Introduction to Atos' Digital Twin Services

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Agenda

Introduction

Participants

1. Atos' Digital Twin Journey
    - Atos' Digital Twin Journey
    - Vision & Strategy
2. Digital Twin Approach / Offering
    - Our DT Offering – Business Model
3. Platform Strategy & Case Studies

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Atos' Digital Twin Journey

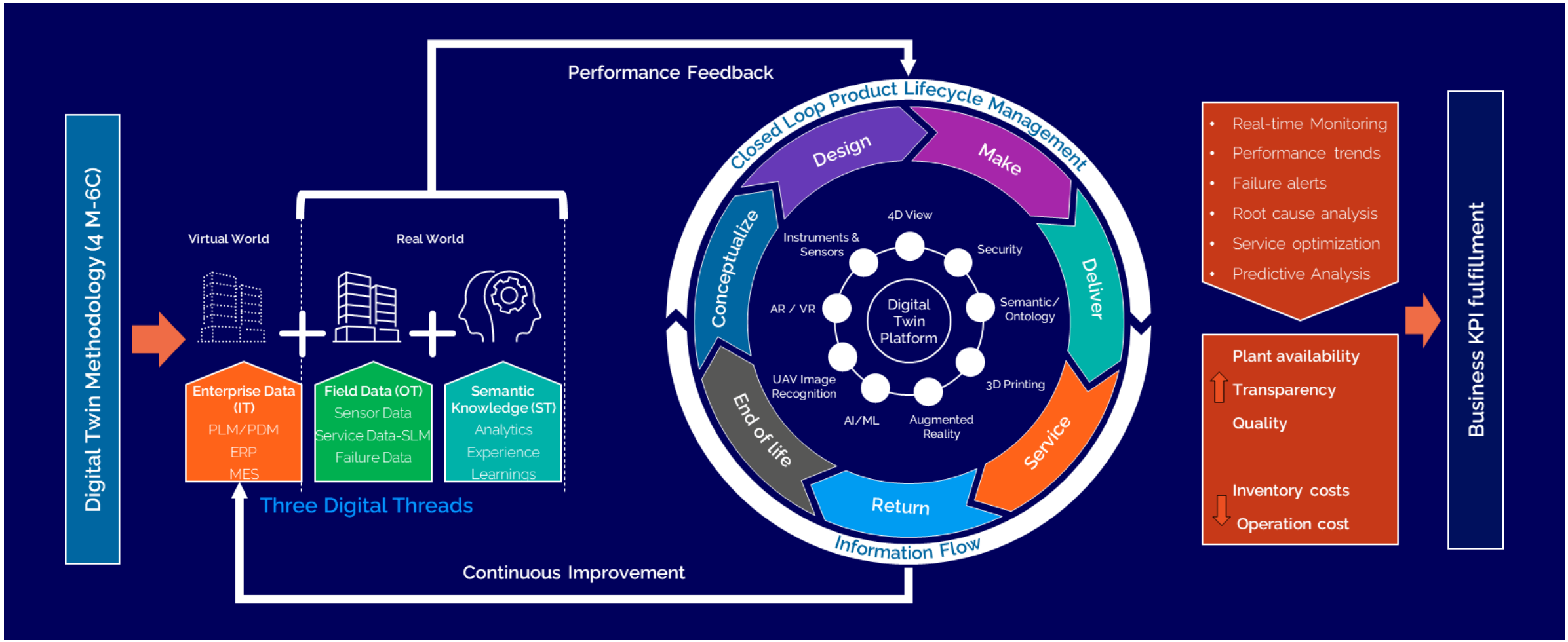
Atos' view of Digital Twin

What is a digital twin? What is a digital twin not?

A digital twin represents a **cross-domain digital meta model** that accurately represents a product, processes, material & resources to monitor, simulate, predict and improve **business performance** and mitigate **business challenges**

Digital Twin / Closed-Loop PLM

Business value through Digital Twin solution template/platform (via Digital Threads)



Atos engagement roadmap to Digital Twin

Atos ways of working at each step of the digital journey

1. Ideation

- Find data driven use cases for your business domain
- Evaluate potential of identified Digital Twin use cases

2. Digital Twin Design Sprint 4M 6C

- Deep-dive business challenge
- Shape a Digital Twin solution and PoV scope
- Data requirements and metrics
- POV benefits and implementation efforts

3. Build an POV

- Development of PoV solution for selected Use cases
- Implementation within POV scope e.g. for Products or regions

4. Live Test and Pilot Implementation

- Field implementation and test

5. Exploitation and Deployment

- Industrial implementation

1-2 weeks	1-3 months	> 6 months

Digital Twin – Value Driven approach

Problem-solving consultative engagement

Sales approach

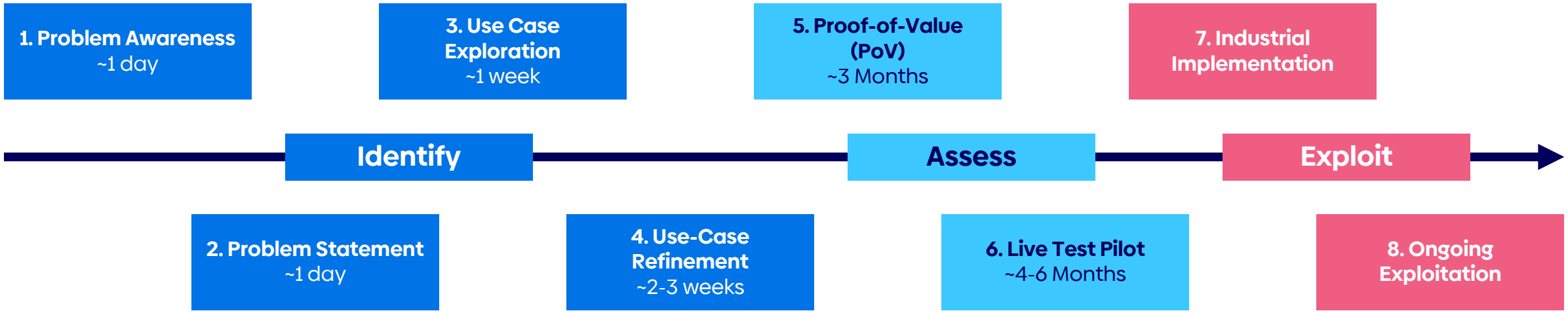
What Digital Twin is :

- It is a problem-solving consultative approach through…
- …top-down business value(up to 5 KPI) discussions…
- …or solution to business challenges / issues…
- ..choose appropriate technologies during PoV.

What Digital Twin is NOT:

- is not about technology to start with.

Our engagement approach



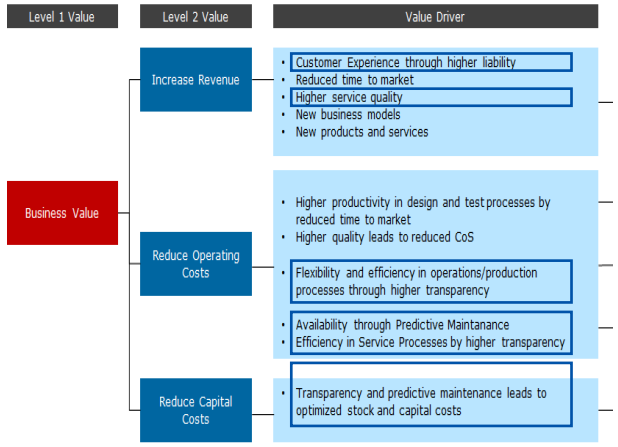
Digital Twin Incubator

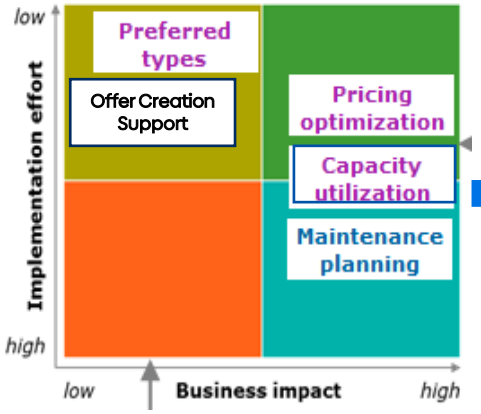
Scope of Ideation and Design Sprint

Ideation

Structure: Business driven
2 day workshop with experts
focused on existing pains and
improvement potentials

Result: Identification of use cases and prioritization
based on implementation effort and business benefit





Design Sprint

Structure: 2 day workshop
with experts focused on
selected use case and related
improvement potentials

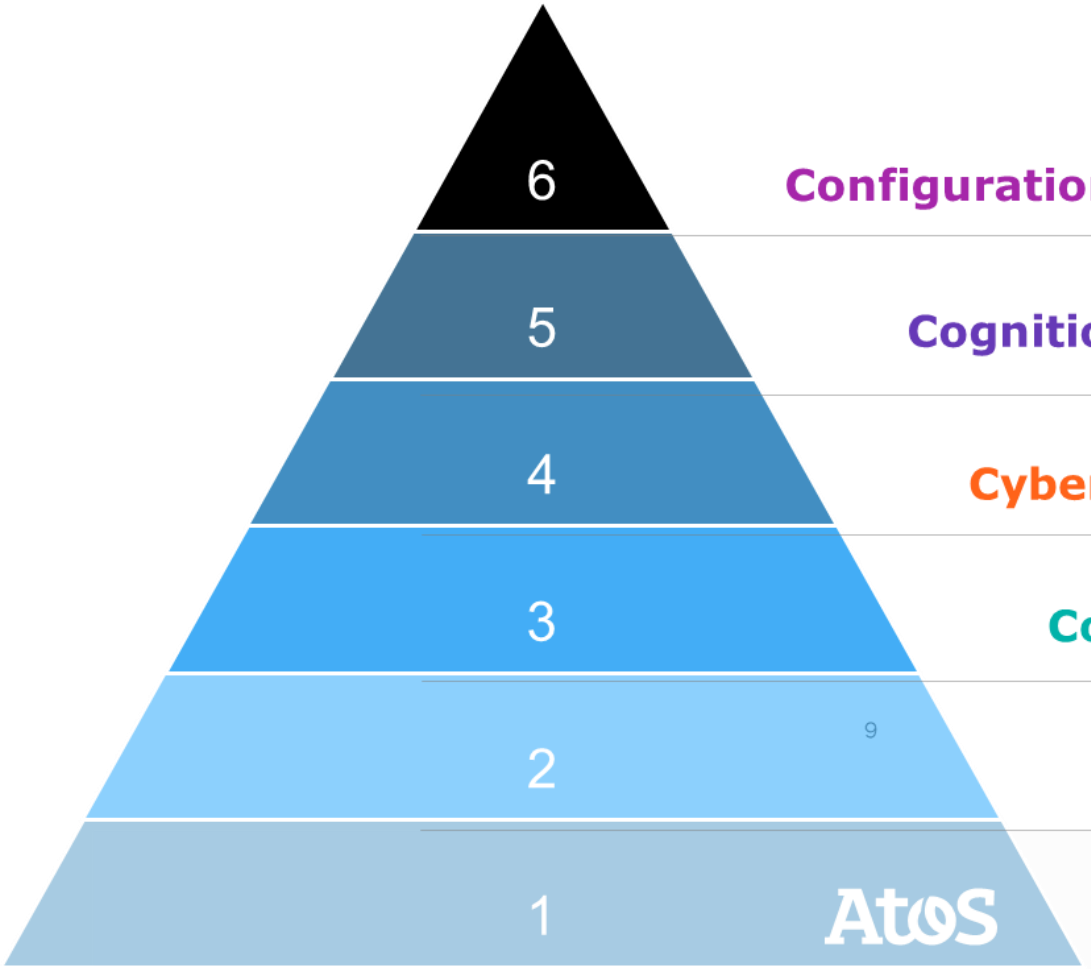
Result: Detailing of use case, effort and benefit to start
with prototype development (DT Platform)

REDUCE VARIABILITY IN PRODUCT QUALITY

CATEGORY	INFLUENCERS	KPI	BENCHMARK	UOM	DATA SOURCE
RAW MATERIALS	Purity of organic and liquids	Spectrum analysis (Raman) TBC	TBC	YES	Spectrometer (offline QC analysis) / data lak
		certificate of analysis	TBC	%	SAP / LIMS (certificate of analysis) /data lak
	API concentration (Raw material)	Certificate of analysis -1A	TBC	%	SAP / LIMS (certificate of analysis) /data lak
		certificate of analysis -1O	TBC	%	SAP / LIMS (certificate of analysis) /data lak
		certificate of analysis-2O	TBC	%	SAP / LIMS (certificate of analysis) /data lak
		certificate of analysis - 3O	TBC	%	SAP / LIMS (certificate of analysis) /data lak
	Channel blockage due to raw materia	No of channels blocked	0	No.	Process system (PCS7) pressure & flow rate
MAN	Raw material prep (high skill)	concentration and impurities	TBC	YES	Spectrometer (SIPAT)
MACHINE	Design impecfection of chamber	Performance qualification (vendor)			TO BE CHECKED
	Pump performance	Pressure in pump	TBD	Bar	Process system (PCS7) pressure
		Flow rate in the pump	TBC	mL / min	Process system (PCS7) pressure
	Leakage in the pipe	No leakages	0	No.	Process system (PCS7) pressure & flow rate / visual inspection
		No leakages			Difference in weight before and after (Control Systems)
PROCESS	Temp of stock solution	Target value as specified (range)	TBC	degree C	PCS7
	Purity of Raw Material	Spectrum analysis (Raman)			SIPAT
	API concentration (in stock solution)				SIPAT
	Flow rate of phases	Ratio of flow rate			PCS7
	Imperfection of chip (Mfg defect)	Performance qualification (vendor)			TO BE CHECKED
	Solvent concentration	As per specification			SIPAT (reference is stored in SAP)
	Temp of chamber	As per specification (should be constrant)		degree C	PCS7
				degree C	

Digital Twin – Maturity Model

"4M-6C" Methodology



Configuration
- Self-configure
- Self-adjust
- Self-optimization

Cognition
- Integrated simulation
- Remote visualization
- Diagnostics & decision making

Cyber
- Twin models
- Time as a dimension
- Data Context & Clustering

Conversion
- Smart analytics
- Performance prediction

Connection
- Plug & play
- Reliable communication
- Sensor network

Consulting
- 4M methodology:
  Man, Machine, Material & Method

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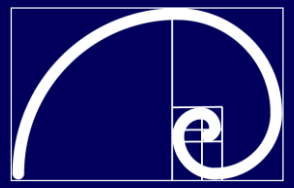
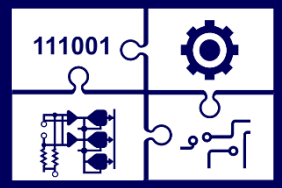
Digital Twin approach

Technological Forces needed for realizing a Digital Enterprise

Changing the way products come to life



Generative Design/ Simulation



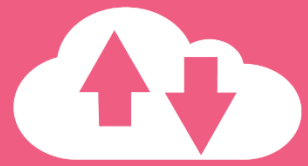
Systems-Driven Development

Changing the way products are realized

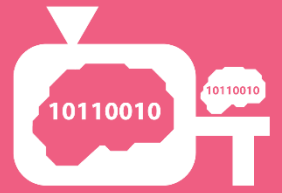
AI / ML

IT-OT Convergence

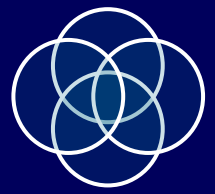
Changing the way products evolve



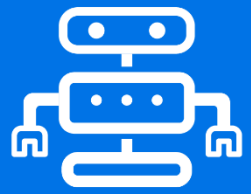
Hyperscaler Technologies



Gen AI / Simantics



Model-Based Engineering



Advanced Robotics

Big Data Analytics

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Platform Strategy & Case Studies in Pharma

Quality assessment and adaptive control in real time

British multinational pharmaceutical company

Intelligent Process Management

Digital Twin of Micro-Fluidics Process enabling quality estimation and predictive control

Client Challenges

- Long time to market for new vaccines
- High cost of production due to batch waste (1 out 5 batches is discarded)
- Quality of batch is only measured once the production is done, holding the next process steps until the lab results are available
- No method to measure and intervene during vaccine growing phase

Atos Solution

Digital Process Twin

- Virtual representation of the client's microfluidics subprocess
- Modelled using physics-based numerical simulation and machine learning (physics-informed AI)
- Runs on top of Siemens SIPAT (IoT platform) and TIA (process control system)

Virtual Process Design

- Process simulation using Siemens Star-CCM+, AMESIM, HEEDS
- Execution of virtual experiments converging to the "golden batch"
- Transfer of the "golden batch" parameters to manufacturing

Adaptive Process Control

- Real-time prediction of critical quality attributes
- Prescription of corrective actions if the process is going off-spec
- Automatic execution of corrective actions

Business Benefits

- Faster product development and time to market: reducing physical test cycles by 35%
- Robust quality, avoidance of deviations and improved yield: reducing production cost by 20%
- Online quality monitoring enabling real-time release and instant cash availability

Improving environmental performance of a product throughout its whole life cycle

French multinational pharmaceutical and healthcare company

Decarbonization and Sustainability

Digital Twin of a Pharmaceutical Product

Client Challenges

- The client's environmental sustainability program includes a commitment to improve the environmental profile of its products through an eco-innovative approach including eco-packaging and circular economy solutions.
- In order to avoid problem-shifting and green-washing, the client was looking for a holistic Life-Cycle Assessment (LCA) approach that considers all stages of the medical product life cycle and all kinds of environmental impact, not just carbon.
- Medicine production processes must meet many regulatory requirements and receive health authority approvals. Any significant change to the process must go through another approval cycle. Therefore, it was important to thoroughly evaluate all possible scenarios at the product design stage.

Atos Solution

Digital twins of medicines and vaccines that use historical data collected across the client's organization to model environmental footprints throughout life-cycle stages:

- Raw materials and Manufacturing
- Packaging, Storage and Distribution
- Use and End of life

Collaborative Eco-design platform that allows to

- Simulate environmental performance of a pharmaceutical product early in the design phase, before any physical product is produced
- Compare the simulated environmental impact of various design and production options across multiple factors: climate change, biodiversity, resources, water, human health
- Identify potential areas of improvement and quantify the impact
- Introduce robust metrics for product sustainability profile

Business Benefits

- Robust data and methodology for environmental impact assessment, reducing the assessment effort from 6 months to 2 weeks
- Actions and levers to minimize environmental impact of the current and new portfolio
- Eco-design thinking at the core of product development activities
- Science-based development and collaboration with academics
- Leading position in LCA tools and methodology development
- Coherent communication strategy strengthening the client's market positioning
- No green-washing

Digital Manufacturing-Proven Experience

Industry 4.0 implementation for a French Innovative Global Healthcare Company since July 2019

About Client

A French Innovative Global Healthcare Company

Challenges

- Existing prolong plant cycle time have degraded customer responsiveness.
- Siloed shopfloor workstyle resulted in delayed decision making and knowledge isolations
- Higher deviations cases across all manufacturing sites resulted in quality, compliance & regulatory issues
- Deficiency of energy monitoring solutions resulted in in higher maintenance cost, Sustainability & compliance challenges.

Technologies

- Digital Twin, Advanced Analytics
- Intelligent Automation
- OEE, MES, SAP MII, Historian
- IoT, Edge Computing, Connectivity

Solution

Atos is a primary supplier for Digital Factory 4.0 program covering:

- Connected equipment/plant: data acquisition, storage, analytics, application ecosystem
- Connected teams & operations: Factory Control Tower, Overall Equipment Effectiveness
- Smart quality: Deviations & Golden Batch Intelligence
- GxP validation supported by Batch Genealogy and Traceability
- Eco-design: environmental impact assessment and reduction across the whole product life cycle

Atos implemented these solutions in a pilot factory and currently rolling them out across 52 manufacturing sites in 20 countries

Customer Benefits

- **30%** Reduction in Plant Cycle Time
- **50%** Reduction in Deviations
- **30%** improvement in golden batches
- **20%** faster personnel onboarding via AR-VR trainings

Business Value

- Real-time data-driven decision-making process
- Enhanced productivity & Quality and defect reduction
- Increased Team Efficiencies
- Cost savings through proficient production planning
- Accelerated Time-to-Market

Mixed reality experience for guiding an operator during the machine setup

Japanese multinational pharmaceutical company

Augmented Work Instructions

Digital Twins of pharmaceutical packaging machines

Client Challenges

- Pharmaceutical packaging is certainly the most complex of all packaging. It is not so much a question of marketing as in the case of food packaging, but it plays an important role, as it is directly related to the health of patients
- Frequently changes as a machine packs different drugs during a single day. Each time a new drug must be packaged, an operator must configure the machine to fit the new package format
- The adjustment procedures of these industrial machines require rigor and precision, and each error leads a loss of time and therefore of production and money

Atos Solution

- Scalable Augmented Reality work instructions digital twin designed and built using Atos CX Immersive Accelerator. The digital twin includes 15+ adjustment points of a packaging machine.
- 3D overlay guides the operator through the machine setup process highlighting the required adjustment points and advising on the setpoint values, avoiding human mistakes
- Integration with the manufacturing system to retrieve the required sequence of operations

Business Benefits

- The packaging process operator is now able to hands free, change over multiple machines with less errors and significantly less cost of non quality.
- The scalable AR work instructions platform is deployed for multiple machines, adding new machines or changing procedures is easy to set up and well structured to maintain

Process optimization in real-time. Operational costs cut by 25%

French multinational utility company

Intelligent Process Management

Digital Twin of Wastewater Treatment Process

Client Challenges

- Wastewater treatment is an expensive and complex process, requiring high capital investments
- Regulatory pressure, heavy penalties in case of water quality issues
- Necessity to improve sustainability of the operations, reduce environmental impact
- Anticipating process deviations, like foam formation that could asphyxiate treatment tanks and is extremely costly to fix
- More efficient way to collect and aggregate huge volumes of plant data, collected via sensors, camera or both to make more informed decisions

Atos Solution

Atos delivered an end-to-end solution for plant operators that includes:

- **Digital Twin Technology:** Creates a virtual model of the wastewater treatment process that learns process dynamics from historical data by leveraging machine learning and AI. It analyzes plant data collected from SCADA systems and incorporates external environmental factors, including temperature, wind, rainfall, and humidity, to enhance accuracy.
- **Predictive Analytics:** Utilizes past data patterns to accurately forecast future wastewater volumes and compositions. This helps in planning and adjusting treatment processes in advance.
- **Optimization Algorithms:** Employs simulations to find ways to lower energy use and reduce the quantities of chemicals needed, such as lime, chlorine, ferrous chloride, and polymers. Additionally, it ensures that sludge management meets specified standards.
- **Prescriptive Analytics:** Offers precise recommendations for adjusting the settings of key plant equipment, including air blowers and various types of pumps and screws, optimizing performance.
- **Co-Pilot Application:** Aids operators by suggesting the best settings for the plant. It allows to review plant operations over the previous 48 hours and project future operations for the upcoming 32 hours, facilitating proactive management.

The solution was deployed on premise using Codex Smart Edge platform

Business Benefits

- 25% reduction in operational costs
- Reduced environmental footprint due to lower energy consumption and chemical use
- Robust water quality, avoiding penalties
- Better prevision and control of energy consumption, reducing penalties from the energy providers
- Early detection of factors, like foam creation, that have negative impact on the process efficiency

Our Key Differentiators

1. Proven Digital Twin methodology (4M-6C) & Digital Twin Data Platform (Patent) & Accelerators
2. Our Complementary offerings - Cyber Security, High Performance Computing & advanced Simulations
3. Our vertical focus and a business-driven approach to address enterprise KPI / Challenges
4. Green Digital Twin offerings backed by our Product Carbon Footprint platform (PCF)
5. Strong Business Ecosystem to strengthen our portfolio (AWS, GCP, Azure, Bentley, Siemens, SAP)

Thank you!

For more information please contact:

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Further Information

Digital Twin @ Atos (Home Page):
https://atos.net/en/solutions/industry-4-0-the-industrial-internet-of-things/targeting-business-outcomes-through-digital-twin

Video (YouTube channel)
https://www.youtube.com/channel/UCrzg_LZcM-pbo54pXe-YJjg

Amazon Market Place Link:
https://aws.amazon.com/marketplace/pp/prodview-5drjqhc32cokm?sr=0-5&ref_=beagle&applicationId=AWSMPContessa

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