Microsoft

Competing in the digital age of manufacturing

Transforming business processes with Industrial IoT capabilities

Executive summary

The Industrial Internet of Things (IIoT) is revolutionizing many industries, and manufacturing is no exception. Manufacturers are using IIoT to digitize their overall businesses—finding new ways to engage with customers and optimizing operations. Operational technology (OT) and information technology (IT) are coming together for the first time, creating new opportunities for digital manufacturers to transform their offerings.

Millions of connected products, people, and things produce terabytes of data every day. Manufacturers that access this information and extract deep insights are able to optimize business and manufacturing processes better than ever before—streamlining operations, making more informed business decisions, and predicting customer preferences and behaviors. More importantly, insight from this data helps manufacturers identify new revenue streams by developing high-value service offerings focused on how products and customers interact in the real world. This transformation is changing the landscape for manufacturers, enabling them to differentiate themselves, achieve operational excellence, and disrupt markets.

Customer expectations are also changing faster than ever before. Manufacturers are rushing to catch up and create business models that attract and retain customers wanting new experiences, new services, and new technologies. Customers no longer base loyalty solely on brand but rather on the integrated experience that a brand provides. They may change allegiance quickly to products that integrate new ideas or to services that make their lives easier.

Therefore, excellence in design and engineering are no longer enough. To gain competitive advantage in today's market requires redesigning and reengineering the customer experience. IIoT is capable of addressing these imperatives so manufacturers can create, advance, and maintain competitive edge by connecting products, people, and services in this new age of manufacturing.

Microsoft provides the solutions and services to help you address these challenges and start transforming your business with IIoT. Comprehensive Microsoft platforms for IIoT enable industry-best device connectivity and management, data management and insights, advanced analytics, and business productivity and processes. The underlying approach that distinguishes our solutions from others in the marketplace today is our open IoT ecosystem. This ensures that you end up with a solution that is a perfect fit for your business.

The Industrial IoT is transforming the way manufacturers do business

A digital transformation is under way in manufacturing.

Technologies like big compute, advanced analytics, and social listening, to name a few, enable manufacturers to do more than ever before. With IIoT, manufacturers can take advantage of millions of connected "things" to capture and analyze data in real time, incorporating insights to improve manufacturing and business productivity. Now, manufacturers can see how the customer is using the product, how the product is wearing out, and how to enhance the product with new features. And with global cloud platforms, manufacturers can scale production around the world quickly and easily.

82% of manufacturers using IoT increased operational efficiency and improved product quality

79% of manufacturing leaders already use IoT technologies to track customers, products, business premises, or supply chains

Manufacturing companies that have digitized their operations are already seeing results—82 percent increased operational efficiency and improved product quality with 49 percent fewer product defects.[1] According to the American Society for Quality, connecting devices and analyzing the data collected enables manufacturers to reduce overhead, conserve resources, increase profits, and optimize operational efficiencies.[1]

Market leaders are already using IIoT technologies and capabilities. Companies in traditionally low-growth industries are realizing accelerated growth rates of more than 16 percent in areas of their businesses where they are implementing IoT technologies.[2] In addition, 79 percent of companies already use IoT technologies to track customers, products, and supply chains to improve their operations and become more efficient and more responsive to their customers.[2]

But this transformation requires a new mindset

For the first time in decades, technology has outpaced the evolution of business processes.

There used to be a time when manufacturing and operations were linear. The customer was predominately involved only at the end of the manufacturing process—product positioning and sales. Sales numbers and focus groups impacted engineering teams' innovations, but it was difficult for manufacturers to connect directly with customers once the product left the factory.

Today, customers are expecting more from the products and services they are buying than ever before, and brand loyalty is a rare ideal. Customers are looking for the newest, fastest, and most cost-effective solution that meets needs right now. And some of the same social technologies that enable manufacturers to rapidly change their businesses are also helping customers alter their allegiance quickly.

To prevent current market share from dwindling and to entice new customers, manufacturers must break away from the traditional approach that limits interactions externally with customers. Instead, manufacturers must focus on customer engagement and collaboration throughout the organization—across virtual and physical teams and throughout the entire value chain.

Streamlining operations with IIoT technologies and enhancing product features are no longer enough to gain a market advantage over competitors. Instead, business transformation requires a shift in mindset. IIoT can help reduce production costs and eliminate inefficiencies. Even more importantly, the technology of today can support an end-to-end approach that drives new business models and revenues.

The Internet of Things, People, and Services enables manufacturers to go beyond improving existing products to revolutionizing their product portfolios. Instead of offering products only, manufacturers can expand their business models to deliver service-based products—solutions that encompass both the product and the related complementary services. Only with the Internet of Things, People, and Services can manufacturers take full advantage of opportunities in the market today.

Manufacturers are taking advantage of the Internet of Things, People, and Services today

Manufacturers are taking advantage today by offering comprehensive solutions never before possible. By delivering connected products, manufacturers can offer continued monitoring and maintenance services to their customers. An example of this is the transition to data-informed predictive maintenance schedules; equipment can inform technicians before services are needed so technicians can proactively address issues and prevent costly downtime.

KUKA Robotics, a leading manufacturer of industrial robots and robotic technology, incorporated the predictive maintenance model into its latest offering. KUKA worked with Microsoft to build a smart robot–based automation solution that enables human-robot coworking, connecting management with the shop floor through Azure IoT services. Movement data from the robot is streamed to the Azure cloud where workers monitor progress and receive status reports through Windows tablets. By connecting IIoT solutions at the plant floor and the device level, manufacturers practically eliminate machine failure and downtime, saving both time and money.

Differentiated service offerings that reimagine the customer experience based on these new capabilities supply new sources of revenue through improving customer satisfaction. Operational efficiencies gained through predictive maintenance help manufacturers like KUKA transition from being reactionary to having predictive—even preemptive—maintenance capabilities, immediately increasing their bottom lines. For manufacturers, digitizing manufacturing and business processes has resulted in a 45 percent increase in customer satisfaction.[1]

Manufacturers can seize new sources of revenue when they consider how they can connect outside of their organizations. There is an opportunity for manufacturers to connect organizations directly with customers and break down the silos between salespeople and service representatives, engineers, production/warehouse workers, and delivery drivers. By collaborating across organizational boundaries, manufacturers can engage customers throughout manufacturing and business processes and access new value from plants, value chains, customers, and products.

The Internet of Things, People, and Services also brings significant internal benefits to an organization by optimizing business processes. Connecting people with the information they need and enabling collaboration across organizational and geographic boundaries helps companies make better decisions.

> "Thanks to disruptive breakthroughs in robotics technology, combined with the power of the cloud, we were able to come up with a smart robot–based automation solution that is both IoT and industry 4.0 ready."
>
> **DOMINIK BÖSL**, Corporate Innovation Office, Technical Fellow, KUKA AG

KUKA

$913B Market
potential of manufacturing IoT spend by 2018

$10.6T Cumulative
GDP impact of IIoT by 2030

The opportunity is substantial

The Internet of Things, People, and Services is a quantum leap for the manufacturing industry—the market potential for IIoT by 2018 is projected to be $913 billion.[3] And with industry analysts projecting up to 50 billion connected devices, the market potential of IoT will be $10.6–$14.2 trillion by 2030.[4]

If manufacturers just apply technology to what they do today, they can certainly improve operational efficiency. But the potential is out there for manufacturers who choose to be at the forefront of the industry by transforming their business models and driving new revenue streams.

Realize the business value of IIoT by connecting operations and services

Microsoft-based solutions for the Internet of Things, People, and Services enable manufacturers to seize greater market share by delivering new services and creating and competing with new business models. To connect operations and services, manufacturers can build on existing technology investments and extend with a comprehensive portfolio of traditional and cloud-based technologies, business process and productivity software, devices, and services. Through our experience in IIoT with other manufacturers, we have found a successful IIoT platform must enable organizations to scale easily, get to market faster, and turn information into action.

Scale easily:
Make cost-effective changes with low-risk, flexible solutions

Expensive capital assets make getting started with IIoT seem like a daunting task. Manufacturers cannot afford to trade out existing implementations and core business systems. The key to implementing IIoT is a cost-effective approach that reduces overall risk by taking advantage of current infrastructure and processes.

Go to market faster:
Develop new capabilities with modular implementations

As manufacturers innovate with new products, services, and experiences for customers, they need a modular approach that enables them to pilot new tools and services, validate design choices, and scale across the business. More importantly, they must be able to accomplish this without disrupting existing business processes unnecessarily.
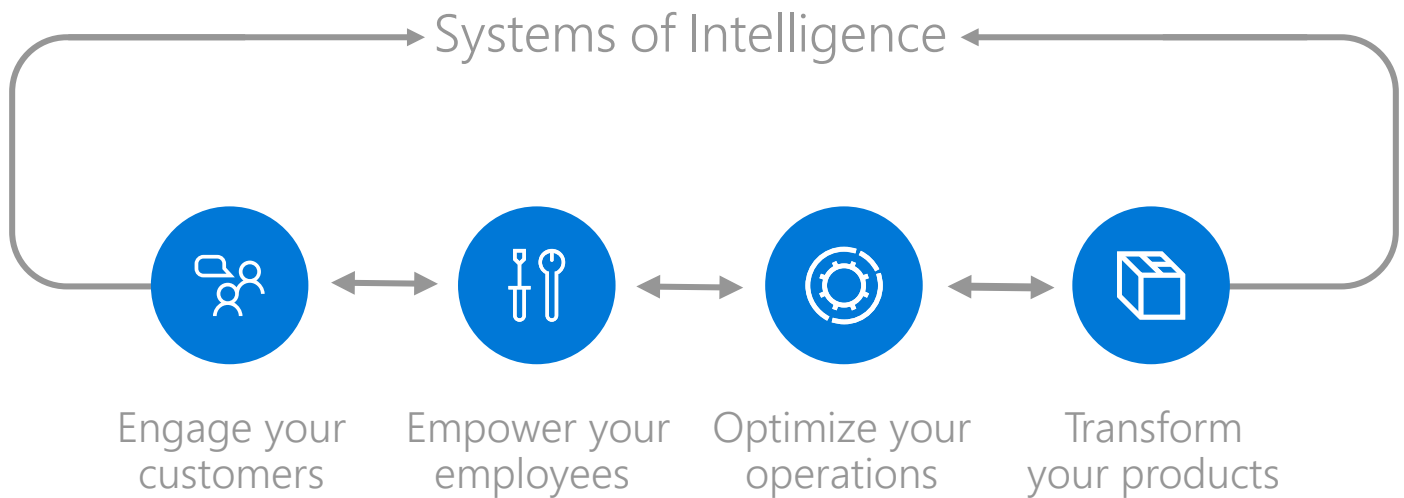
Turn information into action:
Create new services with a holistic platform

Assembly lines disrupted the manufacturing industry during the Industrial Revolution. Today, IIoT is doing the same. Connected systems will become a must-have in manufacturing. And when they do, customer care and quality of service become a competitive advantage. In fact, 89 percent of manufacturing leaders recognize that customer care and quality of service are driving competitive advantage today and for the foreseeable future.[5] This shift in business model improves the overall customer experience while increasing customer loyalty and driving higher margins.

Innovative intelligence for business process transformation

Today's business processes are not linear, they are a continuous feedback loop that calls for improvement toward a higher quality of interactions and improved flow of information, both of which drive greater service and operational excellence and the ability to reengineer products faster and factually. In essence, today's technology is a-la-par to support any type of business process transformation to engage with your customers, empower your employees, optimize your operations, and reinvent products and business models.

Systems of Intelligence

Engage your customers → **Empower your employees** → **Optimize your operations** → **Transform your products**

Manufacturers need IIoT implementations that are flexible and allow the integration of current devices, clouds, and solutions. This enables existing technology investments to extend and evolve. Additionally, manufacturers must be able to deploy new service-based products globally without waiting to develop traditional global solution infrastructures. By building on an intelligent, scalable platform, manufacturers can improve margins and increase customer loyalty by creating more customer-focused solutions, reimagining customer experiences to deliver new smarter devices and machines, and creating differentiated and disruptive services. With a growing skills gap in manufacturing, virtual teams must be able to collaborate and work together across the globe. The digital solutions they use must enable them to develop new solutions quickly, uninhibited by IT infrastructure constraints and deployment complexity.

Engage your customers

Manufacturers have an unprecedented opportunity to engage with customers in a 1:1 relationship. First, by achieving visibility into distributed products with remote monitoring capabilities, they can interact and serve customers better. Second, the media of interaction has changed from phone conversations and portals to real-time connectivity across personal devices. Third, the method of interaction is also evolving, now using artificial intelligence capabilities like voice and gestures that enable interoperability across the Internet of Things and the Internet of People (M2M2P).

Liebherr, a leading manufacturer of industrial and consumer equipment, has teamed up with Microsoft to create a new smart refrigerator.

Liebherr's customers such as pharmaceutical companies, medical labs and food retailers need reliable cooling technologies to ensure that their products stay at precise temperatures during storage. A Liebherr prototype monitors the temperature of each refrigerator as well as the state of the compressor and the door. Liebherr demonstrates how to offer the benefits of predictive analytics to its clients and open service tickets before critical damage can alter the valuable contents of the fridge.

> "We see Microsoft as a technology partner that enables us to create added value for our customers faster and easier. The digital offers and added value from this digitalization are important for everyone."
>
> **STEFFEN NAGEL**,
> Liebherr managing director

LIEBHERR
Quality, Design and Innovation

Empower your employees

Many manufacturers already have connected devices and equipment on shop floors or deployed at customer sites. They need to be able to connect any type of device and communicate to any cloud with any programming language—using their existing IT/OT platform. Manufacturers must be able to selectively choose the capabilities that their employees need in order to improve productivity and collaboration across the value chain.

Fujitsu, the leading Japanese information and communication technology company, partnered with Microsoft to transform a semiconductor plant no longer being used for full-scale production into a lettuce-growing factory.

Working with their existing implementations, Fujitsu was able to dynamically realign their factory by building on their existing Eco-Management Dashboard and their IoT/M2M platform. This created an integrated solution that increased employee visibility into their plant floor in real time and provided remote monitoring capabilities to all groups through an Azure-based solution. Fujitsu improved their time to production while maintaining their high-quality production standards.

> "Together with Microsoft, we are on the leading edge, combining our technologies to leverage the Internet of Things and People to help realize business and social innovations in this hyper-connected world."
>
> **RYOSUKE MORI**,
> Vice President, Global Strategic Alliances

FUJITSU

Optimize your operations

Manufacturers must be able to selectively choose the capabilities they need to enhance operational and service excellence to deliver new business value without replacing current implementations—ensuring the continuity of current manufacturing and business processes. Connecting equipment that is globally dispersed into a virtual view in control rooms and applying advanced analytics techniques like machine learning and stream analytics to predict and anticipate problems before they happen can help improve traditional practices to manage quality, maintenance, energy, or equipment performance.

Jabil, one of the world's leading design and manufacturing solution providers, has built an analytics solution that predicts failures on the assembly floor before they occur, saving its customers time and money while delivering superior quality and shortened product lead times throughout the entire supply chain.

Through a collaboration with Microsoft, Jabil can analyze millions of data points from machines running dozens of steps throughout the manufacturing process. Jabil can predict failures earlier in the process—for example, at step two in a 32-step process instead of step 15.

"Since deploying the Microsoft predictive analytics solutions, we have seen, at least, an 80 percent accuracy rate in the prediction of machine processes that will slow down or fail, contibuting to a scrap and rework savings of 17 percent."

CLINT BELINSKY,
Vice President,
Global Quality, Jabil

Transform your products

By using a modular platform, manufacturers can differentiate offerings while adapting to increasing customer expectations and the new speed of business. There used to be a time that competition was about best products; now, differentiated offerings fuel competition on best business models. New offerings are rapidly becoming products as a service as well as innovative value-added services.

Rolls-Royce, a leading manufacturer for the airline and business aviation market, brings new capabilities to itscustomers by incorporating into its service solutions digital capabilities to support the current and next generation of Rolls-Royce intelligent engines.

Rolls-Royce engines power more than 50,000 flights around the world each month, and the company constantly strives to improve aircraft efficiency, drive up aircraft availability, and reduce engine maintenance costs for customers. To do that, Rolls-Royce offers a broad range of service solutions, including its industry-leading TotalCare services, focused on keeping its customers' engines generating maximum value for them.

"By working with Microsoft, we can really transform our digital services customers right across engine-related aircraft operations to make a real difference to performance"

TOM PALMER,
Senior Vice President,
Services, Civil Aerospace,
Roll-Royce

One key to delivering these services is observing trends and anomalies and using the right data to help airlines determine what actions to take to save money or improve operations.

Moving forward, manufacturers can seize the best business model opportunities through insightful and rich, service-based products that use Industrial IoT capabilities. A fragmented or partial IIoT implementation will not help manufacturers discover new business models. It requires more than simply connecting devices and products or applying advanced analytics to current manufacturing processes. To free up trapped business value, manufacturers need to connect equipment, analyze data, visualize information, and be able to make decisions based on the new insights into customers and operations. By doing this, manufacturers will be able to develop comprehensive digital services and gain a competitive advantage that can drive new sources of revenue for their organizations.
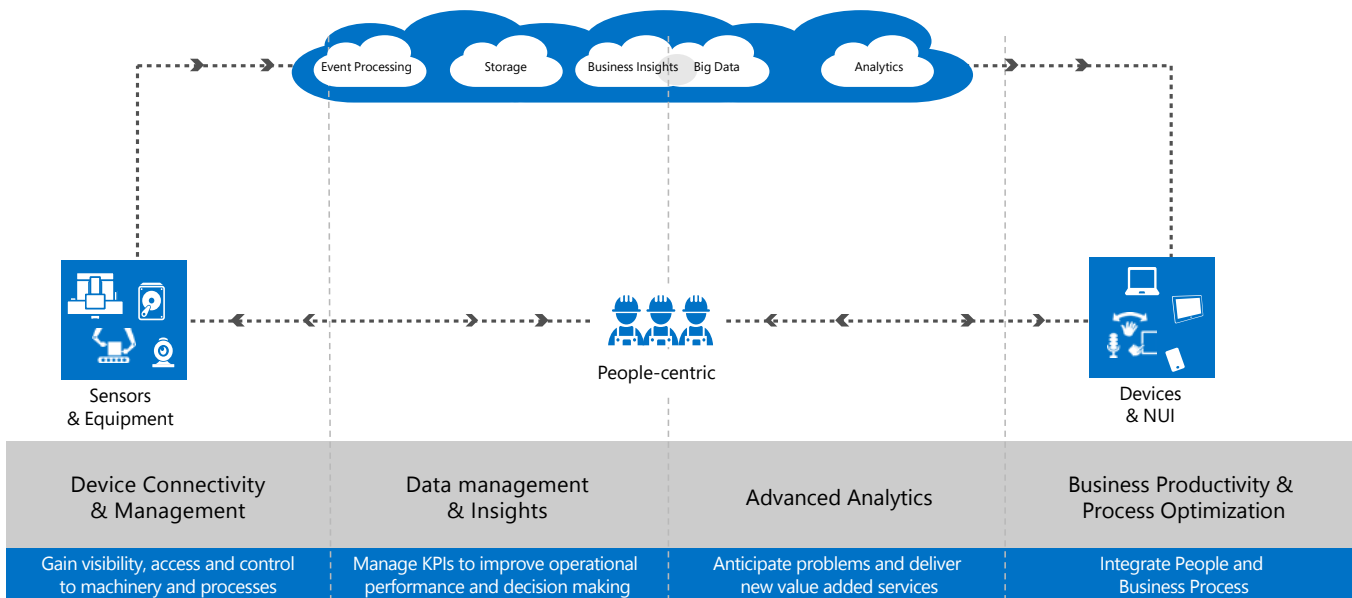
Each manufacturer must determine whether or not to start with existing infrastructure or unlock new business value from connected products their customers are using. They can do so confidently through implementations on a holistic platform that provides the necessary capabilities for an IIoT solution, from device connectivity to business process and productivity solutions.

The Microsoft approach is to start with things you already have in your organization—whether or not they are from Microsoft. With existing infrastructure as a base, we can extend current abilities and add the new IIoT capabilities needed to transform your business. Industry standards, like OPC-UA in the manufacturing community, offer a quick and inexpensive way to modernize legacy systems and old equipment in the plant floor to make it cloud compatible within 24 hours. This is a result of making on-premises and cloud technologies interoperate.

Transform your business with Microsoft solutions for Industrial IoT

IIoT for operations and services has a lot of moving parts, but getting started does not have to be complicated. Take advantage today of low-risk, modular, and holistic Microsoft solutions. Build on the IT/OT platforms you already have in place, use your devices and services in new ways, and incorporate the right technology to turn data into insight and make more informed business decisions.

Microsoft provides the tools to help you analyze the past, understand the present, and predict the future. We focus on four key capabilities to help you deliver on the potential of digitization and IIoT: **device connectivity and management**, **data management and insights**, **advanced analytics**, and **business productivity and process optimization**.

	Event Processing	Storage	Business Insights	Big Data	Analytics	

Sensors & Equipment	People-centric		Devices & NUI
Device Connectivity & Management	Data management & Insights	Advanced Analytics	Business Productivity & Process Optimization
Gain visibility, access and control to machinery and processes	Manage KPIs to improve operational performance and decision making	Anticipate problems and deliver new value added services	Integrate People and Business Process

Device Connectivity and Management

Implement Industrial IoT capabilities in your current environment by using the sensors and equipment you already have in place in the plant and in the field. Use Microsoft Azure IoT Suite to connect sensors, devices, and equipment to gain better visibility, access, and control over machinery and processes. This delivers a new level of management capability, enabling you to optimize manufacturing processes and reduce operational costs. Microsoft Azure IoT Suite provides access to all equipment and sensors while helping to secure transferred data and ensure that IP is protected.

Businesss Productivity and Process Optimization

Once you establish the basis for turning data into insight, it is important to ensure that information is transferred to the people that need it. With a growing skills gap in manufacturing, your people do not need more data; they need insights and recommendations on how to improve operations and better serve customers embedded into their daily workflow. Focus on driving improvement and transformation of customer engagements by integrating people, familiar office productivity tools, and business processes.

With Microsoft Dynamics you can iteratively develop, test, deploy, and scale new business processes and models that are centered on the customer. Embedded insights from remote monitoring of your smart products can be blended with social sentiment and call center data to drive integrated business workflows across service, sales and marketing, and fulfilment of customer expectations across engineering, shop floor, and supply chain. Innovate quickly and iterate quickly with business software that can keep up and that people want to use.

Advanced Analytics

After collecting and managing device and process data, you can begin using that data to gain deep insight into various levels of your operations. With predictive analytics, you can correlate diverse data in ways never possible before. With this enhanced insight, implement new business processes like predictive maintenance or asset performance management to ensure plant, product, and process availability for your customers.

With the state-of-the-art machine learning algorithms of Cortana Intelligence Suite, you can augment and improve your decision-making processes with predictions, proactive alerting, and actionable recommendations. Advanced analytics can help transform your asset management, quality management, and energy management initiatives inside your operations. Additionally, by using the data captured in your business systems, knowledge bases, and published data sources, you can better understand your customers. Analyze patterns of customer service calls, dramatically improve demand forecasting, and start to develop customer experiences that are personalized, predictive, and proactive.

Data Management and Insights

Once you have access to the data from sensors and equipment, compile and consolidate the information in easily accessible locations. With the Microsoft Analytics Platform System, you can access your data through on-premises, hybrid, and cloud implementations. Microsoft Power BI enables you to deliver the insights and analysis broadly to all of your teams that need to optimize not only your operations, but also your supply chain, customer service, engineering, and sales and marketing in a self-service environment.

Count on Microsoft and its Industrial IoT ecosystem

Our open ecosystem helps you realize greater value across your business. We have strategic partnerships that help make sure solutions provide the options you need and meet the latest industry standards. We work with a variety of systems integrators and independent software vendors to help design and deploy tailored solutions. We align to the latest protocol standards and can integrate with the latest enterprise systems. We support edge devices, regardless of device type or manufacturer. Our partnerships with mobile network operators help us connect even the most remote devices to your solution.

Get started today

Work with Microsoft to extend and develop IIoT solutions that will transform your business today. Use our knowledge and expertise in a business outcome workshop, deeper solution session, private preview, or customer focus group—or develop a proof of concept or pilot to drive the right implementations and solutions for your business.

In a business outcome workshop, you can engage with Microsoft Services one-on-one to scope innovative solutions, architectural designs, and next steps. We will take a look at where you are, what you are trying to achieve, and how we can help you get there.

In a deeper solution session, you can explore any of our solution areas in more detail to develop a comprehensive plan of how to proceed.

In a private preview and customer focus group, work directly with engineering teams on innovative new capabilities—starting with our robust tools and your existing infrastructure—to begin developing solutions that meet your specific needs.

Begin a proof of concept (POC) or a pilot with support of key engineering teams and partners. No matter how you start, you can count on Microsoft to provide the solutions and resources to help you transform your business.

For more information

To learn more about how Microsoft can help manufacturers seize the potential of the Internet of Things, People, and Services and get up and running quickly, check out these additional resources:

- Microsoft in Discrete Manufacturing

- Azure IoT Suite

- Analytics Platform System

- Cortana Intelligence Suite

Microsoft