Monozukuri Innovation
Using IoT

Hitachi Metals IR Day 2017

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Monozukuri Innovation Using IoT

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1-1. Overview of the *Monozukuri* Innovation Project

*Monozukuri* skills to achieve greater organic growth

**Build innovative *monozukuri* through IoT** ×  **Achieve innovation in manufacturing technology throughout the entire material flow**

**Improve cash flow by rolling out company-wide activities**

<table>
<thead>
<tr>
<th>Company-wide activities</th>
<th>Reduce lead time and inventories.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis of manufacturing conditions</td>
<td>Reduce loss costs and defect rate. Launch new products quickly.</td>
</tr>
<tr>
<td>Establishment of new production line using IoT</td>
<td>Establish an innovative production line for magnets. (Scheduled for operation in FY2018) Establish a new continuous casting and rolling line for wires/cables. (Scheduled for operation in FY2018)</td>
</tr>
<tr>
<td>Visualization of manufacturing data</td>
<td>Establish a highly efficient production management system.</td>
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</tbody>
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Impact in FY2016: ¥3 billion → FY2017: ¥10 billion → FY2018: ¥20 billion

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# 1-2. Overview of Initiatives in IoT

**Build monozukuri skills that are among the best in the world by utilizing IoT**

<table>
<thead>
<tr>
<th>Improve quality</th>
<th>Traceability</th>
<th>Symptoms diagnosis</th>
</tr>
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</table>
| • Reduce loss costs  
• Eliminate mega recalls  
• Improve risk management | • Improve risk management  
• Strengthen the customer base | • Ascertain anomalous conditions quickly  
• Roll into the business model |

*IoT: Internet of Things*
1-3. Roadmap

**Data gathering**
- Sensing technology
- Automatic data gathering system (sensor/PLC*)
  - Programmable Logic Controller
- Networking
- Traceability

**Visualization**
- Utilization of BI* tools
  - Business Intelligence
- Link 4M* data and process, volume, quality, etc.
  - Difference between plan and actual performance, bottleneck processes, variation in manufacturing conditions
  - Man, Machine, Material, Method

**Utilization in monozukuri innovations**
- Big data analysis
  - Identify causal relationship between manufacturing conditions and quality
  - From tacit knowledge to explicit knowledge
- Diagnostic of symptoms of equipment failure
- Utilization of AI*
  - Artificial Intelligence

Ferrite magnets
Neodymium-Iron-Boron magnets
HERCUNITE™
Specialty steels
Wires/cables

* Programmable Logic Controller
* Business Intelligence
* 4M: Man, Machine, Material, Method
* AI: Artificial Intelligence
1-4. Promoting System

Promoting System with Corporate as the Core

- Aggressive investment led by Corporate, rapid developments
- Introduction of advanced expertise from within and outside the Hitachi Group

Executive Officer, IoT
(GM, Info Systems Div. and Deputy GM, Tech., R&D Div.)

Corporate
- Technology, Research & Development Division
- GRIT*
- Information Systems Division

Business Divisions
- Kumagaya Works
- Kyushu Works
- Yasugi Works
- Ibaraki Works
- etc.

Hitachi Group
External Institutions
- Data science
- Establish IoT platform

*GRIT: Global Research & Innovative Technology Center
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2-1. Example 1: Quality Stabilization of Magnetic Materials

Visualization
Instrumentation of material, pressing, sintering, and grinding process (FY2016)

Technological innovation
Quality stabilization based on big data analysis (FY2017)

Establish innovative production line at Kumagaya Works (Operation in FY2018) ⇒ Global rolling out of achievements
2-2. Example 2: Heat-Resistant Cast Steel
Establish Highly Robust Manufacturing System

Data gathering
- Establish IoT platform (FY2016)

Visualization
- Analyze manufacturing data (FY2017)

Front-end process
- Sand preparation
  - Sand information
- Core
  - Individual identification
  - Daily report information
- Casting
  - Molding information
  - Ancillary equipment information
  - Frame information
  - Ladle information
  - Pouring information
  - In-process/LT information
- Finishing
  - In-process/LT information

Post-process
- Daily report information
- Processing
  - Processing machine information
  - Tool information
  - In-process/Lead time information

Big data analysis, symptoms diagnosis

Production innovation that links analysis with symptom (FY2018)

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2-3. Example 3: Visualization of Specialty Steel Production Track Record Data

Visualization
- Visualization of operation ratio, work-in-process, lead time (FY2016)

Production innovation
- Establishment of data integration system using BI tools (FY2016)

1. Existing tools
   - Quality visualization tool, etc.

2. Cross-organizational analysis BI
   - Leading BI software
   - Hitachi’s data integration/analysis platform

3. Originally developed screen
   - Flow of goods, utilization track record, etc.

Analysis system structure
- Data indication
- Data acquisition/editing
- Data source

Achievement
- Visualize quality information & production volume
- Develop cross-organizational analysis screen for plant-wide revenue, LT, volume of work in process
- Develop screen that visualizes the flow of goods and equipment utilization track record

Refine production plans under complex constraints
2-4. Example 4: Wires, Cables & Related Materials
Develop Highly Efficient Technology

**Visualization**
- Sensor data analysis in a current production line (FY2016)

**Technological innovation**
- Develop dashboard with BI tools (FY2017)

Continuous casting and rolling line

Temperature measurement, image processing
Currently equipment in 80 locations
⇒ New equipment in 300 locations or more

Build innovative line at Ibaraki Works (Operation in FY2018)
⇒ Roll out to HiFC™* and other high-quality copper wires

*HiFC™: A new copper alloy developed by Hitachi Materials with properties equivalent to high-purity copper
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3-1. Further Developments in Utilization of Information Technology

Accelerate four innovation projects using information technology

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<th>Innovation Type</th>
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<tr>
<td><strong>Monozukuri innovation</strong></td>
<td>Build innovative <em>monozukuri</em> through IoT</td>
</tr>
<tr>
<td><strong>Sales innovation</strong></td>
<td>Strengthen sales data linkage within the Group</td>
</tr>
<tr>
<td><strong>R&amp;D innovation</strong></td>
<td>Material Informatics (Participation in IBM Research Consortium)</td>
</tr>
<tr>
<td><strong>Work-style innovation</strong></td>
<td>Improve work efficiency Focus on more innovative work</td>
</tr>
</tbody>
</table>
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- Sudden changes in technological trends
- Changes in competitive advantage and the capabilities of the Company and its subsidiaries and affiliates to develop and commercialize new products and businesses
- Fluctuations in the status of product markets, exchange rates and international commodity markets
- Changes in financing environment
- The capability of the Company and its subsidiaries and affiliates to cope with fluctuations in product supply and demand, the status of product markets, exchange rates and international commodity markets
- Protection of the Company’s intellectual property, and securing of licenses to use the intellectual property of other parties
- Changes in the status of alliances with other parties for product development, etc.
- Fluctuations in Japanese stock markets