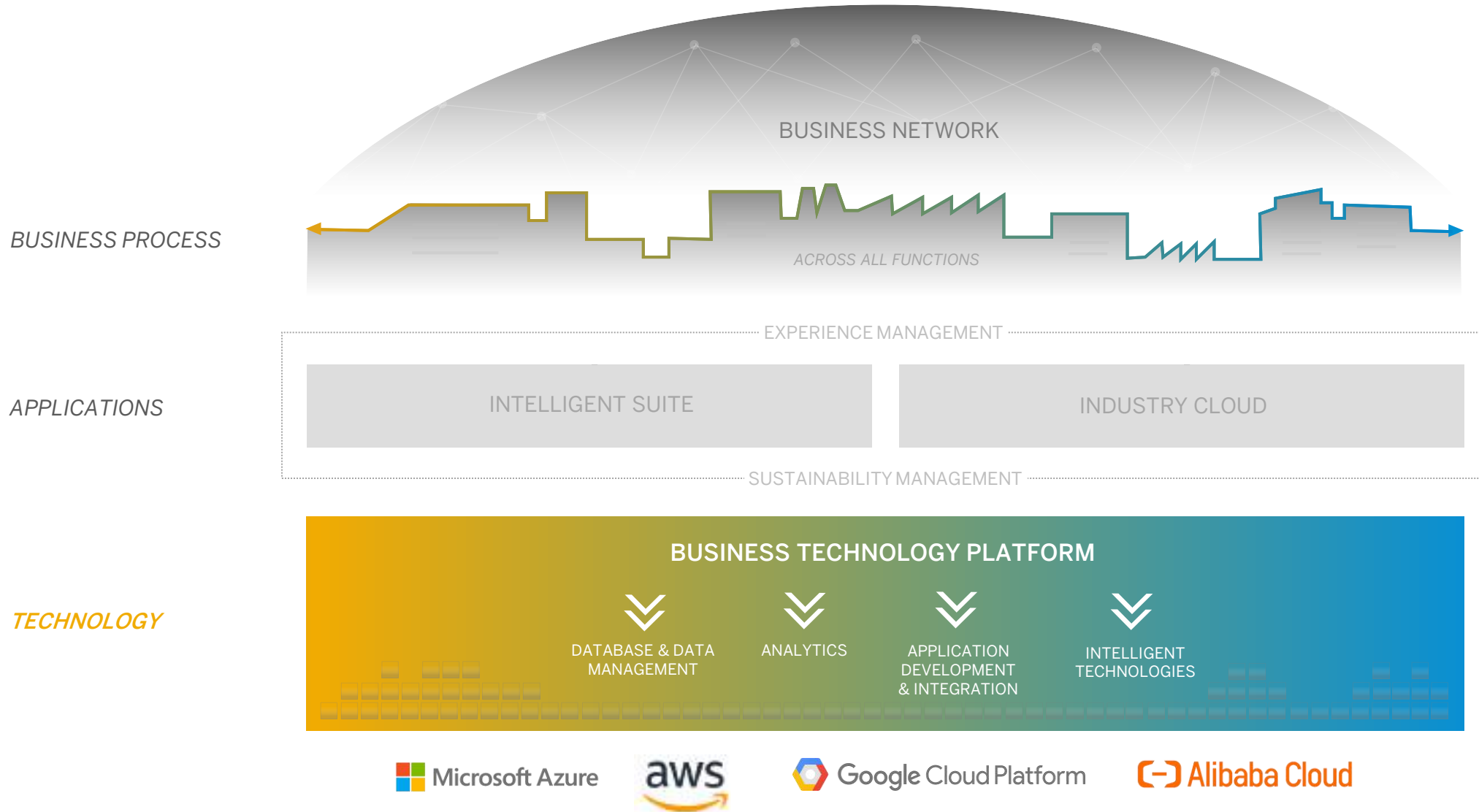## Pipelines (5)   Create   Execute   Deploy   Edit   Delete

Name	Description	Template	Created On
○ **101 Real-time prediction based on IT/OT** ↗	Retrieve data from S4 and OSIsoft. Predict the quality and write details such as con... Show More	Blank	4/19/21, 5:28 PM
○ **100 Real-time prediction based on IT/OT** ↗	Retrieve data from S4 and OSIsoft. Predict the quality and write details such as con... Show More	Blank	4/8/21, 3:02 PM

Business Technology Platform

BUSINESS NETWORK

BUSINESS PROCESS

ACROSS ALL FUNCTIONS

EXPERIENCE MANAGEMENT

APPLICATIONS

INTELLIGENT SUITE

INDUSTRY CLOUD

SUSTAINABILITY MANAGEMENT

TECHNOLOGY

BUSINESS TECHNOLOGY PLATFORM

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INTELLIGENT TECHNOLOGIES

Microsoft Azure   aws   Google Cloud Platform   Alibaba Cloud

Interested in some hands-on experience?
Predictive Quality Workshop

Remote collaboration

½- 1 Day

Free of charge, limited seats
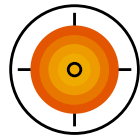
Purpose

- Experience how the SAP Business Technology Platform creates value out of data assets in manufacturing

- Predict whether the quality of a Polymer manufacturing batch will be in- or out-of-spec

- Follow a step-by-step instruction in a live system (Python in Jupyter Notebooks) guided by an expert

Attendees

- Business & Data Analysts
- Data Engineers & IT Architects
- SAP experts new to Data Science
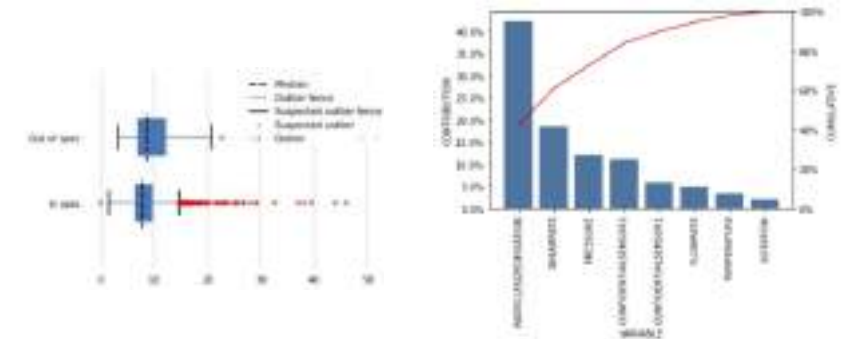- Data Scientist new to SAP functionalities

Tools

- SAP Data Intelligence
- SAP HANA Cloud
- Automated Predictive Library (APL)

Outcome

- Raise Technology Awareness via manufacturing use case
- Hands-On experience with advanced analytics

To sign up, email andreas.forster@sap.com

Thank you.

Contact information:

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