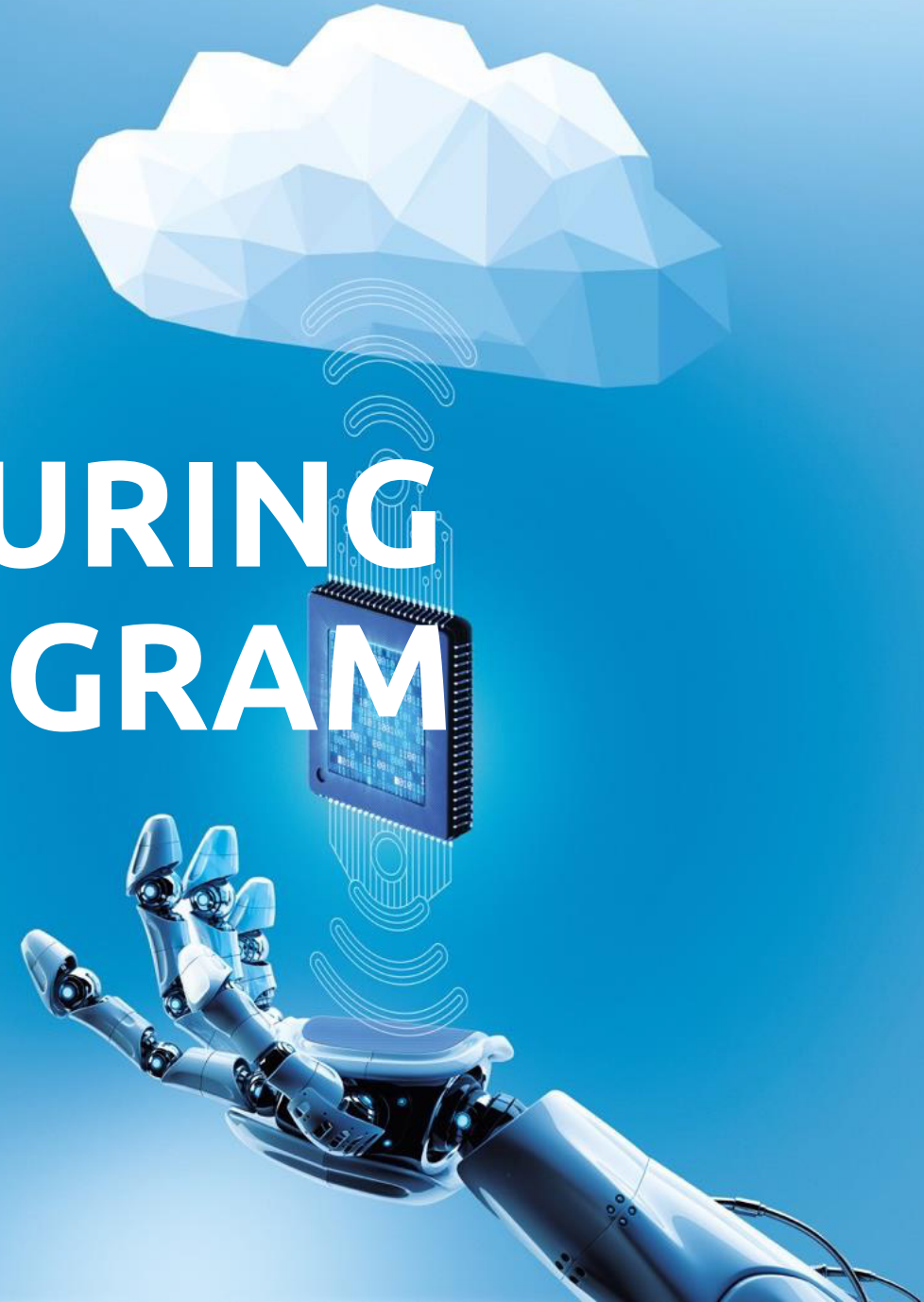**Capgemini engineering**

KEYNOTE SESSION
SMART MANUFACTURING ACCELERATOR PROGRAM

Arranged by NASSCOM   CoE

Presented by

Tridib Roychowdhury, Principal Architect, Capgemini Engineering,

Industrial Automation and Digital Manufacturing

WHAT ARE THE CHALLENGES WE FACE IN MANUFACTURING?

- How do you **address** your industrial performances (OEE, TAKT, …)?

- What are the **key drivers** of your business (flexibility, production growth, quality, new product, processes)?

- How do you address **sustainability** challenges in your manufacturing process?

- What is your status around **IT/OT Connectivity**, the existing **IT/OT architecture**? Is your network **Cyber Secure**?

- How do you address your **Digital Transformation at scale**?
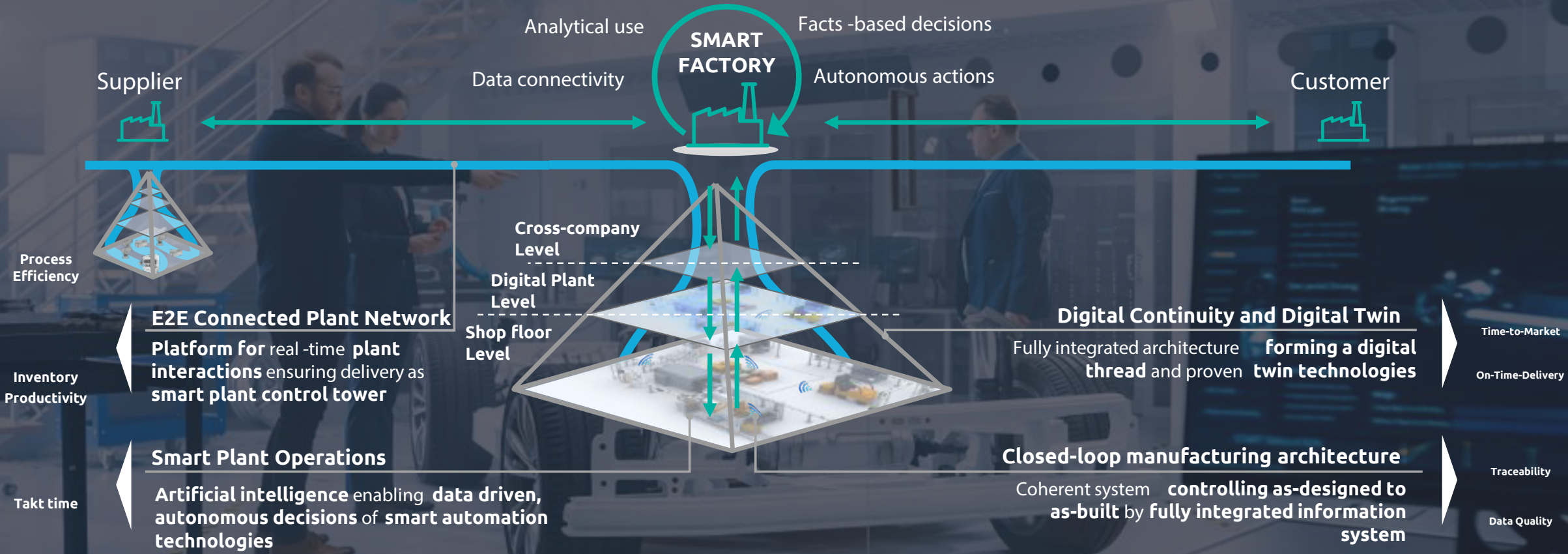
- How do you **address Factory** and **Operator safety**?
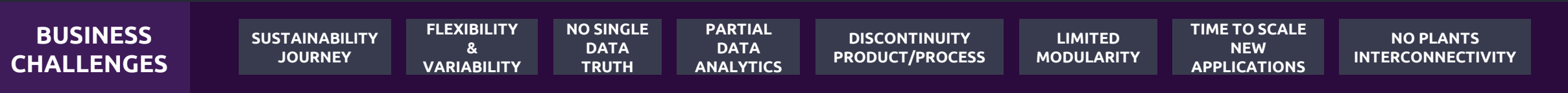
EFFICIENCY	QUALITY	COST

A TYPICAL VIEW OF OF SMART FACTORY ECOSYSTEM
A GLOBALLY CONNECTED SYSTEM, LEVERAGING NEW TECHNOLOGIES

Analytical use

SMART FACTORY

Facts -based decisions

Data connectivity

Autonomous actions

Supplier

Customer

Process Efficiency

Cross-company Level

Digital Plant Level

E2E Connected Plant Network

Shop floor Level

Digital Continuity and Digital Twin

Platform for real -time **plant interactions** ensuring delivery as **smart plant control tower**

Fully integrated architecture **forming a digital thread** and proven **twin technologies**

Inventory Productivity

Time-to-Market

On-Time-Delivery

Smart Plant Operations

Closed-loop manufacturing architecture

Artificial intelligence enabling **data driven, autonomous decisions** of **smart automation technologies**

Coherent system **controlling as-designed to as-built** by **fully integrated information system**

Takt time

Traceability

Data Quality

Offering smart and data driven plants means enabling **full connectivity** and intercommunication of operational devices, processes and infrastructures. **Analytical use** of the **collected data** enables machines and people to make **intelligent, fact-based decisions** – transferred into **autonomous activities** or human action increasing performance efficiency & customer centricity.

←→ Data flow & continuity   ←→ Material flow

FOUR CAPABILITIES ARE CURRENTLY CONSIDERED BY ADVANCED LEADERS TO BRING INDUSTRY 4.0 AT FULL SCALE

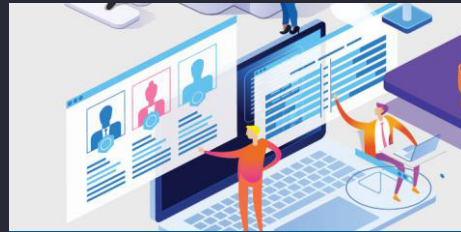| BUSINESS CHALLENGES	SUSTAINABILITY JOURNEY	FLEXIBILITY & VARIABILITY	NO SINGLE DATA TRUTH	PARTIAL DATA ANALYTICS	DISCONTINUITY PRODUCT/PROCESS	LIMITED MODULARITY	TIME TO SCALE NEW APPLICATIONS	NO PLANTS INTERCONNECTIVITY

CAPABILITIES

CLOSED LOOP MANUFACTURING ARCHITECTURE

- Application based services: Personalization with core, specific development and legacy functions
- Interoperability brought by data backbone and services modularity
- From fragmented legacy to modular platform

DIGITAL CONTINUITY & DIGITAL TWIN

- Digital continuity from product, Process Engineering, to Production, Quality
- Simulation based on real product and process data automatically captured

E2E CONNECTED PLANT NETWORK

- Multi-levels : Plant, Regional and Global
- Cross-domain view for monitoring and benchmarking
- Mutual Shared services
- Remote technical assistance

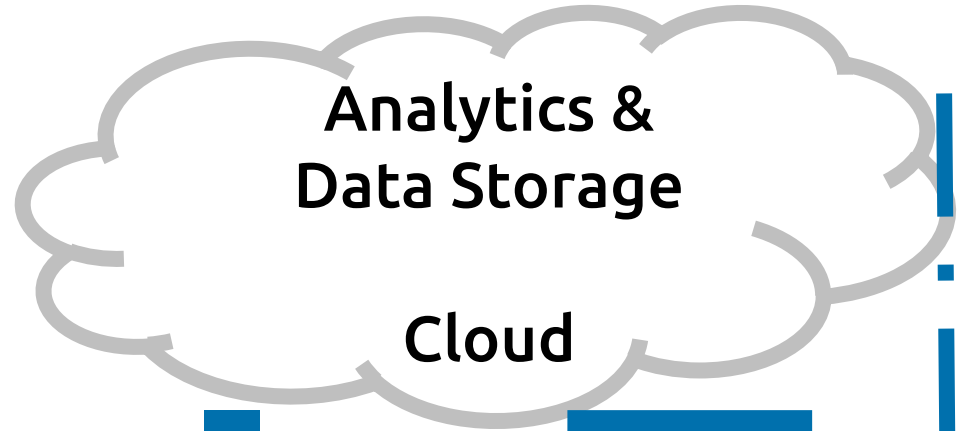### SMART PLANT OPERATIONS

- Artificial intelligence enabling data driven, autonomous decisions of smart automation technologies

OUTCOMES

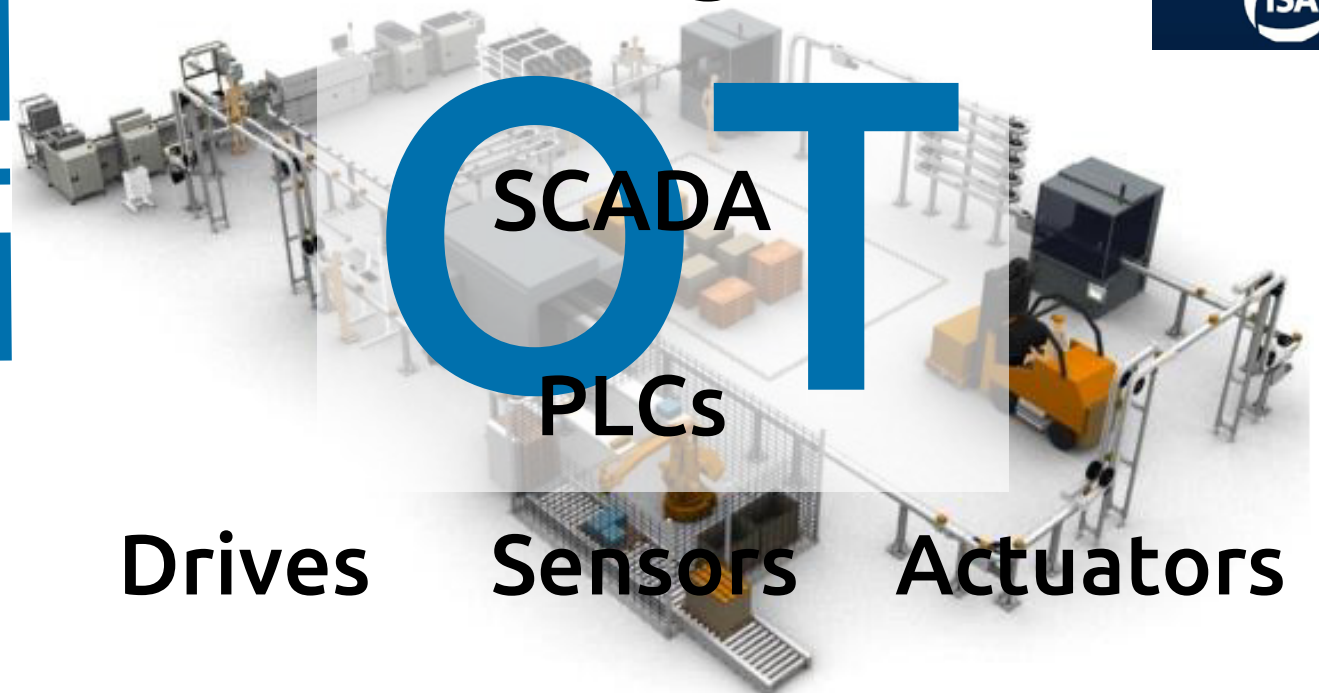| +40% Traceability	+35% Data Quality	-40% Time-to-Market	+20% On-Time-Delivery	+20% Process Efficiency	-25% Inventory	+20% Productivity	-20% Takt time

TYPICAL PROBLEMS SOLVED BY DIGITAL TRANSFORMATION

SIGNIFICANT GAINS REALIZED BY DIGITALLY TRANSFORMING THEIR FACTORIES

All **state-of-the-art** solutions and use cases related to **Smart Factory in operations** have something in common:

It all starts with visibility...
… accurate and timely data,
… across all plants,
… used to anticipate issues, improve performance and orchestrate cross-company processes.

Operations Dashboard

- Planning, Supply chain, Quality & Production for supervision
- Operations KPI dashboarding

Simulation

- Line/flow simulation for line design, line balancing
- Simulation of n ew product/ process introduction

Asset management

- Utilization monitoring and maintenance planning
- Condition -based maintenance
- Predictive maintenance
- Asset tracking
- Analytics for yield, efficiency

Enhanced Operator

- Digital instruction
- Mobile application
- Digital training, 3D enabled immersive training
- Automated operator guidance

Operations Management

- Monitoring execution to individual workstations and machines
- Paperless operation
- Real -time OEE monitoring
- Process – product traceability

Quality

- Statistical process control
- In-line quality, computer -vision
- Adjustment of co ntrol parameters
- AI-based root -cause analysis
- Predictive quality

Intelligent Automation

- Process analysis to eliminate repetitive and manual Interventions
- Robotics/ Cobotics
- AGV

APPROACH FOR TRANSFORMATION TO A SMART FACTORY

Strategy & Assessment	Business outcome-driven transformational path	Technical/Technological roadmap	Implementation Rollout , Scale and Support
Factory Assessment, IT/OT Connectivity Assessment & Industry 4.0 strategy to support short/mid/long term view	Based upon priorities and manufacturing excellence, co-design business cases to address greenfield design & brownfield optimization and secure strategy & transformation path	Define your digital architecture and provide an Edge2Cloud 360 view to ensure Product/Process continuum with data platform and making them Cyber Secure at the same time. Apply State of the art AI and Gen AI techniques for Advanced use cases	Use a team Business & Digital will deliver Manufacturing Management Systems, Manufacturing Data Platform, Digital & AI-Driven Applications. Post Implementation our teams support the systems at different levels

Supported by

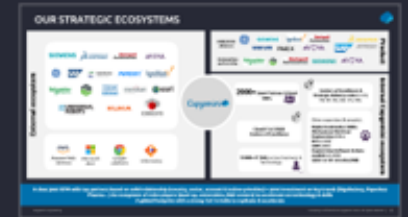| Maturity assessment frameworks & benchmark datasets	Overarching business value framework	use-cases gallery & documented business ROI	Blueprint architectures using Reference architectures (Green & brownfield)	Scale up using partners and hyper scalers

SMART MANUFACTURING FRAMEWORK

PLM, ERP, SUPPLY CHAIN & OTHER ENTERPRISE APPS

DIGITAL CONTINUTIY AND CONVERGENCE

MANUFACTURING SIMULATION

Virtual Plants modeling, Process & Flow Simulation, Virtual commissioning

MANUFACTURING OPERATIONS MANAGEMENT

Advance Planning & Scheduling, Production, Quality, Laboratory Warehouse & logistics

DIGITAL APPS & DATA PLATFORM

Manufacturing Performance platform, Data Driven intelligent operation, Physical -Digital converges – zero distance apps

ENTERPRISE ASSET MANAGEMENT

Asset performance management & Maintenance

SUSTAINABILITY

SECURITY

EDGE AUTOMATION

Real time analytics based operations, image analytics, auto adaptive process

SHOPFLOOR AUTOMATION & DATA COLLECTION

Smart sensors, ID readers, PLC, SCADA, Robotics,, Protocol Gateways & OPC Servers

MOBILITY LAYER

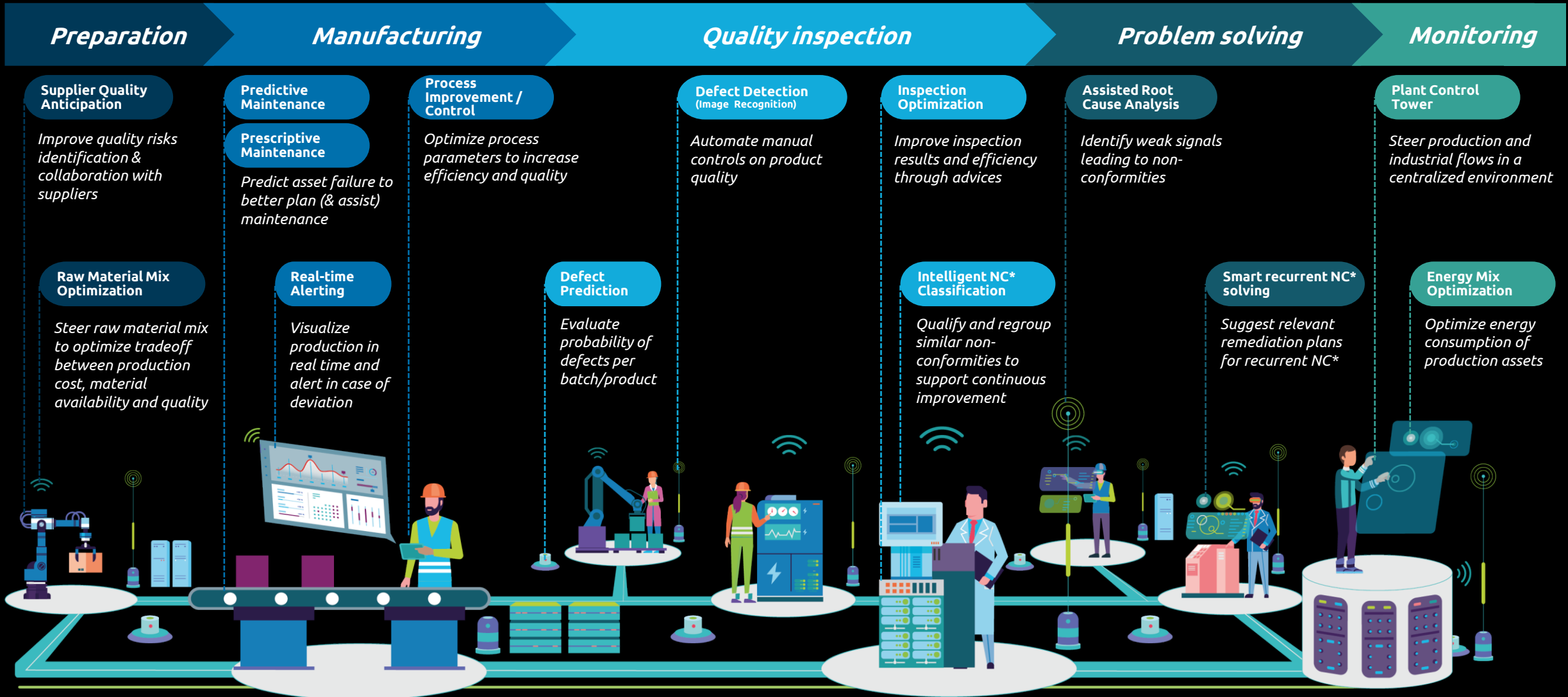Manage wireless flows (LPWAN, 4G/5G, WIFI)

Strategy & Architecture

Solution Implementation & maintenance

Engineering & Design

Tech & Business Transformation
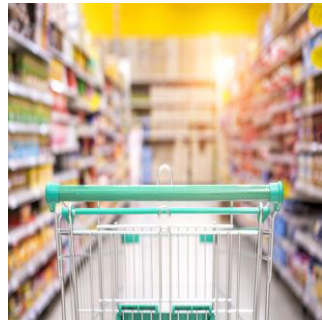
MANUFACTURING & QUALITY OPERATIONS
DATA, ANALYTICS AND AI CAN BOOST PERFORMANCE IN MANY AREAS

Preparation | **Manufacturing** | **Quality inspection** | **Problem solving** | **Monitoring**

Supplier Quality Anticipation

Improve quality risks identification & collaboration with suppliers

Predictive Maintenance

Prescriptive Maintenance

Predict asset failure to better plan (& assist) maintenance

Process Improvement / Control

Optimize process parameters to increase efficiency and quality

Defect Detection (Image Recognition)

Automate manual controls on product quality

Inspection Optimization

Improve inspection results and efficiency through advices

Assisted Root Cause Analysis

Identify weak signals leading to non-conformities

Plant Control Tower

Steer production and industrial flows in a centralized environment

Raw Material Mix Optimization

Steer raw material mix to optimize tradeoff between production cost, material availability and quality

Real-time Alerting

Visualize production in real time and alert in case of deviation

Defect Prediction

Evaluate probability of defects per batch/product

Intelligent NC* Classification

Qualify and regroup similar non-conformities to support continuous improvement

Smart recurrent NC* solving

Suggest relevant remediation plans for recurrent NC*

Energy Mix Optimization

Optimize energy consumption of production assets

*NC: Non Conformity

SOME EXAMPLES

CPG Major

- Digital Cloud Platform on Azure
- Data Mining & Analytics
- Easy factory configuration and onboarding
- Monitoring screen to validate health of sensor feeds

Multinational Tobacco Company

- 4.0 Maturity Assessment & Roadmap
- Predictive Quality & Maintenance using Analytics
- Smart Scheduling & Flow Simulation
- AI HVAC Roll Out

Oil & Gas Major

- X-IoT Solution
- Every machine is connected within a network that compiles data in order to generate a comprehensive report on the state of the production process


Mining Company

- A field -proven cloud - based analytics framework for asset health prognostics
- Condition -based Asset maintenance and production scheduling
- As much as 50% reduction in operational costs with estimated savings of AU$200mn* in 3 years

Consumer Goods Company

- Evaluation and Transition of Cloud and IoT Technology provider
- Development of Edge based AI model for identification of Hot Glue flow monitoring
- Scaling the Application across multiple plants globally
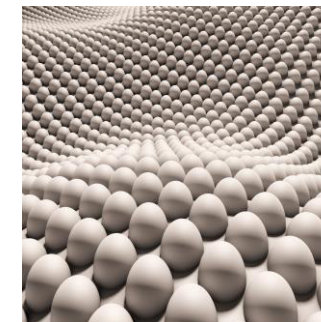
Poultry Production Company

- Automated visual sorting of eggs based on characteristics.
- Sorts eggs into 20 categories
- 36 images per egg & 270,000 eggs per hour
- Improved detection & worker health

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