Digitalization of Manufacturing
Leveraging the Internet of Things for Smart Manufacturing & Operational Excellence

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How we leverage our OT + IT experience to create meaningful IoT solutions
Key Takeaways:

- **IoT is the vehicle for the next level of Operational Excellence improvements and business transformation**

- **Expected benefits of IoT for smart manufacturing** - manufacturers can become more efficient, generate new revenue, improve worker safety and offer new business models by integrating existing data systems

- **How to move from Lean to Digital and where to start – Hitachi’s learnings**

- **What is a baseline journey for leveraging IoT for smart manufacturing, smart products, and smart services**

- **What do you need to know as a leader to execute a successful IoT and smart manufacturing strategy**
Delivering measurable, sustainable business results in all industries.
Hitachi’s Unique Value Proposition

Capability to deliver end-to-end at One Hitachi scale

105+ years + 55+ years + 10+ years

OPERATIONAL TECHNOLOGIES + INFORMATION TECHNOLOGIES + DIGITAL TECHNOLOGIES

INNOVATION

End to end integration – Industrial Grade – Secure – Scale

IMPACT

Co-Creation & Co-Innovation: We work with our Partners to Drive Scalable IoT Solutions

105+ years
OPERATIONAL TECHNOLOGIES

55+ years
INFORMATIONAL TECHNOLOGIES

10+ years
DIGITAL TECHNOLOGIES

Innovation & R&D
Information Drivers
Information Acquisition
Information Storage
Information Dissemination
Information Transformation & Visualization
Information Interpretation
Business Outcomes

Hitachi R&D & Labs
Embedded Things & Applications
Hitachi IoT Platforms & Sensors
Hitachi Data Systems
Hitachi Digital Transformation & AR
Pentaho (a HDS Company)
Hitachi Big Data Lab, BI&A
Hitachi Ops. Consulting

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The Fourth Industrial Revolution (Industry 4.0)

**Industrial Revolutions**

- **First**
  Steam Engine and Mechanization
- **Second**
  Mass Production
- **Third**
  Automation and IT Systems
- **Fourth**
  Digitalization, Virtualization, and Cyber-Physical Systems

How to move from theory to practice?
I4.0 Digital Transformation Opportunities

Digital Transformation - Three Main Opportunities for Manufacturers:

1. **Smart Manufacturing**
   - Productivity, Quality, Flexibility
   - Mass Customization & Virtualization

2. **Smart Products**
   - Tracking, Monitoring, Remote Control
   - Diagnostics & Maintenance

3. **Smart Services**
   - Product-as-a-Service
   - Monetization of Data
Manufacturing Challenges

- Production shifts rarely go as planned
- End-to-end visibility of operations is poor
- Productivity and quality impacted by variation

Excessive time and resources spent “fighting fires”
Challenges with Today’s Manufacturing IT

- 1990s architecture
- "Point solutions"
- Fragmented databases
- Standard apps & systems of record
- Lack of full value stream analytics
- Functional excellence > silo thinking
- Costly integration and maintenance
- Interdependencies & points of failure
- Multiple versions of the truth
- Lack of external data integration
The ‘Industry 4.0’ revolution provides immense opportunity for next level of operational improvements across organizations. Our intent is to partner with Clients through this journey and ‘co-create’ meaningful solutions for addressing business challenges.
IoT Video Link

Are you ready to accelerate growth while mitigating risk?

Accelerate operational excellence with IoT

It's time to turn challenges into opportunities.

Hitachi Social Innovation
IoT is the vehicle for achieving the next level of Opex performance
Start with both sides of the manufacturing portfolio maturity
Integrate with current Lean Six Sigma Operating Systems

Value Data - Determine which data will drive the greatest Opex improvements
Develop IoT Strategy with Executives and Leadership
Selecting a Digital IoT Platform for the Journey

Data must be aggregated and scalable

Data Lake
### Smart Manufacturing Platform Critical Elements

<table>
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<th>Process Automation</th>
<th>Automated operations based on Artificial Intelligence</th>
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<td>Visualization</td>
<td>End-user access to data and algorithms</td>
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<td>Artificial Intelligence</td>
<td>Purpose-built AI for IoT use cases</td>
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<td>Advanced Analytics</td>
<td>Analytics across business, human and machine data</td>
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<td>IoT Microservices</td>
<td>Centralized logging and object storage</td>
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<td>Foundation</td>
<td>Deployments and onboarding of OT and IT assets</td>
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6 functional layers combined to create comprehensive and agile IoT solutions
Hitachi’s Smart Manufacturing Platform - Lumada

Lumada | An Open, Flexible IoT Platform To Deliver Real-World Solutions
Benefits of Smart Manufacturing – Next Level of Opex

- Aggregation, Integration and Streaming of Data
- Creating Correlation, Logic, and Algorithms
- Finding Patterns, Combinations, Exceptions
- Millions of Iterations of Machine Learning
- Driving Continuous Improvement, Leaner Operations
- Creating end-to-end visualizations for all levels of the organization
**Decision optimization**

- **Value driver**
  - Decision models are formulated based on business rules, HCC will make recommendations. Baseline intention is to optimize in order to maximize plant operating profit.
  - Decisions are made applying the decision models. Humans are expected to examine the recommendations and override if necessary.
  - Tuning of decision models is performed regularly via measurement of human decisions or corrections of automated recommendations.

<table>
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<th>Value driver</th>
<th>Key outcomes</th>
<th>Controllable levers</th>
<th>Tools</th>
<th>Hitachi solution</th>
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<td>Less downtime</td>
<td>More first pass yield</td>
<td>Lower MFG order cost variances</td>
<td>More direct labor efficiency</td>
<td>More on time deliveries</td>
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<tr>
<td>Maintenance and production schedules</td>
<td>Standard costs, operating rates</td>
<td>Incentives / penalties, knowledgebase</td>
<td>Production schedule</td>
<td>Redirect resources</td>
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<td>Condition-based and perspective maintenance</td>
<td>Real time monitoring</td>
<td>Predictive schedule adherence</td>
<td>Process modelling and predictive analysis</td>
<td>Predictive schedule adherence</td>
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<td>Predictive maintenance</td>
<td>Production tracking granularity</td>
<td>Ambient shop floor experience</td>
<td>Dynamic scheduling and demand monitoring</td>
<td>Energy management</td>
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<tr>
<td>Predictive quality</td>
<td>RCA cost management</td>
<td>HVS for shop floor</td>
<td>Energy management</td>
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Manufacturing Use Cases

- Dynamic Scheduling
- Predictive Quality
- Maintenance Optimization
- Big Data

Digitalization of Theory of Constraints
Digitalization of Six Sigma
Digitalization of Maintenance Excellence
A global producer of injectors for automotive airbags, Daicel made a strategic decision to digitize its quality management system. Goal: increase certainty of product quality, reduce cost of internal re-work and root cause eradication.

Digitalization of Man, Machine, Method, Material. Aggregation of 3D image analysis with data from IT systems and IoT devices enables defect prediction and improved quality management process. Integrated with continuous improvement system.
EXAMPLE: Dynamic Scheduling at Hitachi Operations

A Hitachi Distribution Center increased productivity by 8% through dynamic scheduling of orders based on data aggregation, analytics, and machine learning.

The Hitachi Omika Factory improved lead-time by 50% in a high-mix, make-to-order production operation through dynamic scheduling. By aggregating customer order data and operational data sets, bottlenecks are predicted and reduced/avoided. As a result, the factory increased both productivity and flexibility.

In both cases, the digital solution is an integral part of the KAIZEN system.
Example: Smart Products to Smart Services
Our Innovative “Co-Creation” Approach

“CO-CREATION”

Digital Customer Experience
Digital Enterprise
Digital Operations
Smart Infrastructure

NEXPERIENCE
PROCESS
NEXDEV

BEST-IN-CLASS PEOPLE

SKILLS FOCUS

PLATFORM

ARTIFICIAL INTELLIGENCE

LUMADA

INDUSTRY SOLUTION CORES ALIGNED TO FRONT BUSINESS UNITS

Urban
Finance, public and healthcare
Industry, distribution and water
Power and energy

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Leadership: Key Takeaways for Executing Successful Smart Operations and IoT Strategy

IoT is the Vehicle for the Next Level of Operational Excellence Improvements

Value Data - Begin with the Business Case (Often 3X ROI)

Integrate with Lean Six Sigma Continuous Improvement System/Culture

Execute a 5-Year Transformation Roadmap; Owned by Leadership

Select a Scalable and Open IoT Platform

Aggregation of Big Data Enables the Value

Start at Both Ends of the Manufacturing Portfolio Maturity

Collaborative Creation – Not Off-the-Shelf Technology Solutions
THANK YOU