POWERING UP THE CONNECTED FACTORY

The 2019 MPI Internet of Things Study
<table>
<thead>
<tr>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction</td>
</tr>
<tr>
<td>2. Methodology</td>
</tr>
<tr>
<td>4. Strategy &amp; Goals</td>
</tr>
<tr>
<td>6. Budgeting &amp; Project Management</td>
</tr>
<tr>
<td>8. Technology</td>
</tr>
<tr>
<td>9. Challenges</td>
</tr>
<tr>
<td>11. ROI</td>
</tr>
<tr>
<td>13. Global Manufacturing Competitiveness</td>
</tr>
</tbody>
</table>
Introduction

The Internet of Things, the Industrial Internet of Things, Industry 4.0—some will argue they’re all the same thing.

There is, however, an important distinction: While the Internet of Things is a critical enabler of the connectivity that underpins Industry 4.0, it is one of multiple disruptive technologies powering the next revolution in manufacturing. Industry 4.0 refers more broadly to the blurring of the line between the digital and physical worlds, bringing together plants, processes, products and people in entirely new ways.

Though this survey focuses primarily on IoT enablement, you cannot talk about IoT without Industry 4.0. Embedding sensors in machines opens up a whole new world of information—but that information is only as valuable as the ability to use it. Applying analytics to extract insights is just the start—which is where the broader universe of Industry 4.0 comes into play.

Manufacturers that build out their IoT strategy in the context of Industry 4.0 potential will ultimately be better equipped to compete in manufacturing’s digitized future.

Read on to learn how the industry is taking on the IoT and gearing up for the Industry 4.0 opportunity.
Methodology

The MPI Internet of Things Study, conducted by The MPI Group and sponsored by BDO, evaluated the readiness of global manufacturers to incorporate smart devices and embedded intelligence within their plants and into their companies’ products. In September and October 2018, 368 manufacturers participated in the study. This report focuses on IoT enablement in manufacturing operations in the broader context of Industry 4.0 adoption.

Who we surveyed

Annual Revenues

- 32% $100 million or below
- 22% More than $1 billion
- 16% $501 million to $1 billion
- 16% $251 to $500 million
- 14% $101 to $250 million

Years in Operation

- 61% > 20
- 23% 11-20
- 13% 6-10
- 3% 2-5
- 0% < 2
Strategy & Goals

It’s (almost) universal: Manufacturers are embracing the IoT.

“You’ve got to eat while you dream. You’ve got to deliver on short-range commitments, while you develop a long-range strategy and vision and implement it. The success of doing both. Walking and chewing gum if you will.”

– Jack Welch
Globally, manufacturers are focusing their IoT efforts on quality and efficiency.

86% have developed or are planning to develop a strategy to apply IoT technologies to production equipment and processes.

81% plan to increase IoT enablement in production processes and equipment in the next two years.

75% plan to increase IoT enablement in non-production processes and equipment in the next two years.

Top 5 Goals:

- Improve product quality
- Increase speed of operations
- Decrease manufacturing costs
- Improve safety
- Improve maintenance/uptime

(But goals vary significantly by country)

APPLYING IoT TECHNOLOGIES TO PROCESSES

- 15% No plans to develop strategy
- 29% Plan to develop strategy
- 33% Strategy in place – implemented
- 23% Strategy in place – not yet implemented

86% have developed or are planning to develop a strategy to apply IoT technologies to production equipment and processes.

81% plan to increase IoT enablement in production processes and equipment in the next two years.

75% plan to increase IoT enablement in non-production processes and equipment in the next two years.

(But goals vary significantly by country)
Budgeting & Project Management

HOW THEY’RE PLANNING TO FINANCE FUTURE IoT INVESTMENTS:

- Working capital: 55%
- Private equity: 31%
- Private debt: 19%
- Public equity: 11%
- Public debt: 4%

28% are using tax savings from U.S. federal tax reform to increase IoT investments.

83% plan to increase IoT investments in the next two years.
HOW WELL THEY'RE STICKING TO THEIR CURRENT IoT BUDGETS:

- **On budget**: 36%
- **Somewhat over budget**: 40%
- **Somewhat under budget**: 7%
- **Significantly under budget**: 2%
- **Significantly over budget**: 15%

*Excludes manufacturers with no IoT

...AND KEEPING IoT DEVELOPMENTS ON SCHEDULE:

- **On schedule**: 36%
- **Somewhat later than scheduled**: 6%
- **Somewhat earlier than scheduled**: 3%
- **Significantly earlier than scheduled**: 18%
- **Significantly later than scheduled**: 37%

*Excludes manufacturers with no IoT

U.S. manufacturers fare better at accurate budgeting:

- 57% of U.S. respondents' IoT projects are on or under budget.

Europe takes the prize for effective time management:

- 51% of European respondents' IoT projects were completed on or before schedule.
## Technology

By layering on technologies like artificial intelligence, automation or augmented reality, IoT insights become actions and outcomes.

### INVESTMENT IN INDUSTRY 4.0 ENABLERS

<table>
<thead>
<tr>
<th>Technology</th>
<th>Extensive use</th>
<th>Moderate use</th>
<th>Some use</th>
<th>No use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Thread</td>
<td>12%</td>
<td>35%</td>
<td>18%</td>
<td>35%</td>
</tr>
<tr>
<td>Augmented reality</td>
<td>14%</td>
<td>29%</td>
<td>17%</td>
<td>41%</td>
</tr>
<tr>
<td>Mixed reality</td>
<td>14%</td>
<td>26%</td>
<td>17%</td>
<td>43%</td>
</tr>
<tr>
<td>Virtual reality</td>
<td>14%</td>
<td>21%</td>
<td>22%</td>
<td>44%</td>
</tr>
<tr>
<td>Co-robots/cobots</td>
<td>16%</td>
<td>27%</td>
<td>21%</td>
<td>36%</td>
</tr>
<tr>
<td>Artificial Intelligence</td>
<td>17%</td>
<td>26%</td>
<td>25%</td>
<td>32%</td>
</tr>
<tr>
<td>Machine learning</td>
<td>19%</td>
<td>31%</td>
<td>22%</td>
<td>28%</td>
</tr>
<tr>
<td>Digital Twin</td>
<td>22%</td>
<td>25%</td>
<td>15%</td>
<td>39%</td>
</tr>
<tr>
<td>Robotics</td>
<td>27%</td>
<td>27%</td>
<td>22%</td>
<td>25%</td>
</tr>
</tbody>
</table>

#### DIGITAL ENABLERS DEFINED

- **Digital Thread:** The digital thread provides a formal communication framework for the flow of information throughout the product lifecycle, across organizational boundaries.
- **Digital Twin:** A digital twin is a virtual replica of a physical asset used to test, monitor and optimize performance in the real world.
- **Virtual Reality:** Virtual reality is a full immersion into a computer-generated environment.
- **Augmented Reality:** Augmented reality overlays virtual elements, such as computer-generated graphics or simulations, on top of the real-world environment.
- **Mixed Reality:** Mixed reality is an advanced form of augmented reality, integrating the virtual and physical worlds to create an immersive interface.
- **Artificial Intelligence:** Artificial Intelligence is a broad concept to describe machines trained to think like humans.
- **Machine Learning:** A subset of AI, machine learning aims to mirror human intelligence by equipping algorithms with the ability to "learn" on their own without human intervention based on experience and new inputs.
- **Robotics:** Robotics is the interdisciplinary field related to studying, designing and building robots. Robots are programmable machines capable of acting autonomously or semi-autonomously.
- **Co-Robots/Cobots:** Cobots, short for "collaborative robots," are designed to work alongside humans rather than autonomously.
Challenges

The road to Industry 4.0 isn’t without obstacles.

TOP 5 CHALLENGES:
- Identifying opportunities/benefits of IoT
- Incorporating smart devices/embedded intelligence
- Adapting existing technologies
- Network capabilities to handle IoT
- Security of corporate devices, network and data

End-to-end connectivity across the supply chain is still an unrealized goal.

NETWORK INFRASTRUCTURE ABILITY TO SUPPORT IoT COMMUNICATION

| Machines to customer IT systems | 21% | 35% | 26% | 19% |
| Machines to supplier IT systems | 23% | 35% | 28% | 14% |
| Machines to enterprise IT systems | 25% | 45% | 20% | 10% |
| Machine to machine | 33% | 35% | 21% | 11% |

- Currently capable
- Some upgrades required
- Significant upgrades required
- Network overhaul required

GAPS IN INFORMATION SHARING

| Company executives | 44% | 23% | 16% | 4% | 13% |
| Customers | 17% | 25% | 25% | 9% | 24% |
| Suppliers | 17% | 25% | 27% | 10% | 22% |

- All who need it have access
- Most who need it have access
- Some who need it have access
- No one who needs it has access
- No IoT data to access
Few manufacturers have adopted security controls designed specifically for the IoT environment.

### STEPS TAKEN TO ADDRESS SECURITY CONCERNS

<table>
<thead>
<tr>
<th>Step</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conducted a cyber risk assessment</td>
<td>41%</td>
</tr>
<tr>
<td>Increased investment in security technologies</td>
<td>39%</td>
</tr>
<tr>
<td>Conducted penetration testing</td>
<td>31%</td>
</tr>
<tr>
<td>Integrated IT and OT security</td>
<td>22%</td>
</tr>
<tr>
<td>Implemented new OT security controls</td>
<td>21%</td>
</tr>
<tr>
<td>Adopted the Industrial Internet Security Framework</td>
<td>11%</td>
</tr>
<tr>
<td>Drafted or revised a third-party risk management policy</td>
<td>11%</td>
</tr>
</tbody>
</table>

15% have taken no steps to improve their security for the IoT environment.
ROI

Investments in the IoT and Industry 4.0 pay off...big time.
Based on those manufacturers who set strategic objectives prior to implementation:

- 16% Achieving all strategic objectives
- 40% Achieving most strategic objectives
- 39% Achieving some strategic objectives
- 5% Achieving no strategic objectives

95% of manufacturers are achieving at least some of their strategic objectives.

**IoT DEVELOPMENTS ACHIEVING THE STRATEGIC OBJECTIVES SET FORTH PRIOR TO IMPLEMENTATION**

**KEY BENEFITS:**

**BUSINESS INSIGHT**

- 60% have seen improvement in their company’s ability to leverage big data

**SECURITY**

- 56% have seen an increase in security from applying IoT technologies to operations

**PRODUCTIVITY**

- LAST YEAR: 70% saw increases in productivity
- NEXT 5 YEARS: 88% anticipate increases in productivity

**PROFITABILITY**

- LAST YEAR: 68% saw increases in profitability
- NEXT 5 YEARS: 86% anticipate increases in profitability
Global Manufacturing Competitiveness

The U.S. lags significantly behind Europe and China in Industry 4.0 strategic readiness—and that's reflected in their business outcomes.

Percentage of manufacturers implementing against a strategic plan:

- U.S.: 44%
- Europe: 65%
- China: 92%
Here's how those strategies have panned out...

**U.S.**

- **33%** Achieving most strategic objectives
- **11%** Achieving all strategic objectives
- **50%** Achieving some strategic objectives
- **6%** Achieving no strategic objectives

**CHINA**

- **45%** Achieving most strategic objectives
- **14%** Achieving all strategic objectives
- **37%** Achieving some strategic objectives
- **4%** Achieving no strategic objectives

**EUROPE**

- **45%** Achieving most strategic objectives
- **27%** Achieving all strategic objectives
- **22%** Achieving some strategic objectives
- **6%** Achieving no strategic objectives

*Excludes organizations with no IoT as well as those that did not set strategic objectives prior to implementation

Chinese manufacturers have been most successful in achieving their strategic objectives.
China and Europe outpace the U.S. in adoption of Industry 4.0 enabling technologies:

### ADOPTION OF INDUSTRY 4.0 ENABLING TECHNOLOGIES

<table>
<thead>
<tr>
<th>Technology</th>
<th>U.S.</th>
<th>Europe</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Reality</td>
<td>30%</td>
<td>57%</td>
<td>68%</td>
</tr>
<tr>
<td>Mixed Reality</td>
<td>42%</td>
<td>65%</td>
<td>63%</td>
</tr>
<tr>
<td>Virtual Reality</td>
<td>25%</td>
<td>57%</td>
<td>82%</td>
</tr>
<tr>
<td>Cobots</td>
<td>22%</td>
<td>52%</td>
<td>77%</td>
</tr>
<tr>
<td>Artificial Intelligence</td>
<td>19%</td>
<td>54%</td>
<td>69%</td>
</tr>
<tr>
<td>Machine Learning</td>
<td>26%</td>
<td>61%</td>
<td>78%</td>
</tr>
<tr>
<td>Digital Thread</td>
<td>34%</td>
<td>68%</td>
<td>73%</td>
</tr>
<tr>
<td>Digital Twin</td>
<td>28%</td>
<td>63%</td>
<td>76%</td>
</tr>
<tr>
<td>Robotics</td>
<td>26%</td>
<td>59%</td>
<td>84%</td>
</tr>
</tbody>
</table>

*Percentage of manufacturers citing “extensive” or “moderate” use

China leads the charge on sharing IoT data outside traditional boundaries:

### ACCESS TO DATA

<table>
<thead>
<tr>
<th>Group</th>
<th>U.S.</th>
<th>Europe</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Executives</td>
<td>56%</td>
<td>78%</td>
<td>90%</td>
</tr>
<tr>
<td>Customers</td>
<td>28%</td>
<td>54%</td>
<td>65%</td>
</tr>
<tr>
<td>Suppliers</td>
<td>29%</td>
<td>57%</td>
<td>61%</td>
</tr>
</tbody>
</table>

*Percentage of manufacturers citing “all” or “most” who need it have access
Comparing Results Across Borders

**BUSINESS INSIGHT**
Percentage of manufacturers seeing improvements in ability to leverage big data

- **U.S.** 44%
- **Europe** 65%
- **China** 92%

**SECURITY**
Percentage of manufacturers seeing improvements in security

- **U.S.** 43%
- **Europe** 54%
- **China** 90%
Whether you want to focus on enhancing your customer interaction, increasing speed and profitability through operational excellence, mitigating risk and increasing flexibility across the supply chain, or monetizing your data, BDO can help you achieve your goals.

Learn more
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