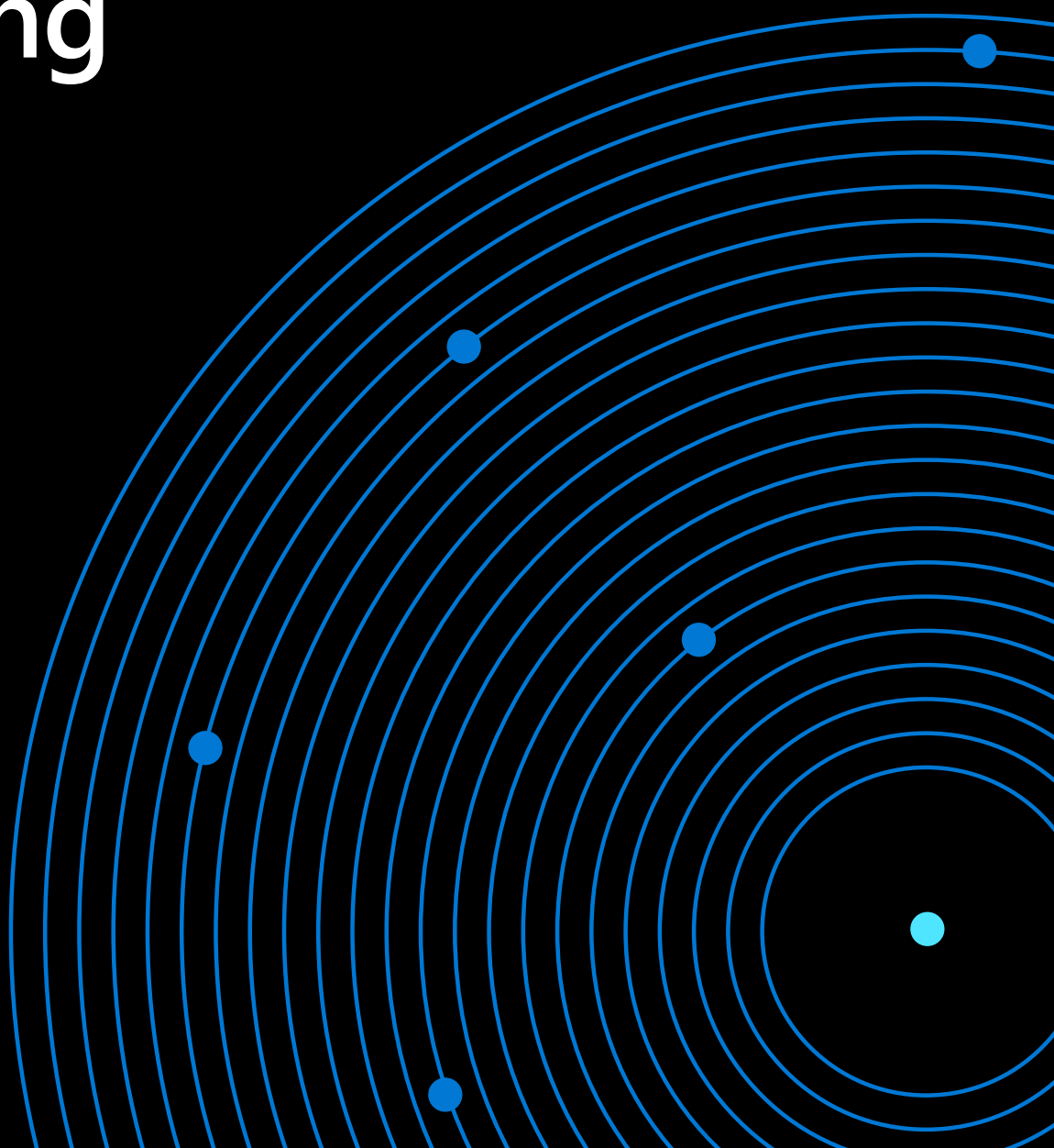


E-book series



A guide to IoT for manufacturing business leaders:

# Connect your data to your decision making



# Contents

## 01. Introduction

## 02. What exactly is IoT?

## 03. Solve business issues with your own data

Condition monitoring

Overall Equipment Efficiency (OEE)

Asset tracking

Connected products

Operational excellence

Intelligent supply-chain

Precision farming

Predictive maintenance

Facilities planning

## 04. Get the ROI you need

## 05. Starting is easier than you think

## 06. Keep it safe

## 07. Trust Azure IoT



# 01. Introduction

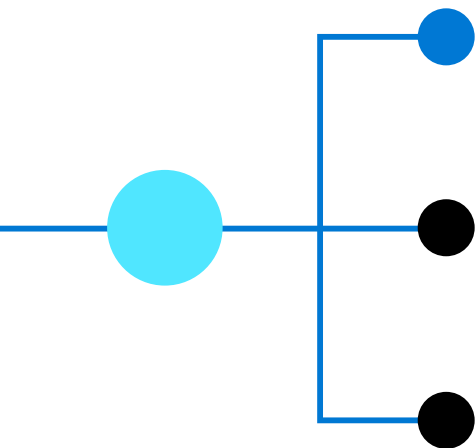
**Lowering the costs of production and operations, creating new revenue streams, and increasing customer satisfaction and loyalty are all paths to greater success and profitability for manufacturers.**

Each one requires in-depth knowledge of your own operations, business, and customers. That unique context can then enable you to make decisions that move the needle on revenue and create competitive differentiation. You can empower your organization to achieve more success by using hidden data to improve operations, efficiency, and decision-making.

What if you could harness the equipment you already have and use it to gather data that reveals new insights? Your industrial machines, equipment, trucks, products in the field, and even your factories and facilities can all gather, send, and process data, creating an invisible workforce ready to be deployed in a number of scenarios:

- **Condition monitoring:** Discover anomalies before they become critical issues and ensure optimal performance and uptime. This data can be used to develop predictive maintenance programs.
- **Overall Equipment Efficiency (OEE):** Connect your processes to sensors and enable data collection to ensure production lines and plants are operating at optimal capacity.
- **Asset tracking:** Tag and automatically track materials, resources, and valuable equipment to avoid unnecessary loss and enhance the productivity of Firstline Workers.
- **Intelligent supply chain:** Use sensors and integrated systems to create a digital supply chain that provides a holistic view across all your operations, both inbound and outbound.

- **Connected products:** Collect data from products delivered to customers and generate insights that can improve engagement, sales, and product design.
- **Operational excellence:** Integrate your operational data and create a holistic system that improves production and connects, monitors, and controls complex manufacturing operations.
- **Precision farming:** Ensure the safety and quality of goods from harvest to shelf and maximize yield by employing smart farming systems.
- **Predictive maintenance:** Mitigate production and service disruptions by connecting your equipment and applying advanced analytics and machine learning to anticipate outages.
- **Facility management:** Create safe conditions for your employees and save money by efficiently managing key environmental controls like heating and lighting.





02.

## What exactly is IoT?

Put simply, the Internet of Things (IoT) is just that. Your things—machines, equipment, products, any kind of device or durable good—are outfitted with data collection and transmission capability.

All your things are connected through the internet, so your systems can receive and analyze that data. Then you can act on the data, by discrete decisions, or in an automated way that's triggered by a specific set of conditions to optimize your processes and operations. Sounds good, right? It gets better.

The real magic happens when you get the chance to look at that data—really analyze it—for insights about your business, your customers, and your processes. Your equipment can tell you a lot that you won't find out any other way. And you can turn those insights into a real competitive advantage. You can even apply artificial intelligence and machine learning to the data and discover insights you might never detect on your own.



**\$267 billion**

Predicted spend on IoT by manufacturers by 2020<sup>1</sup>



**+ \$100 million**

Average increase in operating income among the most digitally transformed enterprises<sup>2</sup>



**25.1 billion**

Gartner predicts 25.1 billion installed IoT units by the end of 2021<sup>3</sup>



## 03. Solve business issues with your own data

You may already see the potential for IoT to drive value for your business. Let's take a look at some use cases adopted by leading manufacturers.

### Condition monitoring

This is one of the scenarios most commonly sought after by leading manufacturers. Sensors in equipment, products, or systems remotely collect data about condition, performance, or other potential problems and then transmit that data continuously or at regular intervals. By monitoring key parameters of equipment, manufacturers can discover anomalies before they become critical issues and ensure optimal productivity from their plants.

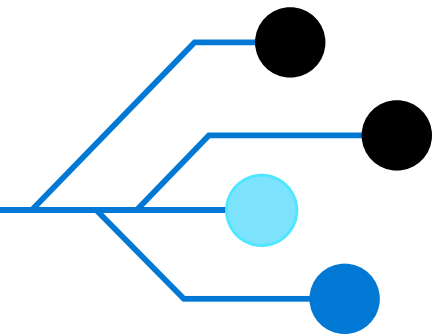
For example, with condition monitoring you can:

- Know how your products are performing and eliminate expensive downtime
- Avoid premature and expensive equipment maintenance costs and extend the lifespan of your machinery
- Apply advanced analytics to the data collected and develop predictive maintenance programs



Many existing systems struggle to filter the signal from the noise and offer the means to analyze things in a consistent way. Our goal is not data for the sake of data, but to embrace the cloud and analytical technologies to deliver more expert insights to the right stakeholders at the right time.

**Nick Farrant**  
Senior Vice President  
*Rolls-Royce<sup>4</sup>*



## Overall Equipment Efficiency (OEE)

Ensuring that a plant is producing up to capacity is a key measurement of success for manufacturers. Measuring Overall Equipment Efficiency (OEE) offers a single KPI that effectively sheds light on this type of data.

By connecting discrete processes to sensors that enable data collection, you can benefit from a holistic measurement for the productivity of your production lines and plant—or even an overall view across all of your plants. This data can be analyzed and used to adjust and optimize operations.

By monitoring and optimizing OEE, manufacturers can:

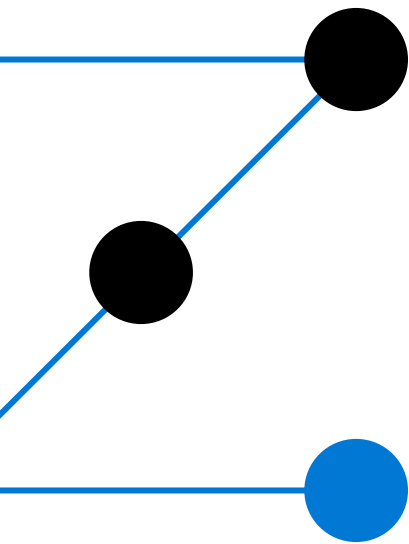
- Quickly identify root causes of reduced productivity
- Simplify monitoring of critical KPIs by integrating measurements for availability, performance, and quality at the OEE level
- Identify incremental yet high-impact improvements quickly

”

When I look at being able to do what we need to do at the speed our customers expect, it's difficult to achieve that level of scalability and flexibility with anything but Azure.

**Matt Behringer**

Chief Information Officer, Enterprise Operations and Quality Systems  
*JABIL*<sup>5</sup>



## Operational excellence

Most continuous industries operate within relatively predictable environments. Differentiation is driven by efficient operations, mission compliance, and excellence across quality, response, delivery, and service.

Process manufacturers, such as those who operate within chemical or food and beverage verticals, constantly strive to achieve operational excellence by integrating data across all processes, production lines, facilities, product lifecycle systems, and customer engagements. This offers a holistic system that connects, monitors, and controls complex manufacturing operations and data flows on the factory floor and improves production output.

Connecting data to integrate systems that unlock operational excellence enables:

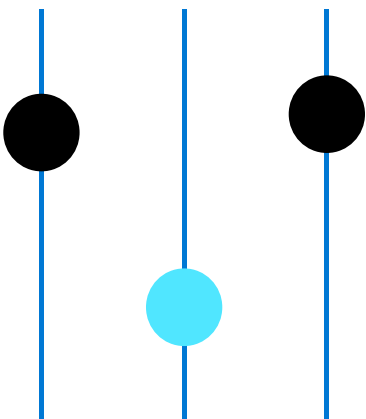
- Increased value driven by improved processes, systems, and assets
- Enhanced safety by reducing risks and eliminating hazards
- Greater predictability and reliability through reduced variation

”

Glass manufacturing is a complex industry with fixed costs and capacities that are therefore very sensitive to variations in demand. It was vital to optimize the operations to drive profitable growth and it was evident that Industry 4.0 was one of the key levers to achieve this.

**Vijay Shah**

Director, Piramal Glass and Executive Director  
*Piramal Enterprises Ltd.*<sup>6</sup>



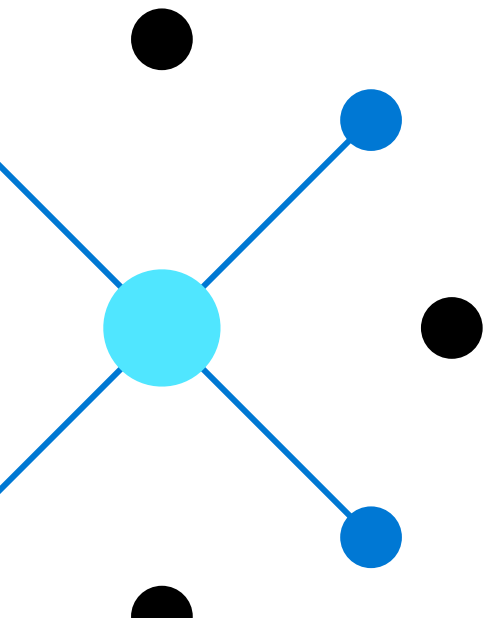


## Asset tracking

In a fully operating factory, numerous moving parts and dynamic processes are all functioning simultaneously. This increases the chances of misplacing equipment, production resources, or other important parts. Asset tracking gives manufacturers the ability to automatically track materials, resources, sub-assemblies, and equipment at each step throughout the manufacturing process.

By tagging and tracking important assets and valuable equipment, manufacturers can add important process checks that:

- Improve production quality
- Limit asset loss and reduction
- Reduce downtime



## Predictive maintenance

What if you knew in advance that a part or machine was likely to break based on the time it had been in use, or the conditions it had been working under? You can collect data from sensors that monitor equipment conditions, and machine learning software can use that data to predict when maintenance should be proactively performed to avoid a breakdown. The more data you gather over time, the more accurate the predictions become, so efficiency keeps improving over time.

Prescriptive maintenance take predictive maintenance programs one step further, by using machine learning and AI to incorporate logic that provides a diagnostic and tells you what needs to be fixed.

With predictive maintenance, you can:

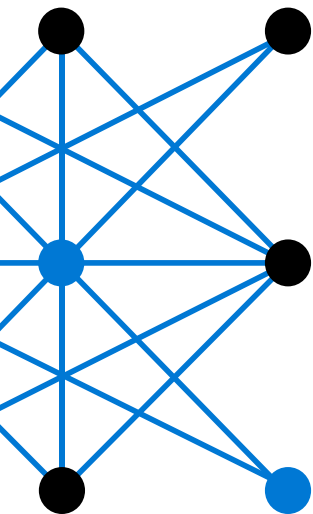
- Schedule the most appropriate technician, with the right parts, at the right time
- Figure out which conditions are causing failures and slowdowns
- Be prepared with adequate parts inventory for issues before breakdowns occur

”

The more data we have, the more we can learn and put together algorithms to predict problems.

**Doug Weber**

Business Manager, Remote Application Monitoring  
*Rockwell Automation*<sup>7</sup>



## Facilities management

Your factories, plants, fields, and facilities can all collect data that you can then use to make better decisions for optimizing energy consumption, space utilization, and even employee experience. It could be lighting on the manufacturing floor, climate control in an office building, or virtually any other condition that a sensor can detect. You can also create a digital representation of a physical environment and model the relationships between people, places, and devices based on real-world data.

The possibilities for facilities management include:

- Improving employee and occupant satisfaction and morale with smart spaces that increase productivity and comfort
- Dimming lights, automating thermostats, or planning meeting and office space based on elevator usage patterns
- Building repeatable, scalable models that combine data from digital sources and the physical world

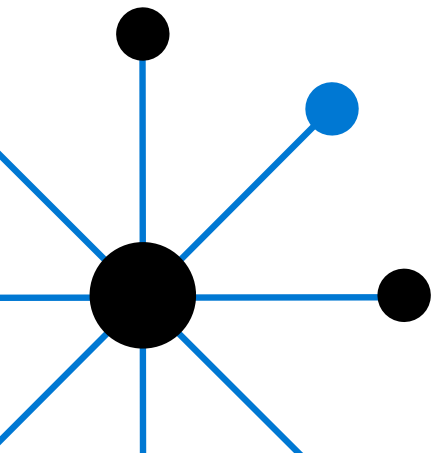
”

We believe that putting intelligence into the building that improves facilities management and analyzes how occupants and visitors use the building is the best way to fulfill their needs.

**Michael Cesarz**

Chief Executive Officer for MULTI

*Thyssenkrupp Elevator<sup>8</sup>*



## Connected products

Connectivity, cloud, IoT, and AI have all contributed to shaping manufacturing tremendously, evolving the sector's traditional transactional business model into a service-oriented one. By creating and selling products with smart components that collect product and usage data from customers, manufacturers can harness new intelligence that greatly impacts operations and offers critical strategic guidance.

Delivering smart and connected products transforms manufacturing in the following ways:

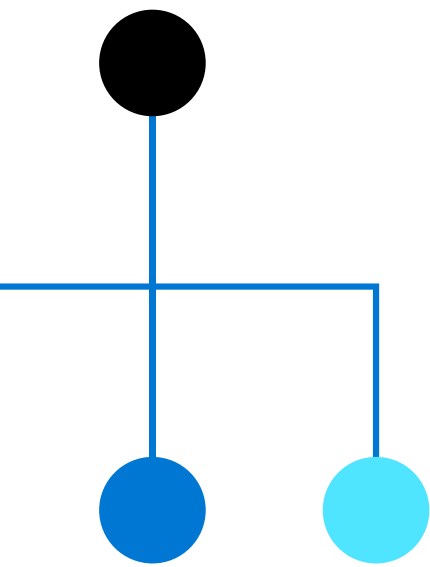
- Generates new revenue streams with business models based on the outcomes and performance of connected products
- Enhances customer engagement by ensuring uptime and optimal conditions of delivered products and machines
- Increases effectiveness of product lifecycle management and product design



Security is a key factor for us as we follow this trend of integrating more solutions into on-premises equipment and putting processing power wherever it makes the most sense—whether it's on the device or the cloud. One of the reasons we selected the Microsoft platform is the ability to connect Windows 10 IoT Core with Azure and ensure secure connections.

**Pat Mulcahy**

General Manager, Thermostats and Sensors  
*Johnson Controls<sup>9</sup>*



## Precision farming

As the world's population continues to increase, so too does the demand for food and subsequent pressure for farmers to produce. This spike in demand means there is a critical need for farmers to become more efficient and cut costs while maximizing yields. IoT has empowered farmers to use sensors, data, and connectivity to develop sophisticated farming systems that adapt to specific field conditions.

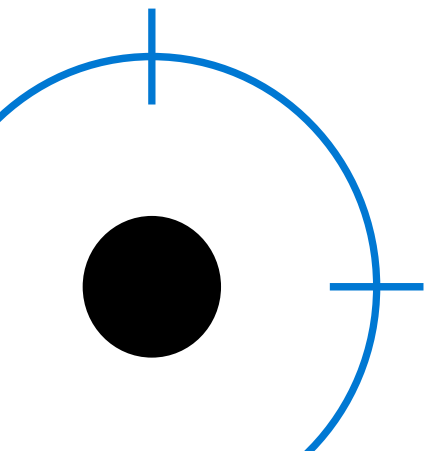
The result is a more efficient system that promotes sustainable growth while cutting costs. Precision farming enables famers to:

- Ensure the safety and quality of goods from harvest to shelf
- Identify which crops to plant and optimal timing for harvest based on data
- Monitor and analyze soil conditions and other parameters to optimize crop yields

”

We're not only going to get economic results, but hopefully we can transform and save lives at the same time. It's the most exciting and valuable project I've worked on in my 40 years with the company. It's a really big thing.

**Ben Deefholts**  
Senior Research Engineer,  
*Buhler<sup>10</sup>*



## Intelligent supply chain

The supply chains of manufacturers—in particular original equipment manufacturers (OEMs)—have always been complex and often unpredictable. In the past, the supply chain typically ended once a product was successfully delivered to a customer.

With IoT, manufacturers can expand their intelligence by managing inbound delivery of the supplies needed to make their products and the outbound dispatch of finished goods to customers. They will also start to benefit from newer, emerging technologies such as AI and blockchain, which introduce intelligence, traceability, and increased security in order to get the most from the extended supply chain.

Sensors, networks, and ambient intelligence can help digital supply chains offer a holistic view of your supply chain to:

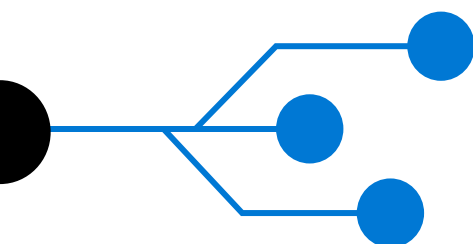
- Provide visibility and traceability of your inbound and outbound logistics
- Increase precision of forecasting by integrating business planning, demand forecasting, inventory, and production lines
- Improve customer relationships by ensuring timely and well-conditioned deliveries

”

Senior supply-chain professionals have typically been accustomed to working with a fairly limited set of data to drive their decisions—but that’s all changed now.

**Daniel Helmig**

Group Head of Quality and Operations,  
*ABB<sup>TM</sup>*





04.

## Get the ROI you need

While reducing operational costs is a major focus of Industrial IoT solutions, that same cost-reduction solution may also be able to generate increased revenue.

As data is collected and analyzed, new trends may reveal new revenue opportunities. Manufacturers with more sophisticated data and analytics capabilities can harness that data to deliver more value to their business, including stronger customer engagement, more efficient and streamlined operations, and improved product design processes.

These organizations are:



2.5x

more likely to harness real-time data and analytics  
to deliver tailored customer experiences



2.3x

more likely to use predictive modeling to anticipate  
customer support requests



2.3x

more likely to inform product design by capturing  
data on how their products are used<sup>12</sup>

There are a lot of variables to consider when implementing an Industrial IoT solution. The place to start is with your challenges. What are you trying to solve? Then you can look at the current costs associated with that issue, the IoT investment required, and the expected savings for comparison.

It's important to mention that capitalizing on the potential of Industry 4.0 can be achieved without the need for expensive equipment upgrades, by connecting your current machinery and equipment to the cloud through a brownfield approach.

The good news is, you don't have to figure it all out yourself. Many options are available to help you control costs and get the ROI you need. A trusted partner with deep domain expertise in the manufacturing space can help you look realistically at your operations. They can propose solutions that fit your needs and budget—everything from simple device sensors connected to your existing systems to a fully managed solution priced per connected device, so you know exactly what it will cost now and in the future.



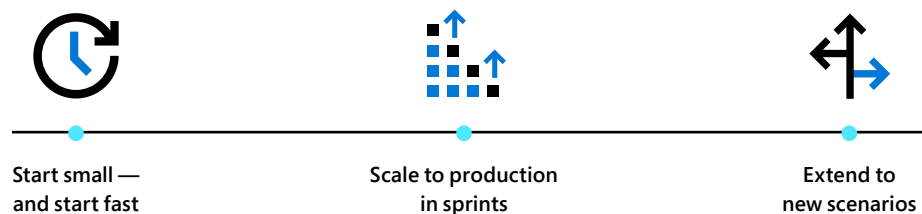


## 05. Starting is easier than you think

Many organizations—especially small- and medium-sized ones—see technology costs and complexity as overwhelming.

But it doesn't have to be that way. IoT can provide amazing ROI, even implemented on a relatively small scale to start. In fact, starting small is a great strategy as a proof of concept. You can scale over time, making additional investments where they make the most sense for your business. Once the initial deployment is running smoothly, you can scale out.

Another potential layer of complexity that manufacturers face when starting their journey with Industry 4.0 is getting locked into specific proprietary systems that connect to their equipment. To avoid this pitfall, it's important to work with a platform that offers full interoperability standards and simplifies the process of standardizing your data.



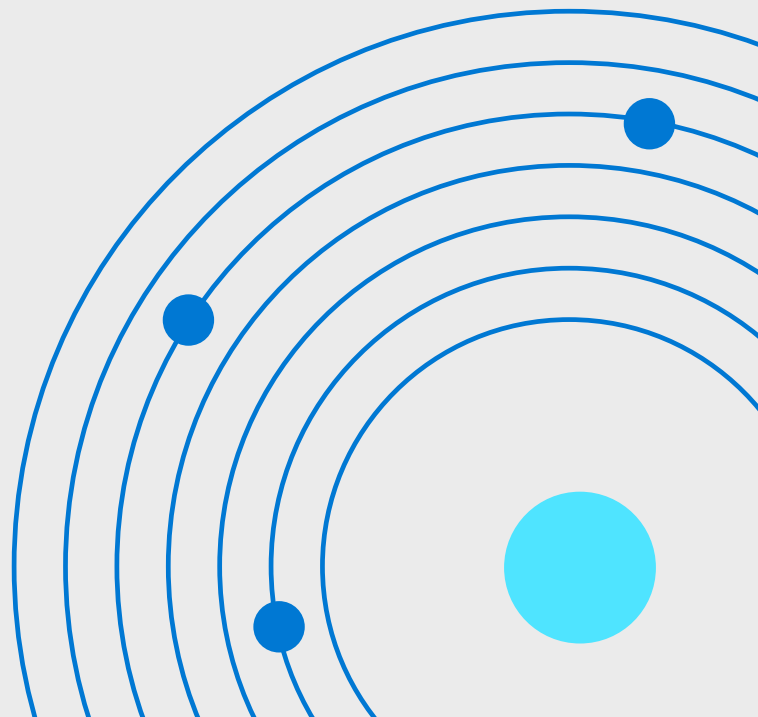
As you continue to fine-tune your solution, you can evaluate adding new scenarios to extend the benefits of IoT across your different operations and business needs. The best part will be the benefits you weren't expecting—the insight your data revealed that you couldn't have predicted. The one that puts you a step ahead of competitors and saved (or made) money in a way you hadn't thought about. After all, that's what digital transformation is all about.



## 06. Keep it safe

**Worried about security for all those Internet-connected devices?  
All those potential points of infiltration?**

That's OK—and reasonable. But it shouldn't stop you from taking advantage of IoT to improve your operations and grow your business. It does mean you should choose your technology partners carefully. Security should be built into every step of the process to help protect your equipment, your data, your network, and your business.





## 07. Trust Azure IoT



What truly impressed me with our Microsoft collaboration was that it was not about selling us a product. It was about building something and addressing the world's water challenge together.

**Christophe Beck**

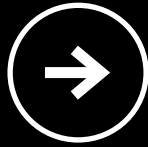
Executive Vice President and President

*Nalco Water, an Ecolab Company<sup>13</sup>*



A proven technology leader with a commitment to the highest levels of trust, transparency, and compliance, Microsoft builds security into every level of our products and services. Azure IoT offers a full range of secured solutions—with predictable pricing—for all the most common IoT scenarios, simplifying decision-making, planning, and implementation. We know how important it is to meet you where you are, start small and scale on success, and offer options for whatever degree of automation or control you want for your business.

Our technology is built on decades of experience empowering businesses from the front office to the factory floor, and everywhere in between. With the largest partner ecosystem in the world and a proven track record of success in IoT, Microsoft is ready to address your business needs and technology challenges—and will be here to continue supporting your growth in the future.



## Find a partner to help you get started

[Contact us to learn more about Azure IoT](#)

<sup>1</sup> <https://www.businessinsider.com/internet-of-things-in-manufacturing-2016-10>

<sup>2</sup> Keystone Strategy interviews October 2015–March 2016; Incremental operating income of \$100M is based on median company revenue of \$3.4B

<sup>3</sup> Gartner Getting Started: How to Strategize, Prepare, Plan and Manage Enterprise IoT Projects, Emil Berthelsen, Peter Havart-Simkin, 12 April 2018

<sup>4</sup> <https://customers.microsoft.com/story/rollsroycestory>

<sup>5</sup> <https://www.jabil.com/insights/blog-main/microsoft-and-jabil-collaborate-to-create-predictive-analytics-quality-assurance-platform.html>

<sup>6</sup> <https://customers.microsoft.com/story/piramal-glass-azure-ai-iot-hub-professional-services-precimetrix-india-en>

<sup>7</sup> <https://customers.microsoft.com/story/fueling-the-oil-and-gas-industry-with-iot-1>

<sup>8</sup> <https://customers.microsoft.com/story/thyssenkrupp-manufacturing-azure-iot>

<sup>9</sup> <https://customers.microsoft.com/story/johnson-controls>

<sup>10</sup> <https://customers.microsoft.com/story/buhlergroup-azure-machine-learning-iot-edge-switzerland>

<sup>11</sup> [https://azure.microsoft.com/mediahandler/files/resourcefiles/putting-customers-at-the-center-of-the-oem-supply-chain/EIU\\_MSFT\\_OEM-Supply-Chain\\_fin.pdf](https://azure.microsoft.com/mediahandler/files/resourcefiles/putting-customers-at-the-center-of-the-oem-supply-chain/EIU_MSFT_OEM-Supply-Chain_fin.pdf)

<sup>12</sup> Keystone Strategy interviews Oct 2015–Mar 2016

<sup>13</sup> <https://customers.microsoft.com/story/ecolabcustomerstory>