Partner Case Study

Greg Dashwood
Product Lead, Internet of Things & Advanced Analytics, Microsoft Canada
About PCL Construction

Buildings | Civil Infrastructure | Heavy Industrial
Our world is getting smarter...

Smart Construction

Smart Buildings

Smart Cities

End to end sensors, data, and analytics
Construction is ripe for disruption

“Digital technology is disrupting all industries. Companies that want to emerge as leaders must transform their organizations now.”

Source: McKinsey, Imagining Construction’s Digital Future
IoT in construction is an emerging trend

"On a construction site, IoT would allow construction machinery, equipment, materials, structures, and even formwork to “talk” to a central data platform to capture critical performance parameters."

Source: The disruption of capital projects - McKinsey, October 2017
Construction technology investment has doubled

Investment spending, $ billion

Transactions, number

<table>
<thead>
<tr>
<th></th>
<th>2008–12</th>
<th>2013–18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt</td>
<td>9</td>
<td></td>
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<tr>
<td>Early-stage venture capital</td>
<td>1</td>
<td>2</td>
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<tr>
<td>Late-stage venture capital</td>
<td>3</td>
<td>8</td>
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<tr>
<td>M&amp;A</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>IPO</td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>27</td>
<td>18</td>
</tr>
<tr>
<td>Total 2008–18</td>
<td>908</td>
<td>1,154</td>
</tr>
</tbody>
</table>

Source: Seizing opportunity in today's construction technology ecosystem—McKinsey, Sept. 2018
Digitizing the construction job site with IoT

IoT Sensors on Job Site

Job Site Insights™

Actionable Insights
Smart construction via Job Sight Insights™

- Device Agnostic
- Reusable Sensors
- Extensible Platform
- Application Integrated
- Cost Effective
Job Site Insights™ using Azure Digital Twins

- **IoT Gateway and Sensors**
  - Gateway Device (Edge-Ready)
  - IoT Sensors

- **Job Site Insights™ on Microsoft Azure**
  - IoT Hub
  - Alerting Engine (Stream Analytics)
  - JSI™ Telemetry Store (Time Series Insights)

- **Reports & Analytics**
  - DataLake Store
  - DataLake Analytics
  - Power BI

- **Clients**
  - IoT in Action

- **IoT in Action**

- **Gateway Device (Edge-Ready)**

- **JSI™ HALI**

- **IoT Hub**

- **Alert Queuing**

- **JSI™ Data Store (Cosmos DB)**

- **JSI™ Services**

- **JSI™ Client API Gateway**

- **Power BI**

- **Azure Maps**

- **Microsoft**
Job Sight Insights™ using Azure Digital Twin

- **Vendor**
  - **Customer**
    - **PCL**
      - **Toronto**
      - **Edmonton**
      - **Sky Residence**
    - **Level 31**
      - **Area 1**
      - **Area 1**
      - **Area 1**
    - **Level 32**
      - **Area 1**
      - **Area 1**
      - **Area 1**
    - **Level 33**
      - **Area 1**
      - **Area 1**
      - **Area 1**
  - **Level 65**
    - **Area 1**
    - **Area 1**
    - **Area 1**

- **Sensors**
  - **Temp.**
  - **Humidity**
  - **Position**
  - **Battery Level**

- **IoT in Action**
JSI™ data insights

- Trending and Data exploration via Time Series Insights
- Hot Zone and device outage at a glance
Job Sight Insights™ Demo
Job Sight Insights™ Value & Opportunities

- Lean construction
- Reduced rework costs and warranty claims
- Increased quality
- Improved safety
- Enhanced productivity
- Building commissioning and turnover
Project Analytics

Smart Construction’s Analytic Pane of Glass
Thank you

Terry Olynyk
Director, Business Development

Chris Palmer
Manager, Advanced Technology Services
The Internet of Things has the potential to generate $4 trillion to $11 trillion in economic value by 2025.

**Potential economic impact by segment,1**

$ billions (2015 dollars)

- Public sector & utilities: 53
- Telecom, tech & media: 55
- Oil & gas and mining: 62
- Discrete manufacturing: 105
- Healthcare & pharmaceuticals: 154

At most companies, Internet of Things applications are still at the proof-of-concept stage.

**Total available market for IoT technology by 2025, $ billion**

- Data readiness1
- Proof of concept2
- Full deployment3

1Robust data, including real-time information from sensors.
2Small number of solutions with limited scale.
3Widespread deployment of Internet of Things solution across enterprises.

Source: McKinsey Global Institute analysis

**IoT in Action**

- Factory: High (3.7), Low (1.2)
- City: High (1.7), Low (0.9)
- Retail: High (1.6), Low (0.2)
- Outside: High (0.9), Low (0.6)
- Worksite: High (0.9), Low (0.2)
- Cars: High (0.7), Low (0.2)
- Home: High (0.3), Low (0.2)
- Office: High (0.2), Low (0.1)
- Total: High (11.1), Low (3.9)
WHY ARE MANUFACTURERS INVESTING?

AI SOLUTIONS IMPROVE ADOPTER’S PROFIT MARGIN BY 8.6%

WINNING WITH OUR CUSTOMERS

- Reducing downtime to increase output
- Empower plant-level employees to make AI-powered decisions
- Enhance the quality efficiency of our clients’ products

75% OF MANUFACTURERS THINK THE LOCAL DIGITAL FACTORY IS MORE EFFICIENT THAN OFFSHORE FactORIES

SOURCE: McKinsey Global Institute AI adoption and use survey; McKinsey Global Institute analysis
SMART MANUFACTURING = INDUSTRY 4.0

1. Mechanization, water power, steam power
   - 0.3%

2. Mass production, assembly line, electricity
   - 0.4%

3. Computer and automation
   - 0.6%

4. Cyber Physical Systems
   - 0.8% - 1.4%

Productivity Gain

AI

Digital Twins

IIoT

OT driven Automation

+ =

Cyber Physical Systems

Autonomous assets

SMART MANUFACTURING = INDUSTRY 4.0

IoT in Action

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HOW DO YOU GET TO INDUSTRY 4.0?

Current State
Hierarchical Architectures
Silos and Pyramids

Defined by ISA95/IEC62264

Vision of Industry 4.0
Locally Controlled Modules
without Hierarchy

Defined by IIRA/RAMI4.0

Internet of Services
("Cyber-physical" systems)
TO INDUSTRY 4.0 WITH QUARTIC.AI ON AZURE

Quartic Platform
AI & IoT for Smart Industry.

Azure

QPro

QLite

Intelligent Sensors

Intelligent Edge

Intelligent Fog

IoT in Action

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ADDRESSING KEY NEEDS FOR INDUSTRIAL IOT AND AI

- Lack of Necessary Talent
- Concerns About Cyber Security
- Uncertainty About Outsourcing
- Concerns About Data Ownership
- Lack of Clear Business Case
- Lack of Courage
- Data Integration Challenge


eXponence™
Intelligence Engine
AI for the Subject Matter Expert

illuminator™
IoT Data Engine
Data Pipeline Built for Industry 4.0


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2-minute video – Quartic.ai on Azure
2-minute video – Quartic.ai on Azure
Smart Manufacturing begins with AI powered Smart Assets

- Liberate stranded intelligence
- Make your existing assets smart
- Enable SME’s to build AI

Manufacturing already generates more data than any other sector

Annual new data stored by sector, 2010

<table>
<thead>
<tr>
<th>Sector</th>
<th>Pentabytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>1,812</td>
</tr>
<tr>
<td>Government</td>
<td>911</td>
</tr>
<tr>
<td>Banking</td>
<td>773</td>
</tr>
<tr>
<td>Communications and Media</td>
<td>776</td>
</tr>
<tr>
<td>Retail</td>
<td>424</td>
</tr>
<tr>
<td>Professional Services</td>
<td>397</td>
</tr>
<tr>
<td>Securities and Investment Services</td>
<td>336</td>
</tr>
<tr>
<td>Healthcare</td>
<td>375</td>
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<tr>
<td>Education</td>
<td>276</td>
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<tr>
<td>Insurance</td>
<td>273</td>
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<tr>
<td>Transportation</td>
<td>256</td>
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<tr>
<td>Wholesale</td>
<td>245</td>
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<tr>
<td>Utilities</td>
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<tr>
<td>Resource Industries</td>
<td>166</td>
</tr>
<tr>
<td>Consumer and Recreational Services</td>
<td>116</td>
</tr>
<tr>
<td>Construction</td>
<td>87</td>
</tr>
</tbody>
</table>
A COMPLETE PLATFORM TO BUILD INDUSTRY 4.0

Built for Industrial OT users

Built on IIoT and RAMI 4.0

IoT in Action

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Thank you
Hitachi Solutions
Business Solutions Group

Our mission is to help our clients succeed by using powerful, easy to use and affordable industry solutions. Our culture is defined by our values and our deep commitment to achieve for our clients.

Global Offices
Australia    Dubai    Canada
France      Germany    Hong Kong
India      Japan    Malaysia
New Zealand    Philippines
Singapore    Taiwan    Thailand
United Kingdom    United States    Vietnam

Industry Experts
2,000 Employees
1,200+ North American Employees
400+ Customer References
30+ Vertical Solutions
35+ Partnerships

Cloud Platform
Microsoft Azure IoT
Microsoft Azure Data + Analytics
Microsoft Dynamics 365
Microsoft Azure Cognitive Services
Hitachi Solutions

Accelerated Time-to-Market

The Core: Hitachi Solutions IoT Service Hub

A scalable, cloud-based, integrated, open, cost effective and tested IoT Service Platform.
Case Study Agenda

Background
Timeline
Use-Case and Vision for Solution
Approach
Lessons Learned
Background

Not so Great to be in the Customer industry segment in 2018

- Industry Employment: 11,871
- Annual Growth 2013-2018: -3.6%
- Total Revenue in 2018: $10bn
Background

Business Problem:
The Customer has identified an opportunity to improve the existing quality control process for production with the goal of reducing wastage. Current annual wastage amounts to $Many Millions USD.

The desire to continuously innovate and remain the market leader, coupled with the reduced barrier to entry for IoT, enhanced data analysis and AI, has created a unique opportunity for this Customer to modernize the production process.

Machines are currently manually operated through most of the manufacturing process.

Business Outcomes Desired
o Reduce Manual Operation Time resulting in Labor savings
o Reduce Quality Issues resulting in Consistent Client Satisfaction
o Reduce Product Wastage resulting in Lower Costs and Additional Revenues
Use Case/Initial Vision for Solution

- Laser thickness monitoring
- Laser alignment monitoring
- Pressure monitoring
- Temperature and moisture content monitoring

Assumed direction of flow
Solution Schematic
Use Case/Vision for Solution – IoT Services Hub

- **Event workflow**
- **Data Retention & Augmentation**
- **Advanced Analytics**

**Temperature**
**Moisture Content**
**Roller Alignment**
**Pressure**
**Product thickness**

**Devices** → **IoT Event** → **IoT Hub** → **Formatting** → **Detailed Event** → **Evaluation Engine** → **Inbound Triggers** → **Real-time Pattern** → **AI** → **Machine Learning** → **Data Lake** → **Visualizations** → **Advanced Analytics** → **Data Retention & Augmentation** → **Event workflow**

**Control variable** = ‘thickness’
**Vector scalars** = pressure, temperature, moisture content, alignment

**Pressure setting**
**Outbound Event**
**Process Evaluation** → **Rule Definitions** → **Action Workflow** → **Workflow data** → **Trigger workflow** → **SMS Message API Integration** → **Workflow data**

**Misalignment alert**

**IoT in Action**

Microsoft
Hitachi’s POC Approach

Customer Current State
Manual QA process

Step 1
Identify all data sources necessary for decision-making. Identify sensors/actuators required for data creation and fit/deploy

Step 2
Load historic data if available for accelerated Machine Learning & AI

Step 3
Enable live (or simulated) data points via alerts and Machine Learning to provide machine visualization and IoT data capture.

Step 4
Design intuitive user interface for data monitoring and visualization

Step 5
Optimize process for accuracy and performance

Step 6
Complete customer case study; Review impact (gains expected/achieved)
Approach

Execute a 60 day Proof of Concept Pilot
Partner with Advantech, Intel and Microsoft to cover a spectrum of technology
Leverage Microsoft Azure Services platform and Hitachi’s Service Hub solution to accelerate capabilities and time to production.
Perform detailed requirements gathering and implement the solution. At a high level, Hitachi will provide:
- Discovery workshops in collaboration with the Customer team
- Analytics and logic to support the Minimum Viable Product (MVP) identified as critical to the proof of concept
- The solution will leverage a combination of hardware, Cloud services, business logic, machine learning and AI components
- Compile an Executive Summary which provides an overview of the engagement together with a roadmap on the next steps to deploy the solution to production in full.
Combined Team Structure

- Customer Project Lead
  - Customer Subject Matter Experts
  - Customer IT Resources (if needed)
- Hitachi Project Manager
- Hitachi Solutions Architect
- Hitachi IoT Developer
- Hitachi UX Developer

Hitachi Engagement Lead
Key Lessons Learned

- It’s imperative to gain Executive sponsorship early in the sales cycle, both client-side and internal.

- The ‘problem’ is not always ‘the problem’.

- We started with being able to automatically control a machine and ended with reducing wastage across the production line.

- These are long sales cycles; many moving parts and alignment with client teams, partners and our own resources make for months of work.

- The payoffs are potentially huge: if we can reduce waste in the process by 10% the time to ROI for Customer’s will be 3 months of operation.

- Stay away from client-side IT as long as possible!
Timeline to Value

- Start Now with Minimum Viable Solution
- Show Value within 30-60 days
- Iterate, adding Value every 30-days
Thank you

IoT in Action

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